Cyber Space or Face-to-Face? Comparing Face-to-Face with Computer-Mediated Communication for Collaborative Learning

By

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Abstract

This thesis compared face-to-face (FTF) communication with the computer-mediated communication (CMC) tools, email and chat, for collaborative learning purposes in higher education. Participants (n = 60) worked in groups of three in one of two communication conditions: FTF or CMC. Each group completed two tasks that required different ways of thinking: convergent thinking (finding one correct answer) and divergent thinking (formulating many solutions). Students obtained comparable task scores regardless of communication media. CMC participants appreciated the divergent thinking task more, had more concerns about time, more difficulties with scheduling, more anxiety about completing tasks on time, and fewer three-person meetings than did FTF groups. Participants in both conditions appreciated working in groups. The communication framework of grounding (Clark & Brennan, 1991), proved useful when analysing the results. The study identified key areas for further research and provided grounds for practical recommendations.

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The giving of love is an education in itself.

Eleanor Roosevelt

Dedication

For Aaron, Sylvia, and Gwen,

with immeasurable love and gratitude.

Cyber Space or Face-to-Face? Comparing Face-to-Face with Computer-Mediated Communication for Collaborative Learning

Conversation is Co-Created

Communication is a social act (Clark, 1992, 1996). Speakers and receivers are both active participants in the process of creating meaning. In a sense, a conversation among three people is analogous to a musical ensemble. If a violinist, a cellist, and a bassist were to sit and simultaneously tune their instruments or play different songs, the result would be meaningless noise. But once the trio begins to cooperate on the process of making music together, the sound that is co-created can be beautiful and harmonious (Clark & Brennan, 1991).

People co-create conversation in many ways. One such way is when speakers formulate their utterances according to their audience (Fussell & Krauss, 1989). For example, a student might write a note in a very truncated form when she knows that she will be the only one to read it in the future, whereas she may write the note out more fully and clearly if she knows that a peer will read the note later.

Speakers formulate and modify their utterances according to how well they believe the addressee is understanding, and addressees cooperate by providing evidence that they are understanding what the speaker is saying (Bavelas, Coates, & Johnson, 2000; Clark & Krych, 2004). To illustrate this phenomenon, take the experiment conducted by Clark and Krych (2004) in which a director told a builder how to assemble 10 Lego models based on prototypes that only the director could see. The builder, following directions, assembled the models from loose pieces of Lego scattered in a workspace. Clark and Krych found that when the interlocutors could speak to each other

freely, see each other's faces, and could both see the builder's workspace, the models were built quickly and accurately. But, when there were restrictions placed on when the interlocutors could speak to speak to each other, see each other's faces, and when the director could not see what the builder was doing in his or her workspace, the models were built more slowly and had more errors.

In face-to-face (FTF) communication, not all coordinated communication activities are verbal. Gestures, facial displays, and eye gaze are effective non-verbal, visible acts of meaning (Bavelas & Chovil, 2000). For instance, Bavelas et al. (2000) found that when a speaker looked at a listener, the listener tended to give some kind of feedback (e.g., returned eye contact and nodded). Once the listener provided the feedback, the speaker looked away again. Interlocutors used this "gaze window" to coordinate their actions.

Collaborative Learning

Great things can happen when people put their heads together. There is a tremendous amount of research that supports collaborative learning. When I refer to *collaborative learning* I am referring to the kind of learning that occurs among students in the absence of a teacher. Sometimes in the literature, the term *cooperative learning* is used, or *collaborative learning* is applied to groups that include a teacher or facilitator (Goodsell, Maher, Tinto, Smith, & MacGregor, 1992; Johnson & Johnson, 1999; McNeill & Payne, 1996; Slavin & Others, 1996). However, it is common to find the term *collaborative learning* in the context of student-to-student collaboration rather than teacher-to-student, or teacher facilitated collaboration. This is how I will use the term throughout this thesis.

In comparison to traditional teacher-student instruction where the student passively receives information, student-to-student collaborative learning creates an environment where students actively participate in knowledge creation (Goodsell et al., 1992; Ocker & Yaverbaum, 1999). Students who learn collaboratively benefit by learning informally from their peers, and by being able to practice collaboration with their peers. Students in collaborative learning environments demonstrate higher interest in the course subject than students in teacher-student environments (McNeill & Payne, 1996). They also spend more time focussed on the task and show higher academic, social, and self-esteem gains (McNeill & Payne, 1996). Over 500 studies on collaborative learning have shown that in these environments, students learn more, are more satisfied with the learning process and learning outcomes than students in teacher-student learning environments (Johnson & Johnson, 1989 as cited in Ocker & Yaverbaum (1999).

Many studies about collaborative learning pertain to students working in-person during class time, or students working in face-to-face (FTF) groups outside of the classroom. There are strong supporters for the idea that in order for a group to be truly collaborative, it *must* be a FTF group (Johnson & Johnson, 1999; McNeill & Payne, 1996; Stahl, 1994). Johnson & Johnson (1999) contend that, "Accountability to peers, ability to influence each other's reasoning and conclusions, social modeling, social support, and interpersonal rewards all increase as the face-to-face interactions among group members increase" (p. 71). They also point to the fact that FTF groups allow for non-verbal responses from group members in order to provide information about a student's performance.

In support of this notion, one recent empirical study that compared face-to-face

(FTF) with computer-mediated communication (CMC) provided support for FTF collaborative learning over CMC collaborative learning. Van der Meijden & Veenman (2005) found that, in primary school, collaborative student groups in FTF communication had higher levels of elaboration on math problems, higher performance scores, and were more satisfied with the communication medium. They also found that students in the CMC condition made three times as many regulative utterances and two times more affective utterances than those in the FTF condition, thus, much of their communication was not subject-based.

There is no doubt that collaborative learning in FTF groups is a beneficial way to learn, but do college students really have to meet in-person in order to benefit from collaborative learning? Is FTF communication really a necessary ingredient for collaborative learning in higher education? Can students use communication technology that is available and known to them in order to learn together just as effectively as in-person meetings?

There are many practical reasons to use CMC for collaborative learning. Communicating with each other through computers allows students to work from geographically distributed locations. Each individual can work at his or her own convenience. There is no need to travel to and from meeting locations (saving on gas or bus fare and certainly on time), and booking meeting places is not necessary. Furthermore, when students use computers for communication, there is the option of keeping a record of the communication; they can later use artefacts for a myriad of purposes.

In addition to the practical components of using CMC for collaborative learning,

empirical evidence is mounting that demonstrates the benefits of online collaborative learning. There is an entire field of research called Computer Supported Collaborative Learning (CSCL). Empirical evidence from this field of research has shown that students in online groups communicate with each other more, communicate more about course concepts, achieve higher grades, and learn better than in FTF groups (King, 1994; Althaus, 1997, as cited in Hollingshead, McGrath, & O'Connor, 1993). Others have found CMC to be just as effective as FTF communication in the areas of professional competence, academic self-efficacy, social self-efficacy, self-efficacy for problem solving among members, and in cooperation and satisfaction with the learning experience (Francescato et al., 2006). Despite these encouraging results, there is surprisingly little research that explicitly compares FTF collaborative learning with CMC collaborative learning (Francescato et al., 2006; Ocker & Yaverbaum, 1999; van der Meijden & Veenman, 2005).

Comparing FTF and CMC. Much of the research that does compare FTF and CMC for collaborative learning is anecdotal in nature (Ocker & Yaverbaum, 1999), or is generalizable only to the population of younger children in K-12 grades, and of that research, the results have been varied (Ocker & Yaverbaum, 1999). To the best of my knowledge, none of the research on student-to-student, CMC, collaborative learning in higher education attempts to place the findings in the context of social psychology, in particular, the construct of "grounding." That is, how people go about gathering the common ground that is necessary in order to convey meanings (a detailed discussion of grounding will soon follow).

Students in higher education are using technology for group work, regardless of

the fact that there is very little research that compares FTF with CMC for collaborative learning. Professors who want to encourage students' collaborative learning are recommending and even requiring CMC (Brandon & Hollingshead, 1999). Given that most students are already adept at using email and online text-based chat programs, it makes sense to suggest that students use these readily available and understood tools for their collaborative learning experiences. The idea that genuine collaborative learning can only occur in FTF groups needs much closer scrutiny. Computer-mediated communication tools may enhance student-to-student collaborative learning, and they are already being used despite the lack of empirical evidence that they do or do not support collaborative learning, therefore, it is essential to gather empirical evidence of its worth.

The purpose of this thesis was to compare the media of FTF and CMC (email and chat programs) as they are used by university student triads to collaborate on learning tasks. It explored many questions: Which communication media best assists students with their collaborative learning goals? Does one medium facilitate more collaboration between peers than the other, or cause more difficulties in terms of scheduling, technical difficulties, or mix-ups with communication?[1]

I contextualized the results of the study in the area of social psychology that is concerned with the *process* of communication. That is, I considered differences in how students were able to prepare utterances, deliver them, receive them, give feedback, and

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[1] There is evidence that students perform equally on learning, quality of solution, solution content, and satisfaction with solution quality, but that FTF is preferred over CMC for group interaction process and quality of group discussion (see Ocker & Yaverbaum, 1999 for a discussion of their own results as well as the studies on which they based their hypotheses). This evidence, however, was gathered using FirstClass software with many features that required students to spend much time and effort learning (similar types of complex programs are used in other experiments). It was suggested that the learning curve could have been a confounding variable. This exploratory experiment used simple CMC tools that students were already familiar with and that required no learning curve, therefore the hypotheses in this study were non-directional.

provide evidence that they understood each other (Clark, 1996).

The process of communication varies between communication media (Brennan, 1998; Clark, 1996; Clark & Brennan, 1991). For example, while a student in a FTF group may only take a moment to ask for clarification of an idea presented by a peer, that same request for clarification may take several hours or even days when they conduct their exchange by email. Conversely, email presentations tend to be more detailed and fewer exchanges occur between interlocutors than in FTF communication (Brennan & Ohaeri, 1999; Clark & Brennan, 1991).

Face-to-Face as a Standard for Comparing Other Communication Media

Understanding exactly how people go about creating conversation in the FTF context, regardless of the topic of conversation, is an important place to begin to understand how communication works in other media such as CMC (e.g., email or chat). Bavelas, Hutchinson, Kenwood, & Hunt-Matheson (1997) argue for FTF conversation as the standard for comparing other communication media because there are three particular features that can *only* be expressed in FTF dialogue. These include unrestricted verbal expression, non-verbal acts of meaning such as gestures and facial displays, and instantaneous collaboration between interlocutors. Although interlocutors use these three features in other media, no other media allows for all three features to occur simultaneously or to their fullest extent.

Clark (1996) suggested that FTF conversation is the appropriate standard because it is, "...the basic setting for language use. It is universal, requires no special training, and is essential in acquiring one's first language. Other settings lack the immediacy or control of face-to-face conversation, so they require special techniques or practices" (p. 10).

There are a tremendous number of studies that examine communication technologies without using FTF communication as a basis for comparison. However, there is a sound rationale for using FTF communication as the standard of comparison against other forms of communication.

Common Ground

One of the most important principles of FTF communication is that of common ground. In any communication effort, interlocutors coordinate on how they go about the *process* of communicating and on the *content* of their communication. What constitutes the process of communication will be made clear shortly. In order to coordinate on content, interlocutors must obtain,

> ...a vast amount of shared information or common ground – that is, mutual knowledge, mutual beliefs and mutual assumptions (Clark & Carlson, 1982; Clark & Marshall, 1982; Lewis, 1969; Schelling, 1960). And to coordinate on process, they need to update their common ground moment by moment. All collective actions are built on common ground and its accumulation. (Clark & Brennan, 1991, p. 127)

Clark and Brennan (1991) provide an excellent example of how the process of communication and the content of communication interrelate. Imagine that a man is speaking to a woman and he makes reference to "my dogs." Each interlocutor must come to the mutual belief that they both understand that the content of the conversation is not about the man's pets, but his feet. The man goes through the process of speaking only when he thinks she is listening (perhaps he taps her on the shoulder [gesture]), she must go through the process of giving him an indication that she is attending to him (she looks him in the eye [gaze], smiles [facial display], and nods [gesture]). In this way they coordinated on initiating the conversation. Then, he talks about his "dogs," she listens (while providing indication to him that she is listening) and then provides some kind of

feedback to let him know that she understood him – perhaps she smiles, says "Mhm," and looks at his feet. Throughout the exchange, the key point is that the coordination of their communication *process* and of *content* were intricately linked. Without coordinating their communication processes they could not come to a mutual understanding of content.

Types of Common Ground

Mutual knowledge, beliefs, and assumptions can be acquired three ways: *community membership*, *physical copresence*, and *linguistic copresence* (Clark & Marshall, 1981). People who share *community membership* can assume common *generic* and *particular* knowledge. For example, educated Canadians share the generic knowledge that the Prime Minister is Stephen Harper. Members of the University of Victoria community share the particular knowledge that there are many rabbits living on campus. *Physical copresence* can garner common ground by virtue of being in a shared physical environment. Imagine a couple strolling hand-in-hand through an art gallery when the woman stops and orients herself towards a particular painting and says, "*That* is so beautiful!" It is by virtue of sharing the physical environment that her partner was able to understand that the woman meant the Van Gough painting in front of her when she used the deictic word "*that.*"

Finally, the type of common ground that most concerns this study is *linguistic copresence*. It is the gathering of common ground through information that is only available through what has already been communicated in conversation. Although it is possible to acquire common ground outside of the realm of language use, language use always involves the process of acquiring common ground (Clark & Brennan, 1991; Clark & Marshall, 1981).

Principles of Grounding

Clark & Brennan (1991) called the process of acquiring common ground, *grounding*. Understanding the grounding process is paramount to understanding language use. Without grounding, communication cannot occur. Faulty grounding results in miscommunication. There are several components and principles involved in the grounding process.

Contributions in conversation. A contribution in a conversation is one unit that consists of two parts; a *presentation phase*, where an utterance is formulated and presented, and the *acceptance phase*, where the utterance is accepted and evidence is given that the utterance was understood.

> *Presentation Phase*: A presents utterance ***u*** for B to consider. He does so on the assumption that, if B gives evidence *e* or stronger, he can believe that B understands what A means by ***u***.
> *Acceptance Phase*: B accepts utterance ***u*** by giving evidence *e* that he believes he understands what A means by ***u***. He does so on the assumption that, once A registers evidence *e*, he will also believe that B understands. (Clark & Schaefer, 1989)

Each interlocutor will seek evidence of understanding (or lack thereof) which can be found via *positive evidence* that the presentation was understood, or *negative evidence* that the presentation was not understood (Clark & Brennan, 1991). A contribution is not complete until each interlocutor believes that the presentation was understood. A contribution may require one or more utterances by producers or receivers (Clark & Brennan, 1991). Evidence of understanding may be *implicit*, such as constant eye contact or the appropriate answer to a question. Evidence can also be *explicit*, such as a request for clarification, rephrasing the original presentation, or *back-channel responses* such as an addressee uttering "uh-huh" at precisely timed moments (Clark & Brennan, 1991;

Clark & Schaefer, 1989).

Grounding criterion. One important principle of grounding is called the *grounding criterion* which states: "The contributor and his or her partners mutually believe that the partners have understood what the contributor meant to a criterion sufficient for current purposes" (Clark & Brennan, 1991, p. 129). That is, interlocutors will work together towards understanding until they agree that they understand each other, and, how hard they will work towards this agreement will depend on the purpose for communicating. When the consequences of miscommunication are high, interlocutors will make much effort to ensure clarity and mutual understanding. The techniques, quality, and quantities of contributions all differ according to purpose (Brennan & Ohaeri, 1999; Clark & Brennan, 1991).

Principle of least collaborative effort. The A principle that closely relates to the grounding criteria is the *principle of least collaborative effort.* It states that interlocutors will, "...try to minimize their collaborative effort – the work that both do from the initiation of each contribution to its mutual acceptance" (Clark & Brennan, 1991, p. 135). This principle explains why interlocutors attempt to reduce the number of turns per contribution; every extra turn adds to the collaborative effort (Brennan & Ohaeri, 1999; Clark & Brennan, 1991). It also explains why producers prefer to repair their own mistakes; it takes more turns for an addressee to repair an utterance than for the producer to make it first (Schlegloff, Jefferson, & Sacks 1977, as cited in Clark & Brennan, 1991, p. 135).

As a result of the collective goal of reducing collaborative efforts, people are incredibly efficient at communicating. This principle applies to how people ground in

FTF conversation (e.g., reducing turns), and it also applies to how they ground in CMC (e.g., make longer instalments per turn in email than in FTF). Furthermore, according to the principle of least collaborative effort, people will try to choose the communication media that requires the least collaborative effort (Brennan, 1998; Clark & Brennan, 1991). This principle will prove to be critical when comparing different communication media.

Costs of grounding. Using communication media other than FTF means that interlocutors must use "special techniques or practices" (Clark, 1996, p. 10) in order to ground. There are costs associated with making these extra efforts. Because communication media differ in what techniques are available for grounding, the costs of grounding will vary according to media. Clark and Brennan (1991) outlined 11 costs of grounding; they are in Table 1.

Table 1

Clark and Brennan's (1991) Costs of Grounding

Cost	Description
formulation costs	The time and effort it takes to formulate and reformulate utterances.
production costs	The effort involved in the actual act of producing an utterance (e.g., speaking vs. typing).
reception costs	The efforts of the receiver such as waiting for her turn, or reading, or processing the information.
understanding costs	The efforts of trying to understand the message in a given context (e.g., it may be easy to understand deictical expressions such as "over there" and "this here" in a FTF context but far more difficult to understand them when they are written in an email).
start-up costs	The efforts of getting another's attention in order to begin a conversation (e.g., giving a little cough in the FTF context as opposed to opening an email program, composing a letter, addressing it, sending it, and waiting for a reply).
delay costs	The efforts of planning, revising, and executing an utterance.
asynchrony costs	The more asynchronous timing is between interlocutor's utterances, the higher the cost tends to be. In FTF conversation timing such as long pauses, interruptions, and response speed can, in itself, convey meaning; this can be lost in asynchronous communication.
speaker change costs	The ease of turn-taking. It is very easy in FTF conversation to coordinate the exchange of turns. It is more difficult in chat conversations, and more difficult still in email exchanges. One effect of high speaker change costs is that people try to do more with a turn.
display costs	The relative ease of non-verbal communication such as gesture, gaze, and facial displays.
fault costs	When there is a mistake in an utterance, there is a cost. It may lead to misunderstanding, or it could lead to a the speaker's loss of face in that (s)he may appear rude, dumb, etc.
repair costs	The costs of repairing faults range from easy to impossible. Producers tend to want to make repairs themselves as quickly as possible thus minimizing the costs. In media that is not cotemporal, repair costs tend to be high.

The following example illustrates how the costs and benefits of the techniques available for grounding vary according to communication media. This example concerns the differences in repair costs and fault costs in FTF communication versus CMC. It is known that speakers prefer to make their own corrections because it generally requires less collaborative effort to make a self-repair (fewer turns result in self-repairs) (Brennan & Ohaeri, 1999; Clark, 1996).

Imagine that a speaker in a FTF conversation made an error, "She loves cats, and he loves dogs." Then, the speaker realised the error and immediately corrected it, "HE… He loves cats, and SHE loves dogs." There was very little effort involved in making the repair and required no additional turns, thus, it had a low repair cost. Now, take the same example in a CMC text-based, on-line, same-time, geographically distributed conversation, commonly known as "instant messaging" or a "chat." The speaker might have typed, "She loves cats and he loves dogs," and pressed the Enter key. Then, the speaker realised that she reversed the words "she" and "he", so the speaker began to type, "HE…He loves cats and SHE lov…"

By that time, the addressee had a chance to read the message, realised the sentence was inconsistent with what the addressee already knew, typed, "But he hates dogs!" and hit the Enter key - all while the original speaker was still formulating a repair. The speaker saw the reply, "But he hates dogs!" and decided to respond to that comment rather than continue with the repair, so the speaker backspaced over the partially constructed sentence and typed, "I know, I meant to say that HE loves cats and SHE loves dogs" and hit the Enter key. Thus, the repair cost for this error involved typing that was never sent, deleting of typing, an additional turn by the addressee, and re-typing! It is

for this reason that people expect CMC speakers to be much more careful in the production of utterances than FTF speakers are. Fault costs (e.g., misunderstandings and speaker's loss of face) in CMC are higher than in FTF communication because of this expectation.

That is not to say that fault and repair costs are inevitably more severe in CMC than FTF. There are instances where the cost of a fault made verbally in FTF conversation can be extremely high. Take for example, the classical Freudian slip where someone asks a woman how much older she is than her lover, and she replies, "It's mother your business!" Had she written those words, she might have been able to self-repair the fault prior to sending the response. However, once she spoke the words, she could not take them back.

