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**Computer-Conferencing:  
A Collaborative Learning Environment for  
Distance Education Students**

Karin M. Lundgren-Cayrol

A Thesis  
in  
The Department  
of  
Education

Presented in Partial Fulfilment of the Requirements  
for the Degree of Doctor of Philosophy at  
Concordia University  
Montreal, Quebec, Canada.

February, 1996

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**ABSTRACT****Computer-Conferencing:  
A Collaborative Learning Environment for Distance Education Students**

Karin Lundgren-Cayrol, Ph. D.  
Concordia University, 1996

In order to discern how to apply Computer-Conferencing (CC) adequately in adult undergraduate distance education contexts, this study experimentally investigated the variation of idea productivity and academic achievement with different group-formation and moderator-intervention treatments. These were factors found seriously in need of clarification on the basis of instructional theory and the literature review.

A (2X2X2) mixed factorial design experiment, with two between-group factors was used to investigate how better to organize and moderate on-line learning activities. The first factor involved randomly assigning students to either high (skilled) or low (peer) moderation intervention techniques. The second involved forming groups either by random assignment, or by choosing group members. The within-group factor investigated the variation of performance and achievement outcome with two different types of on-line collaborative learning activities: (1) writing a joint proposal, and (2) participating in a debate. Achievement was measured by a final exam, and performance by the student's contribution of unique idea units during the two activities. Self-perceived productivity and cohesion was also measured after each of the two activities.



The results reveal that low moderator intervention when used with random assignment to small learning groups appeared to be the most effective and efficient strategy. The results support theoretical prescriptions of both andragogical and constructivist instructional principles.

Findings from the experimental and qualitative aspects of this study provided a basis for the formulation of some novel guidelines for effective and efficient design of on-line collaborative learning activities.

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# Computer-Conferencing: A Collaborative Learning Environment for Distance Education Students

## Chapter 1

### Introduction

*"Until now most of us have operated on the assumption  
that temporary relationships are superficial relationships,  
that only long-enduring ties can flower into real interpersonal involvement.  
Perhaps this assumption is false.  
Perhaps it is possible for holistic, non-modular relationships,  
to flower rapidly in a high transience society"  
From Future Shock by Alvin Toffler, 1970; (p.110).*

### Rationale

The conception of this thesis stems from personal experience with computer conferencing and teaching (Lundgren-Cayrol, 1989; Lundgren-Cayrol & Dicks, 1993; Lundgren-Cayrol, 1993; Bernard & Lundgren-Cayrol, 1994) as well as the literature pertaining to distance education, computer-conferencing and instructional design.

In the last decade distance education (DE) has dramatically changed from simple correspondence study institutions, using regular mail as the main contact system, to highly technological institutions using various types of interactive media, such as audio-conferencing, computer-conferencing, e-mail, interactive satellite-TV, VCR, fax, bulletin boards and on-line libraries (Dede, 1990; Gunawardena, 1991; Bates, 1991; Eisley, 1992; Winders, 1988).

Moreover, to help the student deal with independent and fairly autonomous study, many DE institutions currently provide specially trained tutors, study method courses, counseling, learning contracts and study centers (e.g., OISE, Empire State College, Guelph and The Open University). Both the introduction of interactive media and new ways of providing student support systems, stem from the fact that up to 50% of registered students drop out from DE programs (Keegan, 1990). This very high attrition rate has led to numerous research studies attempting to disentangle the web of variables that produce either success or drop-out (e.g., Kember, 1989; Bernard and Amundsen, 1989).

Keegan (1981) formulated a set of major factors to which the design and organization of distance education would have to answer in order to diminish student drop-out. It can be summarized as follows:

- the identification of students who are at risk;
- design and implementation of student support services;
- provision of a personal tutor/counselor; and
- provision of a variety of compulsory contact activities

Powell, Conway and Ross (1990) investigated reasons why students drop out, and discovered that students rating themselves highly on various measures of persistence (e.g., taking on new projects, a need to be successful, literacy etc.) were more likely to succeed. This study produced a set of "at risk" variables, which clearly suggests that DE institutions must envision change by making instruction more personalized to lessen the feeling of isolation. This change could take the form of computer-assisted group learning, where the social dimensions of learning are enhanced. They further encourage distance education institutions to include a variety of support systems, such as telephone tutoring, peer tutoring, weekend or summer meetings, and/or learning centres.

A similar study, carried out by Dille and Mezack (1991), investigated student demographics, internal-external locus of control (RIELC; Rotter, 1966) and learning styles (Kolb, 1981) in an attempt to construct a "high risk" profile in a DE course. They were able to compose a significant drop-out profile. This "at risk" profile typically showed that students who are 25 years or younger, divorced, with fewer than thirty college credit hours completed, a GPA score lower than 3.0, tending towards an external locus of control, and with a concrete learning style, were most likely not to complete the course. This outcome suggests that diagnostic tools could be used to assist in counseling and guidance for "at risk" students. They would have to be administered and acted upon at an early stage of entering into a DE program.

In terms of psycho-social reasons for success versus failure, Ethington (1990) found that in order to enhance and facilitate persistence in learning, guidance has to be directed at improving the student setting by explicitly demanding that the student formulate performance goals, aspirations and expectations, as well as methods for carrying them out. Ethington argues that to provide successful counseling and guidance, students have to be taught how to make these commitments. She proposes that this could be done through the on-going negotiation and re-evaluation of learning contracts. However, to organize such an on-going conversation between tutor and learner entails that a two-way communication channel must be continually open. Depending upon the size of the DE institution and the tutor to student ratio, this type of counseling is made possible through regular mail, telephone conversations, or more recently computer-mediated communication.

These studies on drop-outs clearly indicate a need for two-way communication. Computer-mediated communication (CMC), including

computer-conferencing, internet, electronic billboards and email, is an alternative that could satisfy this need. Further, computer conferencing (CC) with its specific features for facilitating group discussions has the potential for bringing into distance education not only increased tutor and peer contact, but also the possibility of incorporating collaborative and co-operative group work. This type of group work is viewed as fostering critical and reflective thinking and reasoning skills, as well as increasing the student's motivational level for studying (Johnson & Johnson, 1987; Abrami et al., 1993; Kagan, 1992).

### Two-way communication and interaction

The main goal of CMC is to increase two-way communication among learners, between the learner and the teacher/tutor, and also in terms of qualitative interaction between the learner and the content. As the name indicates Computer-Conferencing (CC) helps people "confer at a distance by the mean of writing" (Hart, 1987). CC and other CMC applications facilitate not only storing and retrieving pieces of text, but also reviewing and modifying text in both synchronous (i.e., chat mode) and asynchronous (i.e., time independent delayed interaction) mode of communication. Two-way communication can be seen from two perspectives by distinguishing between quantitative and qualitative interaction. Quantitative interaction refers to how often interaction takes place during an instructional module, whereas qualitative interaction refers to how deeply the student intentionally elaborates the prescribed content (Hannafin, 1989). CMC obviously makes it possible for distance education students to know each other and discuss course materials, thus potentially alleviating the feeling of alienation and increasing elaboration on course material. Maybe more importantly, CC as

well as other forms of CMC, allows for a social dimension of learning which could be defined as the increase in learning that is gained through sharing, arguing and debating course material. The asynchronicity feature of computer-conferencing, Mason (1988) and Harasim (1987) point out, seems to have a positive effect because it enables the student to formulate ideas in writing. This is further seen as promoting reflective thinking and learning, possibly leading to a higher degree of independent and self-directed learning. Further, computer-conferencing appears to increase interaction with the material to be learnt through the continuous explicit verbalization and exchange of thoughts among peers and with tutors.

One of the main features of CMC is the lack of paraverbal or nonverbal cues (i.e., gestures, facial expressions, tone of voice, eye contact, etc.) as well as physical appearance. This somewhat restrained form of communication can constitute a problem, that can be seen as both beneficial and hindering. It has been argued that the lack of these cues creates equality among students and teachers, since they are not judged or evaluated by physical appearance or, for example, speech impediments (Mantovani, 1994), but it has also been found to intimidate learners who are in need of, or are used to face-to-face interaction, to feel comfortable (Burge, 1994). To counteract this intimidation, on-line users have developed written symbols to indicate, for example, smile :-); wink ;-0; or a shout by using capital letters to indicate intonations or the importance of a word. Another way of dealing with the absence of para- and nonverbal cues often takes the form of using endearing words, descriptive analogies or painstakingly verbose excuses.

One of the initial problems in using CC is the technical aspect, that is the user must be comfortable with the computer, the modem, the communication software and the CC software. In the case of distance

education students, they must also own or have easy access to a computer with a modem to make it beneficial and interesting. Rimmershaw (1992) studied computerized collaborative writing, and found that it must allow for flexible practices, that is, interface programs must be designed to facilitate groups interacting in different ways. As an example, he mentions that some students might prefer to finish pieces of writing in private and then discuss, share, and revise them, while others might be more creative when having access to an ongoing sequential or even fragmented discussion. Most CC software does allow for both synchronous and the asynchronous mode of communication. Many researchers (e.g., LeCavallier, 1990; Henri, 1988; Harasim, 1988; Hiltz, 1987; McConnell, 1987) have found that, when interactions are asynchronous it promotes not only reflective thinking, but it also leaves the student free to communicate within a flexible time schedule.

In terms of exploration in how to use CC for educational purposes, a project called Electronic Networks for Interaction (ENFI) developed collaborative computer-mediated writing classes for deaf students. This model of instruction was designed to shift the authority of the teacher as perceived in face-to face lectures, to allow for student governed activities, where the teacher successively withdraws a high authority profile and gradually becomes an active and equal participant. The theoretical underpinnings of this model of teaching are principles related to reciprocal teaching (Brown & Palincsar, 1989) and sociocultural theories of learning (Lave & Wenger, 1992), where learning gradually develops from observation to participatory actions. Such a strategy uses the teacher as a model for how to interact in a learning discussion, then as a coach who provides structure (scaffolding), and progressively fades from the discussion. The teacher acts as a facilitator for developing a higher degree of responsibility for learning in a student. The outcome of these early writing



classes was very positive in terms of performance, achievement and student satisfaction. The ENFI team proceeded to refine and modify these instructional strategies so as to assist regular students in learning English composition, English as a second language, and rhetoric classes, on-campus as well as off-campus (Bruce, Kreeft-Peynton & Batson, 1993).

Newman and Newman (1992) found out through a critical incidence study why failure occurred in two attempts at collaborative writing using the 1989 version of VAXNotes involving team discussion on the technical features of interface design. They found that one group failed because of lack of group maintenance, the overload of messages, and lack of coherent decision-support systems, which led to an oversight with respect to important decisions, consequently ruining the final project. The other group failed because of inadequate social cohesion leading to annoyance and irritation, finally ending the discussion completely. These two case studies indicate the need for: a) user-controlled support systems; b) a moderator to create social cohesion; c) an instrument for assessing group cohesion and efficiency; d) a need for specially designed conferences where people can share non-threatening "social talk".

### Summary

The above studies illustrate the multi-faceted accumulation of interrelated problems facing distance education developers, tutors, researchers and students who want to use and explore the potentials of CMC and CC, and accordingly a myriad of general questions emerge:

- Is the distance context such that it demands the student to approach studying in a different manner compared to regular on-campus courses?

- Do students choose DE because they are different, that is mostly adults and prefer self-directed studies?
- Is computer-conferencing an effective medium to improve qualitative and quantitative interaction about content and among both between student and their tutors and peers?
- Are cooperative and collaborative teaching methods beneficial for learning in higher education within DE institutions? If so, what type of activities provide the highest learning gain? Then, how can groups best be created?
- Does CC diminish the feeling of isolation often expressed by DE students or is it just a fad?

This thesis investigated learning gains as measured by a final exam in a controlled experimental design. The overall research question pertained to three factors: type of collaborative activity (CA); type of moderator intervention (TMI); and group formation strategy (GFS), as well as how these three factors affect learning and attitudes towards a distance education course.

The theoretical underpinnings for the choice of these particular factors are anchored in constructivist and cognitive learning theories, as well as in instructional design theories, where group work and social interaction play a major role. Constructivist and cognitive theories of learning (Spiro, Feltovitch, Jacobsen & Coulson, 1991; Cunningham, 1991; Resnick, 1987) corroborate with andragogical principles (Knowles, 1975; Verduin & Clark, 1991; Darkenwald & Merriam, 1982), and stress learner activation to promote higher-order thinking and learning skills, thereby maximizing learning gains. A collaborative learning environment implements these ideas in many ways, focusing on meaningful discussion of content, the sharing of ideas and resources, and reflection upon and evaluation of opinions in small group

situations. The cooperative structure inherent in collaborative learning encourages task and group member interdependence, which in turn is seen to develop a higher degree of responsibility for learning, leading to motivational and cognitive gain. Computer-conferencing (CC) can potentially provide such an environment for distance learners.

Chapter 2 provides an overview of the literature pertinent to the factors in this particular research, followed by an explicit problem statement.

Chapter 3 describes the framework for the study in terms of experimental research design, validity and reliability issues and concerns, methods, including subjects, materials, procedures and statistical analyses and research questions and hypotheses.

Chapter 4 presents descriptive and inferential statistical results. This result section is organized according to the data gathered from the on-line transcripts, achievement scores and attitudinal data. The first section reports data regarding the high dropout rate, followed by establishing equality among groups in terms of GPA scores and some of the demographic variables. The second section is dedicated to descriptive statistics gathered to shed light on student participation in two CC activities. The third section relates the results of the analyses on idea units produced for two online activities. The fourth section provides results on self-reported group productivity and cohesion data. Finally, the results from a questionnaire the questionnaire on perceived difficulties of studying at a distance are reported.

Chapter 5 discusses the interpretation of these results attempting to link findings to the literature as well as outlining a new framework for integration of CC in higher education. Suggestions for future research endeavours are also included.

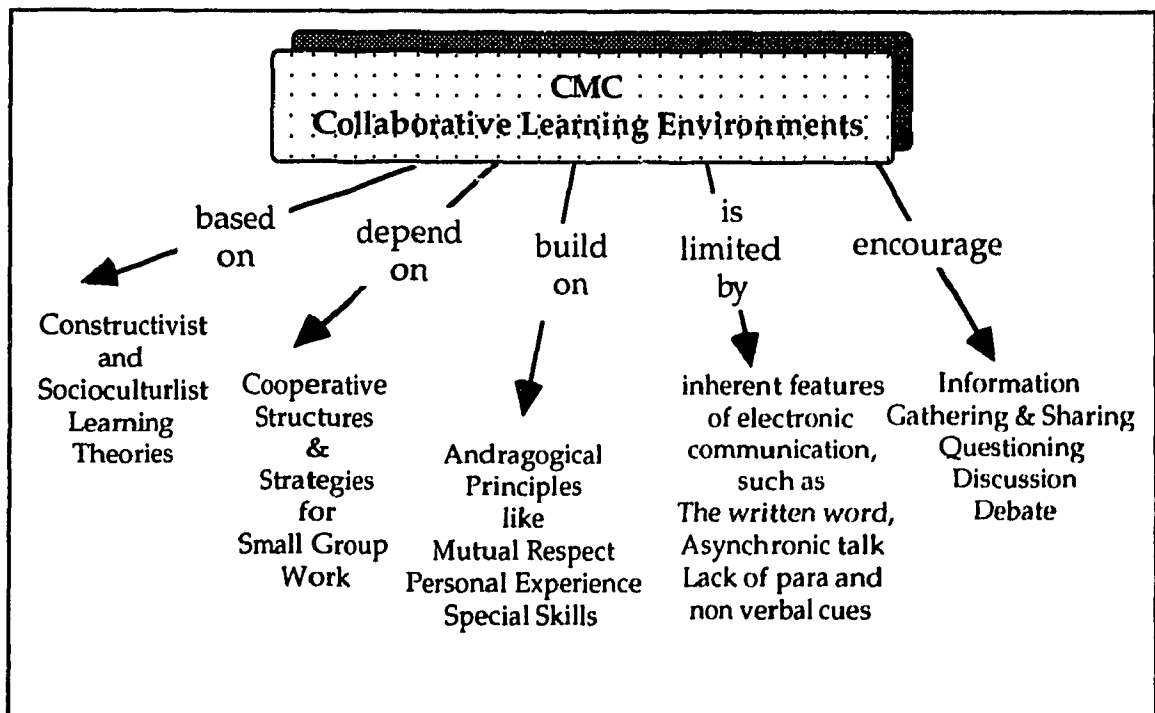
## Literature Review

*"Education should not aim at a passive awareness of dead facts, but at an activity directed towards the world that our efforts are to create."  
From Selected Papers of Bertrand Russell, 1927 (p. 10).*

This literature review has been structured according to learning theories, principles of adult learning, the distance education context, special features of CMC and CC, and instructional strategies in relation to collaborative learning environments.

Figure 1 organizes the fields of knowledge that are seen as the basis for collaborative learning in an electronic environment by the author.

Figure 1. Major components influencing the design of on-line collaborative learning environments



## Learning Theories and its Implications

*Behaviorism, Cognitivism, Constructivism and Socioculturism.* Learning theories have evolved consecutively, although sometimes overlapping, and could be illustrated through the consideration of a learner as a 'black box', indicating a displacement of emphasis from the external to the internal aspect on how one learns.

Behaviorism looks at the learner as a 'black box' where internal processing is of no interest or use. The learner responds only to external stimuli and feedback and learning is measured as the difference between change in behavior from state one to state two (see e.g., Skinner, 1954). Vygotsky (in Rieber & Carton, 1987) however, deeply influenced by Pavlov's research, formulated a basic criticism against the behaviourist view of the mind and behavior (=learning) being isolated concepts:

"This is the other half of the same dualism. Previously we had mind without behavior. Now we have behavior without mind. In both cases, we have "mind" and "behavior" understood as two distinct and separate phenomena. (p. 19)

The idea that behavior and consciousness are conceptually separate represents the most fundamental dissimilarity that lies between the behaviourist and the cognitivist schools of thought.

Cognitivists, on the other hand, believe that the learner is a 'grey box', and concentrate on finding out what is inside, that is the internal processing of thought. Researchers in the cognitive movement inferred from overt behaviour specific mental processes of the mind that organize, store and retrieve information in systematic ways. That is, cognitivists build models of the perceived processes describing what we do with information and consequently how we learn, providing a plethora of mental models. The most prominent are the information processing and the neural network

models, both advancing the concept of learning by carrying out research on intelligent tutoring systems (Wenger, 1987). One example of cognitive theories of learning is Anderson's (1983) architecture of cognition theory (ACT & ACT\*). In this theory, learning is seen as a set of basic mechanisms that compile knowledge, facts, concepts and principles which are gathered and then proceduralized and composed into a set of production rules. The production rules, when fully learned, are united into meta rules that determine problem-solving strategies. The mind has two types of memory, working memory and long-term memory. Working memory manages encoding and retrieval of information. Long-term memory is divided into two parts, the declarative memory storage, where facts, concepts and principles are stored, and the production memory storage, where readily available sets of production rules are stored (Anderson, 1983). Implications for teaching and learning are essentially that the learner needs efficient and effective strategies that teach how to learn. These strategies are seen to be best learned in problem-solving situations, where short immediate feedback is available (Anderson, Corbett, Koedinger, & Pelletier, 1995).

Finally, constructivists (von Glaserfeld, 1985; Duffy & Jonassen, 1991) and socioculturalists theories of learning (Lave and Wenger, 1991; Choi & Hannafin, 1995; Cognition and Technology Group at Vanderbilt, 1990 and 1991) could be seen as having combined these approaches extending the explanation of learning to be dependent on the learner's experience, observational ability and the context in which she/he learns. The learner is seen to construct and reconstruct meaning and knowledge from the learning context/situation by evaluating the experience and information in connection with 'knowledgeable others' (see e.g., Merrill, 1991; Perkins, 1991; Spiro, Feltovich, Jacobsen and Coulson, 1991; Cobb, 1994). This latter

approach, then, clearly prescribes that for efficient and effective learning to take place instruction must be put in a context that is experiential and discovery-based, as well as promoting active participation through conversation. An important difference between the constructivists and the socioculturalists is a matter of emphasis of the location of mental processes. Cooper (1993) summarizes this difference as follows:

"Whereas the constructivist analyze thought in terms of conceptual processes located in the individual, sociocultural theorists take the individual-in-social-action as their unit of analysis (Minick, 1989). From this latter perspective, the primary issue is that of explaining how participation in social interactions and culturally organized activities influences psychological development." (p. 14).

*Teacher and Learner Roles.* According to the evolution of these learning theories a shift in the roles of the teacher and the student can be discerned, going from authoritarian teacher-centred practice and passive learners, to more learner centered environments where the teacher acts as a facilitator and information resource (see e.g., Winn, 1987; 1990; Tennyson, 1990 a & b).

The behaviourist approach prescribed specific behavioral and performance objectives, teacher feedback to reinforce desired behaviours and criterion-referenced tests to measure whether the student reached understanding. Further, learning materials were structured in such a way that the learner is a passive recipient of information receiving preprogrammed feedback to a specific task.

The cognitive movement placed the emphasis on how people learn advancing research on expertise (Holyoak, 1991) and intelligent tutoring systems (Wenger, 1987). This type of research moved the role of the teacher to that of a one-to-one tutor, where the teaching strategies comprised presenting the student with mental models for information storing and retrieval, as well

as continuous correction of misconceptions through dialogue. This was seen to make learners come to grips with and comprehend the world around them. Consequently, the assumed learner's role changed from a passive to that of an active participant constructing knowledge maps or schemata by being aware of how learning is acquired and used, so called meta-cognition.

Building on both cognitivist's and behaviorist's ideas the constructivists expanded the concept of the active learner not only to include internal processing but also to involve the reconstruction of knowledge in terms of a perceived external 'reality' (von Glaserfeld, 1977; Garrison, 1993; Swann, 1995). The constructivists further state that learning is problem solving anchored in personal discovery and that the learner must be intrinsically motivated, thus needing a "...responsive environment in which consideration has been given to the learner's individual style as an active, self-regulating, reflective learner" (Seels, 1989; p. 14; in Cooper, 1994, p. 17).

*Implications for Instructional design.* Instructional design theories have followed these theoretical shifts and consequently learning environments and teaching/learning strategies have altered, maybe most essentially in stressing the idea that learning can not take place unless the learner actively and responsibly participates in his/her own learning (e.g., Garrison, 1993). The theoretical underpinnings expressed by the constructivist school of thought rationalize the implementation of cooperative and collaborative learning environments, where interaction among students is a central part, allowing for mental processes to grow in ordered, systematic, logical and goal oriented ways. Where cognitive theories of learning emphasize meaning and thinking processes, the constructivist theories of learning focus on deriving generative strategies inherent in a specially designed learning environment,



where students are encouraged to experience through personal discovery an increasingly complex model of a concept.

Collaborative learning environments further build on arguments from the sociocultural theorists (Vygotsky, ; Lave & Wenger, 1991; Brown, Collins, & Duguid, 1989), where so called "cognitive apprenticeship" (Lave & Wenger) or "proximal development" (Vygotsky) emphasize the importance of social interaction 'with knowledgeable others', which have given rise to teaching/tutor strategies such as modelling, coaching, scaffolding and fading (Brown & Palincsar, 1987). Although these strategies have mostly been studied with children, there is enough evidence of their benefits to justify application in an adult learning situation (see e.g., the ENFI -project, in Bruce, Kreeft-Peynton & Batson, 1993).

Thus, the theories of constructivism and socioculturalism signify that appropriate learning environments should involve collaboration, where the gathering, sharing and evaluation of information is essential . Designing these environments would entail a cooperative structure which takes into account the principles of adult education.

### Principles of Adult Learning

Since most distance education institution draws its students almost exclusively from the adult population, methods of andragogical origin should preferably be applied (Verduin & Clark, 1991). Empirically derived principles for effective practice of adult learning encourage and prescribe voluntary participation, mutual respect, action in combination with reflection, personal commitment and self-direction (Knowles, 1975; Cross, 1982). Knowles further argues that negotiating or developing learning contracts between the student and the teacher/tutor fosters a higher degree of responsibility for learning in

the student, which in turn is seen as increasing performance and quality.

Laiken (1986) has expressed similar principles and conditions for successful adult learning, stressing especially that learning needs to be meaningful and relevant, which is realized by creating a comfortable atmosphere, by employing co-operative and collaborative strategies, by involving students' personal experiences, by being aware that learning might be a slow process, and by making the students take on a reasonable amount of responsibility for their learning. She further emphasizes that "learning occurs most effectively within a structured framework, with room for personal creativity" (p. 1)

College and University distance education courses are usually directed toward the working adult and assume that the student is a self-directed, independent learner. The concept of self-directed learning implies that the student is capable of self-motivation, possesses efficient and effective strategies, approaches and tactics for learning. Garrison and Baynton (1987) link independence to the concept of control, which has the three dimensions of power, independence and support. They argue that

"Control can be achieved only by striking a balance between independence and other basic elements (i.e., power and support) in the learning process through the process of two-way communication between teacher and student. . . . It is the dynamic balance among these three components that enables the student to develop and maintain control over the learning process."(p. 5).

The implication of this dimensions of control brings forth a crucial point for the design of activities and materials in distance education, namely that independence is fostered through support systems allowing enough two-way communication to make the educational transaction beneficial, which, they state "... goes beyond simply deciding what is to be learned" (p. 14). Modern telecommunications could help satisfy such a demand.

Although adults are usually quite comfortable with the independent mode of studying, progressive intervention strategies should and could be built into distance materials, to encourage the less skillfull student to become more independent and responsible for his/her own learning (Brookfield, 1986). Knowles (1980) distinguishes between 'andragogy' and 'pedagogy' by pointing out that adults come to the learning situation, if not with factual knowledge, at least with a large amount of knowledge gained through experience. He, therefore, claims that adults as compared to children, often show a need to be able to exercise self-direction. Further, Knowles declares that where children are basically subject-oriented, adults appear to be performance centered, which becomes a factor in designing distance education materials and courses.

*Motivational Issues.* On the same line of thought Bohlin, Milheim and Viechnicki (1994) state that most adults are initially subject- and performance oriented, which they found, lead to an increased level of motivation. They further propose six principles in designing adult instructional activities that would promote increased motivation by applying Keller's ARCS's model (1983). They summarize these principles as follows:

- "(1) progressive task difficulty,
- (2) assignments that allow the learner to apply the learnt material to their own context,
- (3) provide feedback that links success to ability and effort,
- (4) give supportive feedback to students lacking in confidence,
- (5) increase the perceived relevance of the learning by providing opportunities for learners to set and achieve high standard of excellence,
- (6) provide instructional examples that relate to possible real-life situations" (p. 13).

Accordingly, guidelines for instructional design directed towards the adult or mature student population support ideas advanced by earlier scholars of andragogy like Knowles (1980), and clearly suggest that instructional activities must be anchored in reality and preferably in the student's own field of work or interest. It can then be inferred that instructional activities must be flexible in terms of learning tasks, and that these activities must supply links to the individual student's possible experience. An underlying assumption here is that students register for a course because of some interest for the content of the course, which then becomes the common denominator to which instructional activities must cater (Furst & Steele, 1986).

However, this assumption is challenged by Houle's 1960 study of (in Darkenwald & Merriam, 1982) adult's reasons for studying. He found three main types of reasons which he used to describe three different types of adult learners:

"The first, or, as they will be called, the *goal-oriented*, are those who use education as a means of accomplishing fairly clear objectives. The second, the *activity-oriented*, are those who take part because they find in the circumstances of learning a meaning which has no necessary connection, and often no connection at all, with the content or announced purposes of the activity. The third, the *learning oriented*, seek knowledge for its own sake." (p. 133)

Interest in this classification scheme led Boshier and Collins (1985) to carry out a meta-analysis on studies applying the Houle's typology. Their results suggest that adult learners can be categorized according to six contributing factors to successful and motivated adult learning: Social Contact, Social Stimulation, Professional Advancement, Community Service, External Expectations and Cognitive Interest. In turn, Houle's goal-directed learner appears to be highly related to the Professional Advancement factor, whereas the learner-directed student correlated highly with the Cognitive Interest

factor. The activity-oriented learner, on the other hand, distributed evenly among the four other factors, so that no clear conclusions could be drawn. However, these studies suggest that students differ not only in respect to initial orientation to learning, but that motivational factors play an important role. Therefore, it would seem conceivable that adults could be motivated by activities that tap into one or several of these factors essential instructional design when dealing with adults, whether in face-to-face instruction or in a distance education mode.

McCombs (1984) has designed a program founded on the theoretical idea that intrinsic motivation and learning success are intimately and positively related. Building on theories of competence motivation, developed from self-efficacy, self-attribution and self-regulation theories, a teachable, generative model of processes and strategies was defined as the underlying ability to generate enough intrinsic motivation not only to learn, but also to continue to learn. She distinguishes three levels of awareness strategies at the dimension of both the student's affective and cognitive systems. At the task initiation level, the student is prompted to become aware of his/her own cognitive style, approaches to studying, and perception of outcome expectations. In the task engagement phase, the student is taught information processing strategies and re-evaluation of personal control, efficacy, self-management and expectations. The task completion level emphasizes the idea of evaluating overall performance, self-efficacy and self-control. Harri-Augstein and Thomas (1990) have developed programs of this type, relying on the theoretical work of Maslow (1954) and Rogers (1969), where skills of self-evaluation/organization are built into the instructional materials and activities. Practice and awareness of these cognitive skills are claimed to produce more independent, skilled and self-organized learners.

Within the same realm of thought, Pask (1975; 1976) believes that students can change and develop their supposedly 'innate' abilities with time and practice. He explored and described learners in terms of how they process information, and discerned two main types of learning, the comprehension approach to learning with a holist strategy, and the operation approach to learning with a serialist strategy when solving problems. The former is often matched with 'a description building to understanding' whereas the latter would typically use 'a procedure building to understanding' and solving problems. Each of these types might develop pathologies, the holist by globetrotting (over-generalizing without evidence), and the serialist by improvidence (over-cautious reliance on detail). According to Pask a third type of approach exists, the versatile approach, which is the one he sees as the most successful. The versatile learning approach implies the capability to successfully switch from 'a procedural building approach' to 'a description building approach' and vice versa depending upon what the situation requires. The versatile approach is usually regarded as the most successful approach to academic study. Pask also suggests that a person usually starts out as one particular type but, with time and adequate training, could progressively develop into a versatile learner if this training is built into the learning environment and materials (Pask & Boyd, 1987).

Closely related, and also building on the information processing model of learning, is Schmeck's (1981) 'deep-elaborative processor' and the 'shallow-reiterative processor'. Schmeck found that the 'deep-elaborative processor' learns faster, has better memory, and higher grade point average, and he suggests that both class and homework exercises should require an active and elaborative engagement in the task. He further believes that, apart from the individual's personality traits, the style, approach, strategy, and tactic inherent

in a 'deep-elaborative' approach, can be taught and developed from specially designed tasks and activities.

Relying on cognitive learning theories, Marzano (1992) described learning as five interlocking dimensions. On the psychological plane, he designates the influence of attitudes and perceptions as one level, and the "habits of the mind", closely related to learning style and intrapersonal skills, as the cognitive level of learning. Moreover, at the cognitive level there are three dimensions of learning which pertain to the acquisition and integration of knowledge (dimension 2); to the extension and refinement of information (dimension 3); and to the meaningful usage of the knowledge (dimension 4). Dimensions three and four include the higher-order learning skills as defined by Bloom (1968), that is the ability to analyze, synthesize and evaluate information. He goes on to state that cooperative learning groups using the task specialization approach (each member specializes on a specific task), and peer feedback, act as agents for increasing the meaningful usage of information as well as extending and refining the existing schemata.

It could be argued that one of the main goals of higher education is to enable a student to apply, analyze, synthesize and evaluate content information in his/her specific domain of knowledge or field of study. Bloom's (1956) taxonomy of learning skills, running on a continuum from knowledge acquisition to being able to analyze, synthesize and evaluate information, gives a framework for organizing the cognitive activities that would promote independent and active learning. Brookfield (1986) has developed a set of principles or prescriptions for effective practice among adults building on cognitive theories of learning, where emphasis is put on relying on previous experience as a resource for better learning gain. Principles such as mutual respect, action and critical reflection in terms of

peer interactions, rephrasing and reforming of content are the major elements of a collaborative strategy, that could possibly also promote independent and responsible action for learning (Pugh, 1993; Joughin & Johnston, 1994).

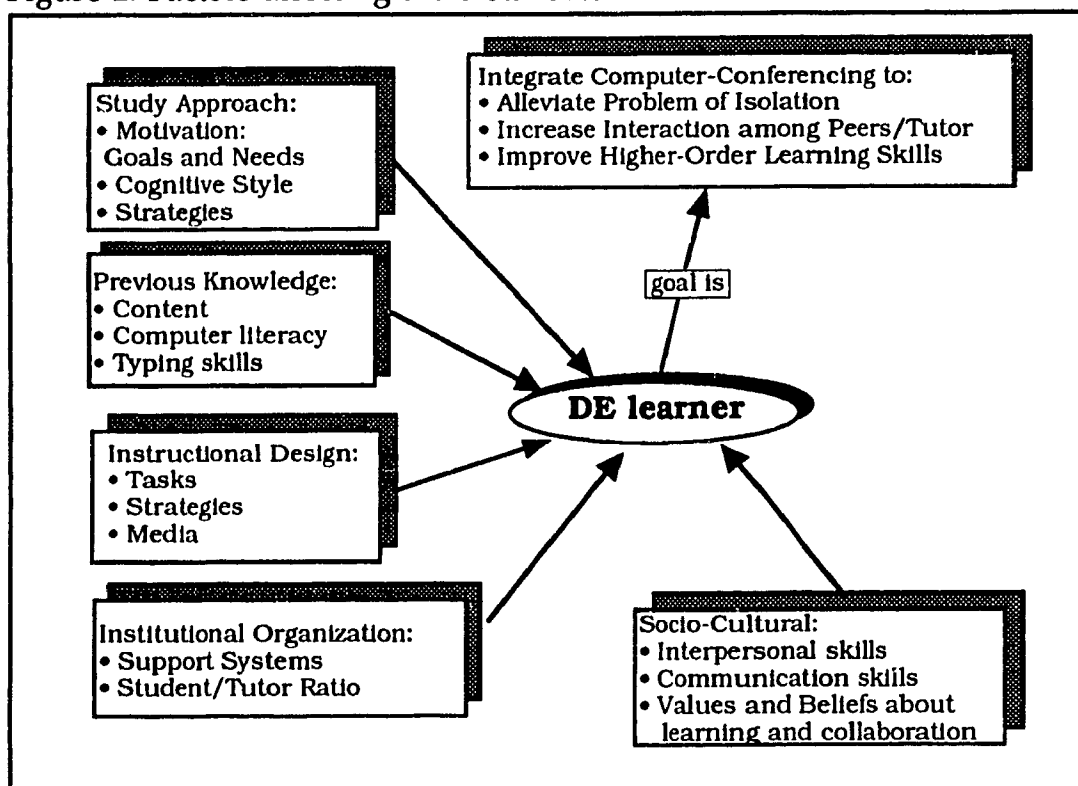
The above ideas and theories indicate that although a learner might possess some apparently deeply habituated personality traits, which might be in disagreement with successful academic study, instructional activities can be designed in such a way that they encourage and progressively develop a 'deep-elaborative' and independent approach to studying and understanding of course content. Moreover, these studies appear to indicate that the adult learner can grow from dependency to independency faster than a child, because first of all they come to study with a larger portion of motivation and secondly because they have already as adult citizens experienced both problem solving and responsibility in their daily life and work. The Newcastle medical school can be mentioned as an example of such an environment where they define and diagnose 'independence' in terms of how well students can (i) formulate the problem, (ii) ask and refine appropriate questions, (iii) effectively use resources, (iv) answer the questions posed, and (v) evaluating their educational experience (Feletti, 1982). Findings suggest that students develop a higher degree of responsibility for their own learning and intrinsic motivation.

Summarizing the impressions from and about distance learners, it appears that distant learners are choosing this mode of study because of the freedom from organizational structure, such as going to class at a certain time in a specific location and studying at their own pace. The negative aspects of offering education at a distance are that it does put higher demands on the distant student compared to the on-campus student in terms of being self-



directed and self-organized to succeed. The distant learner must also be highly motivated to learn by her/himself, and possess good reading and study skills. On the other hand, these demands might be too high causing students to drop out. Some of these perceived problems can be alleviated through the use of diagnostic inventories and through the social contact made possible by CC (Figure 2).