Computer-Mediated Communication

Advantages of CMC. Computer-mediated communication programs offer several advantages over FTF communication. They allow people to communicate without having to be collocated; one of the biggest benefits of CMC. Being able to communicate asynchronously (at different times) is another important benefit. Students are able to edit messages or documents prior to sending, and they can send to several people at once. Furthermore, some CMC programs can provide an artefact of conversations, which can be very useful when people work together for collaborative learning purposes. Students can use artefacts to remind them of what they said, what they agreed upon, and on who was accountable for what. Oftentimes artefacts end up being instrumental in the co-creation of documents.

Disadvantages of CMC. Computer-mediated communication is not, however, a

panacea for the difficulties of FTF communication. First of all, students must have access to computers and the internet. Although owning a personal computer is the norm nowadays, not everyone necessarily owns one, and even if they do, they may not have access to the internet at home. If a student does not own a computer then (s)he must gain access to one, and if there is no home access to the internet, they still have to find a computer that is online. Furthermore, programs used for collaborative learning in higher education should require little in the way of hardware, should be ubiquitous, and should be inexpensive or free. A reduction of any of these factors leads to a reduction in the likelihood of students using the program, or in its usefulness if they do use it. Finally, computers and programs need to be effective, efficient, safe, easy to learn, have good utility, and be easy to remember how to use (Preece, Rogers, & Sharp, 2002). Computer hardware and software developers face incredible challenges and not all designs make the grade. Ultimately, it is the student who must weigh the benefits of using computers for collaborative learning against the costs of not using them.

In addition to the difficulties of computers in and of themselves, there is the fact that when people use them to communicate, they often lack many of the channels through which people use to communicate in FTF conversation. With text-based CMC programs, people cannot see or hear each other. Other forms of CMC might allow for visibility and audibility (as is the case with videoconferencing tools), or just audibility (as is the case with many telephone-like programs). The more channels for communication that a CMC program allows for (e.g., video, audio, images, text), the "richer" the medium is said to be.

There has been much discussion about communication channels in CMC. A very

prevalent theory is the *Media Richness Theory* (Daft & Lengel, 1986). It postulates that the more ambiguous and uncertain the task, the richer format of media is suitable to it. In other words, a medium must allow interlocutors to achieve shared meaning. If a medium does not have enough richness to allow for this, interlocutors may end up misinterpreting messages and having ambiguous communication.

Many studies have involved the Media Richness Theory. One meta analysis of studies that used computer-assisted instruction (technology that assists teachers with presentations, for example, Power Point or digital audio recordings) in colleges, revealed that, consistent with the Media Richness Theory, computer-assisted instruction increases student's performance when an audio channel is used (Timmerman & Kruepke, 2006).

One of the problems with richer media programs is that they tend to get more complicated or expensive. It is fine and well for teachers to use richer computer-assisted instructional technologies because they have access to funding and technical support available through the school. Students, however, do not typically have money to spend on expensive video-cameras or software. They also don't necessarily have the time to figure out how to set up and use new, complicated computer programs. Furthermore, the added complication of using such technology, in addition to the already difficult jobs of learning course material and collaboratively working on course material, might just get in the way of learning. For these reasons, this study used the simplest, most inexpensive, ubiquitous forms of CMC technology available: email and chat.

Human-computer interaction. When people speak to each other in-person, they typically have nothing between them but space. Such is not the case with CMC. People must first "communicate" (or more commonly, "interface") with their computers and then

with each other. Both interlocutors must know how to use their computers in terms of turning them on, knowing how to access applications that will enable communication with another person, and know how to use the applications. Only when each interlocutor has correctly managed to interface with their computers, can they hope to communicate with each other. It is for this reason that any discussion involving CMC should consider human-computer interaction.

Common Ground With Computers

When a human interfaces with a computer, the computer itself is an interactive communication partner, therefore, the human-computer interaction is subject to the same principles of grounding that FTF communication is (Brennan, 1998). There are many similarities in how humans go about grounding with computers, and of course there are many differences. The main differences arise from the fact that computers are not conscious, sentient beings, and they cannot do many of the things that humans do in order to ground (i.e., gesture, gaze, facial displays, prosody, etc.). Grounding with computers takes a different form from grounding in FTF communication.

The grounding problem in human-computer interaction. As with FTF communication, human-computer interaction is a collaborative process. Both partners must collaborate on the process as well as the content of communication. Of course, given that the interlocutors do not equally share the ability to think for themselves; the bulk of the responsibility for grounding falls to the human partner. This phenomenon has been coined the *grounding problem in human-computer interaction* by Brennan (1998. p. 3).

The form of communication and the grounding criterion in human-computer interaction. Despite the grounding problem in human-computer interaction, the form of communication remains the same in human-computer interaction as with FTF communication. Interactions still have two phases of contributions: One partner formulates a presentation and the other actively engages in the acceptance. Humans and computers alike will make efforts to achieve mutual knowledge, beliefs, and assumptions (common ground) to a criterion that is sufficient for their current purposes (the grounding criteria) (Brennan, 1998; Clark & Brennan, 1991).

For example, once a human issues a command or request to a computer, the machine receives input, recognizes the input as well formed, maps it onto a plausible interpretation, maps it onto an application command, carries out the command, and then reports any relevant information from the application domain back to the human (Brennan, 1998). All of these activities take time, but unless the computer provides some kind of evidence of understanding (i.e., that it is processing the input), there is no way the human can tell if the computer registered the command, and if so, how far along it is in its computing process. A human will want positive evidence that her or his command actually had the intended results. Computers can provide this evidence of understanding by using either *static status information*, such as a cursor that changes from an arrow to an hourglass when it is processing information, or *dynamic status information* such as a bar that shows up indicating what percentage of the work has been completed (as is commonly seen when downloading files, or installing applications) (Brennan, 1998).

Computers will seek evidence of understanding from a human by double checking with the human about what the human is requesting. For example, suppose a student

wants to reply to an email from a peer and he accidentally clicks the delete button instead of the reply button. If the computer does not seek evidence of understanding (e.g., "Are you sure you want to delete this email?") the email will be deleted. In this instance, the lack of human-computer grounding resulted in the loss of a message from a peer, consequently, interference in the grounding process between the two students. This problem resulted in the computer failing to ground to a criterion sufficient for current purposes. In order for human-to-human grounding in student-to-student collaborative learning to be successful, each student must successfully ground with her or his computer *first*.

Grounding techniques vary between CMC media. As previously mentioned, grounding changes with CMC media because each CMC program has its own unique set of grounding techniques available. How students go about grounding with their computers varies with the type of computer program used. For example, human-computer interaction grounding techniques in an email program are different from those of a chat program. In the case where a human wants confirmation that the computer program actually sent a message, email and chat programs provide confirmation differently. Email often has small window that pops up to provide some kind of confirmation that it sent the email successfully. With chat, the user knows that the program successfully sent the message if it appears in the larger part of the screen that is visible to all conversants. This is only one example of the many ways that grounding techniques vary among CMC media.

The interaction between CMC type and communication's purpose. How people ground varies according to what grounding techniques are available in each

communication media. Grounding also changes according to the purpose for communicating. These two things interact. Research provides evidence of this by showing that people have distinct preferences for the type of communication medium they use for various tasks. For instance, one experiential study found that people preferred meeting face-to-face for initial introductions rather than meeting in a video conference (Abel, 1990). Other research showed that FTF communication is preferred for reprimanding, while letters and telephones are preferred for refusing an unreasonable request (Furnham, 1982 in Clark & Brennan, 1991). Another study found that the communication medium of choice for schedule coordination, task assignment, and making progress reports, was email, whereas it was FTF for negotiations and coming to consensus (Finholt, Sproull, & Kiesler, 1990, as cited in Clark & Brennan, 1991).

Brennan and Ohaeri (1999) provided empirical support for the theory that media and purpose interact and that, together, they shape the *process and content* of communication. They began by pointing out that when the goal for communicating is to do work (i.e., it is not social), a sub-goal within the communication might be to serve social functions such as being polite. When it is relatively easy to use the communication media, interlocutors equally execute both the goal and sub-goal. However, when the costs of using the media are high, the sub-goal (politeness) tends to get less attention than the primary goal (to do work). An even finer distinction that they found, was that the when a given politeness technique cost about the same in each media, there were no differences in how often that politeness technique was used. However, when a politeness technique was more difficult to use when typing versus when speaking, it was found significantly less often in the typed conversations than in the spoken conversations. Consequently,

electronic conversations seem to be less polite than FTF ones.

Choosing Communication Media

The Principle of Least Collaborative Effort and Choice of Communication Media

The principle of least collaborative effort could be useful to understand when choosing which communication medium to use for collaborative learning. Student triads consider how much effort it takes to interact with their computers *plus* how much effort it takes to communicate with other students, and weigh that against the effort it takes to meet FTF. There are many factors to weigh. Can all the interlocutors type? Does everyone have a computer that is online? Will the program support three-way conversation? Is there a need to communicate with each other simultaneously? What CMC programs exist that will best serve the group's needs? Will it be easier, simpler, cheaper, or take less time to travel to a meeting place for a FTF meeting? Can everyone get there without too much effort? Many factors must be considered before determining what medium will lead to the least collaborative effort and still be able to achieve common ground that is sufficient for current purposes.

Constraints on Grounding

Every medium places constraints on people's ability to achieve common ground. For instance, if interlocutors are unable to hear each other they will not attempt to ground by speaking to each other. The ability to hear each other is a constraint in the sense that it *regulates* the way in which interlocutors are able to ground. Clark and Brennan (1991) outline eight such constraints which are included in Table 2.

Constraints on grounding have profound implications when choosing a communication medium. The challenge is determining which medium to choose

according to the purpose for communicating. One way of comparing communication media is by using Clark and Brennan's (1991) constraints on grounding to compare the media options. Table 3 is such a comparison that uses the media options of FTF communication, and the CMC programs, email and chat.

Table 2

Clark and Brennan's (1991) Constraints on Grounding

Constraint	Description
Copresence	A and B share the same physical environment.
Visibility	A and B are visible to each other.
Audibility	A and B communicate by speaking.
Cotemporality	B receives at roughly the same time as A produces.
Simultaneity	A and B can send and receive at once and simultaneously (e.g., B smiles as A speaks).
Sequentiality	A's and B's turns cannot get out of sequence: There are no other conversations that intervene between speaking turns – such is not the case with email, for example.
Reviewability	B can review A's messages: An artefact of a message is created.
Revisability	A can revise messages for B: A message can be privately revised prior to sending it.

Table 3

Comparing Media by Constraints on Grounding

Constraint	FTF	Text-Based Chat	Email
Copresence	has	does not have	does not have
Visibility	has	does not have	does not have
Audibility	has	does not have	does not have
Cotemporality	has	Receiver does not get the message until producer creates then sends it (has less than FTF and more than email).	does not have
Simultaneity	has	Usually chat does not have simultaneity, although some chat programs allow users to see each other's typing as it is occurs2.	does not have
Sequentiality	has	Sometimes more than one topic can begin, causing different conversation topics to "leapfrog" around.	does not have
Reviewability	does not have	has	has
Revisability	does not have	has – unless using the type of chat where all users can see each other's typing as it occurs	has

[2] Some chat programs like ICQ allow interlocutors to see typing as it occurs but this was not a feature in MSN Messenger, which was the program used for this experiment.

The structure of a CMC program dictates which of Clark and Brennan's (1991) eight constraints on grounding are available and to what degree they are available. As is hopefully clear by now, medium plays an enormous role in shaping communication. Understanding what communication features are required for a given communication purpose, and understanding how CMC programs affect the grounding process may help to explain and predict the appropriateness of a given CMC program for student-to-student collaborative learning in higher education.

Social Structure of Group Communication

Computer-mediated communication software can support a group's social structure, or it can thwart it. When triads of classmates work together on a common task, each member should have equal opportunity to contribute to the work. Peer collaboration is not possible or testable with a system that puts one person in control of the information flow. A. Bavelas (1948, as cited in Leavitt, 1958) showed mathematically that communication patterns vary as a function of information flow. Leavitt (1958) used Bavelas' mathematical model to show that individuals in groups with *high centrality* (one member controls the information flow) behaved differently than egalitarian groups. He found differences in accuracy, total activity, member satisfaction, individuals' contributions, that the likelihood of an individual taking a leader or follower role depended on how central a position he held in the group, and in how well the group was organised. He stated that in egalitarian groups, "...there will be no leader, many errors, high activity, slow organization, and high satisfaction" (Leavitt, 1958, p. 563).

One type of program that supports a hierarchical group structure (or *with high centrality* as A. Bavelas and Leavitt would have put it) is MS NetMeeting. It is a CMC

program created by the Microsoft Corporation and is bundled into their operating platforms (i.e., Windows 95 and higher). The program offers several different types of features including Video and Audio Conferencing, Chat, Internet Directory, File Transfer, Program Sharing, Remote Desktop Sharing, Advanced Calling, and Whiteboard. In order to use NetMeeting one person must take the role of the *host*. The host is responsible for allowing others to use certain features. For example, the host must initiate the Chat feature; subordinates are not able to. The host must initiate the Program Sharing feature as well, but the only programs that the group can share must originate from the host's computer. The host must also initiate the Whiteboard feature. Once everyone in a group has this feature running, the host has control over how it is used. Subordinates must ask permission from the host to take control of the cursor. Only the host can take control away from anyone, at any time. Because the host controls what features are used, how those features are used, and controls the information flow, the host is the most central and powerful member of the group.

MS NetMeeting puts extreme restrictions on *self-determination* (see Clark, 1996, for a full description of the ten features of FTF communication that are present in a FTF conversation, one of which is self-determination). The program imposes a strict hierarchical structure on communication by having a host. The program's inescapably imposed hierarchy works in direct opposition to the requirements of students working in triads to collaborate *equally* on learning assignments. To be fair, NetMeeting may work wonderfully for purposes where a natural hierarchy pre-exists within the group. Indeed, NetMeeting has had much acclaim and support from such users. The point is that even though NetMeeting meets the criteria of being ubiquitous and free, it is an inappropriate

program for the purpose of peer collaboration because it severely restricts the element of self-determination, which is essential to an egalitarian group, and because it forces a group to have high centrality.

Generating Research to Help with Choosing Communication Media for Collaborative Learning in Higher Education

To summarize, educators and students have little and conflicting empirical evidence to guide them when making choices about what media format to use for the purpose of enabling small, egalitarian groups of students to collaboratively learn online – specifically, as a supplement to the traditional classroom model, in order to complete educational tasks in higher education. Students are already using CMC programs for collaborative learning despite the lack of, and conflicting, empirical evidence that supports and refutes its effectiveness. Educators are making recommendations and requirements that students use CMC programs for collaborative learning but they;

> ...are ill-prepared to develop activities for on-line groups due to a lack of familiarity with learning in an on-line environment (Harasim, 1991), have an eagerness to employ a CMC technology without due consideration of pedagogical issues (Anderson, 1996), or a lack of experience using learning groups in the standard classroom (Ahern, Peck, & Laycock, 1992). (Brandon & Hollingshead, 1999, p. 109)

As a result, students end up using communication programs that may or may not be conducive to their educational needs.

Research Purpose

Given the lack of research that compares FTF with CMC, particularly in the context of collaborative learning in higher education, I explored differences and similarities between FTF communication and CMC in that context. The outcomes of this research have high applied value in that educators will discover more about the costs and

benefits of using CMC for collaborative learning, they can use the information to enhance course design, and they will be better equipped when choosing CMC technologies to supplement in-class work. This research will provide university students from a broad range of disciplines with information that they can apply when using the technologies available to them in a way that best suits each of their collaborative learning goals. Finally, participants will benefit from this experiment by engaging in tasks that are relevant to their university experience and by having the opportunity to practice with CMC tools that can be useful to them throughout their education.

I assessed how effective the two media are when used by student groups collaborating on two different types of tasks common to university work: a convergent task, which requires finding one and only one correct answer to a problem, and a divergent task, which requires finding novel or creative answers. Convergent thinking is the kind of thinking that people engage in when they are searching for a particular answer, or "zeroing in" on an idea. Divergent thinking is very different in that it involves expanding the mind to encompass many ideas without being edited or censored (Guilford, 1959). In the current research, three-person workgroups collaborated to complete the two different tasks while communicating either FTF or via email and chat CMC programs. I analysed task outcomes, participants' evaluations, and the processes that students utilized in order to complete their tasks. I also contextualized the results in the social psychological construct of grounding.

Method

This experiment received approval from the Human Research Ethics Board of the University of Victoria. I took measures to ensure participants' confidentiality, informed consent, and debriefing. Participation was a safe and educational experience for students.

Participants worked together in groups of three. Each group met either face-to-face (FTF) or worked entirely through computer-mediated communication (CMC). Participants were randomly assigned to communication condition. There were 10 groups in each condition, who worked together over a two-week period. One week they completed a convergent task and one week they completed a divergent task. The 20 groups (60 participants) participated in one of two sequential phases, which were identical except for order of tasks and the day of the week each condition began working. In Phase 1, five of the FTF and five of the CMC groups did the convergent task in their first week, then the divergent task in their second week. In Phase 2, the remaining five FTF and five CMC groups did the tasks in the other order.

All CMC groups met in person twice during the experiment. The first CMC in-person training meetings took place in a computer lab on the campus. All CMC groups met in person once again at the start of their second week of participation, in a room in the Learning and Teaching Centre on the University of Victoria's (UVic) campus. The second meeting did not involve the use of computers because the researcher merely explained and assigned the second task. When CMC groups met to do work on the tasks, they met online via the MSN Messenger program. Text based conversations using MSN Messenger are also commonly referred to as *instant messaging (IM), text messaging,* or as a *chat*.

Participants

Recruitment

Participants were 60 UVic undergraduates enrolled in introductory psychology classes (PSYC 100), who volunteered through the online Psychology Research Participation System, an online system for the recruitment of students. Participants received extra credit and could earn up to an additional $20.00 based on performance. Requirements for participation included speaking English as a first language and having normal or corrected-to-normal vision. Since students would be required to communicate by typing on a chat program, this restrictions was put in place to ensure that any difficulties with using the program were not due to language or vision problems (i.e., to reduce confounding variables). Volunteers committed to the project for two weeks and a minimum of five hours. The posting also informed participants that they would either be videotaped or they would use a computer. The time slot that they signed up for on the Psychology Research Participation System determined which communication condition they were assigned to; this was a random assignment because students were unaware of which time slots were allotted to which communication condition. One student chose not to proceed beyond the initial information session because she did not want to commit the time. All participants who proceeded beyond the initial information and tutorial session stayed with the experiment; No one dropped out.

Participants in each group were unacquainted prior to the experiment, with the exception of three groups; Group 6 in the CMC condition, and Groups 17 and 19 in the FTF condition. In one group, two participants were together when they signed up for the experiment online, therefore chose the same time slot, thus ending up in the same group.

In the other two groups, it was entirely coincidental that two participants knew each other.

Characteristics

Thirty-six (60%) of the participants were female. There were 20 females and 10 males in the FTF condition, and there were 16 females and 14 males in the CMC condition. For the entire sample, ages ranged from 17 to 41 years (M = 19.82, SD = 3.39). The mean age in the FTF condition was 20.03; SD = 4.29. The mean age in the CMC condition was 19.6 years; SD = 2.22. The majority of the 60 participants (37) were in their first year of university study. There were 11 students in their second year, five in their third year, and seven in their fourth year. Six participants had previous degrees, diplomas, or professional certificates. Perhaps because Psychology 100 is a required course in many departments, there were students representing 19 different departments.

Equipment and Facilities

Face-to-Face Communication

Volunteers in the FTF condition met in one of two rooms located in the Learning and Teaching Centre at UVic. Each room contained the same equipment: a table and four chairs, a computer with high speed internet and MS Office (i.e., MS Word, MS Excel, etc.), a printer with paper, a telephone for local calls, a phone book, a tripod, an 8mm video camera with a lens wide enough to capture the whole room, and several blank 120 minute video tapes.

Computer-Mediated Communication

Before the first CMC training meeting, a research assistant and I had set up 16 UVic WebMail accounts (15 for participants and 1 for the primary researcher), 15 .NET

Passport accounts, and 15 MSN Messenger accounts; all of the accounts required usernames as well as passwords.

Usernames for WebMail were systematic; they consisted of the word *teams* followed by the participant's ID. For ID's, I assigned each group a number and each of the group's three participants the letter a, b, or c. For example, a participant's ID could have been 1a (group 1, participant a), or 2b (group 2, participant b), etc. Each group member used the same password, but passwords differed for each group. The email address for each WebMail account was the username followed by @uvic.ca. An example of a complete WebMail address is teams1a@uvic.ca.