Figure 2. Factors affecting the distant learner



### The Distance Education Context

The distance learning context in itself places very different demands on teachers, students and the institutional support structure, as compared to on-campus face-to-face arrangements (Gunawardena, 1991, Beaudoin, 1995; Keegan, 1990; Holmberg, 1983; Hayes, 1990; Boyd, 1993). Typically, a distance education student receives a package containing a study guide, pertinent readings, written assignments, assignment deadlines, and dates for official

exams (Wells, 1993; Verduin & Clark, 1991; Keegan, 1990). The assigned tasks are to be completed within a certain time frame, although within this period the tasks can often be carried out independently, that is, in the student's chosen time, space and preferred pace. However, materials are often overly structured to facilitate the processing of the material, leaving little or no flexibility for the student to elaborate on his/her own regarding tasks and activities. Overly structured materials have often been criticised, since it appears to rather create teacher dependency than fostering critical thinking and self-directed learning skills, which are necessary factors for successful distance studying (Beaudoin, 1990). In terms of teaching, the distance student is assigned a tutor who mainly provides some telephone assistance, and a grade accompanied with written feedback for individual assignments. Frequently this format of distance education provides some individualized learning support, mostly mediated by telephone conversations; however it is still reported that distance education students feel alienated both from their tutors and peers, thus increasing the percentage of drop-outs in DE (Keegan, 1991; Holmberg, 1983).

Powell, Conway and Ross (1990) propose a multivariate model for analyzing success and persistence in distance education, which looks at the interaction among predisposing learner characteristics, institutional factors and life changes on success versus failure. They found that a substantial amount of the variance was explained by the student's inherent *learning style* and approach, suggesting the early diagnosis of "at-risk" students by using, for example, study habit inventories, time management inventories, reading ability tests and also ergonomic factors (e.g., Do you have a study place?). Students need for support and social contact should also be diagnosed. Further, they suggest that although you cannot train or change learning

styles, training or awareness programs should be built in to the materials to eventually reduce drop out rates.

In her deliberations on the evolution of distance education, Amundsen (1993) describes a shift in thinking about distance education, from the obvious separation of teacher and student, to the utilization of technology to facilitate two-way communication. Precautions must be taken to progressively change the role of the learner, from being not only an autonomous, independent learner but also a progressive, and problem-solving learner in a post industrialist society. This new framework of looking at distance education shifts the role of the teacher/tutor from being the structured authoritarian leader mediated by the 'study guide' and a grade on an assignment, to that of a collaborative facilitator that discusses and argues around content to improve deep-level understanding. Further, she stresses the importance of the type of content in relation to instructional tasks. For example, some content is highly specialized and competence-based which in turn requires high structure, whereas content that is of 'low-structure competence' might be better learnt in a collaborative environment where dialogue is not only possible but emphasized.

Hamm & Adams (1992) looked at formulating, clarifying, and summarizing information as the collaborative dimensions of learning that would lead to a gradually increased ability to analyze, synthesize and evaluate information. They further assert that designers of instruction must provide activities that foster cognitive flexibility by avoiding introductory and oversimplified approaches to teaching and learning, forcing the student to adopt a deep elaborative approach.

Closely related to collaborative learning is the concept of shared learning (Adler, 1991), which refers to the process of how people manage information

and how they communicate information, that is, how decisions are made, how a problem is solved and/or how information is intelligibly synthesized and communicated. Adler identifies three levels of shared learning: (a) the cognitive/intellectual exchange of declarative knowledge (facts); (b) the communication and transfer of information (e.g., procedural knowledge, helps in understanding and applying relevant knowledge resulting in solving problem/task); and (c) the organization and structuring of the groups and the learning tasks.

The central point in Bates (1991) argument for the design of distance education learning environments is that, it is crucial to adopt a selective decision-making process for each type of distance education model and the technology supporting it in light of the costs involved, training, and the uniqueness of the situation (e.g., it would probably be useless to introduce CC in developing countries). He asserts that since the lack of convenient and effective interaction for independent learners has always been a weakness of the industrial model of DE it is imperative to put more effort into the integration of interactive technologies. These efforts include careful assessment of the learner, the course content, the tasks and the learning outcome, again emphasizing normal instructional design principles to bring about the successful integration of media.

The advancement of computer technology is an important factor attempting to shift the distance education context from a solely independent learning environment to a collaborative learning environment. Audio-, computer- and video- conferencing are the main technologies allowing the learner to keep the freedom of time and space, as well as to some degree benefiting from a simulated face-to-face environment. Each technology has its own set of characteristics which can be seen as a potential resource for

building collaborative learning environments. Each technology also has its own drawbacks, which should be viewed in the light of learning gain and cost (i.e., teacher/tutor/learner training and equipment). Both audio- and video-based communication are still time dependent, whereas CC is both time and place independent and quite affordable (see Table 1, p. 28).

The distance factor in itself minimizes both qualitative and quantitative interaction with both tutors and peers. To remedy this gap, many distance education institutions complement their student package with videos, narrow-or broadcast television, teleconferencing, on-line libraries, e-mail, computer-conferencing and/or world wide web pages (e.g., Open University; Guelph; OISE; University of South Queensland) to open up the possibility of enhancing course content, and to increase both qualitative and quantitative interaction.

### Electronic Communication

*Definition, advantages and disadvantages.* Computer Conferencing (CC) can be defined as a 'classroom' mediated by the computer, where people can exchange ideas in writing. CC has already been applied in a wide range of subject matters, varying from undergraduate physics, computer science, group performance skills training, history and archaeology to graduate distance education courses, engineering training and media studies (Wells, 1992; Hiltz, 1987; Harasim, 1989). CC has been used as a complete replacement to face-to-face lectures, as a support unit to enhance certain components within a course, as a discussion forum for students, for course administrative issues, on-line journals, and student counseling. It has been found to be especially useful in terms of discussion, brainstorming activities, problem-solving, collaborative work and reflective contributions based on special preparation. It has also been

Table 1. Advantages, Weaknesses and Basic Instructional Functions of Media in Distance Education

Type of Media	Advantages	Weaknesses	Basic Function
<b>Broadcast Television</b>	<ul style="list-style-type: none"> <li>• cost-effective</li> <li>• readily available</li> <li>• motivational                             <ul style="list-style-type: none"> <li>- visualizes content</li> <li>- enhances content</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• time dependent</li> <li>• often lacking high quality features such as:                             <ul style="list-style-type: none"> <li>• segmentation</li> <li>• indexing</li> <li>• pre-post activities</li> </ul> </li> <li>• availability on videocassette</li> <li>• appropriate (for all) broadcast time</li> <li>• one-way communication</li> </ul>	<ul style="list-style-type: none"> <li>• visualization of material</li> <li>• explanation of abstract concepts</li> <li>• familiarize student with faculty to provide sense of belonging</li> </ul>
<b>Home Video</b>	<ul style="list-style-type: none"> <li>• time independent</li> <li>• low cost</li> <li>• same as television broadcast</li> </ul>	<ul style="list-style-type: none"> <li>• demands high quality to be useful</li> <li>• same as television programming</li> <li>• one-way communication</li> </ul>	<ul style="list-style-type: none"> <li>• enables elaboration by going back and forth</li> <li>• study at your own pace</li> <li>• study at your own time</li> </ul>
<b>CMC</b>	<ul style="list-style-type: none"> <li>• two-way</li> <li>• social communication (one to or many to many)</li> <li>• asynchronous, allows for both spontaneous and reflective learning response</li> </ul>	<ul style="list-style-type: none"> <li>• requires technical training</li> <li>• requires computer equipment</li> <li>• still high costs at distance</li> <li>• needs firm organizational structure (avoid information overload)</li> </ul>	<ul style="list-style-type: none"> <li>• administrative information board</li> <li>• faster feedback</li> <li>• enabling training of higher-order learning skills</li> <li>• counselling</li> </ul>
<b>Multi-Media Courses</b> (The above plus study guide, on-campus meetings)	<ul style="list-style-type: none"> <li>• two way communication enhanced (CC-feedback)</li> <li>• supplementary (Video)</li> <li>• complementary (Study-guide)</li> <li>• synergistic (integration)</li> <li>• promotes collaboration (CC)</li> </ul>	<p><b>Demands on institutional organization</b></p> <ul style="list-style-type: none"> <li>• higher costs of staffing</li> <li>• learning centres to train people</li> <li>• provide hardware and software</li> <li>• "groupware" application to facilitate communication and collaborative skills to avoid message overload</li> <li>• technical and computer training sites</li> </ul>	<p><b>To visualize, explain, promote active learning of basic material</b></p> <ul style="list-style-type: none"> <li>• guidance and counselling</li> <li>• faster feedback</li> <li>• peer and tutor contact</li> <li>• gives sense of belonging since faculty, staff and on-campus students could be presented and contacted</li> </ul>

used as a research tool to investigate different types of communication, interaction and group dynamics (Shedletsky, 1993).

A CC system can be described as a special kind of database, where the data are the messages organized into conferences and topics having a specific storage architecture to facilitate navigation. The conferences are either closed (limited access) or open, allowing groups of people to work discretely (Mayer, 1985). Most CC systems provide descriptive information such as the date the conference was created, a short narrative about the purpose of the conference, information about members, etc. All systems allow for effective searching of messages, adding, downloading, uploading and sending mail to either one person or to a group of people. Other features often found in these systems are on-line tutorials and help functions. In the last few years CC systems start to incorporate graphical capabilities as for example FirstClass and RAPPORT. The most argued disadvantage with CC systems is the lack of para-verbal expressions pertaining to human contact. Recent research projects aimed at enhancing these systems by providing an audio-visual link through integration of video to a desktop computer (e.g., PANDORA) in order to "...recapture some of the flexibility and human warmth that electronic communication has lacked." (Brittain, 1992; p. 44) This might be the systems of the future. They are seen as assisting group discussions and decisions of people far apart, in an instantaneous mode.

*Types of CMC.* Six major types of CMC can be distinguished: electronic mail systems (i.e., e-mail), bulletin boards (BBS), computer conferencing systems (CC), on-line access to library services, groupware and lately the World Wide Web sites on the Internet. The choice of communication software is important, since integration of advanced features for manipulation of multi-modal messages and facilitation of navigation within

each of the CMC system varies. Each has its set of characteristics, strengths and weaknesses that suggest facilitation of certain types of content and instructional strategies. The equipment required to use all types of CMC systems is a computer, a modem with a telephone line connection, and a communication package (Fraase, 1991). A brief description of each system is provided in Table 2 (p. 31). It should be pointed out that the trend is to incorporate all functions in to one system.

*CMC in Distance Education.* Dede (1990) portrays a change in terms of "technological, demographic, economic, political and pedagogical forces" (p.248) driving the evolution of DE into an interactive, alternative form of learning. In relation to technological advances, major efforts are put on merging technologies, satellite television, computer conferencing, fax and interactive video, all with the intent to enhance instruction. Further, he points out the growing affordability and power of these "synthesizing devices" (p.249). In terms of demographics he contends that DE can answer a learning need when there is a problem of "scale" (i.e., not enough students in one location), rarity (i.e., an instructional speciality not locally available) and "cognitive and emotional style" (i.e., counseling and homogenous group contact can be arranged through conferencing systems without face-to-face meetings) (p.250). To counteract the emotional and psycho-social isolation often resulting in high drop-out rates, he contends that recent findings in cooperative and collaboration strategies are found to have a positive effect. He says that a futuristic distance learning environment "...will expand from the classroom to the world and from individual insight to collective intelligence" (p. 262), which is made possible through the selective use of new interactive technology able to satisfy needs according to the type of learner, content and context.



Table 2. Description of the main characteristics for each type of CMC

Computer Mediated Communication	Description
Email	Electronic mail systems were the first to exist and displays the characteristics of normal mail, that is, you send a letter to one or many people and you receive answers on a one to one basis. The letter is stored on a mainframe, the receiver is notified of new mail, and the sender is notified when the message is received. All letters have dates, times and a subject declaration.
Bulletin Boards BBS	Bulletin boards are information centers where questions, suggestions and answers are posted by members of a specific interest group. It is usually organized into topics where scanning and simple "search and find" manipulations are available. Both uploading and downloading is possible. Its largest problem is information overload.
On-line Libraries	On-line libraries are data-bases of the content of a University's library that allows students to search for books, articles by author, year, publication, title, or key words, from their home. To render these systems useful in DE contexts they are connected to a public library capable of offering a loan service. To effectively use these type of systems an initial learning effort of how to search is necessary, interfaces are not yet self-explanatory.
Computer Conferencing	Many different conferencing systems exist, but a common characteristic is that they are organized into open and closed conferences. The conference, serving as the discussion room, can further be divided into topics and sub-topics for easier monitoring of the interaction. A personal mail system, some 'search and find' manipulations, up and downloading facilities similar to the email and BBS systems are included. Most CC software provides some navigational and cross-referencing commands. Recent CC systems include wordprocessor-like editors, graphical capabilities, and menu driven commands, which makes them extremely user-friendly.
Groupware Systems	These are basically integrated applications, such as databases, search and navigation tools and graphics, that facilitate the manipulation of information in a way that it lets each group member take control in linking and piecing information together; or as Fraase (1992) puts it "Groupware is about people managing their collective information resources" (p.47). Theories of cognition and neural networking are the design models these programs (O'Brien Holt & Howell, 1992; Fraase, 1991; Dyson, 1992).
Web Pages on Internet	Webpages are more like a one-way communication, a bit like television with millions of channels. This system includes text, pictures and video clips, which can be downloaded for personal use. Specific to this system is that it allows for flexible reading through a hyperlink interface, which lets the reader choose what and what not to read. Distance education institutions are beginning to use this type of CMC by posting course outlines, articles, and special information about a course.

Gunawardena (1991) investigated the current uses of communication technologies in DE, and found that of the 49 institutions focusing on college education 76% used television (open-broadcast) and 71% videocassette as their primary medium for delivery of instruction, suggesting that this is a medium that is both affordable and widespread. It is interesting to note that 45% of the institutions used both audio and video conferencing as a means of delivering instruction. Computer-mediated communication was seen as an excellent student support medium by the 39% that used it, where the major advantage was seen as simplifying and facilitating asynchronous interaction between instructor and learner, and among learners. Radio (22%) emerged as the least popular device for the delivery of instruction. Only one of the institutions had an on-line library service and indicated that it was difficult to motivate the students to use this facility. One discernible reason for this lack of use, was that it required readily available computers, modems and basic knowledge of how to manipulate these devices, a lack of trainers plus high costs. On-line libraries were, however, seen as becoming one of the most common uses of CMC. Another emerging trend in DE is the establishment of study centres (41%), providing computers, library resources, toll-free counseling and computerized feedback. Gunawardena argues that to successfully use a multi-media approach to DE the basic instructional design must change. She states that if instructional strategies are to help students learn effectively from these type of media, high quality programs must be developed. The CMC facilities must also be integrated with student support services, such as learning centres, telephone counseling and computer-conferencing.

*CMC and Learning.* Computer-Mediated Conferencing brings new opportunities for collaborative learning and promises of changes and improvements in the quality and nature of learning interactions, contributing to new ways of conducting teaching and learning activities (Harasim, 1989; Joughin & Johnston, 1994; Gamson, 1994). In collaborative learning models, the learners are essentially viewed as active participants constructing knowledge through a process of an interactive dialogue among peers and with the tutor. Bouton and Garth (1983) argue that providing students with opportunities to create ideas, share them and receive reactions through computer-mediated discussions will actually optimize and enhance learning outcomes.

Other advantages of CMC are that it favours individualized feedback and contact with both tutor and peers; it allows and promotes reflectiveness because of its asynchronic nature; and it permits students to choose a convenient time for communication (Harasim, 1989; Boyd, 1991). Another function of CMC systems is its capability of collecting messages for later retrieval, using it as a database on a specific subject. Major disadvantages are the cost and availability of hardware and training (Haile & Richards, 1988), and the lack of para-verbal and graphical expressions (Boyd, 1991).

Another much discussed aspect of CMC systems is the question of how to filter and structure the overload of messages which is an often occurring problem in on-line activities. Dicks (1992) proposes AI-techniques enabling the system to "develop profiles of communicators, to restrict communication ...to a useful subset of communicators" (p.41), to guide the user in "who to communicate with, and which information to consult" (p.41), and to focus, leading to an individualized guide tailored to a specific purpose. The World Wide Web system is a start in this more "intelligent" manipulation of

information, by its instant hyperlinks creating chains of knowledge that can be saved and reused, as well as advanced search mechanisms. Recent CC software such as FirstClass (1995) or Cosy 400+ promise positive changes for the future, going from text-based only to images and text based systems, from command line user interface (CLUI) to graphical user interface (GUI).

Although the hardware/software technology is not yet by any means flawless, and is often hard to use because of the lack of appropriate interfaces, Haile and Richard (1988) report that 90% of the students were positively inclined to use the CC system, 86% interacted with other students, 82% joined other conferences, in a off-campus course using a CC as a supplementary device to enhance instruction. On the average, it is reported that well over 70% of the students found computer conferencing motivating because it allows for peer assistance of homework and the sharing of ideas, with both the group and the tutor. Ninety-one percent thought that on-going access to a tutor/moderator was a great advantage, however most of the moderators agreed that keeping up with messages was hard, stressing that an overload of information hinders the creation of worthwhile conversation. Both on-line tutors/moderators and students agreed that it would be even more beneficial and enjoyable if an introductory workshop was given prior to the course.

Kaye (1987) emphasizes the importance of the role of the moderator in CC by suggesting that the content is well structured and limited (e.g., length of messages should not be more than two screens) by the moderator, as well as the use of small discussion groups, where one student at a time 'presents' and the others react. These are some of the methods to tackle the problem of scale in large DE institutions (e.g., Open University in Britain). Further, he believes it is essential not to just integrate CMC as an adjunct to normal correspondence courses, but to incorporate it to its full potential. He suggests

that the potential of the system also lies in (1) gathering student feedback/evaluation data of the course components, and (2) the benefits of a tutor briefing conference, where general announcements can be administered as well as discussed on an ongoing basis. He supports the twofold utilization of CMC as both an organizational tool for DE institution and a learning support tool where the social dimension of learning is accounted for.

Harasim (1987) defines collaborative learning-teaching strategies as 'decision-making, problem-solving and knowledge networking'. Harasim contends that CC is an asynchronous, distributed, collaborative and interactive medium that has the potential to increase active participation, equitable communication, information sharing and cognitive problem-solving strategies. Further, groups working collaboratively promote a cooperative structure, although all tasks might not be done by everybody. Instead sub-tasks are consented upon and solutions are provided and discussed, progressively fostering the necessary skills of synthesizing, communicating and criticizing information. She also outlines limitations of CC mainly pointing out the lack of sound, graphics and video (now underway, see Brittain, 1992), as well as the difficulties of managing the constant flow of information, and the lack of support systems for collaborative techniques (decision-making, problem-solving and knowledge networking tools).

### Collaborative Learning Environments: Structures and Strategies

The basic idea behind a collaborative learning environment is that a group of people work together towards a common goal. Therefore, group dynamics based on knowledge from the cooperative learning literature, both in terms of

education and organization becomes an integral part of the instructional design.

There are many definitions of a group. Some emphasize a common goal, some stress interests or psychological functions, and some see a common organizational structure as the concern that makes up a group (Shaw, 1981). In education, however, one could define it according to several of these concepts. An educational group is thus a group getting together during a limited time and with the common goal to learn some content through interaction. In terms of organizational structure, educational groups could be either teacher or student moderated (peer teaching) largely depending upon the type of content that is to be learnt.

#### Theoretical Underpinnings of Group Dynamics.

Lawler, Nadler & Cortlandt (1980) define groups/organizations as human systems composed of activities and people performing in an intentionally coordinated manner to achieve some goal. Further, they argue that understanding organizations and groups implies the collection of valid information in order to produce predictive control. To do so a holistic perspective with a whole range of variables contributing to the behavior of the organization/group has to be taken into account. They propose the following levels of inquiry to be considered for assessment of organizations:

- Tasks or the common goal divided into sub-tasks executed by smaller groups or individuals. In turn sub-tasks lead to certain organizational demands on the type of structure, needed capabilities and reward systems.

- Individuals. An area of measurement pertaining to the individual's skills, training, abilities; psychological needs, drives and motivation; individual's perceptions, attitudes and behavior.
- Groups. Group dynamics. Capability to solve and/or perform tasks.
- Formal Structure. Included are: the nature of organizational structure, leadership practice and control and co-ordination mechanisms.
- Informal Structure. Refers to the relationships, structures and processes that grow around the formal setting over time.
- Environmental factors. Relates to resources that inflict constraints, demands and opportunities.
- Output factors. Refers to the nature and quality of outputs of the behavioral system of the organization. They propose two sets: The task related and the individual impact side (such as job satisfaction, health and total quality of work life).

For instructional design purposes in DE using CMC, these variables implicate both group structure, dynamics, size and on-line course design. It could be argued that for a group to work collaboratively and obtain satisfactory shared learning, ways of assessing general group productivity has to be addressed. Moreover, they assert that if these variables are measured then they must be conveyed to members in order to increase performance. Bouton and Garth (1983) argue that providing students with opportunities to create ideas, share them, and receive reactions through computer-mediated discussions, will actually optimize and enhance the learning outcome.

Another aspect of group work to consider when designing collaborative learning environments is that groups usually develop their dynamics in phases, where each phase or stage appears to depend on type of task, cohesive

pattern and level of productivity. Greiner (1972) proposed a model where small and new groups grow through: 1) creativity followed by a leadership crisis; 2) direction followed by an autonomy crisis; 3) task delegation followed by a crisis of control; 4) coordination followed by a "red tape" crisis (i.e., bureaucracy); and 5) collaboration leading to an unknown crisis. Although, Greiner suggests that the crisis following collaboration arises from psychological factors, which cause "burnout" and "death" or "renewal" of a group. Moreover, he stated that these phases are approximations, but the mere knowledge of them could help group managers (tutors/teachers/moderators) foresee problems and plan ahead to avoid collapse.

Bales (1950) investigated groups in this sense, and observed three phases: orientation, evaluation and decision making. Each phase displays the need for cohesive behavior which has the potential to increase the group's performance. His scheme for diagnostic assessment of cohesion is complicated and demands direct observation. The ideas behind this type of assessment used for formative or diagnostic purposes shed light on the importance of maintaining both social and cognitive group cohesion. The main point about the scheme of evaluation is that a map of 'giving and asking for information' is reported back to members. To have an effect this feedback must be followed by a discussion of eventual problems. In this way, problems of cohesion can be dealt with and corrected, which in turn is seen as enhancing group productivity, which is the goal.

Similarly Tuckman and Jenson (1977) expressed a group's growth by forming, storming, norming, performing, and adjourning, well defining the different stages or phases that a group typically goes through. They also emphasize that the mere knowledge of these phases facilitates the work of the facilitator or moderator of the group activities.



Together these findings about group dynamics warrant serious thought for the design of instructional on-line activities using the small group format. It can be presumed that for a group to be productive these kinds of phases must be respected and planned for. Further, it also indicates that group members must be made aware of the group's behaviours through evaluation of cohesiveness, to enable a higher degree of group productivity.

Schrage (in Fraase, 1991) defines group collaboration as "the creation of shared meaning about a process, a product or an event..". He further distinguishes two types of collaboration, formal and informal. Formal collaboration refers to structures, procedures and processes. Informal collaboration refers to the way we interact, creating social and cognitive cohesion. Collaborative work is usually manifest in problem solving, creativity and discovery. Finally, he proposes five limitations or constraints in which collaboration must operate.

- Expertise: defines the reason for collaboration, a task is too great for a single person (i.e., the student cannot learn everything by him/herself, and so needs direction and interaction).
- Time: collaboration takes place synchronously or asynchronously. For success, time has to be addressed appropriately depending upon the urgency of the task (e.g., course length, importance of objectives, deadlines).
- Money: the most obvious cost of CC is to provide for hardware and to ensure access thereof.
- Competition: pressure must be addressed (e.g., evaluation of group cohesion, flexible deadlines).

- Synergism: refers to the valuing of group work and cooperative techniques and the potential synergetic product where the goal is collaboration.

He points out that peak performance in collaborative work groups occurs when members recognize that the task is too big, and that they realize a need for peer tutoring or interaction. Schrage concludes by stating that performance thrives through argumentation (i.e., explicitly expressing and debating ideas), and where members learn to accept, respect and value different points of view or, as expressed by Berge (1995), "Teaching and learning using discussion relies on a learner-centered, collaborative, and egalitarian relationship - a sharing of thoughts and ideas"(p. 24).

Adhering to the belief of the educational benefits of collaborative learning leads to several areas of investigation in terms of group dynamics, that is, which factors make a difference in assisting the learner to do well? In terms of group dynamics this thesis focuses on moderator intervention techniques and group formation strategies and their influence on the affective domain, as well as in the cognitive domain of learning. The success of these techniques and strategies is often measured in terms of group cohesiveness and perceived productivity, as well as learning gains according to either group grades, individual assignments, number of idea units contributed or a summative exam.

*Group cohesion* can be loosely defined as "The resultant of all those forces acting upon group members to remain in or to leave the group" (Festinger, 1950 in Shaw, 1981; p. 454;) or "factors that make the group hang together" (p. 213), however leaving a lot of room for interpretation to the reader. More precisely Festinger goes on to pinpoint three meanings that have been attached to the term group cohesion; "(1) attraction to the group, including

resistance to leaving it; (2) morale, or the level of motivation evidenced by group members; and (3) coordination of efforts of group members" (p. 213). If cohesion is seen as only attraction, the most common measure is a usually very simple sociometric test, where group members are asked to tell how much they either would like to work with another person or how much they appreciated working with other members of the group.

A more implicit method was developed by Hill (1969), where group members were asked to tick off a number of positive and negative behaviors that occurred during a group session. An index was then calculated on the number of positive and negative behaviors that group members indicated, suggesting that the higher this index becomes the more cohesive the group was seen to be.

The relationship between group cohesion and productivity appears evident at first, but several researchers (Shaw & Shaw, 1962; Seashore, 1954, in Shaw, 1981) have found that if groups are highly cohesive it could actually impede productivity, as in the case with school children where the goal to become socially compatible overshadows the educational goal. However, according to Cattell's syntality theory (in Shaw, 1981; p. 19 - 22) which claims that the energy or the synergy of a group, that is the group's behaviour is more than the sum of the group member's individual contributions, but dependent on high cohesiveness. Further, he suggests that if high cohesiveness is established, it most often translates into a more productive group.

*Group productivity*, on the other hand, refers to how well the group members use time, develop and contribute ideas, make decisions and the degree to which members participate in carrying out a task (Abrami et al., 1993). Group productivity can be measured or evaluated as a rating on a

perception scale, observed behaviour, a group grade, the average group grade, participation rate, an average of individual grades or a grade/score on a summative test taken after the group sessions. It can also be assessed in terms of statements on a Likert type scale, going from very negative to very positive statements describing what happened in the group. These types of group productivity instruments are used in the cooperative movement as formative tools to make students reflect on their group work in order to improve performance. They have also been used as research tools, shedding some light on how students perceived group work as well as how they were productive in terms of a cognitive test.

*On-line Activities.* To create instructionally sound collaborative tasks for on-line use, several factors must be taken into account. First, to ensure a high participation rate, initial tasks must be extrinsically motivating, such as a grade for message contribution and the number of times logged on, but also easy to carry out, like answering direct content questions. With increased use of the system, intrinsic motivation usually takes over making the student curious of others inputs and the satisfaction of being able to manage the system with ease (Mason, 1988; Lundgren, 1989; Lundgren, 1993). Once initial technical problems are overcome and the student no longer has to spend most of his/her energy on manipulating the applications, more gratifying activities can be designed.

Wells (1995) strongly suggests that it is crucial to choose material where discussion of a topic is an instructional priority. That is, on-line discussion tasks should encompass content areas where more than one opinion or ambiguity is present, or where the content area is large enough that several sources of information must be considered. These types of tasks are seen to create a sense of positive interdependence among students:

"...when gains of individuals or teams are positively correlated. If a gain for one student is associated with gains for other students, the individuals are positively interdependent. Similarly, if the gains of one team contribute to the probability that another team will be successful, then the teams are positively interdependent" (Kagan, 1990, pp.2-3; in Abrami et al., 1993).

Slavin (1983) pointed out that cooperative learning methods have two major components: "a cooperative incentive structure and a cooperative task structure"(p. 431), both are important to create positive interdependence. The incentive as well as the task structure have to be designed in such a way that group members are "allowed, encouraged, or required to work together on some task, coordinating their efforts to complete the task"(p. 431).

Another aspect that has to be accounted for, and which is different from face-to-face cooperative work, is that time and length limitations have to be imposed by the assignment, for them to be efficient and effective. These two research studies suggest that online activities must be limited in time by firm deadlines in terms of when the activity should start, prompts about the number of log-ins per week, and when the assignment is finished. Such constraints seem to work best when teacher imposed (Tagg, 1994; Shedletsky, 1993). In terms of length of messages, not to discourage students with long wordy messages to read leading to overload of information and consequently 'killing' interest, it seems that stipulating 'not more than two screens full of text' is a good measure (Wells, 1995; Burge, 1994; Boyd, 1993; Lundgren, 1989).

In summary, on-line activities must strike a balance between amount of teacher imposed structure versus flexibility, constraints of students time and space, positive interdependence and subject matter. It is of utter importance to successfully introduce computer-conferencing into distance education to overcome the initial anxiety and/or technical problems, that presently appear

inevitable, by instituting either workshops, demonstrations and/or individual help.

*Group Composition and Formation.* Primarily, it has been found that on-line groups work best when group size is within 3 to 5 people (Boyd, 1993; Mason, 1988), which is commonly seen to keep information overload to a minimum and participation to a maximum (see e.g., Wells, 1993). Wells (1995) likens participation rate to a critical mass and states "that insufficient participation can be as deadly as too high an activity level"(p. 1). Consequently different methods exist on how to assign people to small groups depending on class size and material to be learnt. Essentially two differing methods can be used, either random assignment or according to some variable that allows for homogeneity of a group.

A common claim in the group dynamic and cooperative literature is that groups work more cohesively and productively together when learners are allowed to choose their own partners (Shaw, 1981; Abrami et al., 1993). A counterpart to this way of forming groups is to group students either randomly, or by creating either homogenous or heterogeneous groups according to, for example, ability, ethnicity, experience or special interest. The literature is ambiguous on how homogeneous/heterogeneous a group should be to work well. However, it has often been argued that in letting learners choose their own partners, in educational contexts, low achievers have a tendency to choose high achievers but high achievers do not necessarily want to include them (personal communication, Poulsen, 1995). According to Poulsen the other scenario that often prevails is that more aggressive students do the choosing, leaving shy students or latecomers in the last formed group, which has nothing to do with whether they want to work together or not. Moreover, there is evidence that "... academic achievement is

facilitated by (1) heterogeneous ability grouping, (2) sociometric grouping for mutual attraction, and (3) team-teaching methods of instruction" (Shaw, 1981; p.405). Shaw further asserts that team teaching appears to apply equally successfully to adults as to young children. The exception to this finding were teenagers, which he explains that through their struggle to become independent adults, respond better to individualized and structured instruction, than team teaching methods.

For distance education purposes, drawing the major part of their population from adults, it might be inferred that letting students choose their own partners is the most effective way to form groups to ensure better learning (Meloth & Deering, 1994; Morrison & Lauzon, 1992; Mullen & Copper, 1994). On the other hand, it should be taken into account that this assumption relies on findings where subjects know and see each other face to face. This method is time consuming, since the technique implies that students get to know each other's main interests, motivations, goals and aptitudes according to cooperative learning techniques .

*Moderator Intervention Techniques.* A moderator is a person that acts as a group leader carrying out certain functions necessary to the group's well being. The responsibility of a moderator can be categorized in several ways. Mason (1991) divides moderator functions into three categories, the intellectual, the social and the organizational. Berge (1995) speaks of four categories, pedagogical, social, managerial and technical, each indicating important factors for successful instructional design of CC activities.

Feenberg (1989) discriminates among three performance roles of a moderator, specifically the one who contextualizes the situation by opening the discussions, setting norms and the agenda; the one who monitors encourages and prompts participation; and finally the one who effectuates

meta functions, such as weaving and clarifying of ideas and thoughts, dealing with information overload, and remedies problems in context, norms or agenda.

Brown and Palincsar (1989) founded their reciprocal peer teaching strategies on different research traditions, including Vygotskian and Piagetian developmental psychology as well as the cooperative learning environments (i.e., Johnson & Johnson, 1975, Sharan, 1980; Slavin, 1983 in Brown & Palincsar, 1987), basically claiming that meaning is derived from and in conversation with others. In reciprocal teaching, the leader/tutor/moderator progressively fades from the conversation leaving most of the responsibility to the learners in the group. This strategy can further be illustrated in terms of stages, where the moderator/teacher goes from being the model or expert discussion leader, to coaching and scaffolding the discussion, to leaving the major responsibility of questioning, sharing, clarifying, evaluating and summarizing opinions and ideas to the learner. Controversy and uncertainty are ingredients that are encouraged in this type of environment, since it is seen as beneficial to extract different opinions helping the student to restructure their knowledge base. Thus, adopting reciprocal teaching strategies appear to foster understanding and conceptual change, which especially in the summarization phase serve as

"...a means by which progress can be monitored, points of agreement and conflict checked, and ideas from many sources combined into one statement. It serves as a place holder, a method of rounding off conversations in preparation for the next interaction with the text." (p. 443 - 444).

Similarly Dimock (1985; 1987) describes four styles of leadership, namely directing, coaching, facilitating and delegating. He also points out the importance of diagnosing situational factors as measured for example on a



scale from poor, to fair, to good, in terms of their effectiveness on task completion (i.e., productiveness), and group cohesiveness. He found that when situational factors are poor (e.g., new members, budget cuts, pressures) it is necessary to shift from a directing to a delegating style to improve conditions for better outcomes. Comparing Dimock's leadership styles to teaching modes described by Brown and Palincsar (1987) a common denominator can be found, namely that to produce effective group work, tasks and team building activities must move slowly and progressively moving from an authoritarian and structured arrangement to a more democratic and lenient leadership style.

The above ideas on moderator style and function assert that some of the pedagogical as well as the monitoring functions must be placed on the students to ensure effective learning. Emphasis in style is put on discussion through questioning, analyzing, synthesizing, and evaluating opinions and ideas, as opposed to mere criticism. That is, instructional design should focus on creating collaborative environments through cooperative structures and strategies, which are essentially built on the social dimension of learning, where students create meaning through contact with others.

This literature review has attempted to reveal a common pattern by bringing together findings from different fields of study to create a basis for the design of collaborative learning environments (Klein & Pridemore, 1994; Hollingshead, McGrath & O'Connor, 1993; ). First, andragogical principles are congruent with structures for teaching and learning in cooperative and collaborative environments. Secondly, these environments are influenced and build on learning theories proposed by constructivist and socioculturalist proponents. Thirdly, most of the CC literature supports the idea that the features inherent in this medium lend themselves best to content that

benefits from conversation. Finally, these points together with research on group dynamics indicate a need for investigation in order to disentangle the web of factors that are the most important for designing effective and efficient collaborative on-line activities.

### Problem Statement

A computer-conferencing system could fill two of the gaps commonly found in distance education, the lack of a tool for developing higher-order learning skills, and the lack of a forum for social interaction.

As an *educational learning support tool* CC produces an environment where students are forced to use the written word as the format for interaction, which in turn can be seen as promoting reflected thought, reasoning, as well as potentially a deeper elaboration of content, being shared with others of the same or similar interest.

As a *social forum* CC could alleviate the distant learner's feeling of being isolated in his/her learning endeavours, thus changing the socio-structure of the distance education environment. CC potentially provides a forum where the social dimension of learning is emphasized through peer support in terms of, for example peer encouragement, critique, and sharing of information. Groups of students can learn collaboratively together, reading and commenting on each other's input, thus sharing not only subject-matter knowledge, but also strategies and tactics for structuring, organizing, and finding information.

How do students use and interact in this type of environment? Do they see CC as a necessary tool for learning at a distance? What are effective and efficient on-line instructional activities, types of moderator intervention techniques, and types of group formation strategies? These are the main questions that this research study attempts to answer.