The research assistant entered the primary researcher's email address (Trina@uvic.ca) into the address book of each WebMail account. Finally, she emailed every WebMail account a welcome note and attached the first task, the UVic Information Test, in both MS Word and Adobe Acrobat PDF formats.

Usernames for the .NET Passport accounts were the WebMail addresses. Passwords for the .NET Passport accounts were the same as they were for the WebMail accounts. Usernames and passwords for the MSN Messenger accounts were the same as for the .NET Passport accounts.

For the initial training meeting and tutorial, CMC groups met one at a time with either the primary researcher or the research assistant in a computer lab in the Human and Social Development building at UVic. The lab had computers with high speed internet, the Windows XP operating system, and MS Office (i.e., MS Word, MS Excel, etc). After the initial training meeting, participants continued to use the campus computer labs, but they also used computers off campus when it was more convenient for them.

Materials

Tasks

Convergent thinking task. In order to emulate an assignment that would require students to use convergent thinking, I created the UVic Information Test which was a 100 item, multiple-choice, fill-in-the-blank test about campus facts. The test required participants to research items related to campus life. Despite the fact that participants in this study came from 19 different departments, they all shared the common ground of being students at the University of Victoria. The UVic Information Test was designed with that in mind and was intended to be a task that would actually benefit students in their lives beyond the experiment by requiring them to learn facts that might be helpful to them in their academic lives on campus. Furthermore, the test was intended to emulate the kind of tests that are commonly assigned to students in academia. By designing the task in this way, external validity was enhanced. See Appendix A for the UVic Information Test key and the sample of questions that researchers used to instruct participants how to answer the various types of questions they would encounter.

Divergent thinking task. In order to encourage creative (divergent) thinking, I created the Career Resources Task (see Appendix B for the task and its instructions). The task challenged participants to think of resources that were available to them for the purpose of exploring career options. Again, participants shared the common ground of eventually having to find work, so this task was meant to be helpful to people beyond their experiences with participating in this study. In addition, the task was chosen because of how *rarely* divergent thinking tasks are assigned to students in academia. I believe the primary reason for this is because this kind of task is particularly difficult to mark.

However, as educators, there is a responsibility to prepare students for the workplace and divergent thinking is certainly a skill that is commonly found and valued in the workplace. It seemed important to include this type of thinking when evaluating the worth of communication media that is to be used for educational purposes.

The instructions for the Career Resources Task were to "Submit a typed, numbered list. Come up with as many categories of resources and some examples of items that would fall into that category. Number the categories and the items separately." They could earn marks for categories, but not for items. This rule was to prevent a team from listing several highly similar resources as items. For example, if the category was *phone book*, they could have listed every related phone number in the book as a separate item, which would not have required divergent thinking. Therefore, I asked them to come up with categories and to list only a couple of items that might illustrate the type of resource that would go into the category. The items served as illustrators of the category.

In addition to the tasks being intended to be beneficial to students long after their participation in this experiment concluded, there were other reasons for choosing these particular tasks.

Procedure

We did not have enough resources to allow all 20 groups go through the experiment at once. For this reason, half of the groups (five in each condition) completed the experiment in Phase 1 (the first two weeks), and the other half completed it in Phase 2 (the next two weeks).

In order to eliminate any confounding variables between the two phases, I counterbalanced two components. During Phase 1, the first five FTF groups started on

Monday and the first five CMC groups started on Tuesday. During Phase 2, the remaining five CMC groups started on a Monday while the remaining five FTF groups started on a Tuesday. The order of the tasks in Phase 1 was the UVic Information Test followed by the Career Resources Task. This order was opposite in Phase 2. Appendix C is a chart depicting the two phases and counterbalancing measures.

I will describe procedures for Phase 1, FTF, Week 1, then Week 2, followed by Phase 1, CMC, Week 1 then Week 2. All procedures for Phase 2 were identical as those in Phase 1, where the only differences were to make accommodations for counterbalancing; therefore I will not discuss them further.

Phase 1, FTF, Week 1. Each group in the Phase 1 FTF communication media attended a Monday training meeting so that the research assistant or I could give information about the experiment and assign the first task (henceforth, "the researcher" shall mean either the research assistant or myself). Once the researcher had assigned the task, she turned on a video camera and waited in the lobby while each group had their first working meeting. Some groups chose to work on the task right away, while others chose to use that time to schedule their second meeting.

Once all three of the participants had arrived and everyone had introduced themselves, the researcher explained that there were two communication media conditions and that participants would either use a computer to communicate, or they would have videotaped, face-to-face meetings. The researcher emphasized which condition applied to the particular group that she was addressing at the time. The researcher also explained that participants could earn extra money and that participants would be required to give feedback at the end of each week. No deception was used in

the study. The FTF groups agreed to meet in person in groups of three and to be videotaped. Those participants who agreed with the terms of participation signed and took a copy of the Informed Consent (Appendix D) for themselves.

Once participants gave their consent, they filled out the Computing Familiarity and Demographics Questionnaire (Appendix E). The researcher read aloud the FTF Introduction (Appendix F) and the FTF Procedures and Rules document (Appendix G). Students were made aware that the study was a comparison of communication between FTF groups and CMC groups in general terms, but they were not given much detail until they completed participation and were debriefed. Throughout the introduction, participants asked questions as often and whenever they wanted to. The researcher also paused frequently to invite questions and to ensure that each participant understood what was required.

These participants began with the UVic Information Test. The researcher explained how to answer each type of question and used a sample of some of the questions on the UVic Information Test as an illustration (Appendix A). She discussed the task in a way that did not give away answers or clues to the questions and then instructed each individual in the group of three to hand in an identical copy of their agreed-upon version. This requirement was to prevent delegation to one individual who might fail to submit the data, as happened in the pilot study. Participants each took one blank copy of the UVic Information Test. When discussion regarding the UVic Information Test was over, each group member signed up for a time on Thursday when they could return to the meeting room to hand in their copy of the task and give feedback. The participants did not meet as a group on Thursday; each participant signed up for a

time that best suited that individual.

Finally, the researcher started the video camera and left the room; each group chose either to work on the UVic Information Test or to schedule their next meeting. When a group had finished its meeting, participants met the researcher in the lobby and booked the room for their next meeting. After the booking, the researcher returned to the meeting room, turned off the video camera, and prepared for the next group's meeting. All five FTF groups met with the researcher that day.

Throughout the next four days, each group met and had videotaped meetings as often as they wanted. We successfully accommodated all groups' requested meeting times. When two groups happened to request the same meeting time, we were able to accommodate them because there were two cameras, computers, rooms and researchers available. A researcher showed each group member into the meeting room, started the video camera, and left the group to its meeting. The video camera automatically recorded the time. If one individual was unable to make a scheduled meeting, the participants used the telephone to arrange for a new meeting time. Each group met as often as they wanted to until Thursday, when individuals turned in their copies of the UVic Information Test and took 15 to 30 minutes to fill out the FTF Participation Questionnaire (Appendix H).

The Participation Questionnaire (for both communication media) included questions that pertained to two categories of dependent variables: Participants' Evaluation and Process. Participants' Evaluation data consisted of what participants thought or felt about certain aspects of working in groups, completing the tasks, time and scheduling constraints, and anxiousness about completing the tasks. Process measures pertained to items such as how much group work or independent work they did and how

much agreement occurred between group members with regard to the distribution of work. A third category of dependent variable (not represented on the questionnaire) was Task Outcome; it pertained to the scores on the tasks themselves.

Phase 1, FTF, Week 2. On the first Monday of the second week of the experiment, the researcher met with one FTF group at a time to assign the Career Resources Task. She read the instructions for the Career Resources Task to the participants. The instructions contained an example that the researcher used to demonstrate how to structure career resource categories and items (refer to Appendix B for the Career Resources Task instructions and example). She allowed time for discussion and questions and moved on only when she was certain that all of the participants had a clear understanding of the task.

The remainder of the procedures for the second week of participation were the same as the first week. Participants signed up for a time to return on Thursday, the researcher started the camera and left the room. When the group concluded their meeting they met the researcher in the lobby and signed up for their next meeting. All five FTF groups met with the researcher that day.

Again, the researcher met with the Phase 1 FTF participants for a feedback meeting on Thursday of that week. Participants came to the Learning and Teaching Centre according to their individual schedules, not necessarily in their groups. First, they turned in their copies of the Career Resources Task, and then they filled out the FTF Participation Questionnaire.

One difference between Week 1 and Week 2 was that once everyone in the meeting room had completed the questionnaire, the researcher fully debriefed the

participants (Appendix I – Debrief). Participants then viewed their videotape (or chose not to). The video camera had a playback feature and a video screen built into the camera so they could either take the camera into a separate room to view their videotape in private, or if they preferred to, they viewed their videotape in the meeting room with other participants present. Once they were satisfied that they'd seen enough of their videotape, they gave permission for their videotape to be used for some, all, or none of the various purposes listed on the Consent to View form (Appendix J).

The researcher thanked everyone for their participation, reminded them of when and where they could collect their money, and also reminded them to refrain from discussing the experiment until it was completely over.

Phase 1, CMC, Week 1. On Tuesday of the first week of Phase 1, the researcher met with one CMC group at a time in a computer lab on the UVic campus. During the first meeting, the researcher introduced the experiment, gave a tutorial on how to use the required computer programs, and assigned the first task.

The researcher prepared for the meeting by starting up four computers, preparing all of the documents in the order of presentation, and providing spare pens. Once all three participants arrived and everyone introduced themselves, the researcher followed the same procedure as in the FTF condition's first meeting, with the exception of adding a brief computer tutorial.

The researcher read the Informed Consent to the participants and obtained their consent and signatures before asking them to fill out the Computing Familiarity and Demographics Questionnaire. By reading the CMC Introduction out loud (Appendix K), the researcher outlined the purpose of the experiment, explained how participants could

earn extra money, and explained that participants would be required to give feedback at the end of each week. The CMC groups agreed to use UVic WebMail and MSN Messenger to communicate as a group instead of meeting with each other in person or via the telephone.

The researcher also read the CMC Procedure and Rules document aloud (Appendix L). She informed participants that they each had a WebMail and an MSN Messenger account set up for them. Participants agreed to use MSN Messenger when meeting in groups of three, never to use it with only two people, and to save then send all chats to their WebMail accounts. The CMC Procedure and Rules document also outlined a series of do's and don'ts with regard to the use of WebMail, MSN Messenger, and passwords.

As with the FTF condition, participants in the CMC condition agreed to return for a feedback meeting in four days. They individually signed up for a time to hand in their tasks and provide feedback on Friday of that week.

The group then turned to the computers for a brief tutorial on how to use WebMail and MSN Messenger within the context of the experiment. Participants recorded their ID's, usernames and passwords, as well as the usernames of the others in their group, in the appropriate spaces on the WebMail document (Appendix M). They signed into their WebMail accounts, opened their WebMail address books, and added the addresses of the other two participants in their group. The researcher showed them everything that was necessary in order to send emails, send attachments, and receive email. She then asked them to minimize the WebMail window before moving on to use MSN Messenger.

MSN Messenger has two components: the part that the user downloads and installs onto his or her computer terminal and the part that is located in cyber-space, which contains all of the user's account and contact information. The researcher explained to participants that the researchers had already established the cyber-space component, but that participants would need to add more contact information. She explained that they could sign in using their WebMail addresses and passwords. She also explained that if participants wanted to use their MSN Messenger accounts from a computer off-campus, they might have to download the program from the MSN Messenger website. The MSN Messenger document (Appendix N) included the website address from which participants could download the program. The document also provided the website address where participants could find location information and schedules for the only two computer labs on campus that had MSN Messenger installed.

Participants signed into MSN Messenger, opened the main window, and set up their display name so that others could recognize them in a chat conversation by name and ID (e.g., Joe 1a). Each group member then added the other two members as contacts. Finally, two participants began a chat. One of the two actively messaging participants had to invite the third participant to join their chat. This was often a difficult part of the tutorial, because although most participants had used MSN Messenger to chat with a friend before, few had ever chatted in a group of three. Having to invite a third party into a chat conversation was often a new experience for participants. Once everyone understood how to begin a three-way chat and had a chance to type a little, they each saved the text conversation as a chat file, placed the chat file on their computer desktops, and emailed the chat file to their own WebMail accounts (i.e., they used their WebMail

accounts to send the file to their WebMail accounts). In the end, each participant had a copy of the chat file in his or her WebMail account. With this accomplished, participants logged out of MSN Messenger and WebMail.

Once all the participants of a group were confident in their ability to use the computer programs and understood the terms of their communication condition, the researcher introduced the UVic Information Test. The procedure was the same for the CMC condition as for the FTF condition; the only difference was that each participant in the CMC condition had received the task document by email in MSN Word, Adobe.pdf formats, as well as in hard copy.

During the next four days, CMC groups worked on the UVic Information Test. On Friday of that week, they returned individually to the meeting room in the Learning and Teaching Centre on campus in order to turn in their completed tasks and to fill out the CMC Participation Questionnaire (Appendix O).

At the end of the day on Friday, I entered all of the CMC condition's WebMail accounts and saved all of the emails from the Sent folder to my own computer, including all of the chat files. Once I securely transferred the files, I made backups and then deleted all of that week's emails and the blank UVic Information Tests from the WebMail accounts. Finally, I emailed the Career Resources Task to the WebMail accounts in MS Word and PDF formats, in preparation for the second week of the experiment.

Phase 1, CMC, Week 2. CMC groups met again on Tuesday of the second week of their participation. That week they met in the Learning and Teaching Centre (instead of the computer lab). The researcher reiterated the procedures and rules, especially about communicating only when in three's, ensured that everyone still understood the

conditions of participation, and then assigned the Career Resources Task. Instructions for the Career Resources Task were the same as for the FTF condition. Participants in the CMC condition received the Career Resources Task document in MS Word, Adobe PDF as well as in hard copy. All of that week's CMC participants signed up for a time to meet with the researcher on Friday.

On Friday, the final meeting was identical to the FTF condition's final meeting, except that there was no Consent to View component to the CMC meetings. Participants turned in the completed task and filled out the feedback questionnaire. The researcher provided a comprehensive debriefing and gave everyone a P100 receipt for participating. She thanked them for their help, and asked them to refrain from discussing the experiment until its conclusion in two weeks.

As with Week 1, immediately after the last meeting on Friday, I entered all of the CMC condition's WebMail accounts and saved all of the emails in their Sent folders (including the chat files that participants had emailed from themselves to themselves) to my own computer. Once I securely transferred the files, I made backups of the data and deleted all of that week's emails from the WebMail accounts.

In preparation for the first week of Phase 2, I requested that UVic Computing Operations change 15 WebMail accounts from Phase 1 usernames to Phase 2 usernames (e.g., teams1a became teams7a, teams2b became teams8b, etc.). I changed the passwords to the accounts but maintained the pattern of having one password within each group and different passwords between groups. I then deleted all email contact information in the address books, except for my own email address. Once the new WebMail accounts were established, the research assistant created 15 new.NET Passport accounts and MSN

Messenger accounts using the UVic WebMail addresses as the usernames and the same passwords as for the new WebMail accounts.

Participant Payment

Participants earned $0.10 for each correct question on the UVic Information Test. Payment varied between groups but not within groups. I calculated payment for the Career Resources Task by rank ordering scores, dividing them up into 10 sections, and paying in $0.10 increments. The two highest scoring groups received $10.00 and the two lowest scoring groups received $5.50. The most anyone could have earned for the two tasks was $20.00.

Results

Task Outcome

Data Coding and Inter-Rater Reliability

Convergent thinking task. UVic Information Test scores reflected how well participants managed to collaborate while using convergent thinking in FTF versus CMC groups. Researchers asked all groups to submit three identical copies of the UVic Information Test but many groups submitted non-identical copies, therefore each group score constituted the average score of three participants. See Appendix P for individual and group scores.

Divergent thinking task. The Career Resources Task required participants to come up with ideas for resources that could help them choose careers, and then classify them into categories and items. The task required participants to use divergent thinking, which I assessed in two ways: the number of ideas and the uniqueness of ideas. I then used both measures to compare communication media.

The ways that participants classified their ideas were subjective.[3] In order to standardise the classification of ideas, I wrote instructions for coding (Appendix Q), created Rater's Response sheets (Appendix R), and a research assistant and I coded all categories and items according to a Master Category List (Appendix S).

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[3] Different groups often came up with the same idea but they did not always agree on whether to list that idea as a category or as an item. For example, Group 4 had a category they called "University staff" and under that they listed the items "Professors…, Teaching Assistants…, and All staff…" Whereas groups 9 and 16 listed "Professors" and "Teaching Assistants" as categories. Had I marked the task according to how participants assigned their own ideas, Group 4 would not have received credit for the exact same ideas that Groups 9 and 16 would have received credit for.

Another complication was that not all groups assigned resources as requested in the instructions. For example, Group 6 wrote, "Job Stores (business)", "Job Wave (business)", and "Global Career Developers Inc. (business)" as three separate categories Arguably, it was more reasonable to list "Businesses" as a category and the individual businesses as items. The way that Group 6 organized their ideas would have led to three points instead of the more reasonable single point. The reverse was found to be true as well; there were instances where participants could have reasonably counted ideas as categories but they labelled them as items instead.

We calculated inter-rater reliability for each group by dividing the number of rater's agreements by the number of assignments each rater made. We then calculated the overall inter-rater reliability by dividing the total number of rater's agreements by the number of decisions made in all but the six groups used in training. The overall inter-rater reliability was 75%. Once the reliability rate was established, we discussed each of our disagreements and settled on the most appropriate assignment.

Once a standardised score was obtained for each group, I divided each group's score by the highest group's score (27), so a percentage was obtained that could be used to compare with the UVic Information Test scores. See Appendix T for outcome details.

Media and Task Outcome

I subjected communication Media (FTF and CMC) and Task percentages (UVic Information Test and Career Resources Task) to a mixed, two-way analysis of variance.[4]

The main effect of Media yielded $F(1, 18)=1.23$, $p=.28$, indicating no statistically significant differences between task scores in the FTF condition ($M=74.92$, $SD=18.47$) and in the CMC condition ($M=70.45$, $SD=19.32$). The Media effect size, $\eta_p^2=.06$, accounted for only 6% of explained variance. These averages represented a B+ for FTF groups, and a B for CMC groups.[5]

The main effect of Task indicated that all participants achieved statistically higher percentages on the UVic Information Test ($M=87.76$, $SD=7.10$) than on the Career Resources Task ($M=57.61$, $SD=14.01$): $F(1, 18)=105.13$, $p=.00$. The effect size was large, $\eta_p^2=.86$. These averages represented an A for the UVic Information Test and a C

[4] The level of significance for all inferential statistics in this study was alpha.05.

[5] These letter grades were based the nine-letter grading system used in many courses in the Department of Psychology at the University of Victoria. There is no university-wide standard for assigning scores to letter grades within UVic, or across universities.

for the Career Resources Task.

The interaction effect was non-significant, $F(1, 18)=.02$, $p=.90$, with a small effect size that accounted for only 0.1% of the explained variance: $\eta_p^2=.001$.

Communication media and Career Resources Task scores. To ensure that the non-significant main effect of communication media was not due to converting groups' Career Resources Task scores into percentages, I subjected the Career Resources Task group scores to a two-tailed, independent samples t-test. Again, there were no significant differences between FTF group scores ($M=16.10$, $SD=3.67$) and CMC group scores ($M=15$, $SD=4$): $t(18)=.64$, $p=.53$. Cohen's d analysis revealed a small-medium sized effect, $d=.30$. Media did not have a significant effect on how many ideas that participants came up with.

Uniqueness of Ideas on the Career Resources Task

The uniqueness of an idea was another way to measure creativity. Extremely creative ideas usually show up infrequently, therefore by measuring how frequently an idea occurs one can measure its uniqueness.

I counted how often each category came up in the Career Resources Task data set, then rank-ordered the categories from the most-to-least frequently occurring category. This resulted in *frequency scores* ranging from 1 to 19.[6]

Each group had a list of categories that they thought of: Each category had a frequency score. For each group, I added frequency scores and divided by their total number of categories, which resulted in a *uniqueness score*.

For example, suppose a group gave four ideas. The ideas corresponded to

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[6] When two or more categories occurred with the same frequency, I gave the categories the same frequency score. Eight groups came up with ideas that no other group came up with, these each received a frequency score of 19.

categories 18, 5, 8, and 25. Respectively, these categories had frequency scores of 19, 18, 1, and 9. These added up to 56, which I then divided by the number of categories, 4, to come up with the uniqueness score: 14. The uniqueness score was the figure that I used to conduct a two-tailed independent samples t-test to compare uniqueness of ideas between FTF and CMC groups.

Results were non-significant. Face-to-face groups (M=14.79, SD=2.79) were no more creative in terms of uniqueness than CMC groups were (M=13.27, SD=2.20): $t(18)=1.35$, $p=.19$. The size of the effect was medium-large: $d=.64$.

Participants' Evaluation

What Worked Well and What Did Not Work Well

Two of the questions that participants answered at the end of each week of participation (i.e., at the completion of each task) were; "What worked well for you this week?" and "What didn't work well for you this week?" Participants' comments fell into eight categories, which a research assistant and I coded (See Appendix U for coding instructions). We agreed on 74% of our decisions (245 out of 331 decisions, excluding those used for training). Once the reliability rate was established, we discussed each of our disagreements and settled on the most appropriate assignment.

Face-to-face and CMC participants made 96 and 64 comments, respectively, about what worked well for them and 94 and 85 comments, respectively, about what did not work well for them.

Table 4 is a list of the eight comments, their descriptions, and the number of positive and negative comments made by both FTF and CMC participants about what worked well and what did not work well.

Table 4

Eight Categories of Comments Made by Participants About What Worked and What Did Not Work, Their Descriptions, and Frequencies

Category and Description	Worked Well		Did Not Work Well	
	FTF	CMC	FTF	CMC
1. Group work consisted of comments about cooperation, coordination, work distribution, efficiency, productivity, social aspects, personality aspects, miscommunications among members, punctuality, showing up for meetings,[7] etc. (Explicit comments about working via MSN Messenger or WebMail went into the Communication Media category.)	39	33	10	12
2. Independent Work consisted of comments about working alone. (Explicit comments about working via MSN Messenger or WebMail went into the Communication Media category.)	3	8	2	1
3. Both Group work and Independent Work consisted of comments that were *inclusive* of both forms of communication. (Explicit comments about working via MSN Messenger or WebMail went into the Communication Media category.)	9	6	3	0
4. Task consisted of comments pertaining to the overall task itself (e.g., the nature of the questions, task instructions, performance expectations), or pertaining to getting the answers to questions on the UVic Information Test or coming up with ideas for the Career Resources Task.	15	13	22	9
5. Time consisted of comments about time spent or amount of work required for the experiment, busyness in or out of experiment, or scheduling issues in either FTF or MSN Messenger. Note that if there was a problem getting in contact with each other via email in order to schedule a meeting, the problem was email (Communication Media) not Time.	11	5	19	25

[7] A meeting in the CMC condition constituted a three-way online chat using MSN Messenger.

6. Media. The experiment defined how people were able to communicate. Anything that had to do with communication within the parameters set out by the experiment went into this category as well as comments about the actual use of WebMail or MSN Messenger.	3	23	3	28
7. Experimental aspects consisted of comments pertaining to aspects of the experiment that did *not* directly relate to participants working together, working on tasks, or using communication tools (e.g., video camera, researchers, participation incentives, tutorials, instructions *not* related to task instructions). It also included comments about technology or resources *other* than email and chat (e.g., other MS Office programs, telephone, phone book, paper or electronic copies of task, computer and printer).	13	2	2	6
8. Other comments were made that pertained to such things as practice effects (harder or easier depending on practice), or personal issues (e.g., family, health). When a comment did not fit in any other category, or when a rater could not understand what the participant meant, we coded the comment as Other.	3	4	3	4

Notice that 22 participants in FTF groups found that Task did not work well for them, while only nine participants in CMC groups felt that Task did not work well for them. Based on those results, I further analysed the Task category and presented them in Table 5.

Table 5

The Number of Task Comments Made in Each Communication Media and Task, About What Worked Well and What Did Not Work Well For Participants

	Task Comments			
	What Worked Well		What Did Not Work Well	
	FTF	CMC	FTF	CMC
UVic Information Test	10	5	14	9
Career Resources Task	5	8	7	0

WebMail and MSN Messenger

Participants in the CMC condition rated the ease or difficulty of using WebMail (0 to 15 scale) with M=2.81, SD=3.17, and the likelihood of using it for collaborative work in the future with M=9.38, SD=3.82. They rated the ease or difficulty of using MSN Messenger with M=4.53, SD=5.02, and the likelihood of using it for collaborative work in the future with M=10.18, SD=4.02. Participants rated both CMC tools on the easy side to use and they would likely use them both again for collaborative work.

Ratings of Ease or Difficulty of Scheduling Meetings

There were two ratings per participant possible (60 ratings per media condition). Four groups never used MSN Messenger to meet in the first week, and five did not use it in the second week. As a result, answers to the question (0 to 15 scale) , "How easy or difficult did you find scheduling meetings with all three group members this week?" could have been interpreted in different ways by those who did not schedule meetings. There were 27 such responses out of 60. Eight of the 27 indicated "not applicable," due to the fact that they did not use MSN Messenger that week, 16 reported that scheduling was "really hard" (M=14, SD=1.37), two reported "really easy" (M=2, SD=1.41), and one appeared to have misunderstood the question[8] and reported seven.

Due to the variety of responses about how easy or difficult scheduling was from those participants who did not actually have MSN Messenger meetings, I conducted two, two-tailed, independent samples t-tests. The first was to assess if there were any significant differences of schedule ratings between the FTF and CMC conditions, using

[8] This conclusion was drawn from a close reading of the participant's open-ended questions.

all of the available CMC ratings.[9] The second assessed the same question but used ratings only from those participants who participated in MSN Messenger meetings.[10]

The t-test, using all participants' scores, revealed that CMC participants (M=8.60, SD=4.53) found scheduling to be more difficult than FTF participants did (M=3.37, SD=2.64): $t(44.75)$= -5.4, p=.000. There was a large effect size: d= -1.62. The second t-test, using ratings from *only* those participants who had used MSN Messenger, also revealed that CMC participants (M=6.88, SD=4.15) found scheduling to be more difficult than FTF participants did (M=3.37, SD=2.64): $t(31.19)$= -3.4, p=.002. There was a large effect size: d= -1.25.

Anxiousness About Completing Tasks on Time

An analysis of variance where the two factors were Media (FTF and CMC) and Task (UVic Information Test and Career Resources Task) revealed that CMC participants (M=6.78, SD=4.34) felt significantly more anxious about getting the task done on time than did FTF participants (M=4.77, SD=3.83): $F(1,57)$=5.4, p=.02. A partial eta squared analysis, η_p^2=.09, indicated that this factor was responsible for 9% of the explained variance.

Participants did not feel significantly more or less anxious about completing the UVic Information Test on time (M=5.53, SD=3.67) than they did about completing the

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[9] The Week variable had no effect on ratings of scheduling, therefore it was collapsed. This meant that the score used in this t-test was derived either from the average of two ratings, or from a single rating in the eight cases where participants answered "not applicable." In one instance there was no data from either week, therefore there were unequal n. (FTF n=30, CMC n=29). Levene's test for equality of variance was significant F=22.7, p=.000, therefore equal variances were not assumed.

[10] In the second t-test, scores were derived either from the average of two ratings, or from a single rating in the 27 cases where participants did not meet over MSN Messenger. In nine instances, this resulted in no data from a participant, therefore there were unequal n. (FTF n=30, CMC n=21). Levene's test for equality of variance was significant F=7.8, p=.007 therefore equal variances were not assumed.

Career Resources Task on time (M=5.92, SD=4.73); $F(1, 57)$=.29, p=.59. This very small effect size accounted for only 0.5% of the explained variance: η_p^2=.005.

The interaction effect was also non-significant: $F(1, 57)$=3.28, p=.08. It accounted for 5% of the explained variance: η_p^2=.05.

Correlation Between Ratings of Scheduling and Anxiousness

Using all available data, Pearson's Correlation analysis revealed a statistically significant positive correlation between ratings of scheduling and the level of anxiousness about completing tasks on time: r=.33, n=59, α=.05, two-tailed. Eleven percent of the variance was related.

When excluding data from instances where participants did not have MSN Messenger meetings, Pearson's correlation analysis revealed a statistically significant positive correlation: r=.42, n=51, α=.01, two-tailed. Seventeen percent of the variance was related.

Process

Media and the Number of Weekly Meetings

The 10 FTF groups had 22 meetings in the first week of participation and 23 in the second. The 10 CMC groups had 11 meetings in the first week and 7 in the second.

An analysis of variance where the two factors were Media (FTF and CMC) and Week (Week 1 and Week 2) revealed that FTF groups met significantly more often (M=2.25, SD=0.44) than CMC groups did each week (M=1, SD=1.08), $F(1, 18)$=99.89, p=.00. The Media effect was large, accounting for 84% of the explained variance: η_p^2=.84. The main effect of Week yielded $F(1, 18)$=.09, p=.77, revealing no significant differences between the number of meetings that groups held in the first week (M=1.65,

SD=.99) versus the second week (*M*=1.6, *SD*=1.10). The effect size, η_p^2=.01, indicated that the main effect of Week accounted for only 1% of the explained variance. The interaction effect was also non-significant: $F(1, 18)$=.77, p=.39. The size of the interaction effect was very small, accounting for 4% of the explained variance: η_p^2=.04.

Correlation Between Ratings of Scheduling and the Number of Meetings

After collapsing all available data over the Week variable,[11] Pearson's Correlation revealed that 20% of the rating of scheduling could be predicted from their relationship with the number of meetings. This was a statistically significant negative correlation: r= -.45, n=59, α=.01, two-tailed.

After collapsing only data from the instances where participants had meetings, Pearson's Correlation revealed that 12% of the ratings of scheduling could be predicted from their relationship with the number of meetings. This was also a statistically significant negative correlation: r= -.35, n=51, α=.05, two-tailed.

Technical Difficulties

Figure 1 on the following page list and categorises the comments that all participants made about what technical difficulties they encountered during the experiment.

[11] The Week variable had no effect on ratings of scheduling or on the number of meetings, therefore it was collapsed.

Computer-Mediated Communication Condition	WebMail	Contracted a virus through WebMail.
		Unintentionally failed to address both group members on a couple of emails.
		Input the incorrect address for a group member into the address book, which caused difficulties all week.
		There was a problem with an account that participants never clearly defined or solved.
		There were a couple of problems with opening attachments.
		There were a couple of problems with converting attachments.
	MSN Messenger	Some participants had difficulties signing in.
		One participant reported that MSN Messenger apparently changed users' display names to "girl names" on its own.
		MSN Messenger was inaccessible for a period of time one day therefore participants were unable to use it.
		For one group, MSN Messenger displayed the presence of all three members in a chat but in actuality one member was not at her computer.
	Other	Participants twice mentioned poor internet connectivity.
		Computer crashes or freezes occurred twice.
		There was one complaint about Excel.
Face-to-Face Condition		Several FTF participants noted that the printer in the meeting room could only print one page at a time; one participant cited it as a source of concern when her group was only moments away from their deadline.
		There were a few complaints about how difficult Excel was to use.
		One participant mentioned that he was unable to find a couple of web pages.
		One participant wrote that he could not access the T-Drive from the computer provided.
		Six participants interpreted "technical difficulties" as something other than problems with mechanical or electronic devices (e.g., "I guess trying to schedule meetings was the only technical difficulty we had").

Figure 1. Comments pertaining to technical difficulties participants experienced.

Media and Reported Work Distribution

I added the reported percentages on the UVic Information Test for each groups' participants a, b, and c, the added the reported percentages of the Career Resources Task for participants a, b, and c, and then added those two totals together. Ideally, the total should have come to 200%. Then, I subtracted the ideal total (200) from the reported total to obtain the difference (e.g., 210-200=10, or 190-200= -10). Finally, I squared each difference and used those scores to perform an independent samples t-test. [12]

There were no significant differences between FTF groups (M=3456.7, SD=5476.38) and CMC groups (M=2365.2, SD=4111.43) in terms of how much agreement occurred between group members with regard to the distribution of work, $t(18)$=.50, p=.62. Cohen's d revealed a small effect size: d=.24.

Number of Weekly Phone Calls Within FTF Groups

The number of phone calls that were made in FTF groups for the purpose of last-minute scheduling (four in Week 1, six in Week 2) was not significantly different between the first week (M=.40, SD=.97) and the second week (M=.60, SD=1.08): $t(18)$= -.44, p=.67. The size of this effect was small, d=.21.

Participants' Computer Familiarity

Fifteen of the 30 FTF participants and 17 of the 30 CMC participants used a chat program more than once per day. Only three of the FTF participants and one of the CMC participants stated that they had never before used a chat program. By far, the most commonly used chat program was MSN Messenger; 27 of the 30 FTF participants used it and 28 of the 30 CMC participants used it.

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[12] This was not a measure of how equally work was distributed, it measured the level of awareness that participants had about the amount of work that each was contributing.

The frequency with which participants used the campus computer labs was very similar between FTF and CMC participants. In each condition, most participants used the campus computer labs either once per week (11 FTF, 12 CMC) or once per month (8 FTF, 6 CMC). Nine participants in each condition used the campus computer labs either yearly or never, and one participant in each condition used the labs more than once per day. Most participants did not know that UVic designates memory space on its T-Drive for all registered students. In the FTF condition, 5 were aware of it, and 25 were unaware of it; in the CMC condition, 11 were aware of it, and 19 were unaware of it. No one used it regularly.

All participants owned computers. The most common operating system used was Windows XP (21 FTF, 14 CMC). Windows 2000 (3 FTF, 4 CMC) and Windows 98 (2 FTF, 2 CMC) distantly followed. No one in the FTF condition used Mac computers, whereas five participants in the CMC condition used Macs.

Only one participant in the FTF condition reported that she did not use internet on her home computer. One participant in the CMC condition did not know what kind of internet connectivity she used with her home computer. No one reported using a dial-up phone system to connect to the internet. The remaining participants used some form of high-speed internet connection, be it cable, ADSL, or ResNet (the UVic Residence system).

Appendix V contains six tables that summarize the findings for all of the questions about participants' computer familiarity.

Discussion

This experiment compared face-to-face and computer-mediated communication for the purposes of collaborative learning. It revealed that students can achieve similar grades regardless of communication medium, but that students using CMC tools had fewer three-way meetings, more concerns about scheduling, more communication difficulties, and more anxiousness about completing tasks on time. The following discussion will include the three categories of dependent variables, Task Outcome, Participants' Evaluation, and Process, in terms of explaining the results, limitations, suggesting areas for further research, and practical applications.

Task Outcome

Communication Media and Task Outcome

Evidence from this study suggests that FTF interaction may not be a necessary ingredient for collaborative learning. Communication media, in this study, did not make much difference to the final scores that participants earned. Furthermore, one communication medium did not facilitate convergent or divergent thinking any more or less than the other. From an applied standpoint, these results might indicate that it should make no difference whether students collaborate in FTF groups or CMC groups, and that type of thinking should not determine one's choice of communication media. However, the lack of statistical power in this study may have been responsible for the lack of statistically significant findings. It is certainly possible that with more participants, a different outcome would have resulted. Furthermore, task outcomes simply show that students are able to get similar grades when using the two media; they do not tell us anything about how students arrived at those outcomes. It is important to critically

analyse the reasons for task outcomes in the different communication media before judging their worth.

It is also important to analyse the reasons for the significantly different scores between the UVic Information Test and the Career Resources Task. At first glance one might conclude that participants were able to collaborate better when using convergent thinking than divergent thinking (in both communication conditions). However, the difference between the task scores was more likely due to the different approaches to marking the tasks. There were several concerns with marking the Career Resources Task. Unlike the UVic Information Test which had a preset maximum score of 100, the Career Resources Task had no preset maximum. Several participants said that they felt frustrated because they did not know when to stop working or how many ideas were "enough." Different groups may have simply had different ideas about when "enough was enough." Pitting groups against each other by using the top score as the post-hoc, maximum standard was a somewhat artificial way of grading students. Furthermore, marking the Career Resources Task based on the number of ideas that participants came up with did not account for the uniqueness of ideas. Grading divergent thinking tasks is complicated; however, it is a topic beyond the scope of this study. The focus of this thesis was to see if communication media has a moderating effect on task outcomes as a function of the type of thinking that is required. This experiment established that communication media facilitated communication equally within each task.

Uniqueness of Ideas on the Career Resources Task

The fact that uniqueness of ideas did not differ significantly between the two media provided additional support for the notion that one communication media does not

facilitate divergent thinking among groups of students any more or less than the other. Practically speaking, when students make decisions about what kinds of communication media to choose, they should be able to disregard the idea that one medium will be better than the other simply because the task requires divergent thinking.

Motivation and Task Outcome

A concept that is closely related to, or even encompassed by, the purpose for communication, is motivation. When one is highly motivated to complete a task for intrinsic and/or extrinsic reasons, it is quite likely that the individual will put more effort into communicating. Motivation to complete a task was shown to play an important part in the design of the tasks and the experiment. Participants were given a fixed number of percentage points to their Psychology 100 class mark just for showing up, but they were paid money according to how well they performed. Over the course of four pilot studies, it became clear that when participants were extrinsically rewarded with even a small amount of money for their performance, they became far more motivated to perform well. In earlier pilot studies, when no compensation was given for performance, many participants simply showed up and put little to no effort into the tasks. It was for this reason that students in the final experiment were offered up to $20.00 for their performances. Furthermore, the tasks themselves were designed to motivate students intrinsically by providing them with an opportunity to learn things that they would eventually have to learn and that would ultimately benefit them.

Participants' Evaluation

What Worked Well and What Did Not Work Well

Total number of comments. All participants were more satisfied than dissatisfied

with their experiences in this study, however, participants in the CMC condition had more difficulties (or at least made more comments about their difficulties) than FTF participants did. Closer examination revealed that the three most commonly discussed topics, regardless of how well they worked for participants, were Group (94 comments), Time (60), and Task (59).

Group. What participants enjoyed the most about this experiment was working with their groups. Overall, there were a large number of positive Group comments (72) and relatively few negative comments (22). This finding was in keeping with the large amount of research that demonstrates students' preferences for collaborative learning over teacher-to-student classroom learning (Johnson & Johnson, 1999; McNeill & Payne, 1996; Slavin, 1996). Computer-mediated communication participants made slightly fewer positive comments and slightly more negative comments about group work than FTF participants did. This too, was in keeping with Ocker & Yaverbaum's (1999) study that found CMC participants to be less satisfied with the group interaction process and the quality of group discussions than FTF participants.

More empirical research may reveal what factors of groupwork are the most satisfying and what factors are causes for concern. Such research would also help to refine our understanding of why the preferences exist and what impacts CMC has on those preferences.

Time. Time was a concern for participants in both communication media conditions, but it was more of a concern for CMC participants. This result runs counter to the assumption that CMC could save students time because they would not have to leave their workstations to meet. A primary reason for recommending CMC over FTF meetings

for collaborative learning was to provide students with an alternative that would save them time, therefore it is a major concern that CMC does not appear to be a time-saving solution after all.

There are several possible explanations for CMC participants expressing more concerns about Time than FTF participants. One possible reason is the asynchronous communication tool, email. As Clark and Brennan (1991) pointed out, asynchronous communication tends to drive up many costs, including start up, production, and speaker change costs; all of which concern time. It is possible that between using email and having chats, CMC participants spent more time communicating than FTF participants did, causing them to make more negative comments about Time. Or, it could have been that waiting to hear back from group members by email meant that CMC participants were simply more aware of the passage of time. As the old adage goes, "A watched pot never boils."

A second explanation for CMC participants' concerns about Time is that CMC chats took longer than FTF meetings. Unfortunately, due to technical difficulties,[13] I was unable to ascertain the length of time for all MSN Messenger conversations therefore was unable to make such a comparison. The loss of timing data was regrettable and should be included in any study of this nature. In future studies, I would recommend that the length of time participants spent in chat conversations be recorded and reported by the participants themselves. I would also recommend insisting that participants use only the latest versions of the chat program and save conversations in a format that records the

[13] Participants were asked to download the most recent version of MSN Messenger and to save their chats as a Rich Text document. Several groups did not do this; therefore chat transcripts did not automatically include notations of the exact times that each utterance was made. There was no way of ascertaining how long these chats took.

length of time for each chat (i.e., not in plain text format).

Another possibility is that CMC participants were busier than FTF participants. This explanation is also unlikely because all participants came from the same pool and were in communication media condition by random assignment.

Given the importance of the assumption that CMC is a time-saving alternative to FTF meetings, it warrants further research into the exact cause of CMC participants' concerns about Time.

Task. Participants in FTF and CMC conditions made about the same number of positive comments about task, but FTF participants made many more negative comments.

It would appear that participants did not like the UVic Information Test very well since participants from both media made more negative than positive comments about it. Of greater interest, however, is that CMC participants made only positive comments about the Career Resources Task while FTF participants made more negative than positive comments about it. There were no significant differences between the communication media in the number of categories or uniqueness of ideas, yet CMC participants demonstrated a greater appreciation for the Career Resources Task.