# Chapter 3

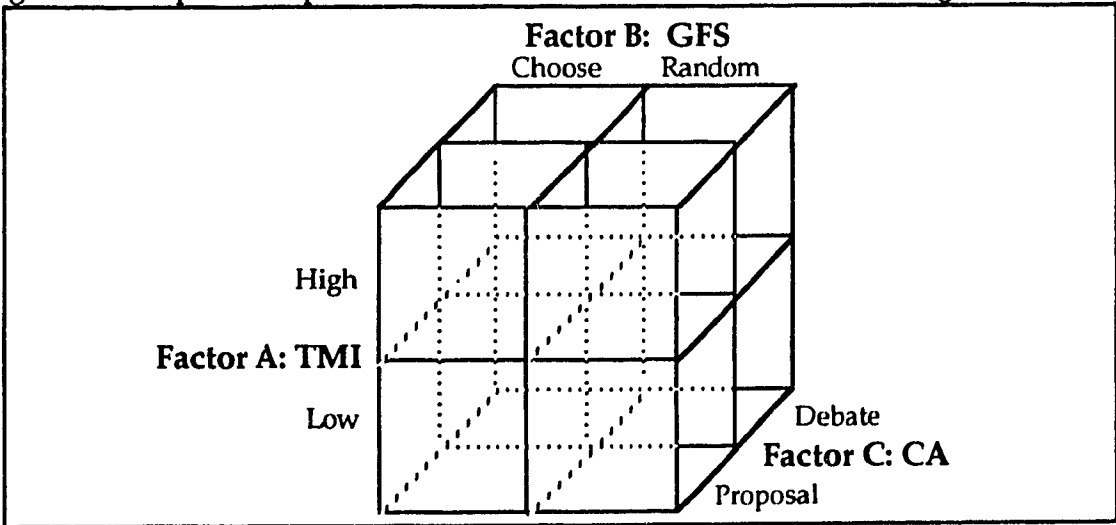
## Method

*"A game is when,  
 although you can avoid doing something disagreeable  
 without any loss or inconvenience you go ahead and do it anyway",  
 From Bernard Suits  
 "The Grasshopper. Games, Life and Utopia" (1978p. 51).*

### Research Design

A 2X2X2 mixed, randomized design with two between group factors and one within group factor was constructed (Figure 3). The first factor describes the group formation strategy (GFS) with two levels, that is, level one 'choose your own partner' and level two 'random assignment to groups'. The other factor pertains to type of moderator intervention (TMI), which also had two levels, that is, high and low moderator intervention. The within group factor, type of collaborative activity (CA) had two levels, that is 'to produce a joint proposal', and 'a debate'.

Figure 3. Graphical representation of the three factors in the design.



The dependent measures were the final exam, number of unique idea units per activity and in total, a self-reported group cohesiveness measure, and a group productivity measure for each of the two on-line exercises. The transcripts of the on-line activities were also analyzed according to type, where directly related content messages served as a dependent measure to see whether these vary across treatments. The students cumulative grade point average (GPA) score served as the covariate for these analyses.

*Internal Validity.* Possible threats to internal validity are history and maturation, because students could have learnt about computers and/or been trained in collaborative learning strategies in other courses, thus affecting the results; Mortality was one of the most important threats to this study, since students were free to leave the experiment at any time. Diffusion of treatment was another possible confounding factor, since these students might be taking other on-campus courses together, thus potentially being able to discuss differences in treatment. Selection was controlled for by random assignment to groups, and testing of equivalence on the GPA score as an initial measure of successful randomization. Experimenter bias was controlled for by removing the researcher from the experimental groups during the experimental phase. Several measures were taken to diminish these threats: 1) students were urged not to talk about the on-line group work; 2) the mail function in the CC system (CoSy) was disengaged to prevent students from different conditions talking to each other; 3) students were only introduced to each other within the same condition; and 4) no on-campus workshops or meetings took place.

*External Validity.* This study refers to undergraduate distance education university students learning in collaborative groups using a text-based

computer-mediated conference system, and to which situation the results can be generalized.

### Operationalization of Factors

*Factor A* : Type of Moderator Intervention (TMI) refers to the amount of intervention provided by the on-line moderator. The students randomly assigned to the high TMI condition were provided with a peer-tutoring strategy, as well as a list of desirable behaviors to take on while carrying out the on-line activities. Furthermore, in this condition the moderator intervened in the conversations by clarifying content and encouraging students to participate on a regular basis.

Students assigned to the low TMI condition only received answers to direct questions, thus leaving it up to the students themselves to take on the responsibility of completing the tasks. This is seen as a strategy to create high task and resource interdependence among group members. This factor was designed to investigate the necessity for and amount of tutor intervention.

*Factor B* : *Group Formation Strategy (GFS)* indicates the two ways in which small groups were formed. Half of the students in the high TMI groups were then randomly assigned to either choose their small group partners, or randomly assigned to the small groups by the researcher. The same procedure was executed for the low TMI group. This factor was created in an attempt to verify studies in the co-operative literature findings that when groups are allowed to choose their own partners they also do better in terms of group cohesiveness and productivity, and often students appear to learn better as well (Shaw, 1981).

*Factor C: Collaborative Activity (CA)* was the within group factor. This factor was designed to elicit information about two types of on-line learning activities. One of the instructional activities placed emphasis on students sharing information by providing information on one task each, and summarizing this information into a Proposal. The underlying theoretical assumptions about this type of collaborative activity are that students learn by sharing, evaluating and summarizing information. The other collaborative activity was constructed to make students elaborate on course content by finding arguments either 'for' or 'against' technology in education in what is heretoforth called the Debate, and in trying to convince the other members of its value by sharing pertinent information. All the literature needed to carry out these two activities were provided in either the course text, the video and/or in the supplementary readings. Both activities were graded, and worth 10% each of the final course grade.

### Subjects and Context

Subjects were undergraduate students registered in the distance education version of Education 305: Technology for Educational Change at Concordia University in Montreal, Canada. This course is also offered as an on-campus course once a year. It is an obligatory course for students in the Early Childhood program, but also given as an elective course for students in any domain or field of study, as well as for independent students. Therefore, students come with a very varied background knowledge to this course. The geographical dispersion of the students is also high. Of students registered in the course only 10% were 'true' distance education students, whereas the others were both on-campus and off-campus students. Most of the students worked either full-time or part-time.

It was the first time the course was given as a distance education course. An on-campus pilot version of the on-line activities was given in the Fall of 1994.

Four tutors were hired to manage the 80 registered students. These tutors covered 16 office hours per week. These were spread over mornings, afternoons, and evenings in an attempt to satisfy the individual student's time constraints.

The course package included a study guide, an instructional video, a text book *Instructional Media* (Heinich, Molenda & Russell, 1993), supplementary readings, and the computer-conferencing activities. The assignments consisted of two written projects (20% and 25%), three graded on-line activities (worth 10% each), and a final exam (25%). Students were individually graded on all the course components (Appendix F).

### Instruments

*Consent form and Entry Questionnaire.* The full consent form can be found in Appendix A. The entry questionnaire provided knowledge about the students in terms of demographic information, computer literacy, attitudes about computers, typing skills, educational background, whether it was their first time studying at a distance, their expectations about the course, and why they chose to study at a distance. The entry questionnaire and the consent form were administered through the regular mail system, prior to the course start, to all registered students. Students registering late received these instruments when picking up the obligatory distance education package.

*Cloze Reading Test.* A cloze test is a piece of text where a certain number of words has been deleted following a set of guidelines (Rye, 1982; Bernard &



Lundgren, 1994). It is seen to measure reading comprehension. The passage used for this cloze procedure comprehension test was from a Reader's Digest article on bird order. It was constructed from a text containing 250 words. Sixty-two deletions were made using progressive difficulty, that is, in the beginning every 10<sup>th</sup> word was deleted, then every 8<sup>th</sup>, 6<sup>th</sup> and 5<sup>th</sup> word. Different procedures can be used to mark cloze tests, depending upon the purpose. As a covariate, and to test equivalency of groups, only exact answers were used. This test lends itself well for distance education purposes, since it is un-timed and unless someone actually has the exact passage, deletions have to be understood by the context itself. This instrument was tested in four distance education classes beforehand, and yielded on the average a high positive correlation coefficient of  $r = +.66$  with final course grades, and  $r = +.73$  with GPA scores ( $N \approx 70$  for each class). It was included in the study to serve as a potential covariate (Appendix A).

*Self-Perceived Group Cohesion Inventory.* This instrument consists of a list of 16 cohesive behavior items and 6 disruptive behavior items, totalling 22 items. These items are a combination of suggested items from two sources, Dimock, (1987) and Hill (1969). Students tick off the one they displayed themselves, as well as those occurring in the group as a whole. The absence of a disruptive or negative behavior was counted as a positively cohesive behavior (e.g., if 11/15 cohesive behaviors are reported, and 3/7 disruptive behaviors, then 4 were absent. This equals to  $15/22 = .68$  or 68% cohesiveness perceived by the student in this group). (Appendix B).

*Self-Perceived Group Productivity.* The group productivity questionnaire consists of 6 statements which were rated on a 5-point Likert-type scale. The

five first questions indicate perceived group productivity, thus the higher the score (25 points possible), the more productive the student thought that his or her group was. The items from this questionnaire were adapted to on-line group work as opposed to face-to face groups in a classroom situation (Abrami, Chambers, Poulsen, Howden, d'Apollonia, De Simone, Kastelorizios, Wagner, and Glashan, 1993). The sixth item on this instrument asks the student to evaluate the instructional value of the on-line exercise. The same instrument was given after the completion of the "Proposal" activity and the "Debate" activity, to find out which activity students themselves perceived as the most helpful. (Appendix B).

*Perceived Difficulties in Distance Education.* This instrument consists of 22 items, combined into 7 factors according to previous research, concerning the differences between on-campus and DE courses. It was developed by Dr. R. M. Bernard; J. M. Barrington, & K. M. Lundgren (1992) and tried out in 4 consecutive DE classes. Items elicit information on the student's perception of the differences on whether it is harder or easier to understand DE requirements, whether there is a need for social interaction, peer support, special learning strategies, more feedback, and a higher reading aptitude as compared to on-campus courses. Questions were phrased with a common stem (i.e., Compared with university-level classroom instruction, in distance education ...) and specific statements (e.g., ... understanding course objectives is:). Students responded on a five-point Likert-type scale, ranging from "much harder/easier" or "much greater/less". This instrument was administered after the completion of the course and only served as a measure to see overall perceived difficulties in DE (Appendix C).

*Verbal protocols.* The transcripts of all the message contributions for each of the on-line instructional activities constitute the verbal protocols. These protocols were analyzed by counting number of messages, number of words, number of unique idea units, and also categorized according to type of message to provide a qualitative appreciation of the on-line learning conversations. There were 3 small groups per activity (the Proposal and the Debate) and condition, which equalled 24 group discussions to analyze. Two independent raters were hired to use the classification scheme on about 15% of the transcripts, which were randomly selected. The researcher analysed and classified all the protocols. An inter-rater reliability coefficient of +.86 with rater number one and +.59 with rater number two was found for the classification scheme (Appendix D).

*Unique Idea Units.* Each of the content messages was further analysed for number of unique idea units and added for each student and activity. The number of idea units is seen as a measure of performance during the activities. An inter-rater reliability coefficient was calculated on the number of unique idea units per message, which amounted to +.93 with rater number one and +.91 with rater number two (Appendix D).

*Final Exam.* The final exam, the achievement measure, was composed of three parts, 25 multiple choice questions, 5 short answer questions and one essay question. The multiple choice and the short answer questions were taken from the bank of questions provided by the author's of the course book, *Instructional Media* (Heinich, Molenda and Russell, 1993), and are still used for this course. Since this document is public the actual questions are not included.

## Procedures

### *Official Course Description.*

"The primary teaching goal for this course is for students to develop an awareness of the possibilities for using innovative technologies in education to enhance learning and classroom processes. It is a survey course that will introduce you to the field of educational technology and the major issues related to the application of electronic media for learning.

The course is designed as a series of six modules. Following an introduction to educational technology, you'll learn about the four broad categories of technology used in education — telecommunications, electronic applications of print, audio-visual media (television and video) and computers. The final module will focus on future trends in technology and education."  
(Study Guide, 1995; p. 1) (Appendix F).

*Logistics.* The experiment started on January 18<sup>th</sup> and carried through April 11<sup>th</sup>, 1995. Table 3 represents the sequence of the instructional events, and the numbers indicate corresponding course weeks. Sessions 2 and 3 are the experimental phases.

Table 3. Schematic representation of the course outline in

1	2	3	4	5	6	7	8	9	10	11	12
		Session 1				Session 2				Session 3	
		Jan. 18 - 31				Feb.15 - Mar. 7				Mar 29-Apr. 11	
Intro	L. T.	CMC	I.N.	Print	E. B.	TV/V	I.V.	CAL		Multi	Ed. C.

- \* Intro = Introductory overview  
 L.T. = Learning Theories  
 I.D. = Instructional Design  
 Print = Print Media  
 E.B. = Electronic Books  
 Ed. C. = Educational Change  
 I.N. = Introduction to Internet  
 TV/V = TV and Video applications  
 CAL = Computer Assisted Learning  
 MM = Multimedia  
 CMC = Comp.-Mediated Communication

The first four weeks of the course were dedicated to training students in using the conferencing system, as well as understanding modem set-ups and main-frame connections. Because of the experimental nature of this study no workshops or on-campus meetings were held. To overcome the initial learning hurdles of using a conferencing system, four tutors covered 16 hours

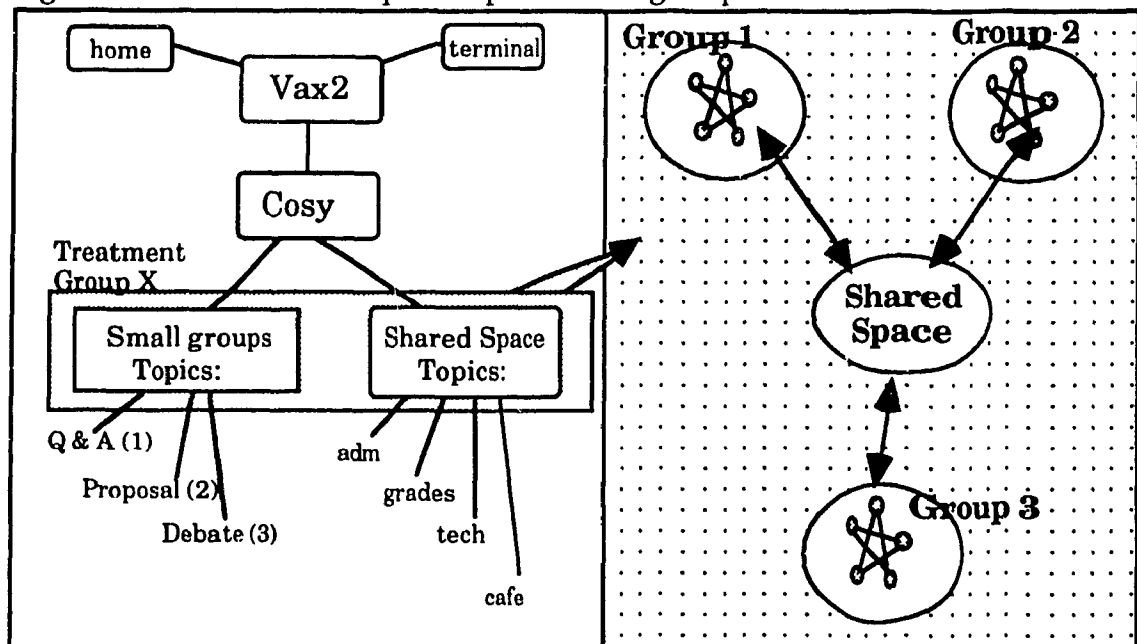
of individual help. Students could phone in or come by during these hours to get individual help. Three of the tutors also logged on about 2-3 times a day to assist students on-line.

Students were randomly assigned to the four treatment conditions before the course started, which in reality meant that they got to know only students in their condition. All treatment related information was provided on-line as well as in a brief manual pertinent to each condition. This manual also included a step-by step guide on how to log on and start using the conferencing system, CoSy (version 3.3., 1988; Appendix E).

### Organisation of on-line treatment conditions

Figure 4 represents the organizational set-up of the on-line conferences and topics. Each small group was composed of 3-5 members.

Figure 4. Schematic set-up of experimental groups on-line



A conference refers to the CoSy grouping feature limiting access to group members only. A topic, on the other hand, is where the interchange of messages takes place. CoSy allows for many topic spaces within the same

conference, basically to organize types of conversations to be separated from each other. Each condition had its own shared conference space and three small group conferences.

The CC component of this course can be classified as a topic discussion (Wells, 1994) based on the course readings. The co-operative techniques that were used are supposed to promote higher-order learning and thinking skills. It was a supplementary activity intended to enhance the social dimensions of learning, such as arguing, summarizing, defending, evaluating and judging. It took the form of three distinct sessions, where Session 1 was entirely devoted to teach and train the student to use the CoSy system. Session 2 and Session 3 demanded cooperation and collaboration of students, both in terms of participation and task dependency. The following is a more detailed description of each session, its goals, motivational incentives, strategies and activities.

### Session 1 (Weeks 3 - 6) (Appendix E)

#### *Goal*

The primary goal of this session was to familiarize and train the student in using the communication package and the CoSy conferencing system.

#### *Motivation*

- 10% of course grade, based on content and participation
- Individual grading
- Content questions related to final exam.

#### *Strategy*

To overcome the initial learning hurdles inherent in learning a new technology, a training manual and some interactive on-line learning exercises were designed. In this session, a conference open only to the

members of each condition was used to help students and tutors to get to know each other. This shared conference space for administrative and social activity stayed open during the whole semester. A topic space was constructed to ask and answer questions related to administrative issues and concerns, another for social chit-chat, another for technical questions and help, a last one where grades were posted.

The task for each student was to answer 5 out of 8 questions on the Learning Theory Module of the course, and to comment on 3 of the other students' inputs. This type of activity was designed to train students in how to construct an on-line interchange, how to trace and respond to a linked line of thoughts, in this case represented by linking answers to questions, and comments on answers.

### Session 2 (Weeks 7 and 8)

#### *Objectives*

To be able to:

- share, analyze and synthesize information on educational multimedia.
- write a group proposal for purchase of media in an elementary school.
- interact effectively using CoSy

#### *Motivation*

- 10% of course grade, based on content and participation
- Individual grading
- Tasks directly related to their instructional design project and the final exam.

#### *Type of Collaboration*

Students were asked to create a proposal to purchase a certain amount of video and computer equipment for an elementary school. They were

asked to get factual information about multimedia platforms and to simulate interviews with subject-matter teachers to decide on which educational software to purchase, and then prepare a joint proposal for the Ministry of Education. This type of activity was designed to promote a collaborative spirit, where students became aware that one person cannot do all the work, and that the sharing of information is essential to successfully complete the required tasks. This is a technique to create positive task and resource interdependence. The exact student instructions can be found in Appendix E.

Students in the high TMI conditions were prompted on key behaviors for effective group work, and received intervention through modelling, coaching, scaffolding and fading actions by the moderator. The moderator was trained in these types of intervention techniques. She was also prompted to participate on a regular basis. This amounted to a participation rate of 18% by the moderator in terms of message contribution.

Students in the low TMI condition were only given the instructions for carrying out the tasks. Only direct questions on the content and task procedures were answered. This amounted to a participation rate of 2% from this moderator in terms of message contribution.

### Session 3 (Week 11 & 12)

#### *Objective*

To be able to present opinions and arguments on a topic, and then evaluate, criticize and judge others' input. An activity promoting content elaboration.



### *Motivation*

- 10% of final grade
- Individual grading
- Concepts related to final exam items

### *Type of Collaboration*

The activity was organized as a debate where students had to argue their 'educated' position using the provided literature on either for or against the use of new technology in education. Students were randomly assigned to these positions. This activity was designed to enhance creative and critical thinking by using higher order reasoning in a controversial situation, another co-operative learning technique (Davidson & Worsham, 1992).

The exact student instructions can be found in Appendix E.

After each session students received the group cohesion and the group productivity inventories. The final exam was administered three weeks after the end of the last on-line activity. During this period students in the same condition could read the messages generated in their peers small group conferences, of course, only within each condition. CoSy provides statistics on who has read something in what ever topic is asked for, thus allowing information to be gathered on how many in each condition actually took this opportunity to revise.

### Statistical Analyses

All the statistical analyses were carried out using SYSTAT for the Macintosh, version 5. 2. (1992). Alpha level was set to .05 for all analyses as is commonly used for educational research.

Descriptive statistics were done on data gathered from the entry questionnaire, the attitude questionnaires, and verbal protocols. They constitute the contextual information within which the results of this experiment can be generalized.

Test of homogeneity of covariance were made on all dependent variables pertinent to the repeated measures ANOVA. In case of a violation to an underlying assumption, several methods of adjustment were available, such as for example Huynh-Feldt and Greenhouse-Geisser-Imhof or blocking of the variable (Tabachnick and Fidell, 1989).

Achievement scores, unique idea units for each activity, were analysed using SYSTAT's repeated measures analysis of covariance procedure, where the CA factor served as the repeated measure variable, and the TMI and GFS as the between group factors. It should be mentioned here that SYSTAT only gives the mean difference and a p-value as statistics, when evaluating simple effects as the result of a significant interaction or main effect. Therefore, significant results will be given using those statistics, instead of calculating by hand the exact F-value for each of those tests.

To test hypotheses concerning the group productivity and the social cohesion measures, a repeated measures analysis was utilized.

## Research Questions and Hypotheses

Question 1: The verbal protocols provide a range of information concerning the contribution of number of messages, number of words, number of content messages, number of organizing messages, and number of encouragements. How do these vary over conditions and activities?

Hypothesis 1a:

- There is no interaction effect for number of student generated messages
- There are no main effects for number of student generated messages

Hypothesis 1b:

- There is no interaction effect for the total number of words per student
- There are no main effects for total number of words per student

Hypothesis 1c:

- There are no interaction effects for number of content messages
- There are no main effects for number of content messages

Hypothesis 1d:

- There are no interaction effects for number of organizational messages
- There are no main effects for number of organizational messages

Hypothesis 1e:

- There are no interaction effects for number of encouraging messages
- There are no main effects for number of encouraging messages

Question 2: Do students being presented with a model moderator and being allowed to choose their own partners show higher

achievement scores as measured in terms of final exam scores and number of idea units? Do these vary depending upon type of collaborative activity?

Hypothesis 2a:

- There are no interaction effects for final exam results
- There is a significant main effect for TMI, favouring high TMI
- There is a significant main effect for GFS, favouring the choose strategy

Hypothesis 2b:

- There are no interaction effects for number of unique idea units
- Students in the high TMI/GFS choose were expected to contribute more unique idea units than all other conditions

Question 3: Which Collaborative Activity affects final exam results most regardless of condition?

Hypothesis 3:

- All assignments are equally important to succeed in the final exam, once variation due to GPA score is accounted for.

Question 4: Are perceived productivity and cohesion related to each other, and to learning gain? Do students in different conditions perceive it differently?

Hypothesis 4a:

- Cohesion and productivity measures are significantly and positively correlated with each other overall, and for each activity.

Hypothesis 4b :

- Cohesion and productivity measures are significantly and positively correlated with final exam results

**Hypothesis 4c :**

- There are no interaction effects for the cohesion measure
- There are no main effects for the cohesion measure

**Hypothesis 4d:**

- There are no interaction effects for the productivity measure
- There are no main effects for the productivity measure

**Question 5:** How are the seven factors related to each other? Are there any differences for the two factors pertaining to social interaction and peer support depending upon condition?

**Hypothesis 5a**

- There are no significant relationships among factors in the perceived difficulties in DE instrument.

**Hypothesis 5b**

- There are no interaction effects in terms of their perception of social interaction in DE
- There are no main effects in terms of their perception of social interaction in DE

**Hypothesis 5c:**

- There are no interaction effects in terms of their perception of peer support in DE
- There are no main effects in terms of their perception of peer support in DE

## Chapter 4

### Results

*"Reality is composed of multiple-simultaneous, interdependent cause-effect-cause relationships. From this reality, normal verbal language extracts simple, linear cause-effect chains." (C. Kiefer in P. Senge, 1990.p. 267)*

#### Descriptive Statistics

*Drop-out rate.* Of the 80 students who were officially registered to the course twelve (15%) never contacted the office to receive their distance education package, leaving 68 students who originally intended to take the course. Within the first two weeks, 14 students left the course, claiming as the two most common reasons for dropping out, (1) registered to too many courses, and (2) the course had too many assignments. In the following three weeks, 5 students left due to personal problems. Four students (6%) had to be removed from the analyses, because they were not able to complete the two experimental sessions, and therefore did not experience the treatments (Figure 5). In all, 45 students were included in the analyses for the experimental design.

Figure 5. Graphical representation of student distribution

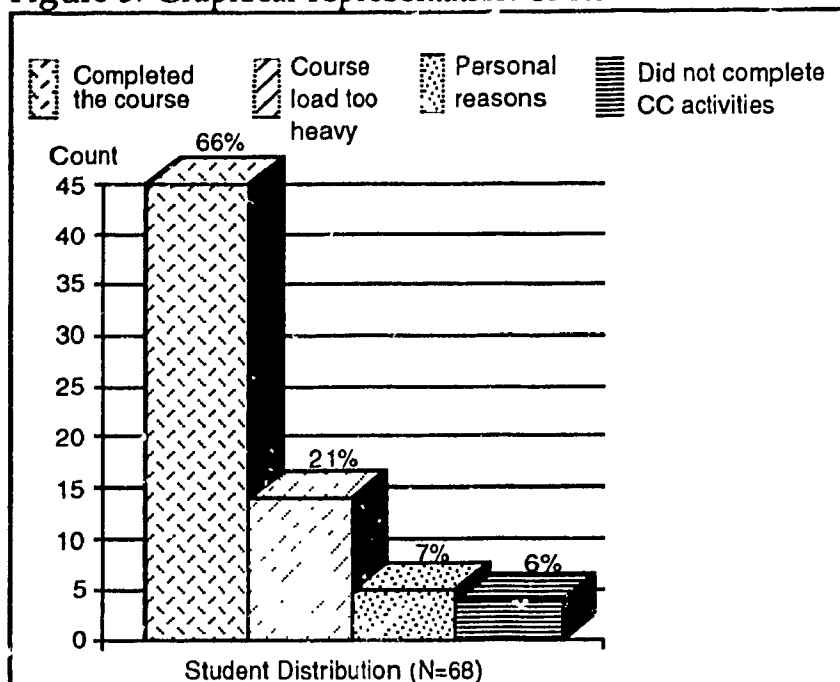


Table 4 shows the computer ownership distribution, including the students that started the course (N=68), in terms of those that owned a computer and a modem, only a computer, and those that owned neither. If they did not own a computer they depended on the university facilities, which were open every day from 8 a.m. to 10:30 p.m. as well as most weekends. It is interesting to note that most of those who did not have a computer system at all still remained in the course (90%). Among these students who did not have a computer system at home, four purchased a computer/modem system during the course, and one student after completion.

Table 4. Distribution of student drop-out in terms of computer ownership

Status of ownership	%	(N)	Drop-out	Completion
Computer with modem	56%	(38)	32%	68%
Computer, but no modem	29%	(20)	30%	70%
None	15%	(10)	10%	90%
<b>Total</b>	<b>100%</b>	<b>(68)</b>	<b>34%</b>	<b>66% (48)</b>

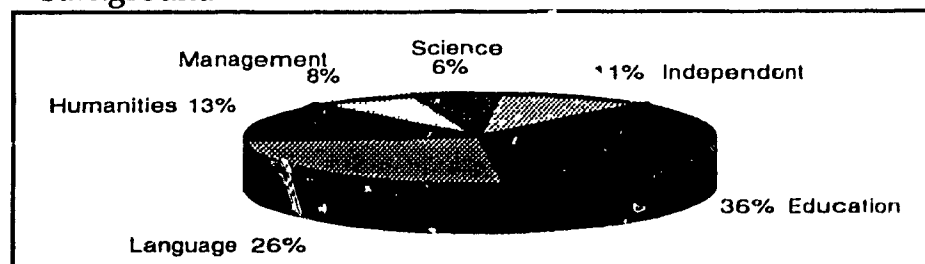
*Demographics.* The median age of the 45 students included in the analyses was 26 years, ranging from 20 to 53 years old. Ninety-six percent of the students claimed English as their first language, 2% French, and 2% another language.

Fifty-two percent of these students (N=45) already had computers and modems, 24% had computers and bought modems, so that after the third week actually 76% of the students worked from home. Twenty-four percent of the students used the University's facility. Sixty-six percent of the students reported average typing ability, 30% minimal ability and 4% reported that they were proficient typists, that is, they could type more than 60 words per minute.

Only 10% of the students were 'true' distance education students, meaning that they did not live in Montreal, and that they were not taking other courses at Concordia University.

Figure 6 illustrates the distribution according to students' academic background, which shows that 68% of the students had education, science or a language program as their background knowledge. Students in the language arts as well as students in a science program also reported that they aimed for a minor in education.

Figure 6. Percentage distribution of students according to academic background





Fifty-one percent of the students reported that they worked full-time, 13% worked part-time and 36% were full-time students. Whether students reported holding a job or not, they had on the average registered to 4 courses for the term.

The distribution on the above mentioned variables (age, language, computer ownership, typing ability, and academic background) did not differ significantly among conditions ( $p > .05$ ).

The entry questionnaire also elicited information on why students had chosen to take the course, and whether they had taken a distance education course before. Fifty-one percent of the students answered that they had chosen this course because it is a convenient mode of studying, 33% reported that they were going to be teachers or instructors of some kind and wanted to learn how to use technology in the classroom. Eight percent mentioned that they wanted to learn more about computers, and a further 8% said they had registered in this course because they wanted to try out "a new way of learning" or because distance education was seen as a convenient mode of learning.

The entry questionnaire also asked students whether they had taken a distance education course before, and 29% reported they had already taken one or two distance education courses. The final questionnaire on perceived difficulties asked whether they would take another distance education course. The combined results of these two questions revealed that of 29% who had already taken a distance education course would like to take yet another DE course. Of those for whom it was a new experience, 94% reported they would like to take another distance education course.

### Session 1: Learning CoSy

Data from session one is reported separately, since all students regardless of condition had the same treatment. These data describe attitudes and feelings about the initial learning period using a computer conferencing system. None of the students knew the CC system CoSy, three reported having used BBS systems before, and one had used Internet and email extensively. As already mentioned, it was in this period when the highest number of students dropped out, mostly because they thought the course load was too heavy. Although they did not explicitly state that the CMC activities were the cause for dropping out, it could be interpreted that the three on-line activities together with the fact that they had to learn how to use the communication software actually was the underlying cause. Those who completed the course were asked a number of questions related to activities and problems in session 1. Table 5 (p. 72) reports these attitudes and feelings in terms of being negatively, undecided or positively inclined towards the statement.

These items were worded in a positive manner having a 5 point Likert type scale going from very negative to very positive (Appendix B). Very negative and negative ratings were collapsed into a single negative rating, and very positive and positive ratings into a single positive rating. A middle position was counted as undecided. An overall score on the 9 items was also calculated, indicating an overall negative or positive attitude towards this first on-line session.

The outcome of this questionnaire shows that overall 85% thought that it was a positive experience. Worth mentioning is that only 43% of the students were clear on the degree of involvement, although 64% claimed that this session met their expectations and 71% thought that goals and objectives for

this session were met. Ninety per cent of the students also thought that on-line activities are useful and motivating. They also maintained that both online tutor help (90%) and guidelines (73%) were helpful. Seventy one per cent also reported being confident in logging on after this session, which was the ultimate goal.

Table 5. Evaluation of CoSy Session 1

Item (N=42; 3 missing)	negative	undecided	positive
1. Goals and objectives were achieved for this first on-line activity.	4 10%	8 19%	30 71%
2. This session met my expectations.	5 11%	10 24%	27 64%
3. I felt I learnt a lot by participating in this session.	4 10%	13 31%	25 59%
4. The degree of involvement was made clear to me?	9 21%	15 36%	18 43%
5. I tried hard to learn for this session.	3 7%	10 24%	29 69%
6. The CoSy guidelines (both on and off-line) were very helpful.	3 7%	9 22%	30 71%
7. On-line tutor help was very useful.	0 0%	4 10%	38 90%
8. I was confident in logging on and getting around in CoSy after this session.	3 7%	9 22%	30 71%
9. On-line activities are useful and motivating for DE students.	1 2%	3 7%	38 91%
These items as an overall evaluation score of Session 1	2 5%	4 10%	35 85%

These results, together with the high drop-out rate, signal that although students find CC interesting and meaningful, and guidelines and tutor help were adequate, overcoming the initial learning hurdle is difficult and hard to explain and comprehend before living the experience.

Since a workshop could not be held because of threat to internal validity, students were asked whether this should be an option. Worth noting is that 75% said yes, 20% said no, and 5% thought that a workshop it should at least be available.

## Overall Interaction Patterns

On the average each student generated about 16 messages each in session one that lasted for two weeks. Eight of these messages were accounted for by the activity itself, for which they received a grade. Most of the other messages were posted in the technical help topic in the shared conferences. It was interesting to follow students progression and different feelings logging on for the first time. A brief self explanatory excerpt showing the progression of feelings occurring when logging on for the first time:

---

=====  
 educ305a/sos #15, yyyx, 161 chars, 24-Jan-95 10:39  
 There is/are comment(s) on this message.  
 -----

TITLE: say  
 I have  
 I have no idea where I am or where I'm going. This can mean only one thing I am LOST

I don't know what I'm doing . Please help me  
 . add  
 cr

=====  
 educ305d/sos #18, xyxy, 206 chars, 25-Jan-95 14:47  
 There is/are comment(s) on this message.  
 -----

TITLE: What Happened?!  
 Just want to know why the message "ARE YOU THERE" appeared on the screen as I was typing. The last time it happened, I didn't respond and got logged off. Explain please...

=====  
 educ305a/sos #18, yyyx, 114 chars, 25-Jan-95 18:52  
 This is a comment to message 16  
 -----

Hi this is to say thanks to XXX. Most of the time I now know where I am and I am cosyng along.Thanks again.

=====  
 educ305d/sos #22, tttb, 65 chars, 27-Jan-95 16:21  
 There is/are comment(s) on this message.  
 -----

TITLE: Need help badly!  
 How do I find my answers to exercise 1?

=====  
 educ305d/sos #23, tttb, 34 chars, 27-Jan-95 16:26  
 This is a comment to message 22  
 There are additional comments to message 22.

-----  
 Never mind I just figured it out.

=====  
 educ305d/sos #40, ppppf, 782 chars, 1-Feb-95 20:05  
 There is/are comment(s) on this message.

-----  
 TITLE: I WANT TO KICK MY COMPUTER!

Yes, kick not kiss, kirk. I am always having problems with the edit.  
 When I want to correct a word by 'substitute' I can't do it, I don't know  
 how and it's killing me.

Please help before I give my computer a good wack behind the ears. I would rather get  
 responses over the phone, if possible.

-----  
Activities in Shared Conferences

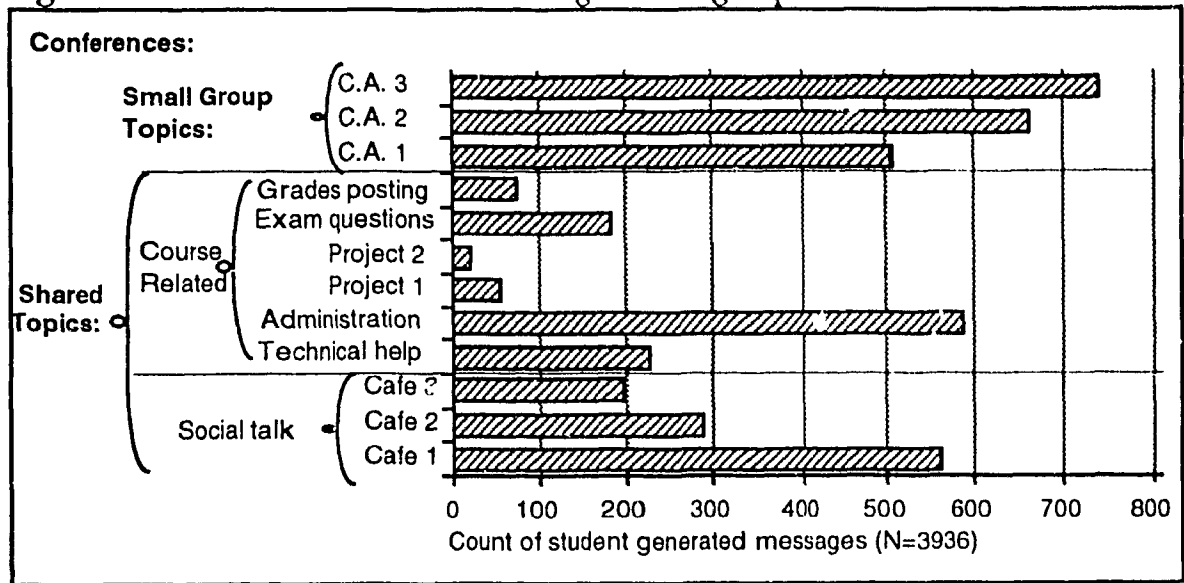
Overall the on-line exchange produced 3936 student generated messages during the three months that the CC conferences were in operation. Each student was a member of two conferences, one where all the students in the same condition could talk to each other (shared space), and the other where he/she worked in a small group to accomplish the tasks for each of the collaborative activities. In the shared conference space, three main topics were created, a 'cafe' topic for social interaction, an administrative topic and a technical help topic. The small group conference was simply divided into three topics, that is one for each of the small group activities. Figure 7 graphically represents the overall distribution of student generated messages in each of the topics.