Face-to-face participants made the most comments about how they appreciated the relevancy of the Career Resources Task. Other comments included an appreciation for divergent thinking, working in a group, having the freedom to work alone, and that it was "easy." Computer-mediated communication participants also appreciated the relevancy of the Career Resources Task but they also commented on a wider variety of items such as an appreciation for divergent thinking, working in a group, having the freedom to work alone, it was "easy," less time consuming, more interesting, they

enjoyed using MSN Messenger, and they had the opportunity to see how others in the group approached the task. There were a greater variety of comments made by CMC participants than FTF participants.

The data from this study do not suggest an explanation for why participants in the CMC condition enjoyed the Career Resources Task more than participants in the FTF condition. It would be interesting to examine the topic using inferential statistics in order to rule out the possibility that this study discovered the phenomenon by chance alone. Was the result unique to this specific experiment or do students in CMC groups generally appreciate divergent thinking tasks more than students in FTF groups? An experiment that supports inferential statistics could provide the answer to this question and possibly even reveal the reasons for it.

Remaining categories. Media was the fourth most commonly discussed category. By far, CMC participants had more to say about Media. The questionnaire itself could have primed participants to answer in terms of Media because the CMC Participation Questionnaire had extra questions about WebMail and MSN Messenger. Also, FTF is a more typical form of communication for student group work whereas CMC is much more novel. It would have been more salient in participants' minds; therefore it stands to reason that they would have written more about it.

Participants made very few comments about working independently. They also made very few comments about being able to use a combination of independent work and group work. To a very small degree, FTF participants appreciated group work more than CMC participants did, but the difference was unremarkable. The Experiment category was not directly relevant to the topic of study, nor was the Other category.

The Principles of Grounding Explain Communication Difficulties

It is noteworthy that there were no comments that gave any indication that participants in the FTF condition had any difficulties with communicating with each other or that they had any misunderstandings. Conversely, in response to the question "What *didn't* work well for you this week?" there were six comments made to that effect by participants in the CMC condition.

Communication media affect the way that people *ground* (Clark & Brennan, 1991). The fact that the only negative comments about difficulties with communication came from the CMC participants, could be explained in terms of the high costs of grounding using CMC tools.

When explaining what did not work well for her, one participant described having high start up costs: "MSN, it seemed that whenever I logged on no one else was on. We had too little time to schedule online time via email." Another participant described high reception costs (the efforts of the receiver such as waiting for her turn, or reading, or processing the information.): "I found that emailing was time consuming and uncertain. I never knew if the other [group members] got my emails etc. And in order to have communicated properly we all spent a lot of time checking our emails." High speaker change cost (the ease of turn-taking) was also described: "If something was asked over email, I would find myself checking my mail until there was a response."

Clark and Brennan (1991) also described how communication media can impose constraints on grounding. One such constraint that is relevant to working with MSN Messenger is audibility, which they defined as, "...participants can hear each other and take note of timing and intonation. In other media they cannot..." (p. 141). One

participant commented on the audibility constraint on grounding: "It was hard to sort out a plan, everyone talking at once, but not hearing each other made for jumbled conversations." The audibility constraint on grounding "made for jumbled conversations," which negatively affected the CMC groups' process.

The comment, "I found that emailing time consuming and uncertain. I never knew if the other [participants] got my emails etc. And in order to have communicated properly we all spent a lot of time checking our emails" was an excellent example of how communication media can make it more difficult for people to ground to a criterion that is sufficient for current purposes (Clark and Brennan's [1999] grounding criterion). This participant described feeling uncertain that her group was achieving mutual understanding because she did not receive immediate (or timely) evidence of understanding from the other two group members. Consequently, much time was spent seeking evidence of understanding by checking and re-checking for addressee's replies. What might have been a quick and clear discussion in FTF communication was a much more involved process when using email.

The costs of grounding, constraints on grounding, and the grounding criterion were three principles of grounding that were useful in explaining why CMC participants had communication difficulties.

WebMail and MSN Messenger

It is best to take the ratings of WebMail and MSN Messenger separately, rather than to compare them. The reason for this is because the question pertained to the specific programs, not the general type of program. Participants assessed how likely they were to use WebMail, not Hotmail, Gmail, or Yahoo Mail for instance. Similarly, they rated

MSN Messenger, not ICQ, Google Chat, or Yahoo Messenger. Had I asked them to rate email and chat generically, the answers may have differed. As it was, these ratings may have been, in part, a critique of the WebMail and MSN Messenger programs.

There were many positive comments about WebMail. Participants said that they liked how easy it was to send attachments, they liked that there was no junk mail, and that it was easy to access. One participant said he would use it more if he knew that others checked it regularly. That comment illustrated the importance of how various media impose constraints on grounding (Clark & Brennan, 1991). People have to check their email accounts because email lacks copresence, visibility, and audibility. Having to check and re-check email accounts causes relatively long delays between the presentation phase of an utterance and the acceptance phase.

Although it was not evident in this experiment, there have been many technological solutions to many of the constraints on grounding. For instance, some programs prevent the need for constant email checking by doing a regular automatic check of one or more email accounts and making an audible and visual notification when they detect new email. More recently, people are using their cell phones to send and receive email and text messages. As technology becomes more and more ubiquitous and affordable, difficulties with grounding will undoubtedly decrease. As technical innovations follow the laws of supply and demand, communication technologies that eliminate the grounding constraints of audibility, visibility, revisability, reviewability, etc. will become more and more affordable.

With regards to MSN Messenger, participants indicated that they would be quite likely to use it again in the future ($M=10.18$, $SD=4.02$). One participant described her

experience with using MSN Messenger in a manner that summarized comments from several other participants and likely explains why they rated MSN Messenger so favourably. She wrote, "...it took a long time for each of us to read our emails and finally arrive at a good meeting time for all of us. When we finally got together, communicating in general was difficult. It was hard to understand exactly what the other two people meant by their comments, and what their true feelings and reactions were because you couldn't see their facial expressions or hear their tone of voice. Once we finally came to some overall level of organization and understanding, the exercise became quite fun and interesting. I think that our personalities came out in our conversation which made it funny and enlightening because we kind of got to know each other a bit and it was neat how 3 people who knew nothing about each other or their work ethics could get together and do an assignment over MSN."

Rating the Ease or Difficulty of Scheduling Meetings

A caveat about using the ratings of scheduling. When participants did not have MSN Messenger meetings, they had four different ways to answer the question "How easy or difficult did you find scheduling meetings with all three group members this week?" Of the 27 instances where participants did not have online meetings, two participants made comments about the difficulties of meeting, five participants explained that email was sufficient for their purposes, and the other twenty participants did not make any comment that explained why they rated scheduling as they did, however, it is reasonable to assume that in 16 cases, participants did not meet online because they felt that scheduling was "really hard."

Using the whole set of available data even though it was not all conceptually

identical was unquestionably problematic. Conversely, excluding data from those who elected to forego MSN Messenger meetings was also problematic because it biased the sample. To be sure, neither option was ideal, but the anomalies were relatively few, and the open-ended questions helped with explanations. For these reasons, I used the ratings of scheduling data to make inferences, but I offer them with a caveat.

Ratings of scheduling and media. There was something about being in the CMC condition that caused difficulties with scheduling. Given that the use of email for scheduling purposes is commonplace in industry and academia, the magnitude of the differences between scheduling FTF and scheduling CMC was unanticipated and surprising. Based on what participants had to say, the cause was most likely email because it is an asynchronous form of communication. One CMC participant wrote, "This week's participation was a challenge. The work required of our group was not the difficult part, it was the limitations on our communications. There was a lot of hit and miss in our group's communication. In order to make an appointment time on MSN we had to find a time that worked for everyone and then make sure we all knew the time. Once we were actually on MSN the conversations went smoothly and were generally short." There were several comments to the same effect. The grounding difficulties associated with asynchronous communication caused problems with participants' ability to schedule meetings.

This experiment did not allow for empirical testing of the difficulties with scheduling. A well-designed experiment, using ordinal data instead of categorical data, aimed at exploring scheduling issues could prove informative and useful. Do the difficulties with scheduling lie with the actual process of coordinating schedules (e.g.,

using email to schedule a chat), or with finding a block of time for the meeting (i.e., busyness), or with the length of time that the chat takes? If participants from FTF and CMC conditions were able to schedule their FTF or online meetings in-person, would there still be a significant difference in the ratings of scheduling (i.e., how much of the difficulties with scheduling have to do with email and how much does it have to do with chat)? At what point does scheduling with email become such a barrier for CMC participants that they decide not to use online meetings? Once again, this explorative study has revealed an area for further empirical research that could benefit those who are interested in using CMC for collaborative learning.

The interaction of email and communication purpose. Many CMC participants found email to be very useful when working on the tasks but did not find it useful for scheduling MSN Messenger meetings. Once again one of Clark and Brennan's (1991) principles of grounding can explain this. They pointed out that the communication media that people use and the purpose that people have for communicating will interact, causing unique impacts on the ways that people ground. This description is a good fit for the fact that email worked well for one aspect of the experiment but not another. It is a matter of finding the right tool for the job. Email may not have been appropriate for scheduling multiple meetings for busy people in a short period of time, but that does not negate its usefulness when working on the tasks themselves. Having a good understanding of the principles of grounding can help to explain and even predict the grounding process to the point where it is helpful when making communication media choices according to communication purpose.

Anxiousness About Completing the Task on Time

Participants in the CMC condition were significantly more anxious about getting their tasks done on time than were participants in the FTF condition. A combination of factors is the likely cause: aforementioned communication difficulties, the fact that scheduling was more difficult for those in CMC groups, and technical difficulties (to be discussed).

The implications of this result do not bode well for the use of CMC tools for student-to-student collaboration. It is a serious concern that the combination of email and chat for group work causes more deadline anxiety than FTF group work does.

In terms of application, it may help to reduce students' anxiety if educators encouraged them to use the telephone or have a brief FTF meeting in order to schedule MSN Messenger meetings. They could suggest that students have an MSN Messenger *dress rehearsal* by having an informal three-way chat. This could increase the group's familiarity with each other, increase their familiarity with using MSN Messenger with three people, and sort out any technical problems prior to a working meeting.

Correlation Between Ratings of Scheduling and Anxiousness

This measure used the ratings of scheduling, therefore is subject to the caveat previously discussed. The statistically significant positive correlation shows that the more difficulty participants had with scheduling meetings (FTF or CMC), the more anxious they felt about completing the tasks on time. That is not to say that scheduling difficulties caused anxiety, only that they co-occurred. An experiment that manipulated the media by which scheduling was discussed could reveal if, and to what degree scheduling is the cause of anxiety about completing tasks on time.

Process

Media and the Number of Weekly Meetings

Participants did *not* discover that they needed to have more or fewer meetings in their second week of participation based on what happened in their first week of participation. This was true regardless of communication media.

The reason why CMC participants had fewer meetings than did FTF participants was undoubtedly because CMC participants were able to use email as a supplement to, or instead of, MSN Messenger meetings. The question is, why did so many choose to use email over chat?

The most plausible explanation lies with the difficulties that participants had scheduling MSN Messenger meetings using email. Computer-mediated communication participants may have found scheduling so difficult that they decided to forego MSN Messenger meetings altogether. This notion is supported by the fact that scheduling difficulties and number of meetings were negatively correlated at the p=.05 level.[14] The more difficult it was to schedule meetings, the fewer meetings participants had. This correlational evidence does not prove causation, but it is highly suggestive.

The logic behind the argument that scheduling difficulties caused fewer meetings can be explained with Clark and Brennan's (1991) principle of least collaborative effort, which states that interlocutors "...try to minimize their collaborative effort – the work that both do from the initiation of each contribution to its mutual acceptance" (p. 135). Participants could have decided that the benefits of synchronous communication with MSN Messenger did not outweigh the costs of checking and re-checking email in order to

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[14] The correlation between the ratings of scheduling and the number of meetings using all available data was r=.05. Using only data from those CMC participants who had MSN Messenger meetings, it was r=.01.

establish a meeting time. Furthermore, participants may not have had a choice in the matter, as one participant explicitly stated, "...We had too little time to schedule online time via email."

There is another explanation that is in accordance with the principle of least collaborative effort. Participants in the CMC conditions were able to complete the task with email exclusively and did not need MSN Messenger. If participants were able to work entirely asynchronously and still complete the task to their mutual satisfaction, there is no reason why they should make any more effort.

An alternate explanation for why there were fewer CMC meetings could be that participants found that MSN Messenger was difficult to use. There were some comments made about the difficulties of using MSN Messenger such as, "Whenever I logged on no one else was on," and, "It isn't as reliable as I thought it was. You cannot expect it to work every time you want to use it..." However, this possibility was not the likely cause because on average, participants rated MSN Messenger as being fairly easy to use (M=4.53, SD=5, on a scale of 0 to 15).

The reason for so few CMC meetings may not have anything to do with how easy or difficult it was to schedule or to use. It could be that in comparison to FTF participants, CMC participants did not experience the same levels of "Accountability to peers, ability to influence each other's reasoning and conclusions, social modeling, social support, and interpersonal rewards..." (Johnson & Johnson, 1999, p. 71). Perhaps CMC participants did not gain the same levels of rewards that would reinforce their use of online meetings. However, groupwork was the most common category that CMC participants wrote about when asked "What worked well for you this week?" Apparently,

participants who did not actually speak to each other at the same time or in the same place were still able to get some degree of satisfaction from group work.

Is it possible that the type or combination of communication media has a direct effect on the quality of student-to-student collaboration? Johnson & Johnson (1999) claim that there are four kinds of learning groups: pseudo learning groups, traditional classroom learning groups, cooperative learning groups, and high-performance cooperative learning groups. They considered only the latter two as truly cooperative groups. They defined cooperative learning groups as,

> Students work together to accomplish shared goals. Students seek outcomes that are beneficial to all. Students discuss material with each other, help one another understand it, and encourage each other to work hard. Individual performance is checked regularly to ensure that all students are contributing and learning. The result is that the group is more than a sum of its parts, and all students perform higher academically than they would if they worked alone. Johnson & Johnson, 1999, p. 68.

Could various communication media enhance or inhibit the formation of such a group? It may prove useful to test the hypothesis by creating the conditions needed to foster this kind of group and then experimentally manipulate communication media. Results from this study have raised several ideas and issues that provide grounds to believe that such an experiment would prove fruitful.

Technical Difficulties

Participants in the CMC condition cited several technical difficulties that were barriers to communicating with each other, whereas the kinds of technical difficulties that FTF participants cited were mainly annoyances rather than hindrances to communication or to their ability to complete the tasks.

As Brennan (1998) pointed out, human-computer interaction is subject to the

same principles of grounding that FTF communication is subject to. Several of the technical difficulties described by participants are explainable in terms of human-computer grounding difficulties. For example, one participant emailed another group member and only much later discovered that he had entered the email address into his address book incorrectly. After sending the email with the erroneous address, the computer did not supply any immediate negative evidence of grounding, that is, the sender did not immediately receive notification from the computer that he sent the email to a non-existent account. Typically, it is up to the human to actively seek evidence of understanding by checking and re-checking for replies from the addressee or for an automatic reply from the email system. This is precisely the type of difficulty that Brennan (1998) referred to when she described the grounding problem in human-computer interaction, where the onus for human-computer grounding usually falls on the human.

Another example of where a failure of human-computer grounding led to human-human communication difficulties was described by the participant who wrote that he, participant A, had engaged in a two-way conversation with participant B, saw that participant C was signed into MSN Messenger and was "Online," and invited C into the existing chat. The program automatically included C without asking if C wanted to join. Participants A and B read that "Participant C has joined the conversation" and began to chat with her. It took some time for A and B to realize that C was not being rude and ignoring them, but that she was not actually present at her computer. Had MSN Messenger been programmed to seek evidence of understanding from the human (i.e., confirmation that C wanted to join the conversation), this confusion could have been

avoided.

Media and Reported Work Distribution

Work distribution was a self-reported measure that I could not corroborate with any other data; therefore there was no way of ascertaining how accurate the reports were. Regardless, there is value in assessing the *perceived* distribution of work.[15] If one medium were to systematically result in perceptions that group members were contributing unequally, students would be less inclined to use the medium because they would come to believe that it does not support a fair distribution of the workload.

There was some evidence that the perceptions of work distribution were a problem. As one CMC participant wrote after finally receiving the last-minute compiled efforts of all three group members on the Career Resources Task, "...I was most ashamed, because it seems that I did a minimal amount of work. I never expected for them to do so much research and brain-storming." The same type of comment occurred in the FTF condition as well. One participant wrote, "...we all arranged to brainstorm [on our own] and I was the only one that actually did it." However, this group's reported work distribution added up to 130%, indicating some lack of awareness of how much work each participant had contributed.

The communication media factor did not significantly reduce the degree of awareness of how much work each member of a group contributed; therefore this variable is not likely to impact the effectiveness of either FTF or CMC for the purpose of collaborative learning. However, it could be that it is simply a problem in both conditions.

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[15] Note that this measure did not assess the equality of work; rather, it assessed how much agreement occurred between group members with regard to the distribution of work.

Number of Weekly Phone Calls Within FTF Groups

Participants in the FTF condition did not make more phone calls in the second week than they did in the first week. This indicates that participants did not deliberately decide to fall back on the telephone as their primary means of scheduling. Furthermore, the fact that 20 triads made only 10 phone calls in a month, would indicate that FTF was a fairly sufficient medium for scheduling.

Participants' Computer Familiarity

Unlike other experiments that use complicated CMC tools in their design (e.g., Hollingshead & McGrath, 1993; Ocker & Yaverbaum, 1999), it is not likely that the results of this experiment were influence by the steep learning curve involved in learning new and complicated computer programs. All CMC participants were familiar with email and chat generally, most were familiar with MSN Messenger specifically (email data was not gathered), and CMC participants all received the same tutorial. Access to computers was not a confounding variable either.

Summary

Task Outcomes revealed that the type of thinking that a task requires should not affect students' ability to perform in either FTF or CMC.

Participants' Evaluations indicated that group work was the most positive aspect of participation for students in both communication media conditions, and that it was only slightly more favoured by FTF participants. Computer-mediated communication participants were much more concerned about time issues than FTF participants were, which was contrary to assumptions made prior to the experiment. I suspect that this was primarily due to the difficulties of working with asynchronous communication; however

there were several possible explanations. Further research in this area is important because the time-saving benefits of CMC were a critical factor in recommending the use of CMC for collaborative learning.

Task was the third most commonly discussed topic. The UVic Information Test (convergent thinking) was less popular than the Career Resources Task (divergent thinking) and CMC participants were more positive about the Career Resources Task than FTF participants..

Difficulties with communication in the CMC condition were useful in explaining the costs of grounding; the constraint on grounding, audibility; and the grounding criterion. The grounding constraints of copresence, visibility, and audibility were helpful when explaining why email would be used more often if all participants checked it regularly.

Despite the difficulties of using email for scheduling, participants rated WebMail as fairly easy to use and they were quite likely to use it again for collaborative learning purposes in the future. They rated MSN Messenger similarly. One participant explained that it took some time to become familiar with MSN Messenger but after a while it proved enjoyable and useful.

Computer-mediated communication participants found it more difficult to schedule meetings than did FTF participants, the reason for this was most likely due to using an asynchronous communication tool, but this cannot be determined for certain without further empirical evidence. Computer-mediated communication participants found scheduling to be more difficult, were more anxious about completing the tasks on time, and held fewer meetings. Correlational analysis was suggestive and indicates an

area for further empirical research.

Process measures revealed that there were more FTF meetings than CMC meetings. According to the principle of least collaborative effort, participants would avoid having meetings if it were difficult to schedule them and if email was sufficient enough for participants' purposes. An alternate explanation for so few CMC meetings could be that the interpersonal rewards and social support that FTF groups experience from group work may not extend to CMC groups to a great enough degree that they would reinforce the behaviour of having online meetings. Johnson & Johnson (1999) stated that there are four kinds of learning groups but that only two of them are collaborative learning groups. I suggested that communication media be experimentally manipulated to see if various media combinations could enhance or inhibit the formation of truly collaborative groups.

Technical difficulties that CMC participants encountered tended to interfere with participants' abilities to communicate, whereas FTF participants' technical difficulties tended to be more annoying than interfering. There were no significant differences between media in terms of how aware participants were about the amount of work that each group member contributed. Finally, FTF participants did not use the telephone excessively for re-scheduling purposes.

Conclusions

It is possible that CMC can be an effective medium for collaborative learning but scholars should choose it very carefully, based on the specific purpose for communicating. Yes, students in CMC groups can achieve the same grades as students in FTF groups, but they have to contend with many more barriers than do FTF groups.