Of interest is the fact that the 'cafe' topic for session 1 generated more messages than it did for both session 2 and 3. This effect is reversed looking at the number of messages generated for the small group activities, that is the debate (C.A. 3) generated more messages than the first question and answer activity (C.A. 1), however not statistically more than the proposal (C.A. 2) ( $p > .05$ ).

The shared conference space for each condition included in all seven topics. These topics were created progressively, however, the technical help

topic, the administrative topic, and the cafe topic stayed open during the whole term.

Figure 7. Overall distribution of messages among topics



The technical 'help' topic was obviously used more in the beginning of the term, and actually after three weeks only very sporadic questions came up. These questions concerned issues on how to use the more advanced features of CoSy, or questions about modem and communication package set-up or how to upload and download messages. It is interesting to note that the last message in the technical help topic was posted on the 30<sup>th</sup> of March, and concerned best times to log on to vax2. All through the months of February and March there was a serious problem with available telephone lines to logon to the University mainframe, which was discouraging to students and tutors, and a fact that most certainly contributed to the high drop-out rate.

The administrative topic was used a lot by all students regardless of condition. Here students were invited to ask any type of course related question (e.g., deadlines, location of computer rooms, who is working with whom in the small groups, exam date etc... ). In an attempt to separate messages concerning off-line projects with on-line projects, three new topics

were created. These were created sequentially to allow for questions concerning project I, then project II, and finally the exam topic. The questions arising in these topics were transferred to the other groups so that no difference in treatment could be attributed to answers given to these questions in one group or another. Table 6 shows only student generated questions in each condition, and not the questions and answers that were copied over to each group by the researcher.

Table 6. Number of student generated messages by topic and condition

Topic	TMI High	TMI High	TMI Low	TMI Low	Total
	GFS Choose	GFS Random	GFS Choose	GFS Random	
cafe 1	82	152	135	32	401
cafe 2	7	136	59	21	223
cafe 3	58	22	64	47	191
<b>Total Cafe:</b>	<b>147</b>	<b>310</b>	<b>258</b>	<b>100</b>	<b>815</b>
help	52	57	64	51	224
adm	141	186	113	146	586
project 1	14	14	26	3	57
project 2	3	2	12	5	22
exam	18	90	44	33	185
grades	19	16	35	7	77
<b>Total Course related:</b>	<b>247</b>	<b>365</b>	<b>294</b>	<b>245</b>	<b>1151</b>

The 'grades' topic gave students a list of grades using their ID as the identifier, much like a normal posting on an office door. Students made some comments about the assignments and the grading schemes for the different assignments, which served as an evaluation forum for the course designers.

The 'exam' topic evoked many more questions as well as peer answers. A very interesting discussion of the pro's and con's on giving on-line exams was initiated by students in the 'high TMI/GFS random' condition, which explains their higher number of messages in this topic. This discussion and all questions pertinent to the exam topic were transferred to the other conditions, so that if one group got an answer to a question in terms of exam material the others did too. This was done to keep groups as equal as possible,

that is to limit confounding factors as much as possible. It was an attempt to isolate the effects of the manipulations in terms of the two between group factors, nothing else was manipulated.

The 'project I' and 'project II' topics rather appeared to confuse students on where to put different types of questions rather than assisting in structuring inputs concerning these topics. As Table 6 above shows very few messages were generated here. Most students either phoned the office or used the administrative topic space for their questions.

The 'cafe' topics were renewed for each session, although they were open for use at any time during the course. Cafe 1 was open between the start of the course to the beginning of the second session. Cafe 2 from the start of the second session to the beginning of the third session. Cafe 3 from the beginning of the third to the day of the exam. This means in reality that each of the 'cafe' topics lasted for about a month. They were used very unevenly by the students, with the students in the 'high TMI/random GFS' condition using it considerably more than any of the other three conditions. There is no obvious explanation for this, however it should be mentioned that a large percentage of these messages were the contribution of about five students. They discussed all kinds of things, from movies to career options to telling funny stories. It most probably served its purpose of socializing and tension relief. Figure 8 below shows the actual number of student generated messages in the three cafe topics.



Figure 8. How students used the cafe topics over time

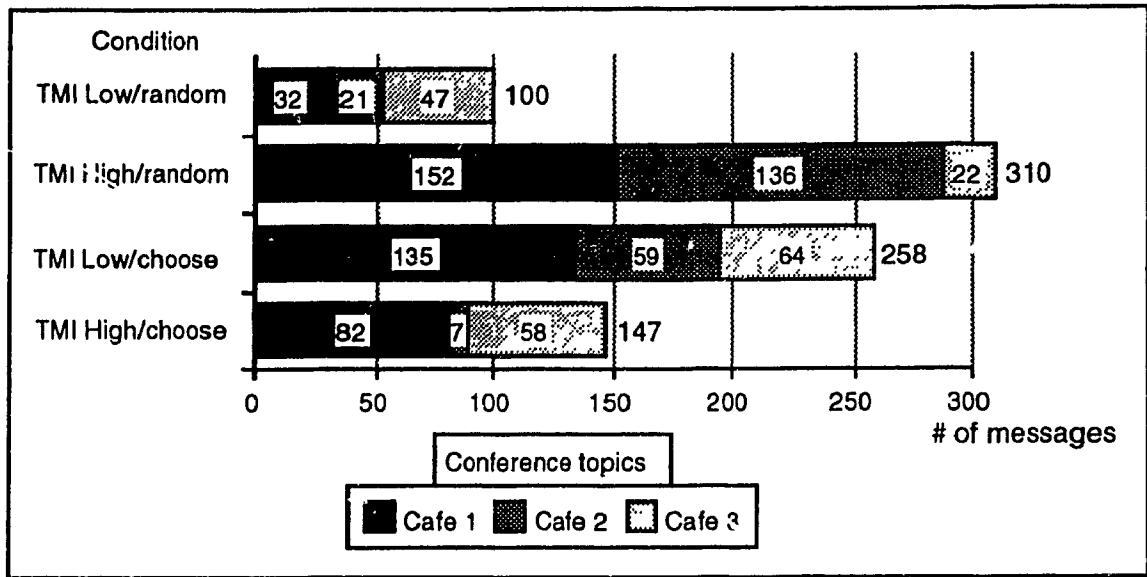
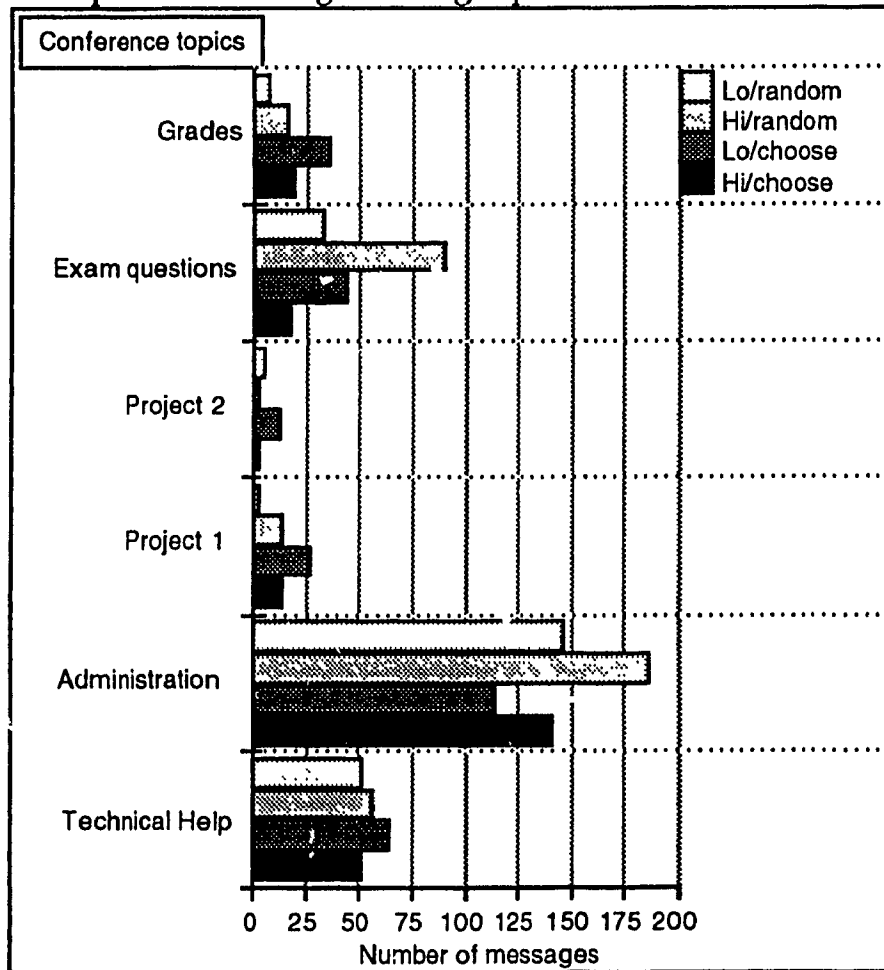
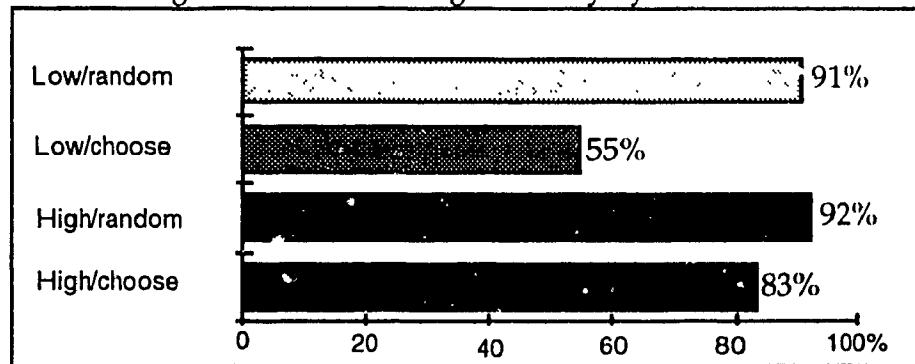


Figure 9. The spread of messages among topics in each condition



As mentioned earlier in the method section, all students within their own condition got the opportunity to review the content for the exam by reading the work done in the other small groups. This was made possible by a command in CoSy which permits a topic to be 'read only', which means that no deletions, additions or modifications can be done by the reader. The CoSy system was open until the day of the exam, that is three weeks after the end of the debate activity. Figure 10 below shows the percentage of students in each condition that used this opportunity. In the LowTMI /GFS choose only about half of the students used it, whereas in all the other condition almost all students took this opportunity.

Figure 10. Percentage of students using the CoSy system to revise for exam



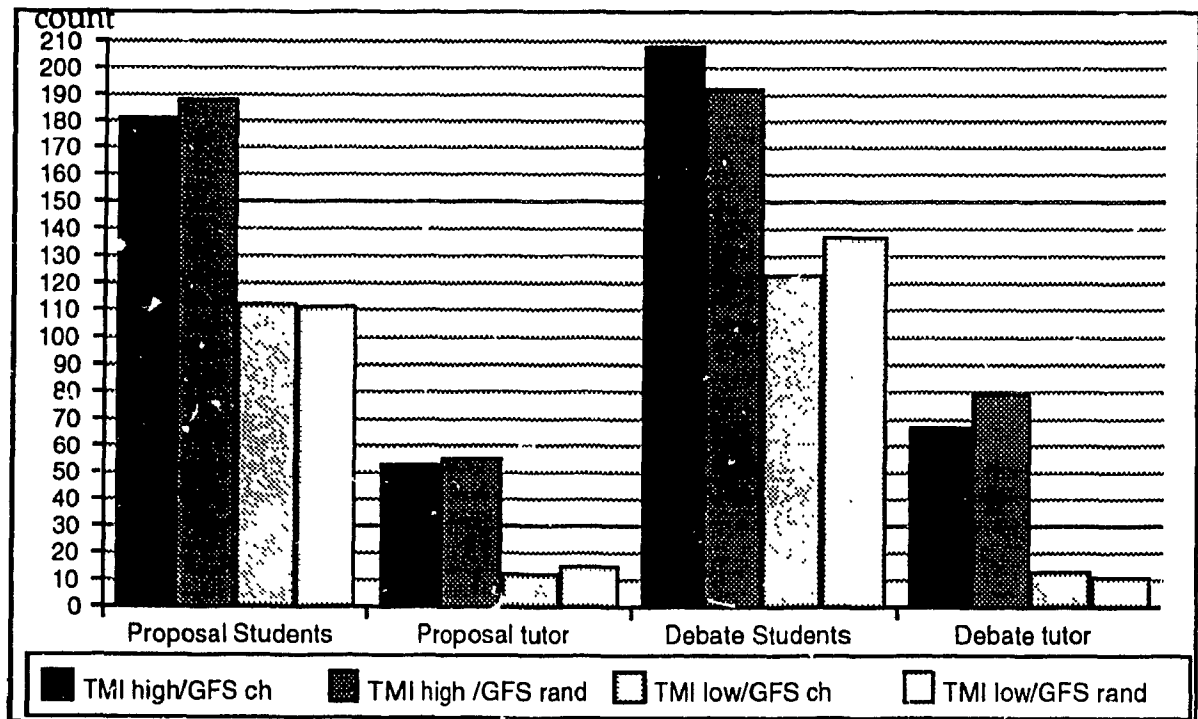
### Experimental Phase

*Verbal Protocols.* A detailed content analyses was made of the verbal protocols generated for the two collaborative activities, namely the proposal and the debate, that were included in the experimental phase of the study. These protocols were analyzed on five levels, (1) number of student generated messages; (2) number of words contributed by each student; (3) average number of words per message; (4) type of message; and (5) number of idea units per student and activity. This was done to shed some light on how

students communicate on-line, and how much they actually participated in the activities, and whether the measures differed among treatment conditions and collaborative activities.

Before reporting the results of the hypotheses tests, Figure 11 shows a graphical representation of tutor versus student activity in terms of the number of messages that were generated for the two collaborative activities. The percentage of tutor activity amounts to in the high TMI conditions to about 19%, and in the low TMI conditions about 2%, calculated as number of tutor generated messages over the total of messages for each activity and condition.

Figure 11. Graphical representation of message distribution among conditions



In terms of the group formation strategy (GFS), those who got to choose their own partners did this in a specially created topic in the shared conference spaces, first for the proposal and then for the debate activity.

Figure 12 is an excerpt of messages showing how choosing your partner on-line was done. Students did not stay in the same small groups for both activities, so that the procedure to choose your partner was repeated twice during the experiment. Students that were randomly assigned to groups were also changed for the two activities. Most students expressed relief and approval of this strategy. It was remarkable that actually none of the groups in the choose conditions chose exactly the same partners twice. Often two or three felt they worked well together and continued to do so with one or new other partners.

Figure 12. Student and tutor exchange to choose partners for small groups

```
=====
educ305/partner #6, gggl, 346 chars, 16-Feb-95 09:46
This is a comment to message 4
-----
Hi its gggl.again, I failed to mentioned in message #4 that neither of us have any experience
with visual media so, guess what? We are looking for group members that do! Thus, cccp would
like to do task #4 and I would like to do task #3. Please let us know soon who would like to do
tasks #1 and 2. Thanks a bunch. Waiting to hear from you...gggl

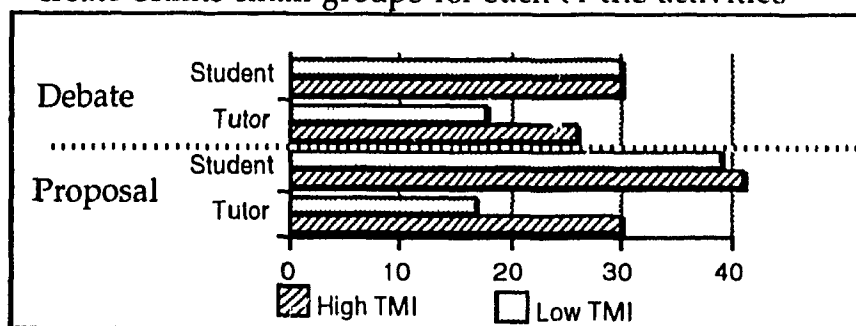
=====
educ305/partner #7, cccd, 263 chars, 16-Feb-95 18:59
This is a comment to message 6
-----
Hey there..
well since we are the only ones on-line right now and i would like to get this group thing going
as soon as possible so i can get down to some work I would be willing to handle TASK #2 or #1 if
you would like to work together on this exercise. cccd

=====
educ305/partner #8, tutor, 262 chars, 19-Feb-95 09:05
-----
TITLE: Partners
To get things going it seems to me that gggl , cccd and cccp would be great for group1a. I will put
you there and maybe you could find a 4th person to work with?? Talk to you soon, Tutor

=====
educ305 /partner #9, vvv h, 485 chars, 19-Feb-95 11:35
-----
TITLE: FINDING A PARTNER
hi THERE. It's vvv. I will read as soon as possible what we are required to do as a group. I'd
like to be part of a group,perhaps the one with gggl, cccd and I think it was cccp. I just read a
message that you guys needed another person. If I'll be part of your group, lets try to get
organized so that everyone does a fair amount of work. I have two exams to write before the 7 of
March. So, if we could get cracking soon!!!! Thanks, vvv
```

Figure 13 illustrates that choosing partners demanded less time and messages for the Debate than for the Proposal, maybe because students now knew the system, as well as each other, better. It should also be noted that there was no restriction on high or low intervention by the tutor for finding your partner, however, it seems that the tutor in the high TMI groups intervened slightly more than in the low TMI group, although the number of student messages were basically the same amount. The role of the tutor was just to confirm partnerships, and to advise them on which group they belonged to.

Figure 13. Number of messages exchanged between students and tutors to create online small groups for each of the activities



As a reflection on the GFS choose strategy, it can be noticed that, although seemingly preferable in regular class situations according to the cooperative literature, on-line activities might need the structure of random assignment to avoid frustrations for both students and moderators/tutors.

### Message Analyses

#### *Hypothesis 1a:*

- *There is no interaction effect for number of student generated messages*
- *There are no main effects for number of student generated messages*

At the most unsophisticated level of analysis of the on-line activities, the number of messages produced by each student were examined through a

repeated measures analysis. No significant difference were found for type of Collaborative Activity (hereafter C.A.), however, a main effect for type of moderator intervention (hereafter TMI) was found. Students receiving high TMI contributed more messages,  $F(1, 41) = 4.69, p < .05$ , than those receiving Low TMI. The average contribution of messages for students in the high TMI conditions was about 16 messages each, whereas the low TMI conditions contributed on the average 12 messages each. No other significant differences were found (Table 7).

Table 7. Source table for the repeated measures analysis for number messages

Between Subjects	SS	DF	MS	F	P
TMI	443.27	1	443.27	4.69	0.04*
GFS	8.31	1	8.31	0.09	0.77
TMI*GFS	0.10	1	0.10	0.00	0.97
Error	3873.61	41	94.48		
Within Subjects	SS	DF	MS	F	P
C.A.	61.16	1	61.16	1.33	0.26
C.A.*TMI	1.73	1	1.73	0.04	0.85
C.A.*GFS	2.69	1	2.69	0.06	0.81
C.A.*TMI*GFS	13.56	1	13.56	0.30	0.59
Error	1883.15	41	45.93		

Participation, in terms of generating messages was then, according to above analysis higher for students receiving high TMI than students receiving low TMI, however, it indicates that students participated as much in the proposal activity as they did in the debate.

*Hypothesis 1b:*

- *There is no interaction effect for the total number of words per student*
- *There are no main effects for total number of words per student*

At the next level of analysis, the number of words were counted for each student message and added to form a total number of words generated for each of the collaborative activities. The aim was to shed some more light on

how much students participated. The repeated measure analysis revealed the same pattern as above, that is, students provided with high moderator intervention techniques also produced more words,  $F(1,41) = 6.48$ ;  $p = .01$ . No other differences were found (Table 8).

Table 8. Source table for the repeated measures analysis on number of words

Between Subjects	SS	DF	MS	F	P
TMI	6616101.22	1	6616101.22	6.48	0.01*
GFS	32503.18	1	32503.18	0.03	0.86
TMI*GFS	836887.69	1	836887.69	0.82	0.37
Error	41892429.41	41	1021766.57		
Within Subjects	SS	DF	MS	F	P
C.A.	1484112.23	1	1484112.23	2.87	0.10
C.A.*TMI	26094.65	1	26094.65	0.05	0.82
C.A.*GFS	959599.61	1	959599.61	1.85	0.18
C.A.*TMI*GFS	26793.89	1	26793.89	0.05	0.82
Error	21217866.36	41	517508.94		

On the average high TMI students produced about 1695 words for the proposal activity, and 1986 words for the debate, whereas students receiving low TMI produced, on the average, only 1185 words for the proposal activity and 1408 words for the debate regardless of group formation strategy.

Although not significant at the  $\alpha = .05$  level, a tendency for the debate to generate more words is worth mentioning  $F(1, 41) = 2.87$ ,  $p = .10$ . This finding led to a repeated measures analysis on the coefficient of variation of number of words per message which can be calculated automatically in SYSTAT. This coefficient describes, in percentage, the variation of number of words a student had for the number of messages that he/she wrote, providing a measure of variation in length of a message.

Table 9. Source table for the repeated measures analysis of the coefficient of variation of number of words per student

Between Subjects	SS	DF	MS	F	P
TMI	2413.55	1	2413.55	2.13	0.15
GFS	2947.10	1	2947.10	2.60	0.11
TMI*GFS	603.10	1	603.10	0.53	0.47
ERROR	46393.00	41	1131.54		
Within Subjects	SS	DF	MS	F	P
C.A.	10555.94	1	10555.94	12.79	0.001
C.A.*TMI	1555.77	1	1555.77	1.89	0.18
C.A.*GFS	906.35	1	906.35	1.10	0.30
C.A.*TMI*GFS	390.88	1	390.88	0.47	0.50
ERROR	33825.32	41	825.01		

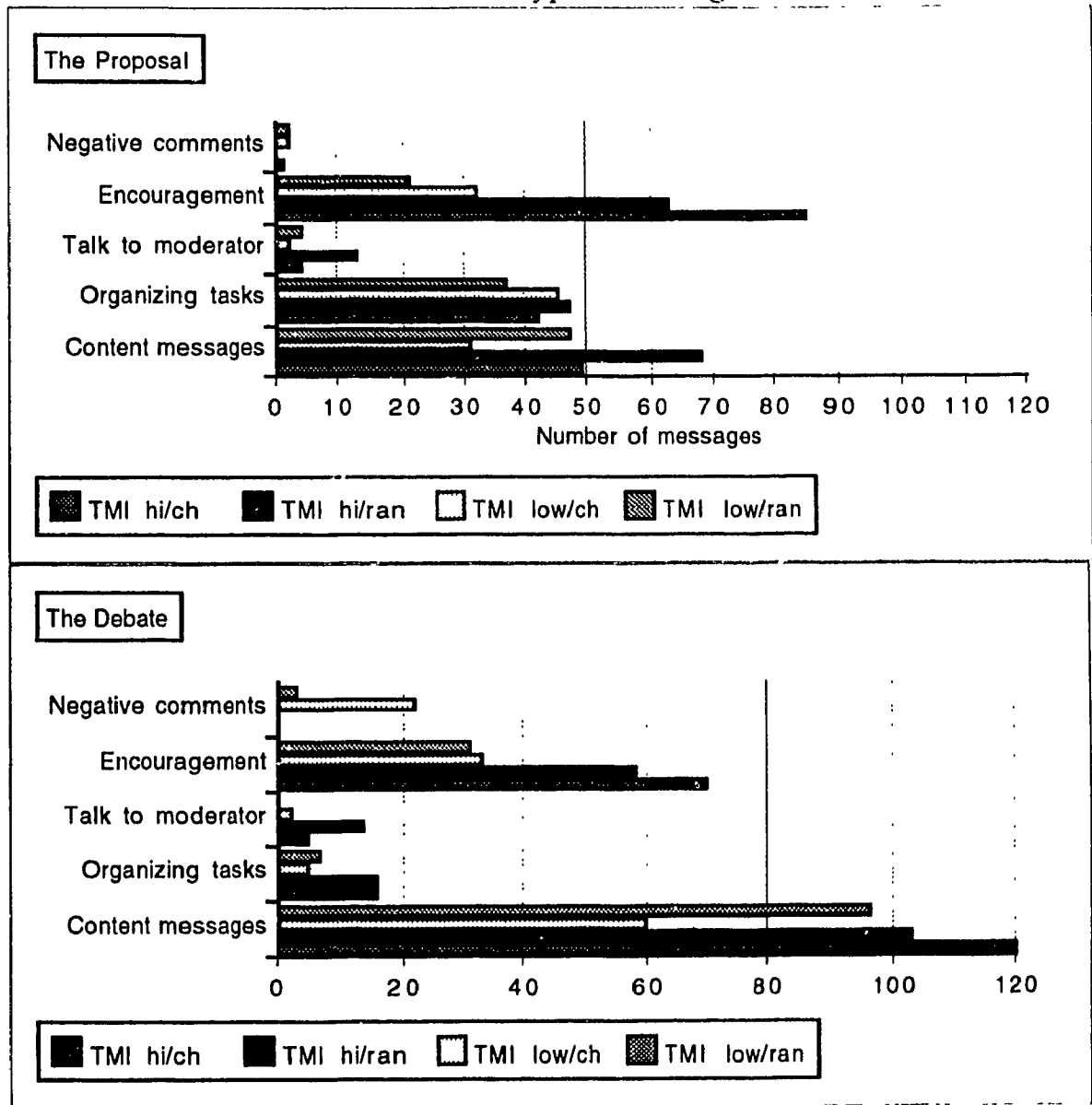
From this analysis it is suggested that students varied less in the length of their average message for the debate than for the proposal activity,  $F(1,41)=12.79$ ,  $p < .001$ . The mean coefficient of variation for messages generated in the debate amounted to 68%, and for the proposal this coefficient was 94%. The outcome of this analysis is reported in Table 9 above, and might suggest that students participated more evenly in terms of length of the message in the debate than in the proposal.

#### Analyses of Message Categories.

At the next level of analysis these messages were classified into five categories (Appendix D); (1) directly related to content (CONT); (2) organizing the tasks among members or setting deadlines for contributions (ORG); (3) talking directly to the moderator (TM); (4) giving encouragement to peers (ENC); and (5) negative or rude messages (NM). Figure 14 shows a graphical representation of the distribution of these categories according to treatment condition and type of collaborative activity.



Figure 14. A graphical representation of number of messages over treatment condition and type of message.



It is interesting to note that most messages were classified as either content messages, organizational messages or messages containing some type of peer encouragement. Table 10 below represents the percentage distribution over conditions and type of collaborative activity of these messages. The remaining percentage are messages either dealing with negative or angry comments from students, or messages classified as talking directly to the moderator, on

the average about 5%. Only in one group TMI low/GFS choose, frustration over late participation generated several angry messages (20%), this happened for the debate where the interdependence among group member is high and fundamentally essential to the task itself (i.e., you cannot carry out a debate by yourself). Worth mentioning is that this occurred only in the condition receiving 'low TMI matched with GFS/choose' and not in the other conditions.

Table 10. Percentage distribution according to group and type of message

Type of Activity	TMI High	TMI High	TMI Low	TMI Low
Type of message	GFS choose	GFS random	GFS choose	GFS random
<b>Proposal</b>				
Content	27%	36%	28%	42%
Organisational	23%	25%	40%	33%
Encouragement	47%	33%	29%	19%
<b>Total %</b>	<b>97%</b>	<b>94%</b>	<b>97%</b>	<b>94%</b>
<b>Debate</b>				
Content	57%	54%	49%	70%
Organisational	8%	8%	4%	5%
Encouragement	33%	30%	27%	23%
<b>Total %</b>	<b>98%</b>	<b>92%</b>	<b>80%</b>	<b>98%</b>

*Hypothesis 1c:*

- *There are no interaction effects for number of content messages*
- *There are no main effects for number of content messages*

A repeated message analysis was first carried out on number of content messages, since the main research question pertains to learning gain. The results revealed a moderate but significant main effect for TMI,  $F(1,41)=4.40$ ,  $p<.04$ , and for type of C.A.,  $F(1,41)=39.84$ ,  $p<.01$ . No other significant differences were found for number of content messages (Table 11; p. 72).

Together these results indicate that, on the average, the debate as compared to the proposal activity generated more content messages, although less wordy as seen from the above analysis, ( $M_{\text{debate}} = 8.58$  versus  $M_{\text{proposal}} = 4.33$ ), and more so for students receiving high TMI ( $M_{\text{debate}} = 9.58$ ;  $M_{\text{proposal}} =$

4.88) , than those receiving low TMI ( $M_{\text{debate}} = 7.36$ ;  $M_{\text{proposal}} = 3.69$ ). Thus, regardless of the between factors, the debate produced more content messages than the proposal, which might signify that a debate is the most adequate type of learning activity for computer conferencing. The basis for a successful debate is high degree of involvement and student interaction.

Table 11. Source table for the repeated measures analysis of content messages

Between Subjects	SS	DF	MS	F	P
TMI	64.97	1	64.97	4.40	0.04*
GFS	30.23	1	30.23	2.05	0.16
TMI*GFS	13.87	1	13.87	0.94	0.34
Error	605.74	41	14.77		
Within Subjects	SS	DF	MS	F	P
C.A.	393.31	1	393.31	39.84	0.01*
C.A.*TMI	5.95	1	5.95	0.60	0.44
C.A.*GFS	1.04	1	1.04	0.11	0.75
C.A.*TMI*GFS	22.05	1	22.05	2.23	0.14
Error	404.77	41	9.87		

*Hypothesis 1d:*

- *There are no interaction effects for number of organizational messages*
- *There are no main effects for number of organizational messages*

The repeated measures analysis for number of organizational messages revealed that students wrote many more messages concerning the organization of the tasks and themselves for the proposal activity than they did for the debate ( $M_{\text{debate}}=.98$ ;  $M_{\text{proposal}}=3.80$ ),  $F(1,41)=38.07$ ,  $p = .01$ . This occurred regardless of treatment condition ( $p>.05$ ).

This result clearly indicates that the proposal activity demanded much more organization and cooperation than did the debate. The fact that the proposal activity required more organization among members might have prevented a larger amount of content contributions. This might signify that,

if a large proportion of their online time has to be spent on organizing group members on deadlines for task completion, then less time is spent on elaborating upon the content.

Table 12. Source table for the repeated measures analysis of organizational messages

Between Subjects	SS	DF	MS	F	P
TMI	1.64	1	1.64	0.29	0.59
GFS	0.48	1	0.48	0.08	0.77
TMI*GFS	2.81	1	2.81	0.50	0.48
Error	230.96	41	5.63		
Within Subjects	SS	DF	MS	F	P
C.A.	184.20	1	184.20	38.07	0.01*
C.A.*TMI	5.47	1	5.47	1.13	0.29
C.A.*GFS	1.02	1	1.02	0.21	0.65
C.A.*TMI*GFS	3.99	1	3.99	0.82	0.37
Error	198.38	41	4.84		

*Hypothesis 1e:*

- *There are no interaction effects for number of encouraging messages*
- *There are no main effects for number of encouraging messages*

In terms of messages classified as encouragement, the repeated message analysis shows that students in the high TMI conditions provided more encouraging messages to their peers ( $M_{\text{debate}}=5.33$   $M_{\text{proposal}}=6.17$ ), than did the students in the low TMI conditions ( $M_{\text{debate}}=3.06$   $M_{\text{proposal}}=2.55$ ),  $F(1, 41)=7.51$ ,  $p = .01$ . This occurred regardless of type of collaborative activity. No other significant differences were revealed (Table 13). It might be inferred from these results that the positive modelling of interaction shown by a moderator is important to maintain a cohesive atmosphere in on-line groups.

Table 13. Source table for the repeated measures analysis for encouragement

Between Subjects	SS	DF	MS	F	P
TMI	193.80	1	193.80	7.51	0.01*
GFS	29.67	1	29.67	1.15	0.29
TMI*GFS	1.57	1	1.57	.06	0.81
Error	1058.26	41	25.81		
Within Subjects	SS	DF	MS	F	P
C.A.	0.60	1	0.60	0.05	0.82
C.A.*TMI	10.01	1	10.01	0.82	0.37
C.A.*GFS	3.77	1	3.77	0.31	0.58
C.A.*TMI*GFS	0.001	1	0.001	0.0001	0.99
Error	404.77	41	9.87		

### Group Equivalence and Covariance Tests

Since the dropout rate was fairly high (29%), it became necessary to verify the randomization process, at least, in terms of academic ability as measured by their cumulative GPA score. Previous academic achievement is generally seen as one of the strongest predictors of academic achievement (Cronbach and Snow, 1977). Therefore, a 2x2 factorial analysis of variance was executed. No significant differences among groups were found ( $p > .05$ ; Table 14). The conditions also varied homogeneously according to Bartlett test for homogeneity of group variances ( $\chi^2 = 1.5$ ;  $df = 3$ ;  $p > .05$ ). These two analyses provides some evidence that groups were initially equivalent according to previous academic achievement, and that the randomization process was successful despite the high loss of subjects.

Table 14. Source table for analysis of variance on the GPA score

SOURCE	SS	DF	MS	F	P
TMI	0.835	1	0.835	1.972	0.168
GFS	0.078	1	0.078	0.184	0.670
TMI*GFS	0.180	1	0.180	0.424	0.518
Error	17.359	41	0.423		

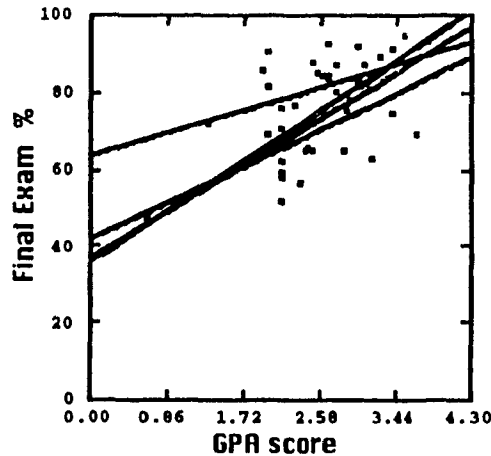
To use the GPA score as a covariate the assumption of homogeneity of the slopes was tested employing the SYSTAT MGH procedure. To do this test the four cells had to be coded into four groups describing each of the treatment conditions, as opposed to using the two factors that would look at the slopes in those two overall groupings. Results show that this assumption

was not violated,  $p = .61$ , and that it was a significant covariate  $F(1, 41)=24.24$ ,  $p<.01$  (Table 15). Therefore, the GPA score can safely be used as a covariate for all the analyses of variance, where it is also positively correlated, that is with idea units and the final exam. The slope for each group is graphically represented (SYSTAT) in Figure 15.

Table 15. Test of homogeneity of the slopes among conditions for GPA

Source	SS	DF	MS	F-Ratio	P
GPA	2260.65	1	2260.65	24.24	0.004
Condition	256.72	3	85.57	0.92	0.44
Condition*GPA	173.20	3	57.73	0.62	0.61
Error	3450.35	37	93.25		

Figure 15. Graphical display of regression lines



Analyses of variances were carried out on all continuous variables preceding the start of the experiment to ensure that treatment conditions were equivalent on those dimensions. In terms of GPA scores, age, score on Project I and score on the CoSy activity I, no significant differences were found ( $p >.05$ ). Table 2 reports basic statistics for these variables in each of the treatment conditions.

Table 16. Statistics for variables observed prior to the experimental phase

Condition (N = 45)		GPA	AGE	Project I Score on 20	CoSy I Score on 10
TMI <i>high</i> / GFS Choose (n =12)	Mean (SD)	2.75 (0.74)	25.69 (5.54)	16.40 (2.48)	8.24 (1.71)
TMI <i>high</i> / GFS Random (n =12)	Mean (SD)	2.78 (0.62)	26.07 (6.92)	16.17 (1.81)	8.43 (1.92)
TMI Low GFS Choose (n =10)	Mean (SD)	2.69 (0.76)	27.69 (9.73)	15.95 (1.71)	8.21 (1.57)
TMI Low GFS Random (n=11)	Mean (SD)	2.30 (0.95)	27.18 (8.08)	15.82 (2.12)	8.29 (1.26)

### Achievement Measures: Final Exam and Unique Idea Units

#### Final Exam.

##### *Hypothesis 2a:*

- *There are no interaction effects for final exam results*
- *There is a significant main effect for TMI, favouring high TMI*
- *There is a significant main effect for GFS, favouring the choose strategy*

A 2x2 factorial analysis of covariance was carried out with the final exam score, in percentage, as the dependent measure. It was hypothesized that the high TMI matched with GFS choose your own partner would do better than any other condition. However, a significant interaction effect ( $F(1, 40) = 6.15$ ;  $p = .017$ ) was found, and no significant main effects were revealed ( $p > .05$ ). The ANCOVA source table is presented in Table 17. This interaction effect accounts for 43% of the variance in the dependent measure. It should also be mentioned that the covariate is strongly significant  $F(1,40)= 25.16$ ,  $p = .001$ , and probably responsible for most of the variation accounted for in the final

exam. These results are graphically represented in Figure 16. Adjusted means and standard deviations are displayed in Table 18. The grand mean was 76.41% with a standard deviation of 12.15.

Table 17. Source table for ANOVA of the final exam score achievement measure

SOURCE	SS	DF	MS	F	P
TMI	26.897	1	26.897	0.292	0.592
GFS	282.196	1	282.196	3.062	0.088
TMI*GFS	567.067	1	567.067	6.153	0.017*
GPA	2318.197	1	2318.197	25.156	0.001*
ERROR	3686.155	40	92.154		

\* significant difference

The coefficient of variance, a coefficient indicating degree of homogeneity of a group (i.e., the lower the coefficient the more homogenous the group) for the different conditions is also shown. Worth noting is that the condition receiving low TMI matched with random GFS had a lower coefficient of variation (C.V.), indicating that this group is slightly more homogenous than the three other conditions, where no differences are discernible (Table 18).

In SYSTAT the simple effect analyses are given with the mean difference (MD) and the probability value, and not with the exact F-values. Simple effects analyses pinpointing this significant interaction revealed that the condition receiving TMI low/GFS random ( $M=83.24$ ) did better than both the conditions receiving TMI low /GFS choose ( $M = 71.02$ ;  $MD = 12.22$ ,  $p < .01$ ) and TMI high/GFS random ( $M= 74.46$ ;  $MD = 8.78$ ,  $p < .05$ ). These results suggest that if high TMI was provided, it did not matter whether groups were randomly assigned or got to choose their own partners, that is, according to the final exam they did equally well. However, students in the low TMI had a higher score on the exam, when they were randomly assigned to groups, than when they had to choose their own partner TMI ( $M_{LTMIchoose} = 71.02$  versus  $M_{LTMIrandom} = 83.24$ ;  $p < .05$ ). In terms of GFS, students who were randomly



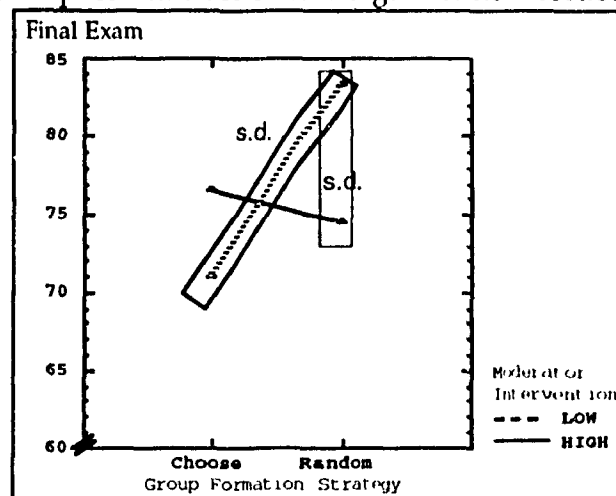
assigned to groups did better when they received low TMI than high TMI ( $M_{HTMI\ random} = 74.46$  versus  $M_{LTMI\ random} = 84.24$ ;  $p < .05$ ).

Table 18. Adjusted means, standard deviations, coefficient of variation and number of participating students (final exam)

Condition	Adj. Mean	SD	C.V.*	N
TMI High /GFS Choose	76.59	11.98	16%	12
TMI High /GFS Random	74.46	14.12	18%	12
TMI Low /GFS Choose	71.02	12.21	17%	10
TMI Low /GFS Random	83.24	9.43	12%	11

\* C.V. = coefficient of variance

Figure 16. Graphical representation of the significant interaction effect



Further, these results suggest that random assignments to groups matched with low moderator intervention techniques might be the best solution to online group work considering that the students are adults in a university level course.

### Unique Idea Units.

#### *Hypothesis 2b:*

- *There are no interaction effects for number of unique idea units*
- *Students in the high TMI/GFS choose were expected to contribute more unique idea units than all other conditions*

Unique idea units were counted for each student and for each collaborative activity in order to investigate whether students contributed more idea units to the Proposal or to the Debate, which is seen as a measure of performance as well as a measure of how much they participated. The idea units were analyzed on these two dimensions. Moreover, it was investigated how much influence that number of unique idea units contributed in each of the on-line activities had on the final exam through a regression analysis.

In terms of performance, it was hypothesized that no interaction effects would be present among the three factors, the within group factor type of collaborative activity (C.A.), type of moderator interventions (TMI) or group formation strategies (GFS). It was, however, hypothesized that a main effect for both of the between group factors would be significant. This is an hypothesis that was directional in its statement, since according to the literature choosing your partners and receiving high moderator intervention would produce a higher degree of participation, and thus hopefully a more pronounced learning gain.

A repeated measures analysis was carried out to test this hypothesis. A significant interaction was found for the two between group factors,  $F(1,40)=5.75, p=.02$ . A main effect for group formation strategy (GFS) was also revealed,  $F(1, 40)= 5.80, p=.02$ . No significant effects were found for type of moderator intervention ( $p > .05$ ) or collaborative activity ( $p > .05$ ), leading to the conclusion that, in terms of number of unique idea units, students

contributed overall as many for the Proposal activity as they did in the Debate.

The GPA score was a significant covariate here too,  $F(1, 40) = 5.63$ ,  $p=.02$ .

Means, standard deviations and the coefficient of variance is reported in

Table 20 (p. 79).

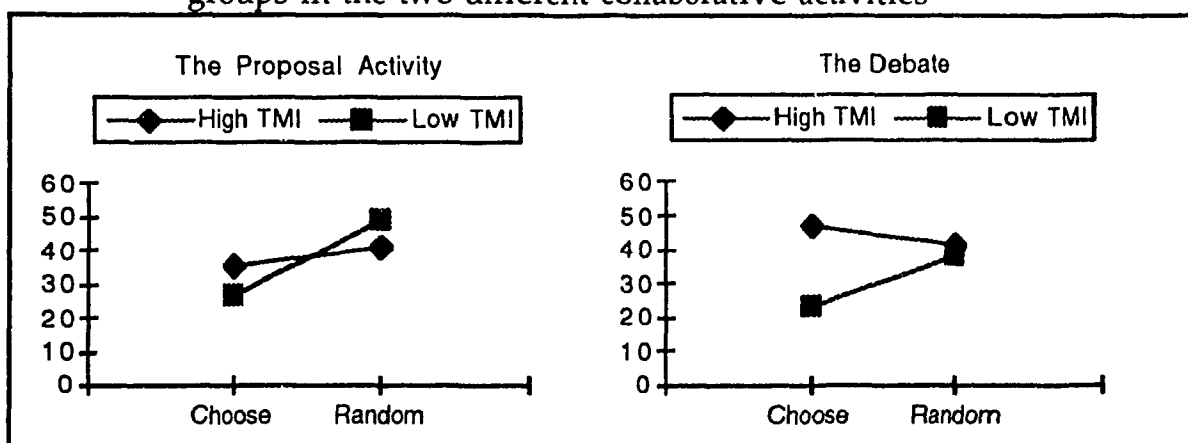
Table 19. Source table for repeated measures analysis of number of idea units

Between Subjects	SS	DF	MS	F	P
TMI	1034.28	1	1034.28	3.02	0.09
GFS	1985.74	1	1985.74	5.80	0.02*
TMI*GFS	1969.77	1	1969.77	5.75	0.02*
GPA	1925.50	1	1925.50	5.63	0.02*
Error	13691.78	40	342.29		
Within Subjects	SS	DF	MS	F	P
C.A.	69.63	1	69.63	0.19	0.66
C.A.*TMI	857.90	1	857.90	2.37	0.13
C.A.*GFS	471.05	1	471.05	1.30	0.26
C.A.*TMI*GFS	23.95	1	23.95	0.07	0.80
C.A.*GPA	56.68	1	56.68	0.16	0.69
ERROR	14479.65	40	361.99		

\* significant difference

Figure 17 below is a graphical representation of the two collaborative activities and the number of student generated idea units in each condition. Although these patterns look different, there are no statistically significant differences between conditions in number of unique idea units produced for each of the activities, nor the effect of the factors under investigation.

Figure 17. Graphical representation of number of Idea Units for the treatment groups in the two different collaborative activities



Since there was no significant difference between collaborative activities in terms of number of idea units as shown in Table 20 (next page), the total contribution of idea units was analysed to pinpoint the interaction effect.

Table 20. Means and standard deviations for number of unique Idea Units for the two experimental on-line activities

Condition	M (SD)	The Proposal	C.V.	The Debate	C.V.
TMI High /GFS Choose	35.75 (10.43)	29%	46.81 (17.75)	38%	
TMI High /GFS Random	41.40 (21.55)	51%	41.18 (26.50)	62%	
TMI Low /GFS Choose	26.74 (20.41)	77%	23.03 (13.57)	60%	
TMI Low /GFS Random	49.17 (18.88)	40%	38.35 (18.96)	52%	

Total number of idea units were simply calculated by adding the number of idea units for each activity together (Table 22). The GPA score was again used since it was significant and highly correlated with number of idea units,  $r=+.66$ .

Table 21. ANCOVA source table for total number of idea units generated by students regardless of activity

SOURCE	SS	DF	MS	F-RATIO	P
TMI	2004.11	1	2004.11	2.87	0.10
GFS	4328.91	1	4328.91	6.20	0.02*
TMI*GFS	4280.30	1	4280.30	6.13	0.02*
GPA	3511.44	1	3511.44	5.03	0.03*
ERROR	27937.13	40	698.43		

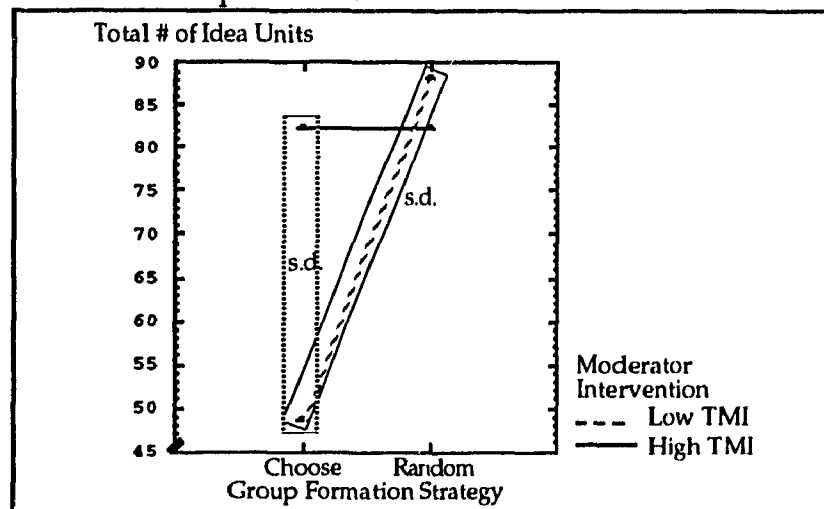
Table 22. Total amount of unique idea units generated by students in each of the of the conditions

Condition	Adj. Mean	SD	C.V.*	N
TMI High /GFS Choose	82.27	24.24	29%	12
TMI High /GFS Random	82.30	35.39	42%	12
TMI Low /GFS Choose	48.71	30.21	63%	10
TMI Low /GFS Random	88.18	17.29	21%	11

\* C.V. = coefficient of variance

A significant interaction was again detected,  $F(1, 40) = 6.13, p < .02$ . A main effect for the group formation strategy was also revealed in favour of random assignment to groups,  $F(1,40) = 6.20, p = .017$ . The TMI factor was not significant ( $p > .05$ ). From the simple effects analysis it can be imparted that students in the TMI Low /GFS Choose ( $M = 48.71$ ) produced significantly fewer idea units than any of the three other conditions (i.e., a mean differences above  $MD = 33$ ;  $p < .01$ ). No other differences were found ( $p > .05$ ). Again it is interesting to look at the coefficient of variance showing the same pattern as for the final exam results, that is TMI Low /GFS random (21%) and TMI high /GFS Choose (29%) appear considerably more homogenous in terms of contributions of idea units, than the two other treatment conditions (42% and 62%) (Figure 18.).

Figure 18. Graphical representation of the significant interaction of total number of unique idea units



Above results appear to corroborate the results for the final exam when considering low TMI, randomly assigned students have a higher number of idea units than students in the choose condition. However, whereas no difference was found between group formation strategies in the high TMI

groups for the final exam, such a difference was found here in favour of the choose condition when counting idea units.

This discrepancy might mean that if students are highly interdependent, produced by a low moderator intervention strategy, they take on more responsibility to finish their tasks. It should be mentioned here, that in the low TMI conditions which constitutes 6 small groups, one of the students was either asked to or on his/her own took on the responsibility of prompting the others to participate and respect deadlines. Although only a qualitative observation, this phenomena did not occur in the high TMI groups whether randomly or choosing partners. (Figure 19).

Figure 19. Excerpts from small groups in the low TMI conditions, showing how students took on the moderator role

=====  
 group1/Debate #6, pppd

There is/are comment(s) on this message.  
 -----

TITLE: Let's get started!

The introduction of completely online courses provides this august educational institution with a new ability to reach out in distance education. Students are no longer limited by the tyranny of the clock, no longer forced to adhere to an inconvenient time frame. The introduction of this course entirely online is a significant achievement in education.

Of course, this is not to say that all education should be conducted in this manner. The social and socialization aspects of schooling must not be understated. But in a post-secondary environment, where many students face the conflict between work and studies, the provision of courses via non-traditional methods permits a much wider spectrum of participation.

=====  
 group2/Debate #8, yyx

TITLE: THIS MESSAGE IS FOR XYy

Due to the lack of time, as a team we will have to write our own statements, add to each other's if need be.

Just to give you an idea of how I plan to go about it, is that I will begin with my opening remarks which you can add to and elaborate on, (in order to avoid repetition as a group), afterwards I will proceed to rebut what has been already stated by our formidable oponents.

If you have any other suggestions or if you have had previous experience with debates whether on line or not let me know what to do to improve our presentation. Let us try not to lose sight of what we are arguing against.

=====  
 group1/Proposal #12, mmmh,  
 This is a comment to message 39

-----  
 To divide the task, I suggest we take the part we feel most comfortable with (of the 5 parts). Since I do have access to teachers in math, social science and biology, I can re verify if they have any knowledge of e-books and their on the subject. \ We have to give ourselves deadlines to bring the info on-line. I will try for wednesday. mmmh.

=====  
 group3/Proposal #5, zzzx,  
 There is/are comment(s) on this message.  
 -----

TITLE: Hey Everyone!

Are experiencing the mid-semester CRAZYNESS? well, me too.

I really like to get organized as soon as possible, cause getting organized is 75% of the work. So please get back to me so we can get a division of labour going.

Especially since some of us might be going away on the break.

zzzx  
 -----

Comparing online with off-line collaborative activities in terms of performance

*Hypothesis 3:*

- *All assignments are equally important to succeed in the final exam, once variation due to GPA score is accounted for.*

To test this hypothesis a hierarchical regression analysis was carried out using as predictors for the final exam score their GPA score (forced in first), their contribution of number of idea units for the Proposal activity and for the Debate, their percentage grade for the two off-line projects, project I and II. All assumptions were verified by saving residuals and scrutinizing them for normality, linearity, independence of error, and that error variance was constant. None of these assumptions were violated, and no outliers were found. According to these results, it appears that the GPA score and number of Idea Units generated for both the activities are good and significant predictors of final exam results, resulting in a  $F(5, 39)=12.77, p=.001$ , for the regression equation. The number of Idea Units for the Debate turned out to be the strongest predictor ( $T(39) =3.71, p =.001$ ), however closely followed by the GPA - score ( $T(39)=2.83, p = .007$ ). The number of Idea Units generated for the Proposal activity, was also significant, ( $T(39)= 2.23, p=.031$ ). These predictors together explained 56% of the variation in the final exam measure.

Redoing this analysis including only GPA scores and idea units generated for the two collaborative activities separately, yields a slightly stronger model, where 59% of the variation in the final exam score is explained. Further, notice that the exam had about equal number of questions pertaining to each of these activities and projects. Thus, there seem to be enough evidence to, at



least, believe that the two on-line activities did help students do well on the exam. The regression statistics are presented in Table 23.

Table 23. Statistics for the significant regression equation

Variable	Coeff	Std Er	Std Coeff	Tol	T	P(2 Tail)
CONSTANT	41.27	5.44	0.00	.	7.59	0.01*
GPA	7.13	1.98	0.38	0.90	3.61	0.01*
Idea Units (Proposal)	0.15	0.06	0.23	0.97	2.32	0.03*
Idea Units (Debate)	0.28	0.06	0.49	0.91	4.71	0.01*

Source	SS	DF	MS	F-RATIO	P
Regression	3878.76	3	1292.92	20.25	0.001
Residual	2617.25	41	63.84		

### Attitudinal Measures

The group cohesion and productivity instruments were administered in order to investigate how students perceived the online activities in these terms. Four hypotheses were stated in their regard (p. 65-66).

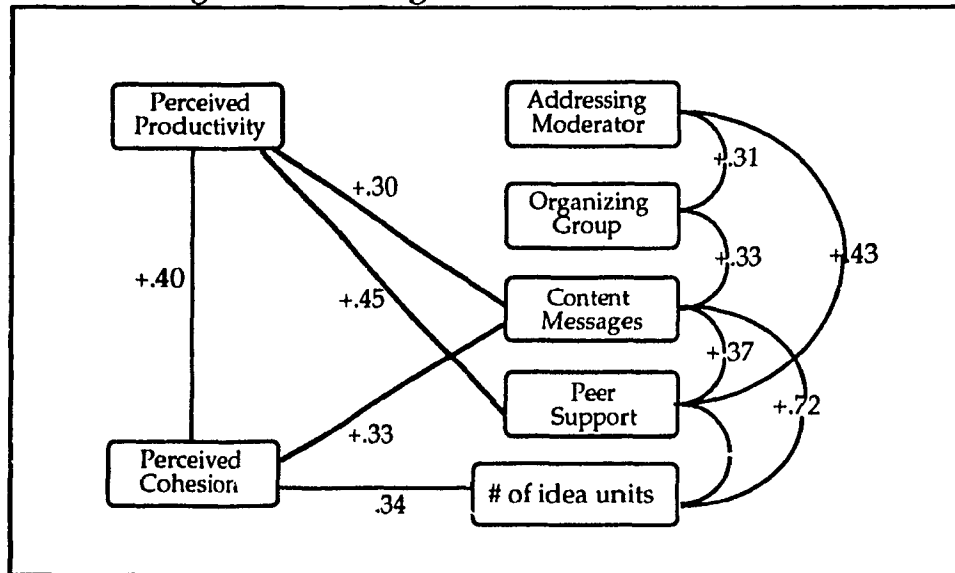
#### *Hypothesis 4a:*

- *Cohesion and productivity measures are significantly and positively correlated with each other overall and for each activity.*

This hypothesis was tested by carrying out a simple Pearson correlation. The combined index scores for these two measures were significantly and positively correlated,  $r = +.40$ ,  $p < .05$ . If taken apart, that is the cohesion and productivity index for each activity, results show that for the Proposal activity  $r = +.29$  ( $p = .06$ ;  $N = 42$ ), and for the Debate this coefficient was  $r = +.38$  ( $p = .01$ ;  $N = 42$ ). Thus, only the Debate produced a significant relationship between these two measures. Relating these measures to categories of messages and number of idea units, it revealed that perceived productivity is significantly related to number of content messages,  $r = +.30$ ,  $p < .05$ , and to number of encouragement messages (peer support) by  $r = +.45$ ,  $p < .03$ . The

cohesion measure is significantly related to both number of idea units,  $r=+.34$  ( $p<.05$ ) and number of content messages,  $r=+.33$ ,  $p<.05$  (Figure 20).

Figure 20. Relationships between perceived cohesion, productivity and categories of messages



*Hypothesis 4b :*

- *Cohesion and productivity measures are significantly and positively correlated with final exam results*

This hypothesis was tested by carrying out a simple Pearson correlation. Only the group cohesion score for the Debate showed a positive and significant coefficient  $r= +.46$  ( $p < .01$ ) with the final exam results. The correlation coefficient for number of idea units and the final exam score for the proposal activity was  $r = +.34$  ( $p = .02$ ) and for the debate it was  $r = +.63$  ( $p < .01$ ). The relationship between final exam results and total number of idea units amounted to  $r=+.69$  ( $p<.01$ ). These results indicate that the number of idea units produced by a student is a good measure of productivity leading to higher learning gains. It also seems reasonable to presume that the more a student participated in terms of idea units, the more the student elaborated

the content, more so in the debate than the proposal activity, and hence produced a higher score on the final exam.

*Hypothesis 4c :*

- *There are no interaction effects for the cohesion measure*
- *There are no main effects for the cohesion measure*

Because this instrument was not validated in experimental terms, a non-directional hypothesis was stated. However, according to the literature choosing your partners typically increases cohesion as well as having an effective moderator that plans ahead, encourages and relieves tensions in early stages of the group work.

A repeated measures analysis was carried out to investigate whether this cohesion measure was dependent on type of collaborative activity, as well as the between group factors. Results show significant main effects for the two between group factors (Table 24). In terms of type of moderator intervention techniques the high TMI condition reported a higher degree of cohesion,  $F(1,38)=8.96, p <.02$ . For the group formation conditions this significance suggest that the random assignment condition produced a higher score on the this cohesive measure,  $F(1,38) = 5.72, p<.03$  (Table 24). Means, standard deviation and C.V. is displayed in Table 25. Figure 21 shows these result graphically as an overall measure of cohesion. It is interesting to notice the coefficient for variation index, which indicates that groups that do better are also more homogenous. It should be mentioned that, although, significance was found, only 27% of the variance for the cohesion measure was accounted for, which makes it a less reliable measure.

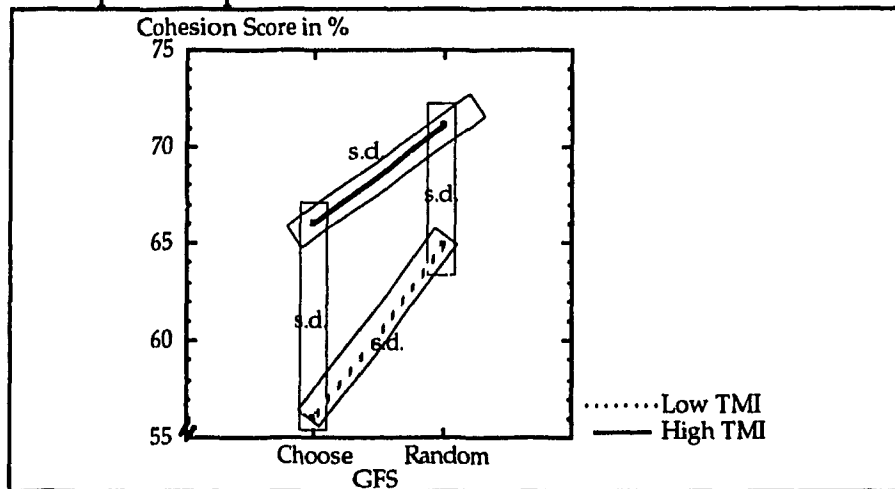
Table 24. Univariate repeated measures analysis for the cohesion measure

Between Subjects	SS	DF	MS	F	P
TMI	1411.19	1	1411.19	8.96	0.01*
GFS	901.12	1	901.12	5.72	0.02*
TMI*GFS	69.59	1	69.59	0.44	0.51
ERROR	5985.69	38	157.52		
Within Subjects	SS	DF	MS	F	P
C.A.	64.15	1	64.15	0.82	0.37
C.A.*TMI	0.21	1	0.21	0.00	0.96
C.A.*GFS	64.11	1	64.11	0.82	0.37
C.A.*TMI*GFS	0.21	1	0.21	0.00	0.96
ERROR	2972.92	38	78.23		

Table 25. Mean standard deviation and C.V. for the cohesion measure

Group Formation		Choose	Random
High Moderator Intervention	M	66.12	71.45
	(SD)	(7.15)	(11.19)
	C.V.	11%	16%
Low	M	56.06	64.46
	(SD)	(11.97)	(5.68)
	C.V.	21%	9%

Figure 21. Graphical representation of main effects for the cohesion measure



It should be pointed out explicitly, since contradictory to the cooperative literature, that again random assignment to small groups seem to be a better alternative than choosing your own partner for on-line group work.

*Hypothesis 4d:*

- *There are no interaction effects for the productivity measure*
- *There are no main effects for the productivity measure*

No significant differences were found for either of the factors ( $p > .05$ ), whether analysed by each item separately or as an overall measure of productivity, a score combined from the responses to the first 5 items of this instrument.

To further investigate the validity of this instrument two regression analyses were carried out, one for each of the activities, using each of the responses to the five items as predictor of productivity in terms of number of idea units. The higher the score the more productive the group should have been. Both of these analyses proved to be non-significant, not one of the items are even close a significant probability level ( $p > .30$ ). It might therefore be concluded that this instrument does not measure productivity for either of the two on-line activities, remembering that number of idea units is highly correlated with the final exam score.

This instrument looks at productivity in terms of the groups capability to manage time, develop ideas, make decisions, how they perceived members involvement in the group work, how they perceived the overall productivity of the group to be, and how their perception of this activity was in terms of understanding course content. In an attempt to illuminate the experience in those terms, items were recoded into three levels; (1) little , (2) productivity okey; and (3) highly productive. Table 26 and 27 on page 110 show these results. Each item was then tested by the table function in SYSTAT. The test statistic given is a contingency coefficient, since for each item a 3 by 4 table is constructed. None of these tables showed any significant differences ( $p > .05$ ). Some of the items appear to differ among conditions (not statistically) and are

interesting to look at as a tendency that might shed some light on earlier results.

*Effective use of time.* Sixty-four percent of the students in the low TMI/GFS choose group thought they wasted too much time, whereas students in the other groups mostly thought they did fairly well (i.e., = ok =3).

*Development of ideas.* About an equal number of students in all groups thought that they developed ideas well or ok (i.e., about 70%) regardless of condition.

*Ability to decide.* Same type of distribution can be seen here, with a slight tendency to discontent in the low TMI/GFS choose group, where 22% perceived their groups as having "poor resolution, couldn't agree", as compared to the other conditions were only about 10% of the students thought so.

*Involvement.* This item is statistically significantly different at the  $\alpha = .10$  level. This tendency lies between low and high TMI, where those receiving high TMI mostly thought they had "an excellent exchange of ideas" (~ 56%), compared to the low TMI, where they mostly thought that "one or two of the members took over" (~ 65%).

*Overall productivity.* For the Proposal activity, about 73% of students receiving high TMI, reported having held a "highly productive session", compared to low TMI, where about 60% reported the same contentment. For

the debate, students receiving high TMI thought themselves more productive (58%) than students receiving low TMI (~40%).

*Increased understanding.* Here students in all conditions but the low TMI/GFS choose condition, perceived the activity as an excellent way to increase understanding of course content, that is 67% overall for both activities. However, if one looks at individual results, the low TMI/GFS choose condition only 44% thought so for the proposal, and 56% for the debate, whereas in the other conditions a larger percentage of students thought that it was excellent for assisting in understanding course content.

Table 26. Percentage distribution for the productivity items for The Proposal Activity \*

Condition	High TMI			High TMI			Low TMI			Low TMI		
	Choose GFS			Random GFS			Choose GFS			Random GFS		
Items: In terms of ... our group did	Little	OK	Well	Little	OK	Well	Little	OK	Well	Little	OK	Well
Effective use of time	9	73	18	28	55	18	22	67	11	64	27	9
Development of ideas	9	55	37	28	9	64	22	44	34	18	46	36
Ability to decide	9	55	37	18	27	55	22	11	67	9	55	36
Involvement	9	37	55	28	18	55	11	67	22	28	64	9
Overall Productivity	0	27	73	18	9	73	0	33	67	9	36	55
Increased understanding	18	18	64	18	9	73	33	22	44	9	9	81

\*All numbers are percentages of students who rated an item either little, ok or well within each condition and for each item separately.

Table 27. Percentage distribution for the productivity items for The Debate \*

Condition	High TMI			High TMI			Low TMI			Low TMI		
	Choose GFS (n=11)			Random GFS (n=11)			Choose GFS (n=9)			Random GFS (n=11)		
Items: In terms of ... our group did	Little	OK	Well	Little	OK	Well	Little	OK	Well	Little	OK	Well
Effective use of time	27	55	18	36	36	28	22	67	11	64	27	9
Development of ideas	18	27	55	18	36	46	44	22	34	18	36	46
Ability to decide	9	27	64	9	36	56	33	22	44	9	27	64
Involvement	27	27	46	9	27	64	22	22	56	18	27	56
Overall productivity	9	36	56	18	18	64	44	11	44	9	56	36
Increased understanding	0	36	64	9	18	73	22	22	56	9	18	73

\*All numbers are percentages of students who rated an item either little, ok or well within each condition and for each item separately.



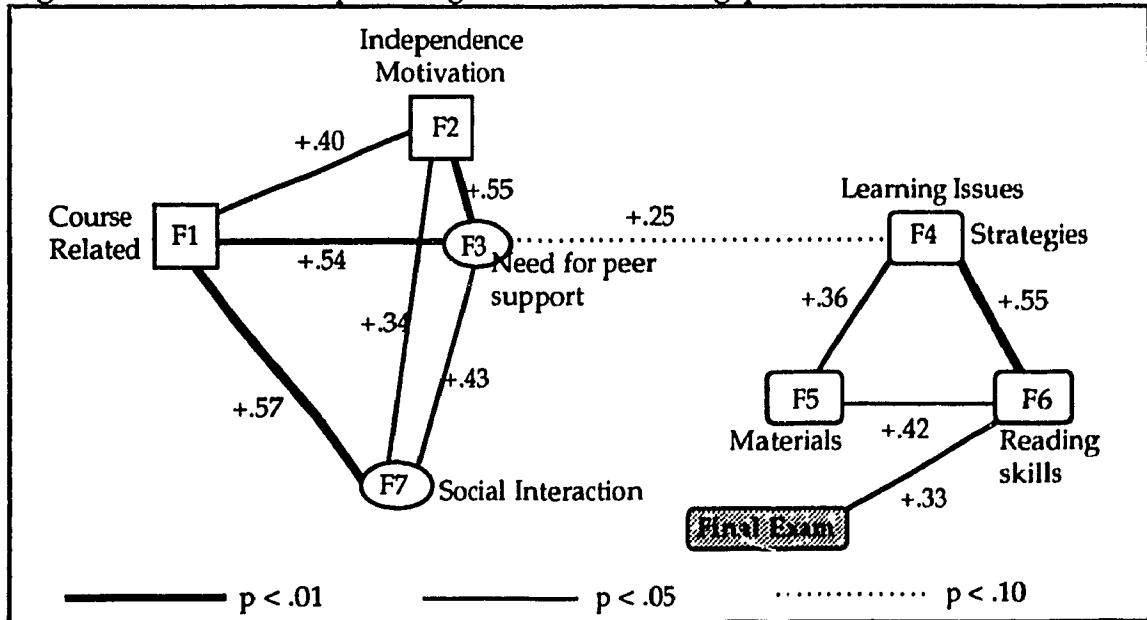
Perceived Difficulties in DE.

*Hypothesis 5a:*

- *There are no significant relationships among factors in the perceived difficulties in DE instrument.*

Since 90% of the students in this course were both on- and off-campus this instrument offers insights on how students perceive differences to on-campus courses by indicating whether they found the item harder/more difficult/greater effort in distance education. First the relationships among these factors were identified as shown in Figure 22 below. Only factor six, describing a greater need for good reading skills and written feedback in distance education, was positively and significantly related to final exam results ( $r=+.33, p<.05; N= 42$ ).

Figure 22. Relationship among factors describing perceived difficulties in DE



The following interpretation can be offered for the above correlation coefficients:

- F1: The harder they thought it was to understand course requirements, the harder they also thought it was to be learning on your own (+.40) and the more they thought that there is a need for social interaction (+.57).
- F2: The harder they thought it was to be learning on your own, the greater they believed that the need for peer support (+.55) and social interaction (.34) was.
- F3: The greater they perceived the need for peer support, the greater they thought that there is a the need for social interaction (+.43), and there was a tendency to believe that there is a greater need for more than one learning strategy and extra help (+.25)
- F4: The greater they perceived the need for more than one learning strategy and extra help, the more they believed that one needs good reading skills (+.55) as well as a greater need for better learning materials (+36).
- F6: The greater they thought the need for reading skills was, the higher their score on the exam (+.33) as well as a greater need for better learning materials (+.42) .

*Hypothesis 5b :*

- *There are no interaction effects in terms of their perception of social interaction in DE*
- *There are no main effects in terms of their perception of social interaction in DE*

No significant differences were found for either of the factors, nor an interaction effect ( $p > .05$ ). Investigating the percentage distribution in terms of

this factor, results show that 30% of students believed that it was easier to discuss contents of the course with other students or the teacher/tutor, 14% about the same, and 55% thought it was harder, when compared to regular class room instruction.

*Hypothesis 5c:*

- *There are no interaction effects in terms of their perception of peer support in DE*
- *There are no main effects in terms of their perception of peer support in DE*

No significant differences were found for either of the factors, nor an interaction effect ( $p > .05$ ). Examination of the overall distribution of responses to this factor reveals that 67% of the students that the need for peer support is greater than in regular classrooms. This factor is combined from two items, "...locating other students to work with is (harder/easier)" and "... the tendency to put off studying is (greater/less)". It appears that although they had the online opportunity to locate students, they still felt that the tendency to put off studying at a distance is greater compared to regular classroom instruction. Only 12% thought this was less, and 20% perceived this need as about the same.

Cloze Reading Comprehension Test

Since only 36 out of the 45 subjects completed this test, it was decided not use it as a covariate. However, it might be worth mentioning that there is some evidence that it is positively correlated to achievement; +.33 with final exam results, +.41 with total number of idea units, and finally +. 47 with GPA scores. It is a test which lends itself well for use at a distance, since no time constraints are imposed. As can be seen though, it is difficult to enforce

because it is difficult to complete, which frustrates students, which in turn leads to a low completion rate and therefore makes it useless.

### Summary

Figure 23 shows the summary of significant effects for the major dependent variables in this study. The results of this study corroborates only certain aspects of underlying theoretical assumptions that were used to state the directional hypotheses.