Computer-mediated communication is not the time-saving solution that I had assumed it to be; therefore group members who physically could meet in person should perform a careful cost/benefit analysis prior to adopting the medium. It does not make sense for students to use CMC tools exclusively and as a result have more worries about time, have to cope with more technical difficulties, and have more anxiety about completing tasks on time, in order to earn grades comparable to FTF groups.

However, participants in this study were quite optimistic about WebMail and MSN Messenger as communication tools and expressed many positive comments about their online groups. Regardless of the difficulties they encountered, they still benefited from the experience of online collaborative learning. Further research could explain why CMC participants had so many concerns about time, why scheduling meetings was so difficult for CMC participants, and whether or not certain combinations of communication media can foster truly collaborative learning groups.

Now that Clark & Brennan's (1991) principles of grounding proved to be excellent guides to understanding the grounding difficulties experienced by CMC participants, the next logical step is to use them for prediction. I believe that they can guide predictions about the effectiveness and usefulness of various combinations of communication media for collaborative learning purposes.

In practical terms, I suggest that students use synchronous communication media when attempting to schedule meetings, use email for sending files and information that is not time-critical, and that group members have a fun and personal dress rehearsal with MSN Messenger prior to using it for working meetings. These suggestions will likely improve students' collaborative learning experience using computer-mediated

communication.

Collaborative learning and communication technology is inevitable. At the moment, technology makes it somewhat more difficult for students to learn with each other online than in-person, but well-directed empirical research based on sound communication principles can help reduce or even eliminate those difficulties. The better we understand how communication technology interacts with collaborative learning processes, the better equipped we will be to use what technology we already have, and to assist in the creation of new technologies that will support students with their educational goals.

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Appendix A

UVic Information Test Key with Sample Questions and Instructions

The following table contains some examples from the test.

Questions in this column	**Answers in this Column**
What is the full name of the person whom the McPherson Library is named after?	_____ _____ McPherson
Name all of the Faculties. (You may use more than one word per blank if necessary.)	Faculty of…… _____
How much does it cost to replace a lost student I.D.?	$_____
Are you allowed to take travel mugs of beverages into the McPherson Library?	Yes No
If you decide not to attend a course that you registered for but then don't officially drop it, which is **not** one of the consequences?	a) you won't be able to enrol in it again b) you receive a failing mark c) it goes on your permanent record d) it affects your GPA
Who is currently the dean of Social Sciences?	Dr. _____ _____
What brand of pizza is sold at the University Centre cafeteria?	_____ Pizza

- The correct answer will contain as many words as there are blanks in the answer column. Exceptions are noted with a bracketed sentence at the end of the question. (You may use more than one word per blank if necessary.)
- If you are asked "how much" something costs, don't include taxes.
- If a question can be answered with Yes/No or True/False—CIRCLE one.
- Some multiple choice questions are worded in the **negative**. Your job is to find the item that is **not** correct.
- You are not required to provide titles or middle initials (e.g., Dr. Donald D. Duck should be just Donald Duck).
- You will **not** find all of the answers to this test on the internet.

All group members to hand in the final copy of the group's UVic Test on Feedback Friday.

1. How many students (in total) attend the University of Victoria as of November 1, 2003?	*18,415 including 2,305 graduate students*
2. One difference between a Faculty and a department is:	a) a department is an administrative body that governs the Faculties ***b) a Faculty is an administrative body that governs the departments*** c) a Faculty is someone who teaches in a department d) a Faculty is a location whereas a department is a group of people
3. What is the tuition for a full-time (5 courses/term), first year, domestic, undergrad student in the Faculty of Social Sciences for 2003/2004 (September-April)?	*$3634.50*
4. What is a paid individual called who assists with a course by providing office hours for students to come and get help, marking exams and papers, invigilating, teaching labs, etc.?	***a) a teaching assistant*** b) a research assistant c) a sessional instructor d) an honours student
5. What is it called when a professor holds their position on a permanent basis without periodic contract renewal?	*Tenure*
6. What is a professor called who is in the entry level professorial rank?	a) a full professor b) an associate professor ***c) an assistant professor*** d) a sessional instructor
7. What is the full name of the person whom the McPherson Library is named after?	*Thomas Shanks* McPherson

8. What is the emphasis in a degree program or a program which involves specialization in a discipline and requires 15 or more units in that discipline at the 300 or 400 level?	**a) *a major*** b) a minor c) a major/minor d) a concentration
9. Journals that have been reviewed by a panel of experts in the field prior to publication are referred to as being _____ reviewed.	*peer* reviewed
10. _____ occurs after admission has been granted and involves claiming a seat in the desired courses.	*Registration*
11. What are the 6 faith communities that are represented by the Interfaith Chaplaincy, as listed on their UVic website?	*Baha'i* *Buddhist* *Christian* *Jewish* *Muslim* *Wiccan*
12. How many portraits are on the walls of the McPherson Library honouring those who have won the Award for Excellence in Teaching?	*31*
13. What are 5 characteristics of an Ombudsperson, as listed on the UVic website?	a) objective, confidential, independent, accessible, and able to make decisions on a student's behalf b) impartial, subjective, confidential, independent, and accessible c) accessible, confidential, interdependent, impartial, and objective d) representative of the university, independent, objective, accessible, and confidential ***e) impartial, objective, confidential, independent, and accessible***

14. Who is the coordinator in charge of PSYC100?	Dr. *Martin Smith*
15. How much does a U Pass cost for a four month term?	*$51*
16. Which one of the following choices contains a place that is **not** one of the food services/restaurants on campus.	a) The Grad Lounge, IQ Bistro, Fraser Snack Bar b) Bean There, Nibbles and Bytes Cafe, University Centre cafeteria ***c) International Grill, Health Hut, Finnerty Express*** d) Sweet Greens, Felicita's, Resident's cafeteria
17. Where is the shelving location for the book "Ghost Stories of British Columbia" in the McPherson Library? 3rd floor, mezzanine?	a) Third Floor ***b) Third Floor Mezzanine***
18. Before they started selling Starbucks coffee, what brand of coffee was sold at Mac's Bistro?	*Tim Horton's*
19. What is the version number and edition of Web CT that is used at UVic?	c) 3.8 UE d) 8.3 UE ***e) 3.8 CE*** f) 8.3 CE
20. What is the summary or list of the main topics of a course of study, text, or lecture that is usually offered to students on the first day of class called?	*syllabus*
21. What colour is the gown that you will wear when you graduate with a Bachelor's degree at UVic?	*Black*
22. A _____ is a monetary award based on academic merit or excellence in the area to which the award pertains.	*scholarship*

23. How much does it cost to replace a lost student I.D.?	*$10*
24. Who is currently the president of the University of Victoria?	Dr. *David Turpin*
25. If you are asked to give five responses to a question worth five points on an exam and you give six but get one wrong, what is **not** one possible mark that you could get, depending on the policy of the individual marker?	a) 0 b) 4 c) 5 ***d) 6***
26. How much is a coffee at Sweet Greens when you use your own **large** travel mug?	*$1.00*
27. Where are two places on campus that Canadian Imperial Bank of Commerce (CIBC) machines are located? (You may use more than one word per blank if necessary.)	*1. On the outer wall of Finnerty bookstore/coffee shop* *2. inside Maclaurin by the elevator/Mac's Bistro.*
28. What percentage of a book you consign at Subtext gets paid back to you?	*75%*
29. What are the call letters and dial numbers of the campus's radio station?	*CFUV-FM 101.9*
30. What building do you find at the corner of McKenzie Ave. and Gordon Head Rd., opposite of the University of Victoria?	a) Centennial Stadium ***b) Ian H. Stewart Complex*** c) Fraser Building d) Lam Family Student Housing Complex
31. Who is currently the dean of Social Sciences?	Dr. *John Schofield*
32. A/an _____ exam occurs about halfway through a course and is always cumulative.	*midterm*

33. Are you allowed to advertise your car for sale in the Martlet?	***Yes*** No
34. How many Faculties are there at UVic?	*10*
35. What brand of pizza is sold at the University Centre cafeteria?	*Village's* Pizza
36. You can go to Room A109, Lobby of _____ _____, Main Floor, University Centre in order to view your written final exams.	*Records Services*
37. What is an honours student?	a) a person who is in the third year of studies and has stated a major b) a person who writes an honours thesis with the help of a graduate student c) a student who attains a certain grade point average ***d) a person who is in the last year of study who has completed various requirements and is writing an honours thesis***
38. What is the speed limit on Ring Road?	*40* km/h
39. In what building and room is the Peer Helping Centre located on campus?	Bdg. *SUB* Rm. *B005*
40. What is a professor who is in the second professorial rank called?	a) a full professor ***b) an associate professor*** c) an assistant professor d) a sessional instructor
41. What is the phone number for the NEED Crisis and Information Line of Greater Victoria, Canada 24 Hour Line: _____* Youth Line: _____**	*1. (250) 386-6323* *2. (250) 386-TALK (8255)*
42. How many days will Campus Security Services keep items in the Lost and Found?	*30*

43. What does B.Sc. stand for?	*Bachelor of Science*
44. What parking lot is closest to the Jack Petersen Health Centre?	g) 1 h) 2 ***i) 5*** j) 6
45. Where can you purchase old exams from previous years that have been submitted by professors?	*Zap!*
46. Which are **not** hours that the McPherson Library will be open during the Summer 2004 term?	a) Monday to Thursday: 8-9 b) Friday: 8-6 c) Saturday: 10-6 ***d) Sunday: 12-6***
47. A _____ is a **non**-monetary award based on academic merit or excellence in the area to which the award pertains.	*medal*
48. What six positions make up the UVic Executive? (You may use more than one word per blank if necessary.)	*President and Vice-Chancellor* *Vice-President of Finance and Operations* *Vice-President of Academic and Provost* *Vice-President of Research* *Vice-President of External Relations* *University Secretary and Registrar*
49. Between 3pm and 4pm it is "Happy Hour" at the Health Food Bar and sandwiches and wraps are reduced by $____ to use up ingredients.	*$1.00*
50. If you are from B.C. and took English (spoken/written) and American Sign Language at the grade 12 level, do you meet the year 1 admission requirements for language in Humanities?	***Yes*** No
51. What month and day are the 2004 spring term examinations over for all Faculties?	*April 24*

52. In what department is Counselling Psychology taught? (Hint: NOT Psychology.)	Department of *Education*
53. Can you ever score more than 100% on an exam?	***Yes*** No
54. What is the website for the University of Victoria Student Society (UVSS)?	http:// *www.uvss.uvic.ca/*
55. Graduation ceremonies are formally called _____ ceremonies.	*convocation*
56. What building and room is the Sexual Assault Centre located in on campus?	Bdg. *SUB* Rm. *B027*
57. What Faculty does the department of Psychology belong to?	Faculty of *Social Sciences*
58. What is **not** one of the four things that the UVSS provides for students, as stated on their website.	a) Advocacy *b) services* **c) *tutorage*** d) representation
59. According to the UVic 2004 Calendar, if you have been a fulltime (5 courses per term) undergraduate student and obtained 41.5 course credits how many years have you completed?	a) 1 b) 2 ***c) 3*** d) 4
60. A/an _____ is an exposition of a given subject delivered before an audience or class, as for the purposes of instruction.	*lecture*

61. Name all of the Faculties. (You may use more than one word per blank if necessary.)	*Business* *Education* *Engineering* *Fine Arts* *Graduate Studies* *Human & Social Development* *Humanities* *Law* *Science* *Social Sciences*
62. Name two locations where you can find Royal Bank Machines on campus. (You may use more than one word per blank if necessary.)	1. *SUB - Felicitas* 2. *SUB – arcade*
63. How much is a UVSS student admission for an evening show at Cinecenta?	*$4.75*
64. How many programs of graduate study are there in the Psychology department?	*five*
65. If you decide not to attend a course that you registered for but then don't officially drop it, which is **not** one of the consequences?	***e) you won't be able to enrol in it again*** f) you receive a failing mark g) it goes on your permanent record h) it affects your GPA
66. Applying for _____ is a process where much information is submitted to the university about a prospective student with the goal of obtaining permission to attend the university.	*admission*
67. Are you allowed to take travel mugs of beverages into the McPherson Library?	***Yes*** No

68. Housing, Food, and Conference Services (HFCS) advertises a "Dining Plus" card that is swiped to pay for food (instead of the user handling money). How much do you save on food purchases by using it?	*10%*
69. What is an optional program that allows students to study in an area outside their area(s) of specialization?	a) a major/minor ***b) a minor*** c) a concentration d) a major
70. What Faculty does the department of Computer Science belong to?	Faculty of *Engineering*
71. What are the first and last names of the two news editors for the Martlet?	*Sarah Petrescu* and *Patrick White*
72. What is the phone number for Safewalk?	*721-7599*
73. What are the Chinese Student Radio Association, Students for Literacy, and Circle K examples of?	a) groups interested in foreign languages b) associations advocating students' right to free speech c) groups consisting of ESL students ***d) clubs active on campus***
74. The template used to answer questions on an exam is called a General Purpose Answer Sheet. True or False	***True*** False
75. If you graduate with an LLB, you have earned a Bachelor of _____.	*Laws*
76. How much does a **colour** copy cost when using the machine on the main floor of the McPherson Library?	*$0.30*

77. A/an _____ exam occurs at the end of a course, may or may not be cumulative, and you must make a special effort to get it back.	*final*
78. What is a professor who is in the third and final professorial rank called?	***a) a full professor*** b) an associate professor c) an assistant professor d) a sessional instructor
79. What is the name of building 181 located at 3800 Finnerty Road (off Gabriola Road)?	a) Campus Services ***b) McKinnon Building*** c) Continuing Studies Building d) L Hut
80. ***The Ring*** is published by UVic Communications on the first _____ of every month, except August.	*Thursday*
81. Which is **not** one of the eight responsibilities of the Board of Governors at the University of Victoria, as listed on the website?	***a) to create the University of Victoria calendar*** b) to distinguish between policy and administration c) to protect university autonomy/board independence d) to assess board performance
82. Another name for a student who is working on a Bachelor's degree is a(n) _____.	*undergraduate*
83. The T-Drive (or, Temporary Drive) can be found on the _____ **server** (HINT: NOT the Drive) in student computing labs.	*Athena*
84. What floor(s) is/are the washroom(s) located on in the McPherson Library? (You may use more than one word per blank if necessary.)	*B and 2*

85. Which on of the following is not a common use of your student I.D. number and/or card?	a) To get onto the bus b) As a library card c) To register for classes ***d) As a computer lab photocopy card***
86. Whom of the following is not a former president of the University of Victoria?	a) Stephen Jennings ***b) Ronald Lou-Poy*** c) Malcolm Taylor d) David Strong
87. The bus pass that all students pay for via student fees is called the _____ _____.	*U Pass*
88. List the nine passing letter grades and their corresponding grade point values (GPV).	Letter Grade GPV *A+ 9* *A 8* *A- 7* *B+ 6* *B 5* *B- 4* *C+ 3* *C 2* *D 1*
89. To calculate a grade point average, _____* the grade point value of each final grade by the number of units for that course, _____** the grade points for all the courses, and _____*** the total grade points by the total number of units.	* *multiply* ** *total/add* *** *divide*
90. The month and day that classes end for the current term is _____.	*April 2*
91. What is the name of the University of Victoria's first major benefactor who left a bequest of $2,250,000 (1873-1962)?	*Thomas Shanks McPherson*
92. What does MFA stand for?	*Master of Fine Arts*

93. A/an _____ is something the provides special, often individual instruction in a particular area. In computer science it might be a program that provides instruction for the use of a system or software.	*tutorial*
94. What is one of the ways that an Ombudsperson is equipped to help students, as listed on the University of Victoria Ombudsperson website?	a) handling allegations of sexual assault b) financial aid ***c) grade appeals*** d) tutorage
95. A transcript is a copy of a student's permanent academic record. A/an _____* transcript can be accessed through WebView online and is free, and a/an _____** transcript can be ordered through Records Services (on the Internet, mail, fax, or in person), costs $8, and is required to apply to graduate school.	* *unofficial* ** *official*
96. Has there ever been a female president of UVic?	*No*
97. Before you can use UVic WebMail, you must obtain a(n) _____ I.D.	*NetLink*
98. The internet address for the UVic Computer Helpdesk is _____.	*http:// helpdesk.uvic.ca/*
99. If you illegally park in a parking space designated for the disabled you will have to pay for your own tow plus a $__ ticket.	*$50*
100. What building and **floor** is the Sociology main office located in?	Bdg. ___*Cornett*__Floor __*3*__

Appendix B

Career Resources Task and Instructions

If you are participating in this experiment, you have chosen to pursue some kind of higher education. It's possible that you chose this path in order to obtain a specific job later on, it's possible that you are here because you know that higher education leads to higher pay, or maybe you are here because you are simply interested in learning. Whatever your reason for being here, you will join or re-join the workforce one day. Once you have your degree you will begin to look for work in your chosen profession. What are your options? How do you find out what your options are? How do you go about discovering what kinds of jobs exist in your field? Who or what can help with this exploration?

Your task for this project, is to think of what resources are available to you for the purpose of exploring career options. These resources may be formal or informal, obvious or novel. Come up with as many categories of resources as you possibly can and itemize a few examples of each. There are no "right" or "wrong" resources but whatever you come up with has to make sense. Go for as many solutions as you can but also try to "think out of the box." This is an opportunity for you to stretch your creative mental muscles.

Just to be clear, your task is not to come up with career options, rather, it is to come up with resources that can help you to come up with career options.

Submit a typed, numbered list. Come up with as many categories of resources and some examples of items that would fall into that category. Number the categories and the items separately. The amount of money you get for this task will be determined by the number of categories you come up with.

<u>In total, spend 2 ½ hours working on this task.</u>

Table B6

Example of How to Present Ideas for the Career Resources Task

Example: List as many resources as you can where you can get help with writing a psychology paper.			
Cat#	Category	Item#	Item and Description
1	Writing Centre		
		1	staff – can go over what I've written and get feedback
		2	library in writing centre – there are books on writing
2	Family		
		3	my mom is a good writer – she can proofread
		4	my uncle Bob is a psychologist – he can check facts
3	Internet		
		5	www.writingpsychologypapers.com – a page with lots of tips on how to do the research for the paper
Etcetera			

Appendix C

Phase 1 and Phase 2, Showing Counterbalancing Measures

Phase 1		Start Task			Complete Task	
		Monday	Tuesday	Wed	Thursday	Friday
Week 1	Communication Media	FTF	CMC		FTF	CMC
	Task	UVic Information Test				
Week 2	Communication Media	FTF	CMC		FTF	CMC
	Task	Career Resources Task				

Phase 2		Start Task			Complete Task	
		Monday	Tuesday	Wed	Thursday	Friday
Week 1	Communication Media	CMC	FTF		CMC	FTF
	Thinking Task	Career Resources Task				
Week 2	Communication Media	CMC	FTF		CMC	FTF
	Thinking Task	UVic Information Test				

Appendix D

Informed Consent

We are asking you to volunteer to participate in Teams 1. This project is under the direction of Dr. Bavelas of the Psychology Department and Dr. Damian of the Computer Science Department at the University of Victoria. If you have any questions or concerns about the study, you can ask the researcher, Trina Holt 721-6691 (trina1@uvic.ca) now or later. You can contact Dr. Bavelas directly at 721-7550 (bavelas@uvic.ca) or Dr. Damian at 472-4249 (danielad@cs.uvic.ca). You can also contact the Associate Vice President of Research at the University of Victoria (721-7968) if you have any concerns about the study that the researcher or the two supervisors cannot help you with.

The purpose of Teams 1 is to compare face-to-face communication with computer-mediated communication when groups of students are working together to accomplish two different types of tasks.

The benefits of participating in this study are (a) The tasks that you will be doing will be informative and helpful to you with post secondary school life and with career planning. (b)You may learn more about how to use the computer to communicate. (c)You will receive 10 points for fully participating through the Psychology Research Participation System. (d)You could earn up to $20 depending on your group's performance.

The costs or inconvenience of participating are that (a)It will take about 5 hours of your time over two weeks. (b)You will be required to think creatively as well as to search out correct answers to questions. (c)You will work collaboratively with two other students that you probably won't know. (d)You will use only a computer to communicate with your team-mates, or you may be asked only to meet in person. (e)If you are meeting in person you will be videotaped, which may at first make you self-conscious. (f)If you are working via computers, your documents will be saved for analysis.

If you agree to participate, you will work in a group on two tasks: (1) find answers to 100 questions about UVic and post secondary school (2) think creatively about how to find resources that can assist with career planning. After completing each task you will be asked to answer some specific questions about your participation.

If you know now of any reason why you will not be able to commit to the study for two weeks (a total of 5 hours minimum) do not sign this form and do not go any further with participation.

Participation in this study is entirely voluntary and you are free to refuse to participate, to withdraw from the study, or to refuse to do any particular part of the study, without any negative consequences and with no effect on your course grade. In the event that you withdraw from the study, your data will be destroyed if you request it, but you would still receive partial or full participation points.