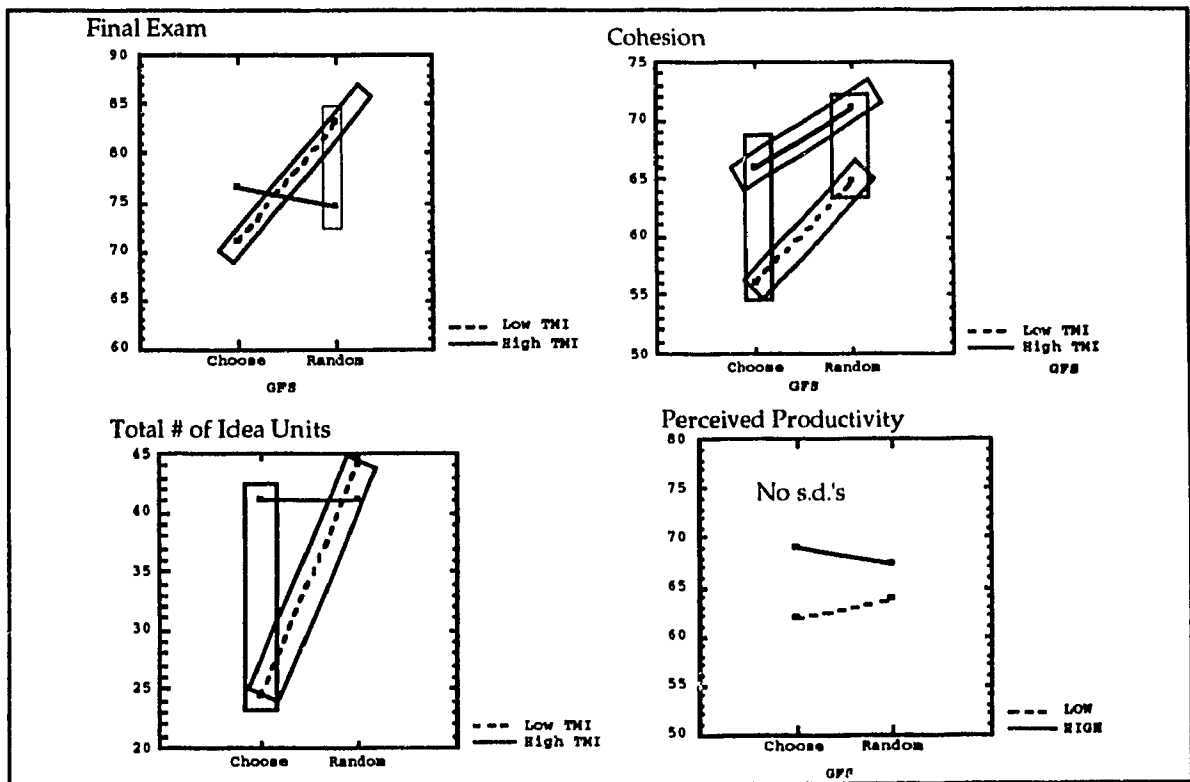
In terms of learning gain, as measured by the final exam, it was found that when high TMI was given, students did equally well regardless of GFS strategy. If low TMI was provided, students did better when randomly assigned to groups than if they choose their own partners. On the other hand, if groups were randomly assigned, students did better with low TMI.

If learning gains were measured as total number of idea units that a student contributed to the online tasks, then again no difference for the GFS conditions occurred. It also confirmed the results for the final exam measure in that the low TMI/GFS random did better than the low TMI/choose condition. However, for the idea unit's measure, no difference for the random conditions occurred, but instead results indicate that if the choose strategy was selected, then students did better if they received high TMI. Keeping in mind that number of idea units were fairly highly correlated with final exam results (+.69), these results are somewhat contradictory.

Taking into account student's perceptions it becomes even more complex. The cohesion measure shows main effects for both the between group factors, but no interaction. Essentially, whether students receive high or low TMI, they feel more cohesive if they are randomly assigned to groups. However,

whether students are in the choose or random GFS conditions, they do better if they receive high TMI. This measure of cohesion was not significantly related to the final exam measure, and only moderately correlated with total number of idea units (.34), therefore not confirming the idea that high degree of perceived cohesion is beneficial to a higher degree of learning gain.

Figure 23. Summary of graphical representations of major dependent measures and effects



In terms of perceived productivity, no significant effects were found at all. Moreover, a weak but positive, however statistically non-significant, relationship was revealed between perceived productivity and number of idea units and ( $r = +.21$ ,  $p = .18$ ). No relationship at all was found between final exam and this productivity measure ( $r = +.07$ ,  $p = .66$ ), strongly suggesting that either it did not measure productivity or that there is no relationship to either performance or achievement.

Globally these results are somewhat ambiguous which lead the researcher to believe that other factors are in play, as explained in the next few pages.

Table 28. Summary of major significant effects indicating the most beneficial condition for primary measures

Measures	Factors	C.A.	G.F.S.	T.M.I.
Final Exam		both	random	low
Number of Idea Units		debate	random	same
Cohesion		debate	random	high
Productivity		same	same	same
Number of Content Messages		debate	same	high

### Reflections in hindsight ...

*"Objective science has thus nothing 'absolute' about it.  
 Science does not rest upon rock-bottom.  
 The bold structure of its theories rises, as it were, above the swamp.  
 It is like a building erected on piles.  
 The piles are driven down from above into the swamp,  
 but not down to any natural or 'given' base."  
 From *The Logic of Scientific Discovery* by Karl Popper, 1959.*

### Rationale

*Balanced Versus Unbalanced Designs of Instruction.* When designing instruction, many factors are considered in terms of who the learners are (i.e., ability, aptitude, prior knowledge, motivation level etc...), time constraints and the content to be learnt, which together determines learning and teaching strategies as well as media that one would adopt, briefly an eclectic approach to practice is usually applied in instructional design (Heinich, Molenda and Russel, 1993). This approach to selection of media and strategies requires analyses at basically two major levels, the learner and the content. For example, for certain types of tasks combined with the age and level of the students determines whether behavioral techniques might apply better than cognitive techniques. If basic facts and procedures are to be learnt, then probably a behaviourist approach is more appropriate, whereas higher order learning skills might be better learnt applying strategies from the cognitive or constructivist theories.

One could look at this decision in terms of amount of supplantive and generative strategies that will be built into the design. Supplantive or mathemagenic strategies are explicit statements that directly alert the student to the events of instruction, objectives and necessary practice that the student needs to carry out. In other words supplantive strategies help the student to structure the content to be learned, leaving little responsibility to the student

for his/her own learning. The disadvantage with these tutor/teacher imposed strategies is seen as diminishing the depth of student's mental processing and thereby also lowering the motivational level (Salomon, 1979). On the contrary, generative strategies (Wittrock, 1974) propose learning situations where the student must actively construct meaning by relating new information to prior learning, which occurs when the student bears the major responsibility for how to structure and organizing the content to be learnt, which is seen to result in better learning . The disadvantage with generative strategies is that they are more time consuming and highly dependent on the learners prior knowledge, motivational level and approaches to learning. Accordingly, it seems necessary to strike a balance between amount of structure that is teacher/tutor imposed versus the amount that will be required from the student.

In light of the above discussion, the following restructuring of groupings were conjectured to be optimal. All the instructions on how to carry out the two activities are seen as supplantive strategies, that is directly telling the student what he/she has to do, the goal of the activity, pertinent literature etc.. Moreover, random assignment to groups further imposed structure on students, as well as high moderator intervention techniques. The two between group factors created four cells, that could be described in terms of structure versus flexibility in a learning environment.

In terms of moderator intervention strategies, high TMI provides more teacher/researcher imposed structure than low TMI, which is seen to provide flexibility to the learning environment. In terms of group formation strategies, letting students choose their own partners provides more flexibility and student responsibility than being randomly assigned to small groups. The following model could be constructed from the above reflections and the



somewhat contradictory results, which would relate to amount of structure and flexibility in a learning environment. Since both too much structure or too much flexibility appears to impede learning, a new between group factor here-to-forth called Design with two levels, a balanced versus an unbalanced learning environment was created. Further, since the GPA score is clearly positively related to academic success, it was tested for use as a covariate. The slopes were significantly different ( $F(1, 41)=4.94, p=.03$ ), and the basic assumptions for use as a covariate was violated. Therefore, it was decided to use a blocked design, that is students having a GPA score lower than 2.6, were classified as low achievers and the others high achievers. This created four new cells distributed as shown in Table 29.

Table 29. Balanced versus unbalanced learning designs

TMI High GFS Choose	TMI High GFS Random	TMI Low GFS Choose	TMI Low GFS Random
<b>Balanced</b>	Too much structure <b>Unbalanced</b>	Too much flexibility <b>Unbalanced</b>	<b>Balanced</b>

Pearson's Chi-Square statistics with 1 DF show not significant ( $p = .45$ ), indicating that counts are not statistically differently distributed (Table 30).

Table 30. Distribution of new groupings

	Design	Balanced N	Unbalanced N
GPA			
High		11	13
Low		12	9

### Achievement

Two separate analysis were carried out using this new grouping system, a repeated measures analysis where the dependent measure is the number of idea units generated in each of the activities, and secondly an ANOVA with

the final exam as the dependent measure. Means and standard deviations pertaining to the three following analysis are reported in Table 31.

Table 31. Means, standard deviations and Coefficient of Variation (SD/M) for number of idea units and final exam results (%)

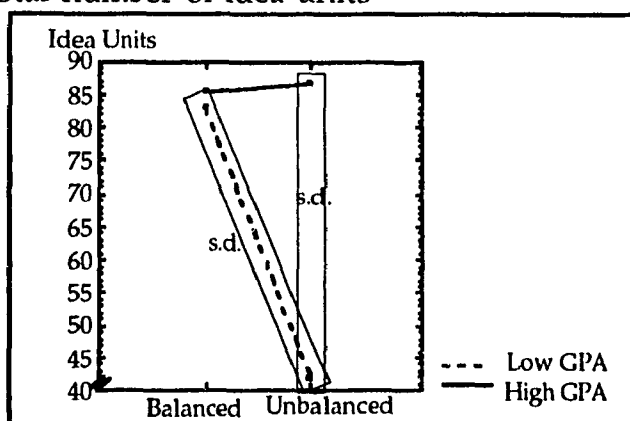
GPA (Design)	(N)	Idea Units Proposal M (SD) C.V.	Idea Units Debate M (SD) C.V.	Total Idea Units M (SD) C.V.	Final Exam % M (SD) C.V.
High (Balanced)	(11)	44.05 (17.27) 39%	50.19 (21.74) 43%	85.18 (23.71) 28%	83.77 (7.62) 9%
High (Un-Balanced)	(13)	51.37 (28.86) 56%	45.11 (24.63) 55%	86.46 (35.27) 41%	81.63 (9.64) 12%
Low (Balanced)	(12)	54.96 (19.40) 35%	38.28 (16.60) 43%	82.92 (18.59) 22%	74.40 (11.27) 15%
Low (Un-Balanced)	(9)	28.04 (14.15) 50%	20.14 (15.42) 77%	41.78 (21.72) 52%	62.56 (9.22) 15%

The repeated measure analysis was carried out on number of idea units as the dependent measure for each of the two collaborative activities. A significant interaction was found for the between group factors,  $F(1,41)= 6.89$ ,  $p < .02$ , explaining 42% of the variation in the dependent measures. Significant main effects were also found for both the between group factors, that is Design,  $F(1, 41) = 6.06$ ,  $p < .03$ , and Success  $F(1, 41) = 8.48$ ,  $p < .02$ . No other significant effects were found, indicating that these effects stay the same regardless of collaborative activity (Table 32 and Figure 24 on the next page).

Table 32. Repeated measures analysis for number of idea units

Between Subjects	SS	DF	MS	F	P
Design	2072.19	1	2072.19	6.06	0.02*
Succes	2899.86	1	2899.86	8.48	0.01*
Design*Succes	2354.98	1	2354.98	6.89	0.01*
Error	14017.34	41	341.89		
Within Subjects	SS	DF	MS	F	P
C.A.	7.32	1	7.32	0.02	0.89
C.A.*Design	46.97	1	46.97	0.13	0.72
C.A.*Succes	860.85	1	860.85	2.39	0.13
C.A.*Design*Succes	363.21	1	363.21	1.01	0.32
Error	14800.90	41	360.99		

Figure 24. The significant interaction between design and success factors for total number of idea units



It is interesting to note that type of collaborative activity did not significantly influence number of idea units that were generated ( $p > .05$ ). Simple effects analyses reveals that high achievers do equally well whether in a balanced design or unbalanced design. High achievers also do better than low achievers in an unbalanced design, but interestingly enough there is no difference between low and high achievers when working within a balanced design. It was also found that low achievers do better in a balanced than an unbalanced design. Thus a balanced design appears to favour both low and high achievers.

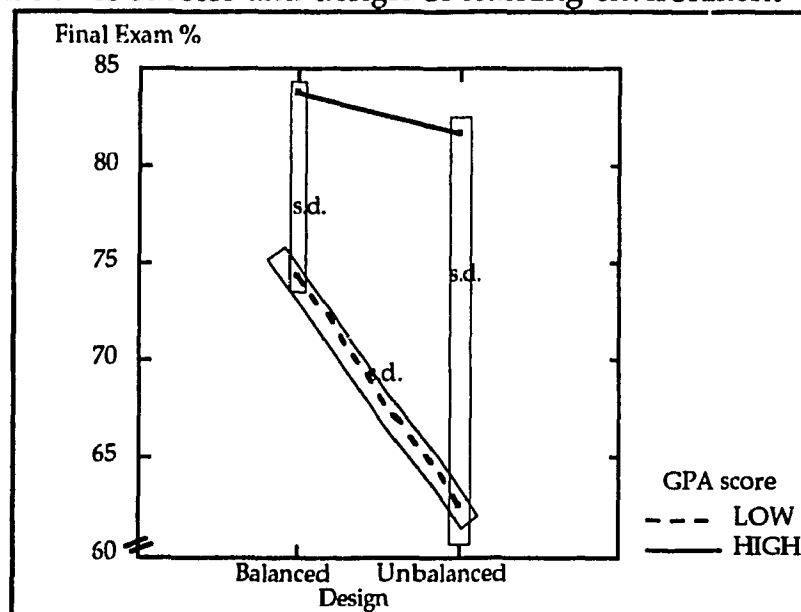
The ANOVA carried out on the final exam did not revealed a significant interaction effect ( $p > .05$ ), but both the Design factor,  $F(1,41)=5.86$ ,  $p = .02$ , and

the academic achievement Success factor,  $F(1,41)=24.26$ ,  $p < .001$ , were significant main effects. Overall, these effects indicate that low achievers did worse than high achievers, and students in a balanced design do better than students in an unbalanced design regardless of GPA score. Moreover, a post hoc examination using Tukey's test for significance revealed that low achievers in a balanced design did significantly better than low achievers in an unbalanced design ( $MD = 11.84$ ;  $p = .04$ ), thus corroborating the results for the idea units as well as the idea that balanced design does make a difference. The source table for this analysis is reported in Table 33, and a graphical representation of those effects are shown in Figure 25.

Table 33. Analysis of variance for the final exam results (%)

Source	SS	DF	MS	F	P
Design	539.52	1	539.52	5.87	0.02*
Succes	2231.65	1	2231.65	24.26	0.01*
Design*Succes	260.02	1	260.02	2.83	0.10
Error	3771.71	41	91.99		

Figure 25. Graphical representation of the final exam results in terms of academic success and design of learning environment



## Chapter 5

### Discussion

*"So a circle is completed: The observer is the observed.  
Reversible and irreversible are levels infused in each other."  
From Looking Glass Universe: The Emerging Science of Wholeness by John D.  
Briggs, and F. David Peat, 1984.*

#### Distance Education and CC

As is well known, computer-mediated communication (CMC) is now readily available to both graduate and undergraduate students in most western universities, offering new educational opportunities. Most prominent among CMC applications may be the on-line access to library searches and registration facilities, but also e-mail and the Internet. Computer conferencing (CC) is one CMC application that has been seriously practised and researched in educational settings since the mid 80's. Principally descriptive research has been carried out to delineate patterns of interactions that occur (Winkelmans, 1988), and collaborative activities that appears to be appropriate for this medium (e.g., Harasim, 1989; Hiltz, 1987; Boyd, 1990, 1993; Spuck, Prater & Palumbo, 1995; Velayo, 1994; Wells, 1995). The most common activities within CC are topic discussions and debates, but also problem-solving in forms of role playing in fantasy scenarios (Davie & Inskip, 1992). Instructional design for these computer conferencing trials has mostly relied upon cooperative strategies and theories of group dynamics stemming from

classroom and/or group dynamics research in face-to-face (FTF) situations (e.g., Smith, 1981).

The medium itself imposes some 'peculiar' limitations to the interaction which is possible, thus deviating in essential ways from regular FTF instruction. For example, CC is void of human images and sounds, and relies completely on the written word. Consequently, the human interaction that occurs is not the same as in a FTF situation, nor is the process of learning. Another characteristic of CC is that it allows learning to be non-linear and possibly more reflective and elaborate because of its asynchronous mode (LeCavalier, 1990). On the other hand, FTF learning situations require active and instantaneous participation in the learning event, which for many learners is inhibiting, and therefore more likely to impede than enhance learning. As opposed to the CC situation, learning in FTF situations can be seen as sequential and therefore because of these differences new ways of communicating and managing learning have to evolve. New ways of communication have to capitalize on these specific features and the conditions that electronic environments impose on the instructional event, instead of trying to infer too hastily design features that have been found beneficial in FTF situations.

Two-way communication can be seen as the cornerstone for efficient and effective adult learning environments. Adult principles of learning recommend that for effective and efficient learning to develop, the tutor role must be that of a facilitator, co-ordinator and equal collaborator, which only becomes possible when continual dialogue is established (Laiken, 1988; Beder & Darkenwald, 1982; Berge, 1995; Tagg, 1994). CC expands on and makes these opportunities of two-way communication possible for distance education institutions. The distance student, on the other hand, must be encouraged

and prompted to take on more of the responsibility for his/her own learning, which progressively might lead to a more self-directed and independent learner, which could in itself be seen as a goal (Beaudoin, 1990; Brookfield, 1986; Knowles, 1975). A collaborative learning environment employing cooperative strategies subscribes to these ideas.

Although CMC is not yet available to all, electronic communication is most likely the medium of the future that will allow for two-way communication for people far apart. However, the explosion of CMC applications (i.e., Internet Services and Web pages), in conjunction with technological improvements in terms of faster modems, more user-friendly interfaces, less costly computers and services will, in a near future, make it available to most students. Therefore, it deserves attention in educational contexts, and more research efforts to investigate effective and efficient uses for education are not only justified, but required (Hollingshead, McGrath & O'Connor, 1993).

The major goal of this study was to investigate collaborative activities (CA), appropriate organizational strategies (GFS) and techniques (TMI) suitable for collaborative on-line learning environments. The inherent characteristics of CC limits and focuses possible alternatives. The underlying problems in DE situations were stated in terms of the lack of qualitative (i.e., social exchange and content elaboration) as well as quantitative (i.e., number of opportunities) interaction, often cited in the DE literature as the main reason for dropping out.

The discussion section is divided into two parts according to the problem statement (p.41), more specifically addressing CC as a social forum and CC as a learning tool for distance education students.

CC as a social forum deals with the impact of the cafe topics and the shared conference spaces dealing with administrative issues on the drop-out rate.

CC as a learning tool will address the three factors in terms of learning gain, productivity and cohesion. The results, although not exhaustive, show some evidence that both the qualitative and the quantitative interaction did enhance student learning under certain conditions.

### CC as a Social Forum

It would seem that the problem of drop-out in this course is basically as high as is usual for DE courses (i.e., 30-50%) and therefore one can not assume that computer conferencing per se helped diminishing the drop-out rate. Only presenting students with an opportunity for a higher degree of interaction, might not yet be enough. Rather, it seemed to impose an obstacle to complete the course, and was initially seen as a larger amount of work to be completed, compared to other courses, even though a large number of students had a computer with a modem. Unfortunately, only a few knew how to use a communication package.

The fact that CC in itself is not yet basic knowledge most certainly contributed to the feeling of a "too heavy course load", which was reported as the most common reason by the students who dropped the course. CC technology is still in its infancy and may not be as "user-friendly" as desired. CC still demands an initial learning period (Mason,1993; Berge, 1995; Burge, 1994; Wells, 1993), that is seemingly hard to overcome, which was certainly confirmed by this study. The learning period was comparatively long and required a lot of tutor time, effort and energy to respond to all kinds of technical problems. Thus, both students and tutors, spent hours figuring out



technical problems, instead of spending time on content elaboration. For this specific course it was justifiable, since the subject area of the course was to provide students with a knowledge of electronic media and technology in education. It might, however, be disproportionate to spend that many hours on technological issues for courses having no links to learning about media and technology.

On the positive side, it should be emphasized that only one of the students not owning a computer left the course directly mentioning the CC component as their major reason for dropping out. The fact that at least ten students, who were complete novices, learnt to be comfortable using the system within the first month, does indicate that CC is a viable solution to the lack of two-way communication in DE. This experience strongly suggests that it is necessary to organize a workshop at the beginning of the term to decrease frustration due to technological hurdles, that is, it is essential to reduce the number of "trial and error" situations.

It is encouraging to be able to report that, of those who completed the course, most agreed that CC provides an essential component to counteract the lack of social interaction in DE. Many more of the students pointed out the problems of access to the mainframe computer, than they did the difficulty of learning how to set up and use the CC system.

### The Cyber-café

This study confirmed that there is a need for distance education students to fill the gap of social exchange that is normal for FTF students, because they are meeting at the same location weekly, thus allowing for both social talk and the development of support groups for studying.

The conversation in the 'cyber café' ranged from information on studying, where to go for counseling, to discussing films and even personal problems. The 'cyber café' also served as a mechanism for relieving tension about the course and the CC system, through jokes and little stories. The most striking fact about these 'cyber cafés' was that students were intensively using this facility in the beginning of the term, and then as the term progressed this use gradually diminished. One possible interpretation for this phenomenon is that the more they used the CC system for content elaboration, the less they needed the social talk, which instead was incorporated as the encouragement and supporting messages within their own work group, and thus less in the cafe spaces in the shared by all (i.e., in the same condition) conferences.

There was however an upswing in number of messages at the end of the term in the cafe topics. The following excerpts, from the cyber cafe's, show a support for the idea that social contact is both needed and appreciated by distance education students.

Figure 26. Excerpts from the cyber cafe's showing students appreciation of social talk

=====  
 cafe3 , ttll, 555 chars, 11-Apr-95 14:00  
 -----

TITLE: LATER

Wow, I don't believe I too feel a bit sad that our course is ending. Even though I have never met anyone on line. I feel as though a good friend is moving away and that I probably won't get to see them again. It would take me a half an hour drive just to get to a computer and until this moment I never even thought I was going to miss it. Oh well..... Good luck everyone and I for one would like to perhaps go somewhere after the exam just so we can put names with faces and interact in that new wave medium.....talking to y'a later, ttll

=====  
 cafe3 , jjjm, 230 chars, 11-Apr-95 13:08  
 -----

TITLE: good bye. GOOD BYE EVERYBOBY!!! It was very nice talking to you all. I hope we could continuing communicating by another kind of distant communication program. Some of you know some other program that we could join? jjjm

=====  
 cafe3 , mmmmd, 249 chars, 11-Apr-95 13:10  
 -----

Hi jjjm! Long time no 'read'. I hope you are doing fine. The time pass so fast that I cannot imagine that this term is over. Today is our last day of class. I hope I could talk to you after the exam. See you at the exam. Good luck!! By. mmmmd

=====  
 cafe3 , nnnb, 150 chars, 11-Apr-95 13:13  
 -----

Good-bye! It was such a special experience Hope everyone trust the system a bit more  
 Congratulations for the teachers on a job sooo well done, nnnb

=====  
 cafe3 , dddp, 110 chars, 3-Mar-95 02:25  
 -----

P.S., I'm desperate for a CoSy friend. but my true life is not a lost cause!! Lonely (CoSy) guy,  
 dddp.

=====  
 cafe3 #49, zzzl, 280 chars, 10-Apr-95 17:29  
 -----

TITLE: TO GROUP 1a

Good going guys... Lot's of hard work.. cckk you gave me a run for my money, lot's of thinking & typing, and no offence taken it's good to see I can make people chuckle. Take Care All & good luck with the exam. Zzzl

=====  
 cafe3 #58, pppd, 524 chars, 25-Apr-95 23:31  
 -----

Hi zzzl! Glad to see you got my messages! I wish you the best of luck on your exams as well! While I'm writing this comment to you, I am eating some DELICIOUS Mr. Felix & Norton tasty treats... no Oreos here! I can't wait to get this exam out of the way. I'm scheduled to go to Cuba as of Sunday morning! Did you want to come? I here that Cuba is not too known for its cookie making! Guess we'll have to plan a trip elsewhere in the future! By the way, you mentioned in one of your messages that you'll be seeing everyone at the exam... just one problem: we'll have to wear name tags! Have fun... I know I will!

=====  
 cafe3 #56, mmmh, 257 chars, 9-Apr-95 18:z7  
 -----

TITLE: I'm all done!

I believe I have done my efforts to contribute to the debate. I must thank one and all the students for participating in the exercises with me, and the moderators for the support and constant availability. See you at the exam. hhhm

---

## CC as a Learning Support Tool

The growth of distance education institutions can be explained by two factors according to Miller and Clouse (1994), namely the change in student demographics and a change of delivery methods. Further, Miller and Clouse explains the shift in demographics as the strong increase of mature working women in the distance education institutions, but also that students were found to be more motivated and independent, than ten years ago. The present study is consistent with these findings, and further emphasizes the idea that instructional delivery methods must change accordingly by employing adult learning principles and innovative technology.

To summarize and attempt to interpret results from this study, the achievement and performance measures, the three factors and the cohesion and productivity measures that were investigated, serve as the underlying structure for looking at CC as a learning tool. Finally, an attempt is made to delineate useful guidelines for future electronic collaborative work.

### Performance and Achievement

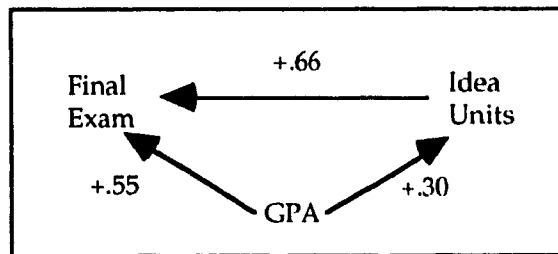
Performance and achievement are closely connected concepts, which are not always differentiated. However, it can be argued, that performance is what a student does in a learning environment, and achievement is the learner's gain at the end of the experience.

In this study, the performance measure was seen as the number of idea units that they contributed for each activity, and the achievement measure their score on the final exam. These two measures were highly correlated,

which could be interpreted as the better a student performs within a learning environment the higher the achievement scores.

Another factor that was accounted for in this study was previous achievement, measured by their GPA score. Even though the final exam and number of idea units have a higher correlation coefficient than GPA scores and number of idea units, these measures are all statistically significantly related (Figure 27).

Figure 27. Temporal relationship between measures of achievement and performance



The treatment effects that were found for the performance measure, idea units, indicate that if students were allowed to choose their own partners, they contributed more ideas if they were provided with high moderator intervention techniques. However, if they were randomly assigned results show evidence that high moderator techniques were not needed, since no significant differences were found when compared to low moderator techniques. It might, therefore, be argued that randomly assigning students to groups is an efficient method for both students and tutors, since they appeared to do equally well whether in high or low moderator conditions. However, caution must be placed in these results because of the relatively small cell sizes.

The achievement measure does not completely corroborate this finding, since for this measure, no difference showed up between low and high TMI,

when groups chose their own partners, instead it was found that if students were randomly assigned, they obtained a higher grade on the final exam if they were provided with low TMI.

Consistency between performance and achievement was found at two levels,

- if students were provided with high TMI no differences were found
- if students were provided with low TMI, randomly assigned groups did better

The inconsistency lies in that for the achievement measure randomly assigned students did better when provided with low moderator intervention than with high, whereas for the performance measure this did not occur. Instead, a significant difference was found when students were in the choose conditions, indicating that high moderator intervention was superior to low, but no difference were found when randomly assigned to small groups.

In an attempt to explain this ambiguity, groups were reconstructed according to balanced versus unbalanced learning designs as well as by being blocked on prior achievement (see p. 98-99). Consistent with the literature on aptitude by treatment effects, high achievers did as well whether in an unbalanced or balanced design, and overall better than low achievers concerning performance as well as achievement. Low achievers performed better for both measures if they were in a balanced design (pp. 100-101). As explained before a balanced design could be defined as being more balanced in terms of teacher and student imposed structures, that is balancing the on amount of responsibility that is put on the learner. Thus results on performance and achievement suggest that, at least for low achievers, a balance of imposed structures is necessary.

## The Collaborative Activities

This research used three types of collaborative activities, one non-experimental and two for the experimental phases. These could, theoretically, be classified according to an eclectic approach to instructional design, thus utilizing underlying assumptions from several learning theories.

Session 1: This activity was structured to help students gather facts and learn procedures. These type of skills are considered best learnt according to behaviourist principles of learning, which briefly means in terms of instructional design, practice by recognizing stimuli, produce response, and receive fast feedback. This activity was essentially designed to train students in using the CC system, by answering questions on content and commenting others, a very rudimentary form of interaction. This type of activity does not really capitalize on the special characteristics of the medium, however, presumably necessary to overcome the initial technological learning hurdles. An encouraging 71% of the students reported that they did feel confident using the system after this activity. Twenty-two percent of the students stated that they felt quite sure, whereas only 7% still felt uncomfortable, supporting the idea that there is a need for such an activity.

Session 2: The proposal activity was designed according to two lines of thought. First, to satisfy the social dimensions of learning, seen as the ability to constructively share tasks, information and resources through conversation. Secondly, according to Bloom's taxonomy, the ability to gather, synthesize and evaluate information. Thus, this activity practised product/process centered strategies following cognitive learning principles, where the intention was for students to learn and synthesize principles.

The global impressions from this activity exposed certain problems that are closely related to the functioning of the CC system. First, they were instructed to choose a task, then, in a message on-line, tell the others why they would prefer or could do the task well. They were also instructed to explicitly state the deadline for completion of their task to organize the time. This took time, and would have required that students logged on daily to make it a viable strategy. Secondly, the last part of this assignment was to put their contributions on each task into a joint proposal with the instructional intent for further elaboration on the content, thus spending more time on organization, which requires a high participation rate. Some of the groups delegated one person, and some groups choose to set it up in several parts, each doing one part. Both methods were suggested and permitted. It was left up to the group to decide which strategy to adopt at responsibility of the group, which, in fact, might have unnecessarily complicated the activity.

The number of organization messages confirm that this activity was very time consuming for students and required, all over, a very high participation rate to be successful and worthwhile. For those who were also in the conditions choosing their own partners even more time was spent on organization alone. The time involved to select and organize groups might be part of the explanation for random groups doing better, because structure in terms of forming their groups were provided and no time was lost.

The excerpts on the next page show how time consuming, confusing and frustrating this activity was perceived by students. (Please, keep in mind that the deadline was on the 7<sup>th</sup> of March).



## High TMI groups

---

=====  
 activity 2 #6, vvvv, 325 chars, 20-Feb-95 23:49  
 -----

TITLE: Hi Group

It's vvvv. I think I read earlier that you, ccck would be handling task 1 and 2. I would do task 3 if everyone agrees. I don't mind doing another task, but from I see there aren't any. Correct me if I'm wrong. Lets confirm to each other who is doing what again. say between tomorrow and the day after.

=====  
 activity 2 #13, gggl, 802 chars, 24-Feb-95 08:49  
 -----

Hi! It's L.A. I think there was a misunderstanding because in the conference 'partners' I expressed an interest in task #3, ccck is interested in #4 and we were looking for group members who were familiar with visual media. ccck said he would do either task #1 or #2. Then I believe vvvv joined our group. I had left a message on Monday that we should all get started so I did! I started working on task #3!!!!!! So, vvvv would you be able to do task #2? O.K. forget that, I will do task #2 to make it easier on us but I will need some time to get started on it.

## Low TMI groups

=====  
 activity 2 #29, aaab, 475 chars, 1-Mar-95 16:42  
 -----

TITLE: Hi, its aaab. Sorry for not logging on for the past week. I hope that choosing to answer the first question which is giving a description of the unique characteristics of visual media and how it can enhance and facilitate student learning is o.k. I realize that someone has already chosen it but if there are five people in our group with only four questions, which should I choose? Please answer as soon as possible mmmc, pppc, hhhm or ddds.

=====  
 group2c/exercise2 #5, sssf, 100 chars, 23-Feb-95 13:42  
 -----

pppd where are you? I would like to start organizing ourselves. Any preferences?

=====  
 activity2 #11, rrrl, 324 chars, 2-Mar-95 13:36  
 -----

Hi this is rrrl on-line. I'm glad to be in the group and I'm anxious to start working. I wasn't sure how I was to go about doing this exercise. I'd like to know how we are splitting up the tasks can someone leave me a message? Thanks! As soon as I know what part of the exercise I am working on I will enter my responses.

=====  
 group1c/exercise2 #30, hhhm, 100 chars, 1-Mar-95 18:31

This is a comment to message 29

There are additional comments to message 29.

=====  
 O.K. with me aaab, I do not remember who choose the 1st question. we must ask that person.

=====  
 activity2 #5, jjjr, 306 chars, 6-Mar-95 02:52

This is a comment to message 4

=====  
 Perfect. Now at least I'm a part of a group. I hope I haven't caused too much trouble by not starting earlier. Just in case my other group members logs on soon, I'll be covering the question about VCR's and camcorders. I'll put my first answer in tomorrow morning. Till then, jjjr

---

Overall, this assignment appeared too complex and demanding of time to be efficient for on-line collaborative work. Tuckman & Jensen (1977) proposed that for groups to grow and develop into productive groups, the "storming and norming" phases have to take place, which is supported all the organizational messages in this study. However, the confusion and frustrations that occurred, instead indicate that this is not at all a suitable strategy for on-line instruction, and that maybe the "storming and norming" phases have to be dealt with by a teacher imposed structure. It might be, that on-line collaborative work demand more imposed structure and control from tutors to reduce confusion because of its asynchronous nature. Cooperative strategies that leaves too many decisions to the group does not seem to be a viable solution according to this study.

Session 3: The debate was created to develop higher order thinking/learning skills, such as evaluation and problem solving. It was based in constructivist and socio-culturist learning principles, that emphasize the construction of meaning through conversation. Cooperative strategies such as "learning by controversy" was used by imposing a 'for' and 'against' position on students. It is important to assign students to these positions to avoid negative conversation, such as personal critique. Instead, emphasis should be put on encouragement and promotion of constructive conversation ( see e.g., von Glaserfeld, 1990), that is, making the knowledge/content relevant, viable and useful for their own 'reality'.

The design of this activity was aimed at producing an even higher task interdependency than the Proposal activity. In the Proposal activity students could eventually do all, or most of the tasks individually without

help from the group, which was, of course, virtually impossible in the Debate activity.

In conjunction with quantitative results, the qualitative impressions from this activity lead me to believe that the students realized the relevance for their own situation bringing into the discussion real life examples, which in turn appeared to be very motivating and increased the participation rate for this activity as compared to the Proposal activity. Overall, students also appeared to remember more from this activity as measured by the final exam.

To summarize, these interpretations of the three different types of collaborative activities, Figure 26 gives a framework that delineates one way of viewing the relationship between types of collaborative activities and strategies as well as type of higher order learning skill according to Bloom's taxonomy (1956).

Figure 28. Types of learning and instructional strategies

Types of learning	Input Centred Strategy	Product/Process Centered Strategies	Social Centered Strategies
Session 1: Q & A Facts and procedures	Answer straight forward questions <b>Analyze</b>	Learn CC system	Socialize (get to know each other)
Session 2: Proposal Concepts & Principles		Explain concepts Explain principles <b>Synthesize</b>	Gather and Share information Divide the task
Session 3: Debate Problem solving			Share, argue, evaluate & judge your point <b>Evaluate</b>

In combination with the outcome of the anonymous course evaluation results (not reported here), the results and the reflections pertaining to this study seem to indicate that the constructivists principles of learning are best suited for learning activities utilizing CC in a DE context. To elaborate, there

are a lot of common elements between constructivist and andragogical instructional principles. For example, both schools are proponents of personal relevance and intentionality of the learning task, active participation and construction of meaning, development of self-regulatory skills and attitudes (Crotty, 1995). Both theories also look at how to balance the learning situation considering tutor/material versus student control with a desire to promote personal autonomy by balancing expository versus generative strategies, that are built into the activities. Further, both these instructional theories propose problem solving situations where, dialogue or conversation are the essential 'means' to enable decisions on how to solve a problem, hence actively reconstruct meaning and understanding (i.e., learn).