Your confidentiality will be protected. Documents that have your name on it will only be made available to Trina Holt, Dr. Bavelas, Dr. Damian, and their assistants. However, anyone who knew you could recognize you in videotape, so you will control access to the tape (i.e., who, if anyone, can view it) by filling out a Permission to View form after you have seen the tape. The tapes will be kept in a secure office with a code that indicates which uses you gave permission for, and the permission form with your name on it will be kept separately. At the conclusion of the study, all of the documents will be kept in a secure office under the same viewing restrictions.

Having understood the above information and been given an opportunity to have my questions answered, I agree to participate in this study:

Name (Print): _____

Signature: _____

Date: _____

Appendix E

Computing Familiarity and Demographics Questionnaire

Name: _____ Participant Group/Letter: _____

Date: _____ Student Number: _____

Phone Number: _____ Email Most Used: _____

(Check ☑)

1) **How often** do you use any instant messaging CHAT PROGRAM (e.g., MSN Messenger)?

	Never
	Yearly
	Monthly
	Weekly
	Once per day
	More than once per day

2) **What** instant messaging CHAT PROGRAM do you use?

	None
	MSN Messenger
	Yahoo
	ICQ
	Other: _____

3) How often do you usually use the **campus** computer lab(s)?

	Never
	Yearly
	Monthly
	Weekly
	Once per day
	More than once per day

4) Are you aware that UVic had designated memory space for you on the **T-drive**?

	No.
	Yes, but I have never used it.
	Yes and I've used it in the past.
	Yes and I use it regularly.

5) If you own a computer, indicate what **operating system** you use.

	Windows XP
	Windows 98
	Windows NT
	Windows Me
	Windows 95
	Windows Other: _____
	Mac OS X 10.3 or later
	Mac OS 9.2.2 or later
	I don't know

6) If you own a computer, indicate what type of **internet connection** you have.

	None
	Dial-up (slow phone line)
	Cable
	ADSL (fast phone line)
	ResNet (UVic Residences)
	I don't know

Demographic Information

Age:	
Sex:	Female Male
Year of study:	1 2 3 4
Dep't or area of study:	
Other diplomas/degrees:	

Appendix F

FTF Introduction

The purpose of this experiment is to examine **face-to-face communication** versus **computer-mediated communication** among student work **groups** who are working on two types of **tasks**.

You will spend time during the next two weeks in videotaped, **face-to-face** groups of **3**, working on two tasks. One task involves finding the correct answers to 100 questions about the University of Victoria and post secondary school (a.k.a. **UVic Test**). The other task involves finding Resources to Assist With Career Planning (a.k.a. The **Resources Task**).

It is possible for you to earn **money** for your good works! Each group member will receive the same amount of money. If you get 100% on the UVic Test you will get $10 each! That works out to 10 cents for each **correctly** answered question – so do your best! You can earn another $10 for getting lots of **categories** of resources (this will be scored on a "curve" based on the performance of all groups). If you participate **fully**, you can collect your money at the end of the second week. Two participation points will be given for showing up today, and the remaining 8 will be given at the end of the two weeks.

When in a group of 3…

- you will be **videotaped** in a room in the Learning and Teaching Centre (probably **CIT 126F)**
- you will have access to the internet, a printer and a telephone
- you can meet for as **short** or **long** or as **many** times as you wish
- how you **approach the task** as a group is entirely **up to you**

When alone…

- you may use whatever means you choose to get ideas or to do your work
- it is important that you work entirely **alone** without communicating with either of your group members
- one exception: you **may telephone** others in your group **only to arrange meetings** (NOT to talk about the task or organizing work)

On Feedback Day…

- Every participant will meet with the researcher again for half an hour to:
- complete a **questionnaire** about your experiences that week
- return a copy of the group's completed task (i.e., 3 copies per group should be handed in)
- groups don't have to come in together on Feedback Day, a sign up sheet will be provided and you can choose a time

Appendix G

FTF Procedure and Rules

Meetings

- all face-to-face meetings will have **3** (**never** meet in **2**'s)
- all meetings will be **videotaped** in the Learning and Teaching Centre (usually **CIT 126F**) – **never** meet **off-camera**
- **book** the room through the researcher with as much **notice** as possible
- the researcher won't help with scheduling issues
- meetings may occur in one of two time frames, depending on what day you begin:
- Monday – Wednesday, 8:00 AM – 8:00 PM and Thursday from 8:00 AM to 1:00 PM (i.e., **your deadline is 1:00 PM Thursday**)
- Tuesday – Thursday, 8:00 AM – 8:00 PM and Friday from 8:00 AM to 1:00 PM (i.e., **your deadline is 1:00 PM Friday**)

Working Alone

- **don't** EMAIL anyone in your group for any reason
- **don't** use instant messaging (e.g., MSN Messenger) to communicate with any group member
- you MAY telephone others in your group to arrange meetings but **don't** talk about the task or organizing your work (it is your choice to share your telephone number, or not)

Submitting Documents

- everyone must come to **CIT 126F** on "Feedback Day" for half an hour in order to complete a questionnaire and to return the task that you did that week
- groups don't have to come at the same time on Feedback Day – you may sign up for a spot between 2 and 4:30 PM
- each group member submits a final version of the task – that means that the researcher should receive 3 identical copies of the task

About the Money

- each participant can earn up to $20 for fully participating in the experiment
- each group's members will receive the same amount

- each task can be worth $0 to $10 depending on how well the group does
- the UVic Test will be marked according to correct questions you get
- the Resources Task will be marked according to how many categories you get
- Payday is on March 30th, in CIT 126F from 12:00 to 3:00 PM

Refrain from discussing any details about the tasks or about the experiment until May 2004. This is <u>important</u> because you could inadvertently influence another participant of our experiment.

Appendix H

FTF Participation Questionnaire

Please answer the following questions AFTER you have completed the week's task.

Name: _____ *Participant I.D.* _____

Date: _____ *Task*: **UVic Test** or **Resources**

1) Before reading through the rest of the Participation Questionnaire, write a paragraph or two **in your own words** – whatever comes to mind – describing **your experience** of this week's participation.

[The remaining two-thirds of the page was left with blank lines where participants wrote about their experiences.]

2) What worked **well** for you this week?

_____

_____

3) What **didn't** work well for you this week?

_____

_____

4) What did you **like** about working in the group this week?

_____

_____

5) What **didn't** you like about working in the group this week?

_____

_____

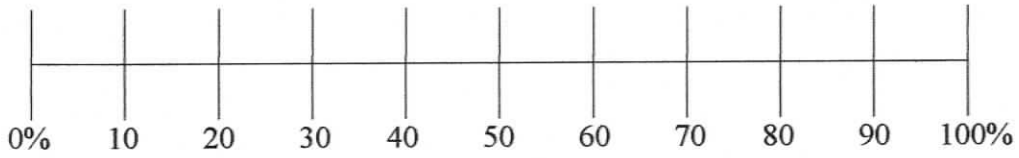
6) What did you **like** about working on the task this week?

7) What **didn't** you like about working on the task this week?

8) If you had any technical difficulties this week please describe them briefly.

9) About what percentage of the work do you think that **you** contributed within the group this week?

(Place a mark on the line.)



10) In what way(s) did your group **divide** up the work up this week?

11) How easy or difficult did you find **scheduling meetings** with all three group members this week?

(Place a mark on the line.)

Really Easy Really Hard

12) How **anxious** did you feel about being able to get the task **done on time**?

(Place a mark on the line.)

Not Anxious — Really Anxious

13) How many **telephone conversations** did you have with group members regarding scheduling this week?

Number: _____

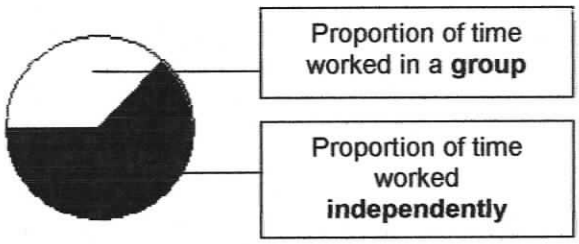
14) How many **hours** did you spend working **independently** on the task this week (i.e., NOT in a group)?

Number: _____

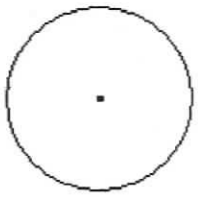
15) What proportion of time did you spend working **independently** versus working **with the group** this week?

*(Divide the circle on the **right** into proportions that show how much time you spent working with the **group** [white] and **independently** [black].)*

EXAMPLE



YOU DO THIS ONE



Appendix I

Debrief

Thank you for participating in Teams. The purpose of the study is to compare **face-to-face communication** with **computer-mediated communication** when **groups** of students are working together to accomplish two different types of **tasks**. There were 11 groups that worked on both tasks, face-to-face, while videotaped, and there were 11 groups who worked on both tasks while communicating only via computers. The two tasks represented two different types of thinking. The *UVic Test* represented **convergent thinking**, which is the kind of thinking that we use when looking for one correct answer to a question. The *Resources to Assist With Career Planning* task represented **divergent thinking**, which is the kind of thinking that we use when we are looking for many solutions or creative answers to one question.

The communication condition was one independent variable, while the type of task was a second independent variable. Several dependent variables will be looked at including: how many correct answers, how many creative answers, scheduling issues, levels of enjoyment, and organization strategies, to name a few. If you are interested in learning about the results, feel free to contact the researcher, Trina Holt (trina1@uvic.ca) in May.

The study will run through the month of March, therefore it is EXTREMELY important that you **do not discuss your participation or any aspect of the experiment** until the end of March. By talking about the experiment you could inadvertently influence another participant or potential participant. This would compromise the integrity of the results.

Thank you for participating, your help is greatly appreciated!

Appendix J

Consent to View

Communication Research

Dr. Janet Bavelas; Dr. Daniela Damian; Trina Holt

Please indicate below the way(s) we can use the videotape made during this experiment. You can select some and not others – or none at all. Your experimenter will answer any questions you may have about these options.

Your video would be kept in a secure place and labelled only with a code number, not your name. This sheet, which connects your video with your code number, are kept in a separate place. Obviously, however, video is not anonymous to anyone who knows you or would recognize you.

Viewing and analysis by Dr. Bavelas, Dr. Damian, Trina Holt, and their assistants:	**Yes**	**No**
Playing as an example for professional audiences (e.g., at a professional conference or another university):	**Yes**	**No**
Playing for other research participants (i.e., from Psychology classes) who might rate various verbal and nonverbal aspects:	**Yes**	**No**
Playing as an example for classes at UVic:	**Yes**	**No**
Playing as part of instructional material for communication research:	**Yes**	**No**
Available on the Internet on sites restricted to professionals in the area of communication research:	**Yes**	**No**
Available to the public via Dr. Bavelas' UVic website:	**Yes**	**No**
As a still photo in a journal article:	**Yes**	**No**
Available as a CD in conjunction with a journal of communication research:	**Yes**	**No**
None of the above; please erase the tape:	**Erase**	
Name: _____	**Teams 1** Participant I.D.	
Signature: _____	_____	
Date: _____	March 1-12, 2004	

Appendix K

CMC Introduction

The purpose of this experiment is to examine **face-to-face communication** versus **computer-mediated communication** among student work **groups** who are working on two types of **tasks**.

You will spend time during the next two weeks in **computer-mediated communication** groups of **3**, working on two tasks. One task involves finding the correct answers to 100 questions about the University of Victoria and post secondary school (a.k.a. **UVic Test**). The other task involves finding Resources to Assist With Career Planning (a.k.a. The **Resources Task**).

It is possible for you to earn **money** for your good works! Each group member will receive the same amount of money. If you get 100% on the UVic Test you will get $10 each! That works out to 10 cents for each **correctly** answered question – so do your best! You can earn another $10 for getting lots of **categories** of resources (this will be scored on a "curve" based on the performance of all groups). If you participate **fully**, you can collect your money at the end of the second week. Two participation points will be given for showing up today, and the remaining 8 will be given at the end of the two weeks.

When in a group of 3…

- you will be using **MSN Messenger** to have 3-way conversations (never 2-way)
- these conversations will be:
    - saved to the computer's desktop and…
    - then emailed to the UVic WebMail account that has been assigned to you for this experiment (it will look like "teams_ _ @uvic.ca") and will contain your Participant I.D.
- how you **approach the task** as a group is entirely **up to you**

When alone…

- you may use whatever means you choose to get ideas or to do your work
- you **can EMAIL** your fellow group members using the WebMail accounts that has been assigned to them for this experiment

- you must **NOT** talk about the task or do any organising with group members **in-person** or on the **telephone**
- Emails and Chats will be read by the researchers so don't write anything too personal

On Feedback Day…

Every participant will meet with the researcher again for half an hour to:

- complete a **questionnaire** about your experiences that week
- return your own copy of the group's completed task (i.e., 3 copies per group should be handed in)
- groups don't have to come in together on Feedback Day, a sign up sheet will be provided and you can choose a time

Appendix L

CMC Procedure and Rules

Contact the Researcher

Trina Holt - with any questions. ***There is NO DECEPTION in this study – promise!***

Meetings

- a 3-way "**chat**" using **MSN Messenger** is considered a "Meeting"
- **don't** have 2-way chats
- **don't** ask the researcher to help with scheduling issues
- **save** all MSN Messenger chats to **desktop**, then **email** them to the UVic WebMail account that has been assigned to **you** for this experiment (i.e., all three of you will save the same chat to the WebMail account that has been assigned to you)
- **don't** change passwords

Working Alone

- using email and working without communicating with the others in your group is considered "Working Alone"
- **don't** meet in-person (either in 2's or in 3's)
- **don't** telephone each other
- **do** email using the "teams_ _ @uvic.ca" UVic WebMail account that has been assigned to you and your team-mates
- **don't** use personal email accounts
- **do** send attachments via email if you choose
- **don't** change passwords
- **don't** delete anything from the WebMail account. The researcher will empty the accounts at the completion of each task.

Submitting Documents

- everyone must come to **CIT 126F** on "Feedback Day" for half an hour in order to complete a questionnaire and to return the task

- groups don't have to come together for Feedback Day – you may sign up for a spot between 2 and 4PM
- each group member submits a final version of the task – that means that the researcher should receive 3 identical copies of the task
- Emails and Chats will be cleared out of the WebMail accounts at the completion of each task. These will be read by the researchers later.

Refrain from discussing any details about the tasks or about the experiment until May 2004. This is <u>important</u> because you could inadvertently influence another participant of our experiment.

Appendix M

UVic WebMail Instructions

UVic WebMail

Login Page: http://wm2.uvic.ca/

Participation I.D. is your group number, followed by the letter "a" "b" or "c" This will be consistent throughout the study.

An email account has been set up for you to use for this experiment. It will look like "teams_ _ @uvic.ca" and will contain your Participation I.D. in it.

Notice the "Quick Reference" link at the bottom of the Login Page for instructions on how to use the various features of UVic WebMail.

With regards to using email during this experiment:

- **do** use ONLY this account for anything having to do with the experiment
- **don't** share the account information with anyone
- **don't** change the password
- **don't** permanently delete anything from the account
- **don't** use Outlook or any other system that retrieves email from the UVic system.
- at the end of the week, all documents in the account will be removed by the researcher

UVic WebMail In-Person Tutorial

- Log In to your UVic WebMail account.
- Access the Address Book
- Add the email addresses of the two others in your group
- Log Out

Group: __1__

Name	#	NetLink ID for WebMail	WebMail Password	Email
	1a	teams1a	hello1	teams1a@uvic.ca
	1b	teams1b	hello1	teams1b@uvic.ca
	1c	teams1c	hello1	teams1c@uvic.ca

Appendix N

MSN Messenger Instructions

To download MSN Messenger onto a PC or MAC go to their Home Page (try out their on-line tutorial if you want!): http://messenger.msn.com

- MSN Messenger has two components to it:
    1. the part that you download that runs the program on your computer
    2. the part that is located in "cyber space" and contains all of your account information and the information of your contacts.
- The computers in the HSD and BEC student computing labs already have the first component installed on the computers (no other labs allow chat programs).
- We have set up accounts for you in "cyber space" already in the form of.NET Passport accounts.
- The information for accessing your account and for adding your team-mate's information is set out in the table below.

For the location and hours of the HSD and BEC computer labs: http://www.sfg.uvic.ca/

Use **ONLY** the **Send an Instant Message...** function (although it is fine if you want to play with text colours or emoticons)

The following table contains account information for group **1** .

Name	#	Sign In Name	Password	Display Name
	1a	teams1a@uvic.ca	hello1	1a
	1b	teams1b@uvic.ca	hello1	1b
	1c	teams1c@uvic.ca	hello1	1c

MSN Messenger In-Person Tutorial

- Open MSN Messenger on the HSD computer (Start, Programs, MSN Messenger).
- Sign In using the NetLink ID and password assigned to you for this experiment.
- Click **Tools**
- Click **Options…**
- And change your **Display Name** to your **first** name, followed by your group # and your participant letter (e.g., Trina1a).
- Add the two others in your group as contacts.
- Begin a three-way chat (once two of you have a chat window open, you must "invite" the third person into the chat).
- **SAVE THE CHAT** conversation to the desktop
- **EMAIL THE CHAT** to your "teams_ _ @uvic.ca" WebMail account

Appendix O

CMC Participation Questionnaire

Participation Questionnaire

Please answer the following questions AFTER you have completed the week's task.

Name _____ *Participant I.D.* _____

Date _____ *Task (circle one)* **UVic Test** **Resources**

1) Before reading through the rest of the Participation Questionnaire, write a paragraph or two **in your own words** – whatever comes to mind – describing **your experience** of this week's participation.

[The remaining two-thirds of the page was left with blank lines where participants wrote about their experiences.]

2) What worked **well** for you this week?

_____

_____

3) What **didn't** work well for you this week?

_____

_____

4) What did you **like** about working in the group (via MSN Messenger) this week?

_____

_____

5) What **didn't** you like about working in the group (via MSN Messenger) this week?

_____

_____

6) What did you **like** about working on the task this week?

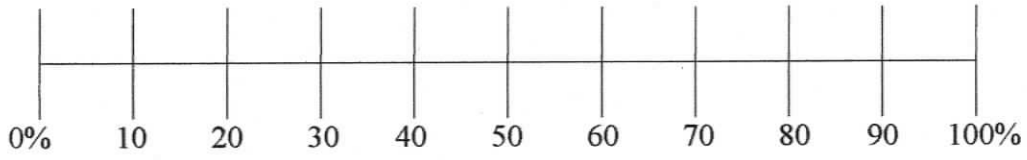
7) What **didn't** you like about working on the task this week?

8) If you had any technical difficulties this week please describe them briefly.

9) Where did you spend time working on a computer for the experiment this week?

10) About what percentage of the work do you think that **you** contributed within the group this week?

(Place a mark on the line.)



11) In what way(s) did your group **divide** up the work up this week?

12) How easy or difficult did you find **scheduling MSN Messenger meetings** with all three group members this week?

(Place a mark on the line.)

Really Easy Really Hard

13) How **anxious** did you feel about being able to get the task **done on time**?

(Place a mark on the line.)

Not Anxious — Really Anxious

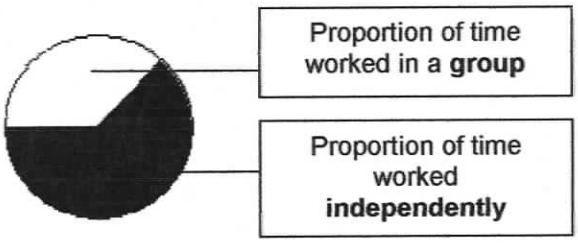
14) How many **hours** did you spend working **independently** on the task this week (i.e., NOT in an MSN Messenger chat)?

Number: _____

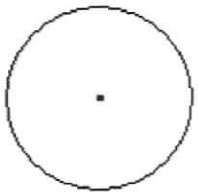
15) What proportion of time did you spend working **independently** versus working **with the group on MSN Messenger** this week?

*(Divide the circle on the **right** into proportions that show how much time you spent working with the **group** [white] and **independently** [black].)*

EXAMPLE



YOU DO THIS ONE



About UVic WebMail

16) Rate how **easy/difficult** it was to use UVic WebMail for this week's task.

(Place a mark on the line.)

Really Easy — Really Hard

17) **Describe** anything that you found **confusing** about UVic WebMail.

_____

_____

18) Rate how **likely** are you to use UVic WebMail to do collaborative work in the future.

(Place a mark on the line.)

Never Again Definitely

19) **Explain** why you **would** or why you **would not** use UVic WebMail to do collaborative work in the future.

_____

_____

About MSN Messenger

20) Rate how **easy/difficult** it was to use MSN Messenger for this week's task.