In a short term study Danningberg (1992) found that only presenting students with excellent examples of a learning approach, was more beneficial for immediate recall of content, as opposed to requiring college students to practice to construct their own organization of the materials to be learnt. It might be concluded from this finding that at the university level these mature students are capable of 'imitating good learning behaviour' just by being exposed to it, and perceive practice basically as a waste of time?

Observation and imitation are also the basic idea behind Brown and Collin's (1987) reciprocal teaching strategy, although it was developed for and with children. If transformed into an adult learning strategy, the mere knowledge of this basic learning strategy of how to form questions, clarify, predict and summarize information might be enough? This study showed some evidence to this effect, since, when high interdependency was created (i.e., GFS: random , TMI: low and C.A.: debate) students participated more. They also seemed to learn and recall more of the content without high TMI to back them up, which is confirming findings reported by Cavalier, Klein &

Cavalier (1995). It should be noticed that in the first session all students got high TMI regardless of condition, thus all students had the opportunity to observe a 'model' tutor of how to communicate on-line.

### Moderator Intervention Techniques

To briefly recapitulate findings, the results revealed that, if high moderator intervention was provided, no significant differences were found for group formation strategy on most dependent measures. However, if random assignment to groups was practised, then, students in the low TMI condition scored higher on most measures. Thus, results do not clearly prescribe a preference for either moderator intervention technique, only that one or the other is better for certain measures, when grouping strategy is accounted for. Globally, analysis show that low TMI, is as good as high TMI, but for the cohesion measure. Students in the high TMI conditions perceived themselves as more cohesive than students in the low TMI conditions.

The following excerpt provides some qualitative evidence on how students in the 'low TMI/GFS random' condition, who on their own initiative, took on the responsibility for carrying out the tasks, encouraging and prompting each other to participate. All three small groups within this condition developed the same behaviour, which is an indication that, maybe, low TMI does promote a higher degree of interdependence, and therefore a higher degree of responsibility on the part of the students for their own learning.

### Random GFS/low TMI

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=====  
 activity 2 #7, eees, 447 chars, 22-Feb-95 00:06  
 =====

TITLE: Group1 llk, aaaf & kkka

Hey ladies, it's eees eager as ever to embark on this exciting journey known as activity 2! We have a lot of work ahead of us and just as much teamwork. We're going to have to log in enough times and share a heck of a lot of duties. I have read some of the material and saw the required video. I'll be waiting for some responses. Until such time, enjoy your spring. I mean reading week!!!! eees

=====  
 activity2 #5, ttbt, 457 chars, 22-Feb-95 19:13  
 =====

TITLE: Group2

Hi this message is for those students in group 2. I haven't seen any messages left yet by anyone so I taking it upon myself to say if any of you are interested dividing up the research for the proposal I will be very glad to hear from you. I personally would like to write about the use of the camcorder in the classroom. Let me know what your interested in researching. I am very flexible for researching other topics. Thanks for the attention. ttbt

---

To further shed light on the moderator phenomenon, Feenberg's typology on moderator functions is helpful (1989). This typology describes three types of functions: contextualizing; monitoring and meta functions. The moderator in the high TMI groups was instructed to model, coach, scaffold and progressively fade from the group conversations. The moderator in the low TMI groups was instructed to only answer direct questions, with the intention of letting this role develop from "within" the group. They were informed of appropriate roles to take on [i.e., the encourager, the manager (deadlines), the summarizer and the clarifier (Abrami et al. 1993)] to ensure good cohesion and management of a group. In the high TMI groups students appreciated, but tended to be dependent on the moderator to "help" them out. In the low TMI conditions, students appeared to take on these roles to clarify content, to encourage each other, to prompt participation and setting deadlines for task completion (i.e., proposal activity) or arguments (i.e., debate).

Feenberg's typology of moderator functions appears as an excellent starting point to combine and reconsider how economically (i.e., time and money) these two strategies could be presented to the students. Another justification for requiring more responsibility of the learning from the student in electronic environments, is that the amount of hours that were covered by the tutor in the high moderator intervention conditions in this study, is not a viable solution from the point of view of both cost and time.

In an attempt to unravel which of the moderator functions should and could be that of the student's and which should/could be that of the tutor's responsibility the following table was constructed according to Feenberg's typology. Again, these can be seen as components of a balanced design in terms of amount of structure that is tutor imposed and what is student imposed.

Table 34. Student versus tutor responsibilities in on-line conversations

Moderator Functions	Student Responsibility	Tutor Responsibility
Contextualizing	Opening comments Clarifying content Provides opening statement	Setting agenda Explaining rules of behavior
Monitoring	Recognizing and encouraging peer comments Prompting participation	Prompts, encourage and recognizes the group as a whole
Weaving	Deals with information overload Remedies problems of context, clarity and relevance. Attempts micro-weaving.	Provide closure and meta-weaving

### Group Formation Strategies

To come to grips with organizational aspects of on-line instructional design, two group formation strategies were investigated: (1) choose your

partner, and (2) random assignment. Choosing your partner gives flexibility, whereas random assignments provides tutor imposed structure. Although, it has been found in the face-to face literature to be an advantage to 'choose your own partner' for small group work (Shaw, 1981), this was not confirmed by this study. On the contrary, students having to deal with finding partners often found it too time consuming and frustrating, especially for those students that were delayed in their work because they had to find partners.

The most frequent explanation for the frustration, when due to low participation rate, was that students did not log on often enough. There were many reasons for this, however, the most common was the frequently busy telephone lines accessing the CC system. Inevitably, choosing your own partner removed one of the main advantages of CC systems, namely the advantage of being able to work in your own time and pace.

Students in the randomly assigned groups, who did not have to deal with the frustrating flexibility of choosing your partners, started their assignments earlier, had more discussions, and finished their tasks faster. Although, not quantitatively unambiguously determined, since several interactions with moderator intervention techniques were found, there is some evidence that for on-line small group work it might not be necessary or even desirable to let students choose their own partners.

These results are obviously dependent on the situation, that is CC applied in distance education, where students do not see or know each other at all. It might be that if CC is implemented as an extension to classroom education, choosing your partners might be a better alternative. However, it appears to me, that in whether in FTF or CC, spending on-line time choosing partners is not an effective or efficient strategy.



What might be relevant to investigate for on-line organization of groups is group size. For example, it appeared that the few groups that had four or five members had a greater exchange and more genuine participation rate, than those who were only three. Group size was not a part of this study the observation that bigger groups had a higher participation rate is only a qualitative impressions, however interesting.

The problems that occurred because of the "choose" group formation strategy triggered several thoughts on the balance of structure and flexibility. The following matrix is an attempt to decipher how this balance could be conceptualized.

Table 35. The balance between structure and flexibility to create high interdependence in small collaborative groups

Instructional Component	Strategies	
	Expository (structure imposed by the system/tutor/materials)	Generative to provide student flexibility/responsibility
Organization	All	Avoid
Events	Positions Roles	Relating to own experience Debating/Arguing
Moderating	Initial Modelling Coaching, Scaffolding but Fast Fading Provide explicit guidelines Macro - weaving	Micro weaving synthesising practice elaboration encouraging

### Group Cohesion and Productivity

The theoretical idea behind those instruments are mainly formative, that is, to function well the results should be fed back on a continuous basis to improve the quality of the group interaction. This was also the original idea for this study and which would have been desirable, but which became

impossible because students did not send in their forms on time. Therefore, these instruments were used for research purposes, revealing somewhat ambiguous results.

The cohesion measure explored type of positive versus negative behaviours (Appendix D), that students perceived was occurring during the two collaborative activities. None of the measures were significantly different from one activity to the other, it did not appear to make a difference at all. Random assignment to groups, regardless of type of moderator intervention strategy, appeared to improve the cohesiveness of a group, but also high moderator intervention techniques, regardless of group formation strategy, improved cohesiveness. In summary, evidence seems to indicate that cohesiveness was more pronounced when groups were randomly assigned and provided with high moderator intervention techniques. What is disturbing is that the cohesion measure was not significantly related to the final exam results, and only moderately related to productivity as measured by contribution of idea units.

The self-perceived productivity measure did not seem to measure productivity, if productivity is to be correlated with individual learning gain (i.e., final exam results) or performance as measured by the contribution of idea units during the two experimental activities. The elements of this measurement are geared towards effective use of time, development of ideas, decision making, group involvement and perceived overall productivity, which all appear necessary ingredients for productive small group work. That no differences were found might be explained by the idea that this self reported measure only can serve as a formative measure designed to assist a group in improving their performance.

### Guidelines for On-line Collaborative Communication

Some major problems were experienced in this study, among which the on-line student participation rate, the amount of tutor time that was sacrificed, on-line access, and gathering of data can be mentioned. In turn, these problems signal specific demands for incorporating and successfully use CC in distance education. For example, it is important to realize and weigh the reasons why students seek distance education when designing on-line activities. Students mostly register because of DE's flexible schedules and virtually non-existent space demands, but also because they feel capable of learning on their own to a greater extent than is usually promoted in on-campus courses. It, then, follows that unless these demands are respected, CC cannot successfully be incorporated in DE.

Another aspect of the instructional design, that emerged from this research, is the importance of balancing amount of structure, where both too much structure as well as too flexible environments appear detrimental to effective and efficient learning. These insights are well supported by the adult learning literature as well as by collaborative learning principles. Further, the fact that students both perceived and appeared learnt more from the debate, further supports the idea that on-line activities benefits from a belief in constructivist learning theories, above all encouraging conversation, synthesis and evaluation to elaborate upon content.

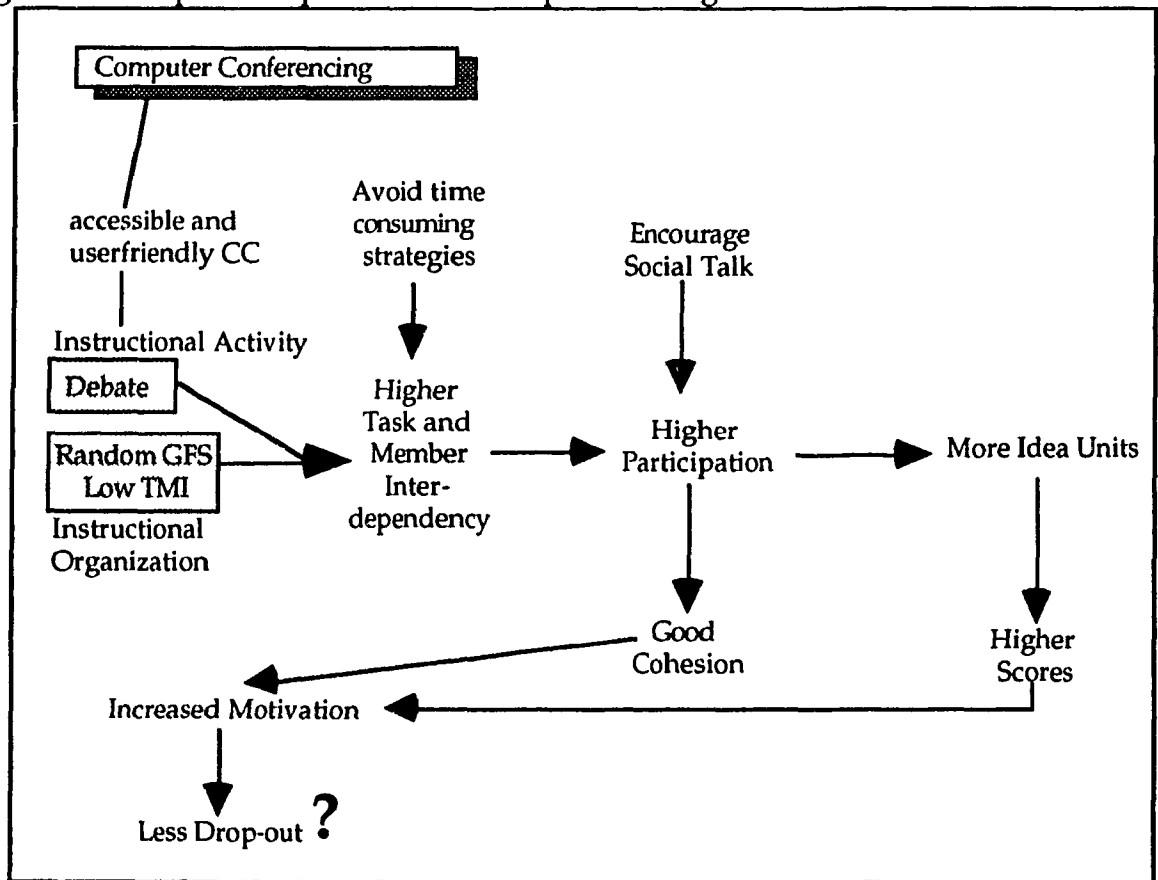
Therefore, from the results of this study the following instructional design predicates for effective on-line collaborative learning can be drawn:

- balanced design in terms of tutor versus student imposed instructional strategies
- choose a highly user-friendly interface for the CC system
- provide adequate access to the CC system

- give a workshop to learn to deal with the technical problems of electronic communication before course start
- randomly assign students to groups and tasks for efficiency
- use cohesion and productivity instruments formatively to ensure positive group interdependence
- provide explicit instructions of the student's responsibilities,
- provide guidelines on how to efficiently and effectively communicate on-line, rather than high tutor intervention
- negotiate learning contracts with students to enhance participation and facilitate grading of on-line activities

Figure 29 shows graphically how the relationship among these points are conceived for successful use of computer-conferencing in DE situations.

Figure 29. Graphical representation for possible organization of successful CC



### Suggestions for Future Research

The most important drawbacks of this study were the large drop-out rate matched with the crucial difficulties experienced in collecting the questionnaires. To a certain degree the root of these problems stems from difficulties of the technology itself on two levels: (1) students have no experience with CC, and (2) inadequate access. Both of these problems are decreasing according to statistics made by the Council of Ministers of Education: Distance Education and Open Learning from December 1994, stating that there is an increase in number of people wanting distance education as well as an enormous explosion of people owning computers.

Moreover, the enormous advancements made in interface designs of computer conferencing system in only the past year might alleviate some of these problems experienced here. Newer systems (e.g., FirstClass, Cosy 400+) allow for on-line gathering of data and questionnaires, by easy to fill-out on-line forms. They contain easy to use menu systems for anything from uploading to downloading messages to graphical cues on what you have read and not read, how to link and trace messages, and the capacity of newer systems to transmit fully edited documents. New CC systems also supply interesting tools such as showing who reads what and how many times thus creating a history of who replies to whom, who reads what etc., opening up new possibilities for research on group dynamics.

Future research should capitalize on these evolving electronic features to gain insights in electronic group dynamics, and learning related to cohesion and productivity. Table 36 contains a set of generic questions that can be developed into instruments that could potentially serve as both diagnostic and research tools to improve a group's growth into a fully functional

collaborative unit. Inventories like these could be given several times during a on-line experience, which, in turn, might shed light on the phases that electronic groups go through.

Table 36. Generic questions for formative research on on-line groups

Group productivity:

- are sub-tasks done on time?
- is pertinent information shared correctly?
- is everyone participating adequately? if not, what are the problems?
- what is/are the advantages/disadvantages of your solution?
- what recommendations for improvements do you have?

Psychological Maintenance of Groups

- Are you included in group activities?
- Group attractiveness (feelings toward/among group members)
- Positive versus negative reactions in the group?
- Logging on often enough?
- Your goals and abilities accounted for?
- Efficiency of the group?

Individual satisfaction of the group work

- psychological (overload, quality of work life etc.)
- ergonomic factors (organizational and physical factors)

Summative evaluation of the group work

- what was "good" (quality, methods, structure etc.)?
- what was "bad" (quality, methods, structure etc.)?
- what did we learn as a group?
- could we work as a group again? What would be different?

---

As a final reflection, I would like to add my thoughts on educational research with the emergence of new learning theories, such as the constructivist and socio-culturalist, new research paradigms has to evolve (MacConnell, 1991; Osman & Hannafin, 1992; Pugh, 1993; Steeples, Goodyear & Mellar, 1994 ). To gain insights in and for educational practice, which I see

as the ultimate goal of research, one might have to change research procedures. It can be argued that education as well as the social sciences have long been influenced by the quantitative paradigm, where the main idea is to isolate and manipulate certain variables to find significant differences in order to explain a certain phenomenon. However, both humans and the interaction among humans, which is what education is all about, are extremely complex and variables are very hard to isolate (e.g., Cooper, 1993; Li & Merrill, 1991; ). My experience from this study supports the above statement, and I would argue that the findings from this experiment can only be meaningful and useful by incorporating the descriptive accounts.

Therefore, in agreement with the constructivist and socio-culturist approach to learning, I argue, that to gain meaningful insights the researcher has to participate, reflect and use results for formative decision-making to inform students and tutor/teachers about the current situation. Timing seems to me to be of utmost importance, that is, decisions should be recorded but immediate action must be taken to improve educational practices. Or as stated by Jerome Bruner, to learn (i.e., advance knowledge) one has to "construct, unconstruct and reconstruct" over and over again. . .

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## **Appendix A**

## Student Consent to Participate in Research

A research team in the Department of Education, headed by myself (Dr. Robert M. Bernard), is currently conducting studies in instructional techniques and learner characteristics. Our intention is to gain a better understanding of student learning in various modes of course delivery, more specifically regular classroom learning and distance learning. Since this course is offered in these two modes (EDUC 305 is a on-campus course in the Fall Term) we would like to see how they differ.

Through your responses we hope to find out more about the characteristics of your learning style and study preferences. We will also use the results of your assignments and tests as part of the comparison. All information collected will be kept **strictly confidential** and will be used for research purposes *only*. This research is solely for the advancement of knowledge about the conditions under which people learn. There are **no other motives**.

If you are willing to participate in this study, please sign this consent form and return it to the instructor. In addition, before the next class meeting please respond to the enclosed Student Learning Questionnaire, designed to assess your approach to studying, and complete the reading test (instructions are provided on the reverse side of the form). These questionnaires will be collected by your instructor in class and delivered directly to our research office. A final questionnaire will be given to you at the end of term and returned in the same manner.

Your cooperation in the collection of this information is greatly appreciated, but is completely voluntary. You have the right to choose not to participate in this research project. **Your decision will in no way affect your grade in this course.**

Please indicate by checking one of the boxes below whether you freely consent and agree to participate in data collection for research in distance education. If you have any questions regarding these procedures, please feel free to contact me at 848-2027.

This research is funded by the Social Sciences and Humanities Research Council of Canada.

Yes, I do consent to participate                       No, I do not consent to participate

Name (please print): \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

### Questionnaire

Please provide the following information. All of this information will remain confidential and be used for group data only. No student will be singled out by name or ID number. We are asking for you name ONLY so we can locate you again during, and at the end of the semester.

1. Name: ..... Tel: .....
2. Student ID .....
3. Age    \_\_\_ 18-22    \_\_\_ 23 - 27    \_\_\_ 28 - 32    \_\_\_ 33 - 37    \_\_\_ over 38
4. Gender            \_\_\_ Female    \_\_\_ Male
5. Preferred language  
                          \_\_\_ English    \_\_\_ French    \_\_\_ Other (Please specify)
6. I own or have easy access to a(n)  
      IBM/compatible    \_\_\_ MacIntosh    \_\_\_\_\_ Other (Please specify)
7. I own or have easy access to a modem     yes     No
8. Do you know how to use a word processor  
      \_\_\_ yes, fairly well  
      \_\_\_ yes, a little  
      \_\_\_ not at all
9. Do you use a word processor to do your writing assignments?  
      \_\_\_ always  
      \_\_\_ sometimes  
      \_\_\_ never
10. How would you rate your typing ability?  
      \_\_\_ I do not type at all  
      \_\_\_ minimal (under 25 words/min)  
      \_\_\_ average (30-60 words/min)  
      \_\_\_ proficient (over 60 words/min)
11. How many hours per week do you plan to study for this course?  
      \_\_\_ 5-10 h/w  
      \_\_\_ 11 - 15 h/w  
      \_\_\_ more than 15h/w  
      \_\_\_ other (Please specify)
12. In all I am taking \_\_\_\_\_ courses this term.



13. What was your main reason for choosing the off-campus version of Educ305?

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14. Have you ever taken another distance education or off-campus course?

- yes       No

15. What are your main expectations for this course?

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*Thank you for your collaboration!* 

## READING TEST

Name: \_\_\_\_\_

ID# \_\_\_\_\_

**Instructions:** The following test is being evaluated as an instrument to measure reading comprehension. As such it might be too easy or too difficult. Since this is what we want to find out, please do not be concerned if you cannot complete it. Send it back to us anyway. The test itself requires that you fill in blanks with words which seem to fit the meaning of the text. There is only **ONE** single word to be found for each deletion (hyphenated words count as one word). Deletion lines are always of the same length, regardless of the words to be found. Proper names have not been deleted. Here is a practice example:

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**The Beechwood Chair**

Once upon a time, (1) \_\_\_\_\_ chairs were cheap and (2) \_\_\_\_\_ and came from High Wycombe, (3) \_\_\_\_\_ suitable for pre-war nurseries (4) \_\_\_\_\_ post-David kitchens. The Principle (5) \_\_\_\_\_ holds.

The best strategy for success is to read through the text once and replace the most obvious deletions. Then, read it again and try replacing the rest of the deletions by going back and forth in the text. This will help you understand the author's meaning, writing style and general choice of words. There are many clues in the text, including words that were not deleted that will help you arrive at a better result (e.g., beechwood is in the title and is the first deletion). This test will not affect your grade in any way; we just need your name and ID# to match other quest'naires that you will be completing.

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**Key:** (1) *beechwood*
(2) *solid*(3) *so*(4) *and*(5) *still*

*A noted social observer examines the evidence*

**First, Last or Middle Child - The Surprising Differences**

As a last-born child I have been intrigued - and perhaps a bit miffed - by the seeming pre-eminence of first-born offspring in the world. Also, having a special concern with the role that status plays in our lives, I am interested in how birth order influences the way we are treated.

In recent years hundreds of behavioral specialists have pondered, (1) \_\_\_\_\_ and measured people for evidence of the possible impact (2) \_\_\_\_\_ being the oldest, middle, last - or only - child. I (3) \_\_\_\_\_ examined about 60 of these studies and made a modest (4) \_\_\_\_\_ myself. No exact conclusion can be drawn about (5) \_\_\_\_\_ particular child, and on certain points the investigators disagree (6) \_\_\_\_\_ themselves. Still, some startling differences emerge in sizeable groups (7) \_\_\_\_\_ people are compared on the basis of birth (8) \_\_\_\_\_.

Take the matter of achievement. A variety of studies (9) \_\_\_\_\_ searched for any link between birth order and (10) \_\_\_\_\_ or genius. Behavioral scientist Stanley Schachter of Columbia (11) \_\_\_\_\_ sums them up by saying that first-borns predominate (12) " \_\_\_\_\_ astonishing consistency". They are over-represented in *Who's Who*. (13) \_\_\_\_\_ the first 23 astronauts to go on U.S. (14) \_\_\_\_\_ missions, 21 were either eldest or only children ( remarkable, (15) \_\_\_\_\_ you consider that later-borns outnumber first-borns by (16) \_\_\_\_\_ two to one in the general U.S. population ). (17) \_\_\_\_\_ a

recent analysis of 1618 finalists (18) \_\_\_\_\_ National Merit Scholarships in the United States showed (19) \_\_\_\_\_ nearly 60 percent of them were first-born.

(20) \_\_\_\_\_ know of no reliable evidence that first-borns (21) \_\_\_\_\_ more brainpower. Rather, the way they are (22) \_\_\_\_\_ makes them more bookish and more achievement-oriented. (23) \_\_\_\_\_ - for economic reasons - more of them manage (24) \_\_\_\_\_ go to college.

One of the more (25) \_\_\_\_\_ analyses was made as a part of (26) \_\_\_\_\_ Study of Adult Development at Harvard University. (27) \_\_\_\_\_ more than a decade, psychologist Charles McArthur (28) \_\_\_\_\_ social anthropologist Margaret Lantis studied some 200 (29) \_\_\_\_\_ graduates as they started their families. These (30) \_\_\_\_\_ parents reported on themselves as well as their (31) \_\_\_\_\_. Analyzing these accounts, and systematically observing the (32) \_\_\_\_\_, the researchers found that the first-borns did (33) \_\_\_\_\_ different personality patterns from later-borns - and there (34) \_\_\_\_\_ clear-cut agreement on what those differences were. "(35) \_\_\_\_\_ family constellation". McArthur concluded, "is an important (36) \_\_\_\_\_ of personality". Here are my impressions (37) \_\_\_\_\_ why - and how - we tend to (38) \_\_\_\_\_ our children differently according to their (39) \_\_\_\_\_ order.

The first-born child, at time (40) is likely to be a (41) \_\_\_\_\_ most wanted child - they are proving (42) \_\_\_\_\_ capacity to have progeny, and in (43) \_\_\_\_\_ way assuring their own immortality. They (44) \_\_\_\_\_ expect more of this first child (45) \_\_\_\_\_ of later children. They are likely (46) \_\_\_\_\_ snap their photograph more often, talk (47) \_\_\_\_\_ romp with them more, but also (48) \_\_\_\_\_ worry and fret more over them. (49) \_\_\_\_\_ in the art of parenthood, (50) \_\_\_\_\_ tend to be tense. A calmer environment (51) \_\_\_\_\_ prevails when the second child arrives, (52) \_\_\_\_\_ there has been an interval of two (53) \_\_\_\_\_ or more. Two thirds of (54) \_\_\_\_\_ young Harvard-study parents said that with (55) \_\_\_\_\_ second-born they were more relaxed, less (56) \_\_\_\_\_, and administered spankings only half as (57) \_\_\_\_\_. As later children come along, parents (58) \_\_\_\_\_ not only to diffuse their attention (59) \_\_\_\_\_ them all, but also become less (60) \_\_\_\_\_ with the child-rearing role. Later children may (61) \_\_\_\_\_ that they are more on their (62) \_\_\_\_\_.

## Appendix B

## The First CoSy Exercise



CoSy name: \_\_\_\_\_ CoSy group: \_\_\_\_\_

### Goal:

- To become a confident CoSy user; to become interested in CMC and Internet possibilities.

### Objectives:

- To learn to manipulate the communication software and to navigate in CoSy
- To get to know group members
- To reflect on questions pertinent to the final exam, Module 1 and 2

**Please, tick only 1 (✓) option for each question! Thank you!**

- How well do you think you achieved these goals and objectives?  
 not at all     a bit     somewhat     well     exactly
  - To what extent did this CoSy exercise meet your expectations of CMC?  
 not at all     a bit     somewhat     well     exactly
  - How much do you feel you learnt participating in this session?  
 zero     a bit     some     a lot     more than usual
  - How clear were you on the degree of involvement that on-line discussions take?  
 not at all     vague     fairly clear     clear     very clear
  - How hard would you say you tried to learn, in this session?  
 not at all     a bit     some     hard     very hard
  - How helpful did you find the CoSy Guidelines in combination with the learn topic?  
 not at all     a little     some     helpful     very helpful
  - How useful did you find the on-line help provided by tutors?  
 not at all     a little     somewhat     useful     very useful
  - How confident do you feel in logging on and getting around in CoSy?  
 not at all     somewhat     okay     confident     very confident
  - Do you believe on-line discussions are useful for facilitating/motivating distance education learning?  
 not at all     a little     somewhat     useful     very useful
  - Which on-line topic(s) did you find the most important?  
 adm     sos     cafe     project1     exercise1
- Did you purchase a modem  yes  no    /computer  yes  no    this term?

**Any comments are welcome, please continue on the reverse, if needed!** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

*☺ Thank you very much for your collaboration! ☺*

Group Name: \_\_\_\_\_ Your Cosyname: \_\_\_\_\_

### Assessment of Group Productivity: EXERCISE 3

**Directions:** Please evaluate the functioning of your group on the tasks just completed in EXERCISE 3: Media in the classroom. Put a **X** on the number which best represents how you would rate the performance of your group. The results of this questionnaire are confidential, and only combined results will reported.

#### In terms of

- **Effective use of time, our group**

①.....②.....③.....④.....⑤  
 spent too much                      did well, once                      wasted no effort  
 time without purpose              ideas were clear                      -stayed on target

- **Development of ideas, our group**

①.....②.....③.....④.....⑤  
 did little to                      ideas were imposed                      encouraged each other                      generate  
 ideas                      by one or two members                      to generate and explore ideas

- **Ability to decide issues, our group**

①.....②.....③.....④.....⑤  
 had poor resolution                      made compromises                      provided genuine  
 - couldn't agree                      just to get the job done                      support and agreement

- **Group involvement, our group**

①.....②.....③.....④.....⑤  
 had little group                      one or two members                      had an excellent  
 interaction - everyone                      took over                      exchange of ideas  
 just worked alone

- **Overall productivity, our group**

①.....②.....③.....④.....⑤  
 did not                      barely                      held a highly  
 accomplish our goal/tasks                      accomplished our goal/tasks                      productive session

- **On the whole, how helpful did you feel this session to be in terms of increased understanding of the course content?**

①.....②.....③.....④.....⑤  
 poor                      fair                      mediocre                      good                      excellent

- **What would you do differently could you do this session over again?**

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**Group Cohesion**

- Please indicate which of the following roles **you played** some of the time during this EXERCISE 3 by making √ marks in the **A** column opposite each description of behavior.
- Please indicate which of the following roles you felt were exercised adequately **by the group** during EXERCISE 3 by making √ marks in the **B** column.

**A** = your own actions

**B** = which of these actions did occur regardless of person

<b>A</b>	<b>B</b>		<b>A</b>	<b>B</b>	
.....	.....	Initiated conversation	.....	.....	Gave examples
.....	.....	Gave information	.....	.....	Asked for examples
.....	.....	Gave positive reactions/opinions	.....	.....	Asked for clarification
.....	.....	Gave negative reactions/opinions	.....	.....	Gave clarification
.....	.....	Asked for positive reactions/opinions	.....	.....	Encouraged others
.....	.....	Asked for negative reactions/opinions	.....	.....	Standard setting
.....	.....	Probed others	.....	.....	Relieved group tension
.....	.....	Restated contributions	.....	.....	Was status seeking
.....	.....	Asked for restatements	.....	.....	Was dominating
.....	.....	Was helpful	.....	.....	Was competitive
.....	.....	Was hostile or defensive	.....	.....	Sought sympathy

- Any comments regarding **EXERCISE 3** are welcome and appreciated, whether it refers to type of tasks or instructions on how to carry it out, or other complaints or appreciations that you might have!

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*Thank you for your collaboration!*

**Note:** The same instruments was given after activity 2.

## Appendix C



## Your Reactions to Distance Education

Name: \_\_\_\_\_ ID Number: \_\_\_\_\_

### Part I — Comparing Classroom Learning with Distance Education

**Instructions:** This section has been designed to assess your perception of the differences between learning in distance education course and in regular university-level classroom instruction. In responding to each question, please try to consider the characteristics of distance education courses in general, not just the courses you have taken recently. *Please be aware that the wording of the scales change from time to time.*

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#### Compared with university-level classroom instruction, in distance education ...

1. ... understanding course objectives is:  
 much harder       harder       about the same       easier       much easier
2. ... understanding course requirements is:  
 much harder       harder       about the same       easier       much easier
3. ... getting the grade you want:  
 much harder       harder       about the same       easier       much easier
4. ... judging the instructor's own opinion of the content is:  
 much harder       harder       about the same       easier       much easier
5. ... not seeing other students regularly makes learning:  
 much harder       harder       about the same       easier       much easier
6. ... managing one's personal life is:  
 much harder       harder       about the same       easier       much easier
7. ... learning on your own is:  
 much harder       harder       about the same       easier       much easier
8. ... the need for good reading skills is:  
 much greater       greater       about the same       less       much less
9. ... discussing the content of the course with other students is:  
 much harder       harder       about the same       easier       much easier
10. ... discussing content of the course with other tutors is:  
 much harder       harder       about the same       easier       much easier
11. ... motivating yourself to study, in a DE course is:  
 much harder       harder       about the same       easier       much easier

12. ... the tendency to put off studying and starting assignments is:  
 much greater     greater     about the same     less     much less
13. ... the temptation to drop a DE course is:  
 much greater     greater     about the same     less     much less
14. ... the need for specially developed materials (e.g., study guides) is:  
 much greater     greater     about the same     less     much less
15. ... the importance of clearly written textbook materials is:  
 much greater     greater     about the same     less     much less
16. ... having a carefully integrated package of course materials is  
 much greater     greater     about the same     less     much less
17. ... locating other students to work with is:  
 much harder     harder     about the same     easier     much easier
18. ... the amount of extra help that students need is:  
 much greater     greater     about the same     less     much less
19. ... the need for extensive written feedback on assignments is:  
 much greater     greater     about the same     less     much less
20. ... the need for more than one learning strategy is:  
 much greater     greater     about the same     less     much less
21. ... the need to know "how to study" is:  
 much greater     greater     about the same     less     much less
22. ... figuring out how to study for exams is:  
 much harder     harder     about the same     easier     much easier
23. Would you take another distance education course?     Yes     No

**Appendix D**

The following categories, slightly modified from Rogerson's (1993) study, were used to analyse the on-line protocols for each of the two experimental activities.

Two more categories were also used, Talking directly to the Moderator, which is self-explanatory. The other was Negative Commenting, including lashing out at group members for not logging, or participating enough, as well as a very few destructive comments.

Raters were given explicit examples of how to code, before starting the coding procedure.

Content Messages	Organizational Messages	Encouragement Messages
<ul style="list-style-type: none"> <li>• rephrasing statement</li> <li>• clarifying</li> <li>• asking for examples</li> <li>• asking questions</li> <li>• giving information</li> <li>• summarizing</li> </ul>	<ul style="list-style-type: none"> <li>• organizing tasks</li> <li>• organizing who does what</li> <li>• setting deadlines</li> </ul>	<ul style="list-style-type: none"> <li>• social chit-chat</li> <li>• reassure/encourage</li> <li>• tension relief</li> <li>• hostile/defensive</li> <li>• technical problems</li> <li>• personal information</li> </ul>

Pages 179 - 181 provides a more detailed account of the coding procedure.

**CODING INSTRUCTIONS:**

ENC = Encouragement among students  
could be

- rephrasing /commenting on someone answer **without** giving new unique ideas.
- explaining why their answers were late or logons hard
- saying that someone's answer was great or show sympathy
- questions on content or tasks to peers

NC = Negative criticism or reactions

TM = addressing the moderator could include questions or greetings or thank you's

ORG = messages containing organisational matters either on the tasks, deadlines or what members should be doing

CONT = messages directly dealing with the content of the tasks. This code is always followed by a number denominating number of idea units found.

\*\* if a CC message brings up new ideas then it becomes CONT, and then counting each new idea

**IDEA UNITS:**

Included

- |  |   |
|--|---|
| • defining concepts                                      | 1 |
| • numerating types of materials or types of uses/methods | 1 |
| • arguments/justifications                               | 1 |
| • giving examples of for examples and their uses         | 1 |
| • referencing to the provided literature                 | 1 |

EXAMPLES:

I have only included a few examples here, but in fact we trained and discussed about a whole group of messages before coming up with the scheme.

=====  
group3a/exercise2 #21, xxx, 976 chars, 6-Mar-95 14:59 -155=Number of words  
There is/are comment(s) on this message.

CONT= 10

-----  
TITLE: Task # 1

Visual media is a communication device that serves as a more concrete referent to meaning than the spoken or written word. Most people are visually oriented. They learn about 10% from listening but over 80% from what they see. They remember only 20% of what they hear but over 50% of what they see and hear. 1  
1

Visuals are iconic and serve as concrete clues to meaning. The likelihood of successful communication is increased when concrete referents are present. Visuals can also motivate learners by increasing their interest in a text or presentation. They attract attention, sustain it and generate emotion. Reiteration is another important function of visuals. They can underscore the information in printed material by presenting it in a different form. Visuals can also simplify what is difficult to understand and remember. They can also serve as an organizational function by illustrating the relationships among elements or concepts being studied. 1  
1  
3  
1  
1  
1

=====  
group3a/exercise2 #30, xxx, 320 chars, 6-Mar-95 16:45 -53  
This is a comment to message 5

ENC

-----  
Good answer yyy! Camcorders and VHS machines enhance learning because viewing stimulates interest and sustains it. Most people are visually oriented. They learn about 10% from listening but over 80% from what they see. People can remember only about 20% of what they hear but over 50% of what they see and hear. (THIS WAS ALREADY SAID, THUS ENC)

=====  
group1b/exercise2 #9, yyy, 142 chars, 1-Mar-95 22:48 -26  
This is a comment to message 6  
There is/are comment(s) on this message.

ORG

-----  
xxx & zzz Hey xxx its yyy as far as I am concerned you can do #3 (Ms. Initiative) and I will complete #2 OK !?! Talk to ya soon

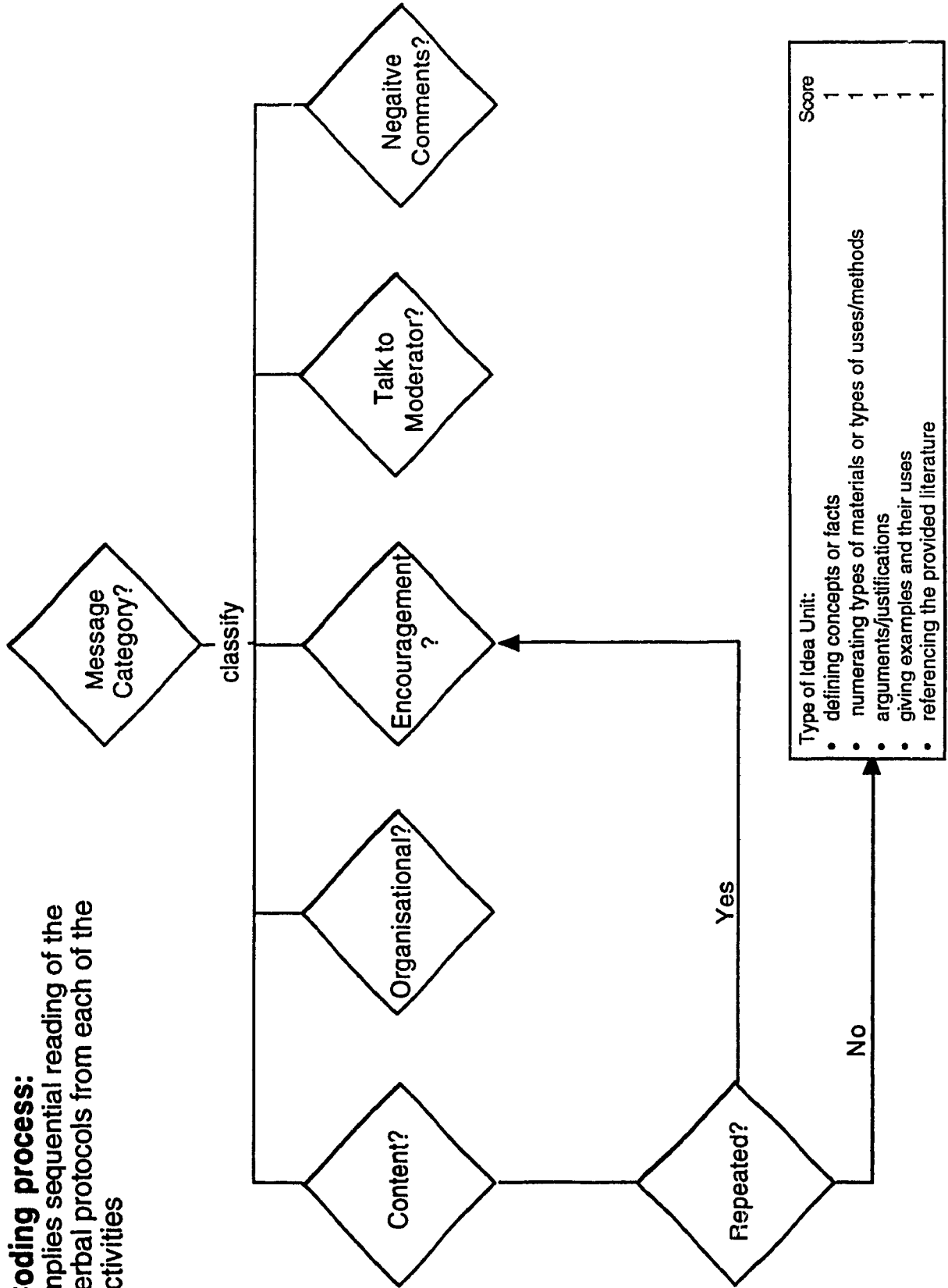
CONT= 7

=====  
group1b/exercise2 #5, ggg, 613 chars, 23-Feb-95 01:36 -98

-----  
TITLE: Task #1

The unique characteristics of visual media are its ability to manipulate time and space. The manipulation of space provides the learner with many different perspectives. Time lapse can be used to present a happening that would normally take two long to present. Visual media can be used to enhance and facilitate learning in many ways (DOES NOT GET POINT SINCE UNDEFINED). Something that is normally dangerous to observe can be presented through visual recordings. Skills which require practice and/or observation can be recorded and watched numerous times. Visual media can also be used to dramatize events and bring emotional impact to the learner. 1  
1  
1  
1  
1  
1

**Coding process:**  
Implies sequential reading of the verbal protocols from each of the activities



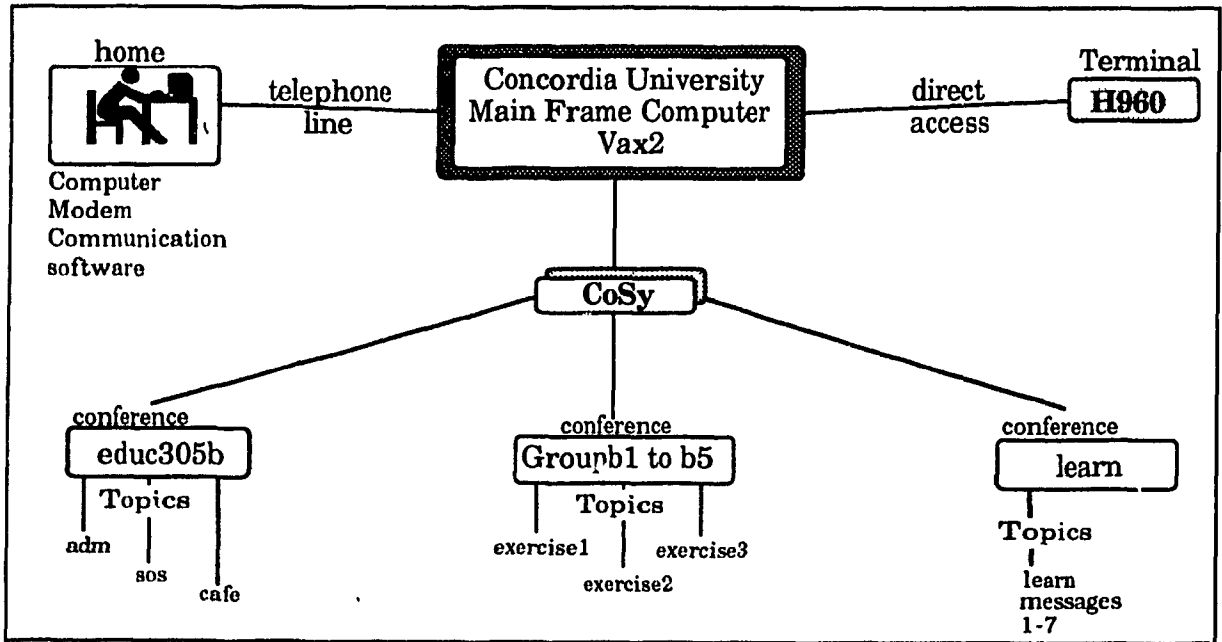
## Appendix E



# CoSy Computer Conferencing

## Guidelines for Educ 305

by  
Karin Lundgren-Cayrol  
and  
John Bentley



## Introduction

**What is CoSy?** CoSy stands for **C**onferencing **S**ystem. It is a type of computer-mediated communication, which allows users to discuss ideas and exchange information, just like a face-to-face meeting. It was developed at Guelph University, to give students and teachers the opportunity to "talk" outside class time, independent of time and location. CoSy has many conferences, organized into different topic discussions. Unlike face-to-face discussions, many discussions are going on at the same time, and you are free to join them when you want to.

This system encourages both reflective and spontaneous conversation. For example, Rita asks a question about internet, then Joe logs in three hours later, sees the question and types in an answer. Later Lou enters the system and reads the answer. He has another answer, which he adds. Then Rita logs on and reads the messages that have been added since she was last entered. The conversation goes on, just like a normal discussion, but the difference is that you have time to consider your answer in your own time, and that you can always read them again.

**What is a conference?** A conference is the grouping feature of CoSy, that allows access to specific members. It could be likened to a course (e.g., the EDUC305 groups students and teacher in a classroom for 13 weeks). The classroom is the grouping feature.

**What is a topic?** A topic is a space within a conference, where information is exchanged in the form of written messages. Each conference can have many topics. It could be likened to the lectures, where different topics within a course are discussed.

**What conferences are you a member of?** In this distance education course, Education 305, students will be divided into four groups, with about 15 students in each group. These groups are called educ305a to d, and you will be automatically joined to **educ305d**. These conferences each have three topics, adm for administrative questions and answers; sos for technical help questions; cafe for social chit-chat to get to know each other. Everybody is also a member of the **learn** conference with its one topic learn. This topic is to help you learn CoSy and is in tutorial form.

For the on-line activities you will be assigned to small groups of 3-5 students. They will be called **group1d to group5d**. You will be automatically placed in one of these groups. These groups are different conferences which have three topics each, one for each exercise that you will complete as assignments in this course. They are called exercise1, exercise2 and exercise3.

**What do you need if you have a home computer?** To log on from **home**, you need a computer, a modem, and some type of communication software.

- 2400bpm modems cost about \$100.00; you could buy a used one for about \$50.00.
- If you have an IBM or compatible, you can purchase PROCOMM from us for \$1.50. This is a communication software
- If you have a Macintosh you can purchase MacKermit from us for \$1.50. This is another communication software.

If you do have a home computer and a modem, then go to page 6 for instructions on how to use CoSy from home. It is important for you to realize that once you are entered into CoSy, whether at home or on the 9th floor, the procedures for using the system are identical.

However, if you don't have a home computer you can do your assignments on the computer terminals on the 9th floor of the Hall Building. Directions for using these terminals are on the next page.

## STEP 1 Logging on to CoSy

**How do you log on from H-960 terminals?**

In room H-960 there are 9 terminals available. Terminals are like computers without a disk drive. These are linked directly to the Concordia University Mainframe.

**Note:**

From now on what **you** type and do is in **bold**, and what the computer displays is in *italics*

Make sure the terminal is turned on, then hit the return/enter key. You will see:

*Username:* **COSY** (then press RETURN)

You will see some information about CoSy that you need not worry about. Check that your caps lock is off, that is, type in lower case letters.

*COSY*

*Name:* **your cosyname** (then press RETURN)

*Password:* **your password** (invisible text, then press RETURN)

You are now logged on to CoSy. You will find some information on new messages, then CoSy will put you at the **main level** which is represented by a **colon (:)** on an empty line. This is where you type in your commands.

## STEP 2

**How do you join the learn conference?**

### Joining the learn (tutorial) conference

The first conference that you must join is the learn conference, under the topic learn. The first 7 messages will teach you the main features and commands necessary to get around in CoSy. It will take 10-15 min.

Now, at the main level prompt type

**:join learn** (then press RETURN)

To start reading the messages, just press return. The most important features in this topic are how to add messages, using either add or comment.

When you are finished, type

*Read:* **skip to last** (then press RETURN)

There are more messages in this topic, because it is an interactive topic and everybody adds a few messages.

To reread the learn messages, type **skip to first**, instead.

- It is extremely important that you learn how to get around.

## STEP 3

**How do you join educ305d and move from one topic to another?**

### Joining your group

Now join your educ conference, which is **educ305d**. You will see three topics there, adm, sos and cafe. Join the adm topic.

**:join educ305d** (then press RETURN)

*Topic?* **adm** (then press RETURN)

You cannot jump from one topic to another within the same conference, without rejoining the conference again.

For example, you just read a message in the adm topic in educ305d conference, and you want to say hello to everyone in the cafe topic.

*Read:* **j educ305d cafe** (then press RETURN)

As a general rule, you join a conference, then put a space, then the topic name. This is a shortcut that you can use at the mainlevel prompt too.

## STEP 4      Helpful hints

### What is a Header?

CoSy will automatically take you through all new messages regardless of which conference or topic they are in. This can be confusing, but remember the header always tells you "where you are".

A **header** of a message is placed at the top of a message, like this:

```
=====
educ305d/adm #3, bentleyj, 533 chars, 25-Dec-94 11:24
-----
```

Here you would know that you read message #3, in the topic adm, in the educ305d conference, written by bentleyj on the 25th of December 1994, at 11:24.

### Who is who?

Since bentleyj is a CoSy name, you can find out who this actually is by doing the following:

```
Read: show who bentleyj            (Press Return )
John Bentley
```

### How do you read new messages?

Every time you log on to CoSy, a list of new messages is displayed.

	Conference	topic	how many
	educ305d	adm	3
	group1d	exercise1	4

To read those messages sequentially, just press return.

### What does More... mean?

Long messages (over a screen full) will trigger CoSy to stop and to put out a *More ...* prompt.

You can deal with this in two ways. If you want to continue reading it, just press return. If you do not want to continue, but only want parts of the message like the header, type a q after the periods, and then you are back to the *Read:*, where you can use 'comment' or 'say' again.

**More... q (for quit) or press return (to continue reading the message)**

### What is the difference between say and comment?

Both *say* and *comment* are command words that add a message into a topic.

- *say* is used when you start a new line of thought, a statement.
- *comment* is used to link messages together, really like commenting on what somebody says.

### How do you go back to a specific message?

```
: join group1d            (press return)
```

```
Topic? exercise1        (press return)
```

```
Read: 2                    (you simply put the number of the message you want to read.)
```

CoSy will display message 2 again, and you can now either add a new message or comment on it, be sure not to press return twice. That would put you either in another conference with unread messages or at the mainlevel prompt, forcing you to rejoin the topic again.

**How do you reread all messages?****Read: skip :o 1**

This will allow you to reread messages 1 to the end (end = number of messages in the topic), as if they were new messages, just by pushing the RETURN key.

**How do you use the editor?**

When you *add* or *comment*, be sure you are at the *Read:* and not at the main level prompt, represented by colon (:). When you type in a message you are in the editor. What you type is saved in a temporary file, resident on CoSy, called the scratchpad.

**Read: say** (press return)  
**TITLE: Question 2** (press return)

For example:

This will bring you to the editor, which looks like a > sign on an empty line:  
 > This means that you are in the CoSy editor and that you can start  
 > typing using both lower and uppercase letters as well as commas,  
 > periods and quotation marks. The editor works like an old type writer and  
 > you have to do a **RETURN at the end of each line**. If not, you are soon  
 > thrown out of CoSy (256 characters). You would have to log on again.  
 > When you have finished your text, press **RETURN so that you are on**  
 > **an empty line, then type a period (.) and press return again**.  
 > This tells CoSy that your message is finished.  
 > .

**Add/action: help** (press return, shows available commands)  
*help* — explains the following commands  
*add* — adds the message to the topic  
*edit* — allows to modify the message, spelling, adding etc..  
*quit* — brings you back to *Read: without* adding your message

**Add/action: edit** (press return)

Try the edit command by typing edit, then at the

*command* —> **help** (press RETURN)

**x** (exit and add); **q** (for quit and not add); **c**(clear text; **a** (append text at the end of your message); **s** (to substitute a word or two); **l** (lists your message and puts numbers for each line); **d** (deletes a specific line).

**How do you read linked messages?**

```
#1      #2
↑ linked to ↑
#3      #4
#5      #6
#7
```

Log in and join your educ305 conference, choose the 'sos' topic. Even if there are new messages, go to message number 1.

**:j educ305d** (press RETURN)  
**Topic? sos** (press RETURN)  
**Read: 1** (press RETURN)

In the **header** you will see that there are comments on this message.  
**Read: ref** (press RETURN)

**Read Ref:** (press RETURN)  
 until you are back to a normal *Read:* prompt

**To log off**

At any Read prompt just type bye and you are logged off. Like this:

**: bye**  
*logged off at 3:34:02 etc...*

---

## CoSy COMMAND REFERENCE GUIDE

**MAIN LEVEL  
COMMANDS**      The following commands will ONLY work at the MAIN LEVEL. The prompt character at this level is : (a colon)

**show who** lists all CoSy members  
**password** change your password

**NOTE:** At this level CoSy will interpret an unrecognized command as a JOIN command and will put you in the 1st conference on the list, or display no conference called whatever you wrote.

**MAIN LEVEL  
and Read:  
COMMANDS**      The following commands can be used at both MAIN LEVEL and READ PROMPTS. Bold letters are abbreviations, that you can use, instead of typing the whole word.

**bye** logoff CoSy  
**edit** edit a temporary file, which can be a message that was not added  
**help edit** tells how to edit  
**file 1 to 4** puts a series of messages in the scratchpad for downloading  
**join** to join a conference and topics  
**show** shows the name of all conferences, o=open and c=closed

**READ:  
COMMANDS  
(only in a topic)**      The following commands are only functional at the Read:, that is you are in a topic space.

**add** adds a message to a topic, not linked  
**backward** sets read direction backward (latest read first)  
**comment** makes a comment to a specific message  
**header** reads header and first line only (good for searching a specific message)  
**nea 1 to 10** reads headers and the first line of messages 1 to 10, or any numbers  
**help** if you type help and any command word, CoSy describes it  
**last** reads the last message in the topic  
**3** any number displays only that specific message within a topic  
**quit** lets you leave a topic at a Read ; or a message at a More... sign  
**reference** lets you read linked messages  
**resign** lets you resign from a conference, which you can join again  
**search** in a topic space, you can search for specific words, type 'help search' at any read prompt to see how.  
**sh confname** shows information on a specific conference  
**sh new** shows list of conferences with new messages  
**sh participants** shows list of conference participants  
**sh status** shows list of participants and when they last logged on  
**sh who id** shows full name of user (id=cosyname)  
**skip to x** skips to message x (x= any message number in the topic)  
**withdraw x** removes message x, but only if you are the author of that message

---

### Logging in from Home

The following text gives you an exact account on how to log in and start a CoSy sessions. The "70w" is a code for those of you having a telephone with a waiting line. This code turns the waiting line off, so that you cannot be thrown out from Vax2, should your phone ring.

If you have a	<i>Waiting line</i>	<i>regular line</i>
<b>Modem with</b> <b>2400 bdp dial:</b>	70w8488800 also           ⇒	8488800 01 to 05
<b>1200 bdp dial:</b>	70w8488828 also           ⇒	8488828 29 and 30

If you plan to work during the day the 2400 number is almost always busy, then try the 1200 number. If you do not have a waiting line exclude "70w", and if you use a computer connected from the University you exclude 848 as well, and just dial the 4 last digits.

Bold, greyed text are help messages, which indicates what to do next (these are not present when you are in CoSy). What the computer displays are in cursive text.

**In PROCOMM push ALT+D at the same time, then choose the desired number in the menu. When dialling you will see the following message:**

```
ATZ
OK
ATDT70w8488828
CONNECT 1200 (press return)
```

**After CONNECT 1200 (if you are on 1200 bpm, and 2400 if you use a 2400bpm modem ) The following messages comes up on your screen:**

*For more info. and a list of valid service names type:   HELP*

*CONCORDIA UNIVERSITY NETWORK (PACX NODE H)*

*SERVICE? vax2 (press return)*

**At SERVICE? you type vax2, with lower case letters, and then push<return>which triggers the following message:**

*DIAL28.4 CONNECTED S0700009*

**At this point the computer is very slow, so you push the<return>key a few times to connect faster:**

*Concordia University  
VAX2 (VAX 6510)*

*Username: COSY (press return)*

**You have now entered CoSy, just go back to page 2 in this handout. Start with typing in your cosyname. From here on the procedures are identical.**

---

## CoSy Activity 1: January 18 - 31 (10%)

**Goal**

- To make you confident using the CoSy conferencing system. It is essential to go through the CoSy manual before starting this exercise.
- To prepare you for the final exam through questions and answers.

**Tasks**

- To log on at least **five** (5) times making at least 1 statement and 1 comment.
- To answer 5 of the 8 questions below.
- To comment on 3 of the answers from the other students.

**Grading**

- 5 points for logging on 5 different times in this topic, exercise 1.
- 2 points for each correct answer. (10p)  
2=excellent; 1.5=good; 1= o.k.; 0=wrong
- 5 points for relevant commenting  
(5=excellent; 4=very good;3=good; 2=fair; 1=poorly; 0=irrelevant)
- 20/2 = 10% for final mark (your score/2= your %)
- Contributions are individually graded

**Related Materials**

- the course book, preface, chapters 1 and 12
- the video "Designing Learning Environments" and "Connecting for Learning"
- selected readings Module 1 and 2

**On-line Set-up**

- Each question number corresponds to a message number in your group conference under the topic exercise 1.
- To answer a question, read the question by typing the corresponding message number, then at the read prompt type comment.
- Message #1 displays the above information on-line.

- #2. What is the main difference between the behavioural approach and the cognitive approach?
- #3. According to Dr. Schmid, are humanism and technology at odds with one another?
- #4. What happens when there is too much flexibility in instruction? When is it important to have more structure?
- #5. What is meant by an "eclectic" approach?
- #6. What is meant by computer-mediated communication (CMC)? What is Internet?
- #7. List three examples described in the video of how computer-mediated communication and the Internet are being used in education?
- #8. List three major advantages and three major disadvantages to the use of CMC and Internet in field of education?
- #9. How is this technology changing education and traditional teaching.



---

## CoSy Activity 2: February 15 — March 7 (10%)

### Goal

- To experience the "Virtual Classroom".
- To gather information, share it with others and summarize it.

### Related Materials

- Chapter 3, 6 & 7, and pp. 293-307
- the video "From Print to Pixels"
- Modules 3 and 4

### Grading

- 3 points for **logging on** three different times making at least 1 statement and 2 comments. Points will be calculated as follows: 9 messages at three different times = 3 points. If e.g.,  $5/9 = .6 \times 3 = 1.8$
- 4 points for **content**, based on how well you used the literature, 4=outstanding; 3.5=excellent; 3=good; 2.5= quite good; 2=fair; 1= poor; 0=irrelevant
- 3 points for **organization**, how well your information is organized 4=outstanding; 3.5=excellent; 3=good; 2.5= quite good; 2=fair; 1= poor; 0=disorganized
- Contributions are individually graded

### Scenario

The Nebula Elementary school is an innovative and progressive school where teachers believe in anchored instruction and situated cognition as well as the benefits of cooperative learning strategies.

To fully explore and practice these learning strategies, they have to put together a proposal to the Ministry of Education to raise necessary funds. Their proposal has to provide a justification for visual media in education.

### Tasks

1. Give a description of the unique characteristics of the visual media, and how it can enhance and facilitate student learning.
2. Give a description of how you can use camcorders and VHS machines to enhance and facilitate learning.
3. Explain and describe the differences between print-based material and 'electronic books'. What are the advantages and disadvantages of each?
4. Pretend you have interviewed the teachers in math, social sciences (history and geography) and biology. They provided you with general ideas on what types of 'electronic books' and videos that they would like to use for group projects, for individual in-depth learning, or remediation learning.
5. Use your answers to 1 - 4 to write the proposal. A joint proposal is a justification for the use of visual media in education, include type of equipment that they would need to buy.

### Strategy

- Divide the tasks among you
- To write up the final proposal, several people can do it, just indicate Proposal in the TITLE of those messages.

---

### CoSy Activity 3: March 29 - April 4 (10%)

**Goal**

- To carry out a debate on-line, that is, learning through argumentation and clarification
- To use the literature to state and evaluate opinions

**Related Materials:**

- The Neil Postman article "The Huxleyan warning"
- The course book
- The selected readings and the video clips
- You could also use newspapers, computer- and school magazines to support your opinions

**Grading**

- 3 points for **logging on** three different times making at least 1 statement and 2 comments. Points will be calculated as follows: 9 messages at three different times = 3 points. If e.g.,  $5/9 = .6 \times 3 = 1.8$
- 4 points for **content**, based on how well you used the literature, 4=outstanding; 3.5=excellent; 3=good; 2.5= quite good; 2=fair; 1= poor; 0=irrelevant
- 3 points for **organization**, how well your information is organized 4=outstanding; 3.5=excellent; 3=good; 2.5= quite good; 2=fair; 1= poor; 0=disorganized
- Contributions are individually graded

**On-Line Task:**

- Each of you will be randomly assigned to take a position **FOR** or **AGAINST** the below scenario. Students that have been assigned to defend the below scenario are to initiate the discussion.
- You are to log on **AT LEAST 3** (three) different times, and make **AT LEAST 1 (one)** statement and **2 (two)** comments each time!
- The opening scenario is in message #2, in the group that you have been assigned to. Each group still has three topics, this debate takes place in the exercise3 topic.
- Message #1 will contain the above information.
- Message #3 will tell you whether you have been assigned to take a position **FOR** or **AGAINST**.

**MESSAGE #2: Scenario****The "Virtual" Classroom**

In the virtual classroom of the future, although classrooms won't be obsolete, there will be important developments in distance education. The trend will be for students to do course work online using telecommunications technologies. For example, Communications 145, a course on computer writing, will have no set meeting time. Students will register whenever they like and will be able to take up 16 weeks to complete the course at their own pace. New students will read the course outline and instructional files on-line. They will download assignment instructions and e-mail, their finished assignments for tutorial feedback and grading. Text and student work will include video clips and full-colour graphics. Teacher feedback will include annotation.

## **Appendix F**

# Study Guide

**EDUC 305**

**Winter 1995**

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## Technology for Educational Change

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*If you want to understand something, try to change it.*  
Kurt Lewin

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<i>State-of-the-art Oakville has it all (1 page)</i>	
<i>For the home, think multimedia, practicality, memory (1 page)</i>	
<i>Before buying that future library, take discs out for a spin (1 page)</i>	
<b>6. Educational Change</b> .....	<b>37</b>
* <i>The Huxleyan warning (5 pages)</i>	
* <i>The impact of society on Educational Technology (5 pages)</i>	
* <i>When school comes to you (3 pages)</i>	
<i>The business of education: Try advertising (6 pages)</i>	
<i>Canadian education: A system in flux (1 page)</i>	
<i>Creating the global classroom for the 21st century (4 pages)</i>	

**APPENDICES** (attached at the end of the respective Module)

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3.2 Project I Guidelines.....	23
4.1 Presentational Characteristics of Television .....	29
5.1 Project II Guidelines.....	35

## Course Information

### Course Overview

This Study Guide and accompanying course materials represent the distance education version of the Concordia course Education 305. The primary teaching goal for this course is for students to develop an awareness of the possibilities for using innovative technologies in education to enhance learning and classroom processes. It is a survey course that will introduce you to the field of educational technology and the major issues related to the application of electronic media for learning.

The course is designed as a series of six modules. Following an introduction to educational technology, you'll learn about the four broad categories of technology used in education — telecommunications, electronic applications of print, audio-visual media (television and video) and computers. The final module will focus on future trends in technology and education. These six modules are outlined for you below.

- Module 1** *Introduction to Educational Technology* will provide you with an understanding of educational technology and a background on the theoretical roots of the field.
- Module 2** *Telecommunication Systems* will introduce you to the latest developments in telecommunications technology, and in particular to computer conferencing and the Internet.
- Module 3** *Print-Based Instruction* will trace the evolution of printed materials in education through to the latest innovations of desktop publishing, hypertext and electronic books.
- Module 4** *Television & Video* will look at the unique characteristics of the audio-visual media for instruction, as well as the latest methods for formatively evaluating educational television.

- Module 5** *Computers & Multimedia* will focus on the design of computer-based "learning environments", and in particular on the latest developments in CD-ROM technology.
- Module 6** *Educational Change* will discuss some of the larger issues related to the impact of technological innovations on education and society at large, as well as examine the possible future of education.

### **Course Organization**

The course is designed to give you a well rounded learning experience. Each module contains content that would normally span two classroom periods (and three periods for the Computers & Multimedia module). In other words, you'll have two (or three) weeks to complete the readings and activities required for each module. It is a multi-media course involving the use of this study guide, selected readings, a textbook, a 120-minute videotape and some computer conferencing. These materials are described below.

- Study Guide** This Study Guide is like your teacher for the course; it includes the important information you'll need to succeed, as well as the additional readings for the course.
- Textbook** The required textbook for the course is *Instructional Media & the New Technologies of Instruction* Fourth Edition (1993) by Robert Heinich, Michael Molenda & James Russell.
- Videotape** An *Educational 305 Video Series* (1994) has been produced specifically for this course by John Bentley and Frank Roop, graduates of the Educational Technology program at Concordia.

## Computer Conferencing

Computer conferencing will be used to give you a sense of what communicating with computers is like and to involve you in three interactive projects with some of your "classmates". The system that will be used is called CoSy and it is designed to facilitate communications and conversations among people in different locations. It is asynchronous communication, meaning that communicators do not talk to one another in "real time" like a telephone conversation, but at different times. It is more like writing letters to one another, although it is far more sophisticated than electronic mail messaging systems. More information on computer conferencing and the first project that you will be involved in is contained in the separate handout titled: "CoSy Guidelines for EDUC 305" which is included in the courseware package.

## Study Guide Format

The format of the study guide is as follows. For each module you'll read an introduction to the topic being covered (printed on colored paper to be easily distinguished from the supplementary readings), view a segment from the *EDUC 305 Video Series*, read parts of the required text and the required and supplementary course readings, as well as complete a task for assessment purposes. Each of these different components is described below.

## Video Segments



The first thing you'll find at the beginning of each module is an abstract from the *Education 305 Video Series*. These abstracts are included as "advance organizers" to give you a feel for the overall content to be covered in each module. The videotape itself contains six, twenty-minute segments that demonstrate and summarize the various technologies and issues you'll be reading about. There's a lot of information condensed in these video segments, so we recommend that you view each segment before you begin your readings to whet your appetite and to give you an overview of the content to come. It's further suggested that you view the segment again once you've completed each module to consolidate your learnings. You might want to view the videotape one more time before the final exam.

**Required readings**

Each module begins with a review of the textbook's coverage of the topic to be studied. The text provides most of the basic information you will need to know. It has a good index and glossary for reference purposes. At times, however, it's not as up-to-date as we'd like. It also lacks local examples of educational technology applications. For this reason, we've attached to each module a set of additional readings. These will also be reviewed so that you know what to expect.

**Key points**

You will find a list of learning objectives for each module to give you an idea of the key points to look out for in your readings. These objectives are intended as both a road map through the content and a yardstick to measure your own understanding. Questions will also be posed on what we think is important about the each topic to help focus your attention when viewing the videotape and reading. It will be your responsibility to make sure that you can answer these questions. You'll also be preparing project work and writing a final exam, so hints on how to take good study notes to facilitate your learning will also be included in this section.

**Project work**

We've designed two self-study projects for you to complete during the semester. One will involve selecting and evaluating an example of print-based materials, and the other will require selecting a piece of software and designing a lesson for a computer-based learning environment. These projects are described in more detail below. You'll find explicit guidance on how to relate your readings to these projects in the respective module introductions.

### Computer conferencing



As mentioned before, to give you some "hands-on" experience working with technology, you'll be required to participate in a series of computer mediated exercises using a computer conferencing system (CoSy) accessed through the Concordia VAX2 computer network. These exercises will be like mini-assignments that you'll receive individual feedback on, as well as an individual mark that will accumulate towards your final letter grade. They will also give you the chance to communicate your views (and concerns) with other distance education students in the course. Specific instructions on how to proceed with these exercises will be provided in the respective modules.

### Supplementary readings



Following each module introduction you'll find two or three supplementary readings that have been selected to offer different perspectives on the material to be learned. For the most part these readings are short newspaper or non-academic articles offering an easy-to-read journalistic perspective on innovative applications of technology. The purpose of these readings is to encourage you to think beyond the basic content of the course.

### ***Evaluation***

As explained above, your success in this course will depend on your participation in a series of self-directed learning activities. Each module will provide you with the opportunity to apply your new learnings, either in the form of project work or computer mediated discussions. A brief description of these required activities is given below.

### **Project I** Due February 14, 1995 (20%)

For the first project, you will need to construct an appraisal form (based on examples in the text) that captures specific text design principles discussed in the readings. You'll select an example of printed materials and evaluate it in relation to these principles. You'll also be asked to discuss the possible advantages and limitations of transforming the materials you've selected into an "electronic book". More hints on how to proceed are included in Module 3.

**Project II** Due March 28, 1995 (25%)

For the second project, you will need to select an example of computer-based instruction and design a lesson around it. You'll be expected to document the various decisions you make in your design (i.e., your learners, learning objectives, teaching methods and evaluation procedures). You'll also need to use your imagination in preparing activity sheets to support the computer-based lesson. More specific guidelines on how to proceed are included in Module 5.

**CoSy Exercises**

Three computer conferencing exercises (on-line group work) have been organized for you to participate in during the course of the semester. Specific guidelines on how to access the computer conferencing system (CoSy) and proceed with these exercises is included in the separate handout provided. Although these exercises will involve group work, you'll receive a mark based on your individual performance. The three conferencing exercises are briefly described below.

**#1: Questions & Answers – open January 18-31 (10%)**

The first exercise will require you to log onto CoSy at least five times. You'll be prompted to join two conferences and respond to specific questions based on the topics covered in Modules 1 and 2. You'll also be expected to comment on at least three other students' responses.

**#2: Proposal – open February 15 to March 7 (10%)**

The second exercise will involve you collaborating with other students in the course, and together responding to a case study scenario based on your readings in Module 4.

**#3: Debate – open March 29 to April 11 (10%)**

The third exercise will involve you participating in a debate with other students in the course based on the readings in Module 6 on technology and educational change.

**Final Exam** Date to be announced during the exam period (April 12 to May 7) (25%)

You will also be required to write a final exam in which you will have an opportunity to demonstrate your learnings from the course as a whole. The exam will include a combination of multiple choice and short answer questions, as well as one essay question. You'll be informed by mail of the date and time of the exam. If necessary, we'll schedule a review session during the last week of term.

Unless otherwise negotiated, you'll be expected to respect the deadlines for assignments. IPs (incompletes) will only be given for unforeseen emergencies and must be requested in writing.

Final letter grades will be assigned on the following basis:



<u>Final score (%)</u>	<u>Letter grade</u>	<u>Qualitative</u>
97-100	A+	Outstanding
94-96	A	
90-93	A-	Very Good
85-89	B+	
80-84	B	
75-79	B-	Satisfactory
70-74	C+	
65-69	C	
60-64	C-	
57-59	D+	Marginal Pass
53-56	D	
50-52	D-	Fail
Less than 50	F	

You'll need to organize your time carefully to keep pace with the requirements for this course. To assist you, a week-by-week schedule is provided on page 8. The icons appearing on pages 3 and 4 will also be repeated throughout the modules as a visual reminder of the tasks to be completed.

We strongly recommend that you schedule about four to six hours per week for working through the course materials. You'll be allocated a tutor for the duration of the course whom you may call upon for help as required. Information on your tutor's name, telephone number and office hours will be provided separately.

## EDUC 305/DE Weekly Schedule Winter 1995

Modules	Topic	Readings & Assignments
Module 1 Weeks 1 & 2 (Jan 04-17)	Introduction to Educational Technology	Read Module 1 readings in study guide Read Preface of textbook Read Chapters 1 & 12 in textbook
Module 2 Weeks 3 & 4 (Jan 18-31 )	Telecommunication Systems	Read Module 2 readings in study guide Read Chapter 10 in textbook CoSy Ex. #1 due in this period (10%)
Module 3 Weeks 5 & 6 (Feb 1-14)	Print-Based Instruction	Read Module 3 readings in study guide Read Chapter 3 in textbook Project I due February 14 (20%)
Module 4 Weeks 7 & 8 (Feb 15- Mar 7)*	Television & Video	Read Module 4 readings in study guide Read Chapters 6 & 7 & pp. 293-307 in textbook CoSy Ex. #2 due in this period (10%)
Module 5 Weeks 9, 10, 11 (March 8-28)	Computers & Multimedia	Read Module 5 readings in study guide Read Chapters 2, 8 & 9 in textbook Project II due March 28 (25%)
Module 6 Weeks 12 & 13 (Mar 29-Apr 11)	Educational Change	Read Module 6 readings in study guide Read Chapter 14 in textbook CoSy Ex. #3 due in this period (10%)
T.B.A. (Apr 12-May 7)	Course Review	Final Exam (25%) During exam period

*\*February 20-24 Winter break*