(Place a mark on the line.)

Really Easy Really Hard

21) **Describe** anything that you found **confusing** about MSN Messenger.

_____

_____

22) Rate how **likely** are you to use MSN Messenger to do collaborative work in the future.

(Place a mark on the line.)

Never Again Definitely

23) **Explain** why you **would** or why you would **not** use MSN Messenger to do collaborative work in the future.

Appendix P

UVic Information Test Scores

bold indicates that all P's scored the same
≈ indicates that two P's scored the same
≡ indicates all P's scored differently

ID	FTF Scores	ID	CMC Scores
≈12a	97.0	≈1a	85.0
≈12b	95.0	≈1b	85.0
≈12c	97.0	≈1c	50.0
≈13a	88.5	**2a**	98.0
≈13b	88.5	**2b**	98.0
≈13c	87.5	**2c**	98.0
≡14a	87.5	≡3a	75.5
≡14b	85.0	≡3b	72.0
≡14c	88.0	≡3c	84.5
≈15a	91.0	≈4a	83.0
≈15b	90.5	≈4b	83.0
≈15c	91.0	≈4c	84.0
16a	93.5	**5a**	95.0
16b	93.5	**5b**	95.0
16c	93.5	**5c**	95.0
17a	89.5	≈6a	89.0
17b	89.5	≈6b	88.0
17c	89.5	≈6c	89.0
≈19a	83.0	≈7a	84.5
≈19b	82.0	≈7b	84.5
≈19c	82.5	≈7c	86.0
≈20a	89.5	≈8a	88.0
≈20b	89.5	≈8b	86.0
≈20c	88.0	≈8c	86.0
≈21a	95.5	≡9a	93.5
≈21b	96.0	≡9b	92.0
≈21c	96.0	≡9c	92.5
22a	89.5	≈10a	72.5
22b	89.5	≈10b	73.5
22c	89.5	≈10c	73.5
	3/10		**2/10**
	≈6/10		≈6/10
	≡1/10		≡2/10

Appendix Q

Coding Instructions for the Career Resources Task

Participant's were given the following instructions:

"If you are participating in this experiment, you have chosen to pursue some kind of higher education. It's possible that you chose this path in order to obtain a specific job later on, it's possible that you are here because you know that higher education leads to higher pay, or maybe you are here because you are simply interested in learning. Whatever your reason for being here, you will join or re-join the workforce one day. Once you have your degree you will begin to look for work in your chosen profession. What are your options? How do you find out what your options are? How do you go about discovering what kinds of jobs exist in your field? **Who** or **what** can help with this exploration?

Your task for this project, is to think of what **resources** are available to you for the purpose of exploring career options. These resources may be formal or informal, obvious or novel. Come up with as many **categories** of resources as you possibly can and itemize a few examples of each. There are no "right" or "wrong" resources but whatever you come up with has to make sense. Go for as many solutions as you can but also try to "think out of the box." This is an opportunity for you to stretch your creative mental muscles.

Just to be clear, your task is **not** to come up with career options, rather, it **is** to come up with resources that can help you to come up with career options.

Submit a typed, **numbered** list. Come up with as many **categories** of **resources** and some examples of *items* that would fall into that Category. Number the categories and the items separately. The amount of money you get for this task will be determined by the number of categories you come up with."

Participants were provided with this example of how to present their ideas.

Example: List as many resources as you can where you can get help with writing a psychology paper.			
Cat#	**Category**	**Item#**	**Item and Description**
1	Writing Centre		
		1	staff – can go over what I've written and get feedback
		2	library in writing centre – there are books on writing
2	Family		
		3	my mom is a good writer – she can proofread
		4	my uncle Bob is a psychologist – he can check facts
3	Internet		
		5	www.writingpsychologypapers.com – a page with lots of tips on how to do the research for the paper
Etcetera			

As you will see, although each group came up with many of the same or similar ideas, not all groups used the same process of categorizing. It is our goal to give credit for all creative ideas for career resources, regardless of how the groups organized those ideas.

Your job now, is to go through the responses from the groups and sort each of the responses by the Master Category List that is provided. The Master Category List is a standardized list that has been created based on responses from participants. Each Category in the Master Category List has a number (hereafter, the Master Category and the number that accompanies each Master Category will be referred to as the Master #). You will be pairing each group's Category with a Master #.

The categories that participants came up with will be referred to as "P Categories" and the Items that they came up with will be referred to as "Items." In most cases, Items will be assigned the same Master # as their corresponding P Categories, however there will be several cases where Items will fall into a different Master # than the P Categories that the participants organized them under.

The following are some examples of reasons for changing the organization structure of a group's responses.

An appropriate Category is given but the Items that are listed under it actually describe a different Category, in that case we should count the Item as a Category as well.

In some cases what was listed as a Category was too broad or vague therefore the

Items within it may be counted as several different Categories.

Through the following process of standardizing each group's Categories, we will have a more accurate way of comparing all of the groups' performances.

Steps to Standardize the Categories in Participant's Responses

Have in front of you:

- a group's answers (don't make any marks on the group's answer sheets; they will be used by both raters.)
- the Rater's Responses sheet for that group
- the Master Category List
- these instructions

Read through the Master Category List thoroughly and ask for any clarifications. The more familiar you become with the list, the easier it will be to work with it. Notice that each Category has a number, a name, and a short description.

Notice that on the Participant's Response sheets (the ones with a large black number in the upper right-hand corner), there are Categories and Items. The numbering system begins with the first Category through to the last Category and then continues with the first Item through to the last Item. In this way no numbers are repeated.

Notice that the Rater's Response sheet for each group has a column called P Category # (Participant's Category #), and a column called P Item # (Participant's Item #) that reflect the way that the Participant's Response sheets are numbered. To the right of each of those two columns is a column called Master #. **Each** and **every** one of the P Categories and Items will be matched to a Master #.

Procedure for Assigning Master # 's

1. Read P Category #1. Consider what Master # that P Category #1 is most similar to. On the Rater's Response sheet for that group write the Master # next to P Category #1 on the Rater's Response sheet and praise Allah that it was that simple.

Example:

P Category #	Master #
1	34

2. Move on to the next P Category # and repeat the process until you reach the end of the P Categories. Then move up to the first Item and assign Master #'s to each Item.
3. As much as you can, treat the P Categories and Items separately. This won't be possible in all cases but do your best. If there is any ambiguity as to what Master # to assign an Item, give it the same Master # as you gave the P Category. If there is any ambiguity as to which Master # to assign to a P Category, refer to the Majority Rule and First-Come-First-Serve rules as described below.
4. This will not be simple. The Notes and Rules below will inform you as to what to do when you come across something confusing.

Notes and Rules

When an Item is Actually a Description

Sometimes the participants did not give examples of Items that fall into their P Categories (as requested) but instead chose to give a description of that P Category. For example, if the P Category was "Friends" and as an Item they said "Can support us in our endeavours" instead of something like "my best friend can tell be about her career." Obviously "Can support us in our endeavours" cannot be matched with a Master # on it's own; it MUST be taken in context with the P Category it is listed under, therefore it will be assigned same Master # as you gave the P Category.

When P Categories and It's Items Don't Share the Same Master #

Stand-Alone Rule – Sometimes Items within P Categories will fit nicely into that P Category and other times the Item could *stand on its own* in a Master # that is different from the P Category. In this case, assign the good-fit Items the same Master # as the P Category and the stand-alone items the closest matching Master # despite the fact that it

will differ from the P Category's Master #.

- Example, Group 6:
- P Category 9 states, "'JobStores' (business)" [clearly this is a Career service, Master #8]
- Item 45, "job placement" [fits into P Category and nowhere else]
- Item 46, "resume services" [yes, you would find this Item in the P Category, but it is also a stand-alone in that it very nicely fits into Master #27 "Job acquisition (hunting)"]
- Item 47, "job search" [nice fit with P Category and none other]
- Item 48, "vocational testing" [fits the P Category and is also a stand-alone Item - Master #24 "Inventory / Personality type tests" so give it #24]
- Item 49, "skills and personality assessment" [fits the P Category and is also a stand-alone Item - Master #24 "Inventory / Personality type tests" so give it #24]
- Item 50, "career option lists" [fits the P Category and none other with exceptional clarity]

P Category #	Master #	Raters Match?	Final Decision	P Item #	Master #	Raters Match?	Final Decision
9	8			45	8		
				46	27		
				47	8		
				48	24		
				49	24		
				50	8		

When a P Category is Unclear

1. If the P Category does not clearly fall into a Master #, read the Items (or descriptions) that the participants wrote beside it; sometimes the Items (or descriptions) can give you a clue as to what they were intending with that category. Look for keywords. If it is still not clear as to what Master # the P Category would fall into, you must assign a Master # based on the Item's

Master #'s. There are a hierarchy of rules to follow when this occurs.

- If all of the Items clearly fall into one Master # then give the P Category that same Master #.
- If the Items fall into more than one Master #, go with the Majority Rule and assign the P Category the same Master # as the one assigned to the most Items.
    - Example (Group 6) of Majority Rule:
    - P Category 2 states, "Newspaper" [there is no category for that but the two closest ones are Master #6 – Advertisements, and Master #7 – Non-advertisements. Look to the Items for clarity.]
    - Item 34 states, "classifieds, wanted ads" [Master #6]
    - Item 35 states, "advertisements for new businesses [Master #6]
    - Item 36 states, "stocks show what industries are booming [Master #7]
    - There are 2 Master #6's and only 1 Master #7 so give the P Category #2 the majority – Master #7.
- If there is only one Item or an even number of Master #'s within the Items, use the First-Come-First-Serve Rule and assign the P Category the same Master # as the first Item listed.

2. You may find yourself attempting to analyse each Item and example and word and syllable down to the molecular components of categories. If you begin to get this sinking feeling (signs may include facial tics, up-welling of emotion, general shiftiness, etc.) use the Take-The-High-Road, Rule-of-Thumb and try to find primary or secondary categories rather than tertiary or quaternary categories. Remember that you are not a co-author of participant's work; you are merely trying to re-categorize the ideas that they identified as career resources.

When a P Category or an Item is About the Internet

1. The internet is essentially "cyber life" and most of its websites can be mapped onto "real" life. If the category has anything to do with the internet, find what Master # would best reflect the purpose or service that the site provides and assign

the P Category (or Item) that Master # but put a small "e" in front of the Master #.

- Example from Group 6:
- P Category 28: "University Web Sites"
- Take away the words "web sites" and you have a clear fit with Master #10 – Educational.
- You should assign "e10" to that P Category.

P Category #	Master #
28	e10

2. If the participants said something about the Internet in general without making any specific reference to the particulars of a site, use the Master # e25 (Libraries / Bookstores / Internet).
3. General search engines like Google go into Master #22 (Encyclopaedias) as "e22."
4. If you are assigning an "e" to any Master #, it must be totally explicit that the P Category or Item that is being assigned an "e" has to do with the internet (e.g.: if the P Category is not clearly about the internet but its Items are, the Items would get an "e" but the P Category would not).
    - P Category #27 states, "Coop Department" [Master #4]
    - Items 64 and 65 go with it and state,
    - (64) Engineering Coop Website http://www.engr.uvic.ca/coop.html [Master #e4]
    - (65) UVic Website http://mycoop.coop.uvic.ca/ [Master #e4]

P Category #	Master #	Raters Match?	Final Decision	P Item #	Master #	Raters Match?	Final Decision
24	4			64	e4		
				65	e4		

When To Use the "To Be Discussed" Category

There are three circumstances where you may want to use Master #30, "To Be Discussed."

a) Should be in a category – you think that the P Category or Item might fit into a category but for some reason aren't certain where to put it. Perhaps you can see it fitting into more than one Master #. It's best to use the To Be Discussed category rather than just guessing which one it ought to be assigned. If both raters chose this option, it counts as an agreement (you both agreed that this was a special case for whatever reason) and both raters should discuss and agree upon which Master # would be the best fit.

b) Too vague or unclear to know (NA) – Not Analysable – sometimes there is just no way to know what the participant meant by what is written. Perhaps you could interpret it several different ways and there is just no way to "read minds" in order to classify the P Category or Item.

c) Give credit for category of their own. This was a task about creative thinking and some participants came up with some very clever things and did a great job of thinking outside of the box. If you think that the participants came up with something that just doesn't fit neatly into any of the Master #'s, give it the Master #30 and both raters can agree to credit the participants for having a category all of their own. *Note that if this is the case, the group should be credited only ONE category per original concept.

Reliability

1. Using ONE person's sheet, fill in the "Raters Match?" column (this will determine inter-rater reliability) with the other rater. Mark whichever rater's sheet that was chosen as the "MASTER."

2. Divide the number of agreements (✓) by the total number of decisions (which will be the last P Item #). On the front page, in the right-hand margin of the Rater's Response MASTER sheet, write "Reliability = XX%"

After Inter-Rater Reliability Has Been Calculated

1. Discuss disagreements and decide which Master # to assign.
2. Complete the Final Decision column of the MASTER sheet.
3. Count up how many Categories the participants came up with. The same Category should never be counted twice. Starting at with the first Master #, look down both Master # columns for duplicate numbers and circle any that you find. Move onto the second, un-circled Master # and circle any duplicates of that number. Proceed though both of the Master # columns until completed.
4. Disregard the "e" for electronic categories; treat them as though they were regular categories. The only exception to this is if a group came up with e-categories but did not explicitly come up with e25. If you see e-categories and no e25, add one category to the total number of categories.
5. Count up the number of un-circled Categories for the group and in the right-hand margin write "XX Categories."

Appendix R

Rater's Responses Sheet (Sample) For Coding the Career Resources Task

Group 1 Rater's Responses

Rater's Name: _____ Page __1__ of __1__

P Category #	Master #	Raters Match?	Final Decision	P Item #	Mater #	Raters Match?	Final Decision
1				17			
2				18			
3				19			
				20			
4				21			
				22			
				23			
5				24			
				25			
6				26			
				27			
7				28			
8				29			
				30			
9				31			
10				32			
				33			
				34			
11				35			
12				36			
13				37			
				38			
14				39			
15				40			
16				41			

Appendix S

Master Category List for the Career Resources Task

	Category	Description
		Activity
1	Career fairs	Any large gathering of potential employers and employees to do with employment in general or specific industries for the purpose of recruitment or career information dissemination.
2	Courses / Workshops / Lectures / Seminars / Forums / Support groups	A group of people get together for the purpose of learning, discussing, support, etc.
3	Indirectly related	Personal growth, clubs, hobbies, sports, meditation, good grades, journaling, travelling, asking self, spiritual development, religion, psychics, etc.
4	Job sampling	Co-op, job-shadowing, volunteering, paid/unpaid, summer jobs, international exchanges, getting to know potential clients (e.g.: children, elderly, etc.)
5	Psychology experiments	Like this one!
		Organisations
6	Advertising - Job banks / listings / classifieds	Any media that can advertise for 2+ employers (e.g.: bulletin boards, telephone poles, newspaper classified, anything that uses the term "recruiting")
7	Non-advertising	Any media that is NOT an advertisement (e.g.: news, sitcoms, documentaries, films, videos
8	Career services	Employment Counsellors / Agents /Agencies –school run, privately run, career counsellors, career coaches, job centres, temp agencies, etc. Websites such as Workopolis and Monster go here too (e8).
9	Company specific – potential work places / people / resources	Inquire at a place you may want to work. Talk to people who work there, employers, HRD, info sites (e or other), in-house or public promotions and postings specific to that workplace.

10	Educational	Universities, profs, instructors, TA's, faculties, departments, resident advisor, alumni, other students (not friends), etc. (except advisors – academic or employment counsellors have assisting w job/career advice as a part of their job description – that goes under Career services).
11	Government	To work for, to get $$ from, to get info from, etc. Community planner, stats Can, military, recruiting, disability stuff, etc. Any level of govn't. (* if stats are listed but their origin is unspecified, put it here)
		People
12	Family	Must have a "family" term in there somewhere. Supersedes any other potential category if "family" is mentioned.
13	Friends	Be liberal with this one – family friends, "Joe", friend of a friend, etc. Supersedes any other potential category if "friend" is mentioned.
14	Mentor / Mentoring programs / Trainers	Hands-on teaching of one individual who is dedicated to teaching another individual about a job or specific career.
15	Networking generally	Word of mouth, strangers, unspecified people – fall-back category for people that don't fit neatly elsewhere
16	Personal employment experiences	Past or present. People and resources whom you have worked with.
17	Professional advocacy organizations	Unions, Canadian Psychological Association, Plumbers of America, Tri-Counsel of Canada, etc. (any publications like journals would go in "Industry Publications/Profiles" category).
18	Role models	Could be known personally or not.
19	Workers in area	People who work in an area that you are interested in – you would talk to them for info gathering purposes rather than to be hired specifically.
		Written
20	Books - other	Unspecified or not in other "book" categories
21	Computer programs	Download/install onto your personal computer.
22	Encyclopaedias	Paper or electronic (general search engines like Google go here).

23	Industry Publications/Profiles - Descriptive	Books, reports, or journals to do with the industry or career area (i.e. NOT books to do with careers in general or career exploration – they go in "Occupation guidebooks" category).
24	Inventory / Personality type tests	Online or offline (if stated as being on-line, put the item in THIS category, not the internet category).
25	Libraries / Bookstores / Internet	Libraries – public or private, bookstores, public or private. Internet cannot be mapped stuff goes here too.
26	Occupation guidebooks – geared for employment	Books listing, describing, discussing occupations.
	Other	
27	Job acquisition (hunting)	Anything to do with resumes or interview skills.
28	Financial aid	Non-govn't – banks, family, friends, etc.
29	Career portfolio	Put together a portfolio of your past jobs, resumes, and interests and see how they all relate to job interest.
30	To Be Discussed (TBD)	a) should be in a category b) too vague or unclear to know (NA) c) give credit for category of their own

Appendix T

Inter-Rater Reliability, Scores, and Percentages for the Career Resources Task

CMC				FTF			
Group	IRR*	Score	Score/27	Group	IRR*	Score	Score/27
1	83%	11	41%	12	90%	15	56%
2	80%	15	56%	13	-	19	70%
3	65%	7	26%	14	69%	17	63%
4	-	17	63%	15	91%	11	41%
5	76%	17	63%	16	65%	27	100%
6	-	14	52%	17	86%	13	48%
7	79%	21	78%	19	78%	19	70%
8	78%	14	52%	20	88%	16	59%
9	-	17	63%	21	81%	20	74%
10	-	11	41%	22	63%	17	63%

* Inter-Rater Reliability (IRR)

Appendix U

Instructions for Coding "What worked/did not work well...?"

Groups of three met to do collaborative work in either videotaped, face-to-face (FTF) groups, or in computer-mediated communication groups (CMC) (they used email and text-based chat programs to communicate). They were allowed to work in their groups, as defined by the experiment, or independently. In the CMC groups, "working in a group" meant having a three-way conversation using MSN Messenger, but using WebMail (UVic's email system) was considered "working independently." FTF groups were able to meet anytime between 8:00 a.m. and 8:00 p.m. They participated for two weeks. Each week they collaborated on one of two particular tasks.

One task was the UVic Information Test, which consisted of 100 questions about UVic to which there was only one correct answer per question. Another was the Career Resources Task, which required participants to come up with as many ideas as they could about resources that could help them with a career search. That is, resources that could help or places where they might find information about careers.

At the end of each week they filled out a questionnaire. Two of the questions on that questionnaire were, "What worked well for you this week?" and "What didn't work well for you this week?" I have compiled all of the answers to these questions in a document entitled, PARTICIPANTS' ANSWERS. There are three columns in this document. The left hand column contains the participant's identification number, the middle column contains the responses to "What worked well for you this week?", and the right hand column contains answers to the question, "What didn't work well for you this week?"

I also created a document called CATEGORIES. The CATEGORIES document is a standardized list based on responses from participants. Each category on the list has been assigned a number. Your job is to match each item in the PARTICIPANTS' ANSWERS document with a number from the CATEGORIES document.

You will also have a RATER document which has a table on it that corresponds to each cell in the PARTICIPANTS' ANSWERS document. Read what the participant wrote and find the best match for it in the CATEGORIES document. Write the category number(s) in the corresponding cells of your RATER document.

Steps to Standardize the Categories in Participant's Responses

1. Have the following documents in front of you:
    - INSTRUCTIONS
    - CATEGORIES
    - PARTICIPANTS' ANSWERS
    - RATER
2. **Read through the** CATEGORIES **document thoroughly and ask for any clarifications. Become very familiar with it.** You will notice that some categories are similar so be aware of the differences, it will save you tonnes of time later. The better you know this document, the easier this job will be.
3. Read the first entry of the document.
4. Consider what category(s) from the CATEGORIES list that the item(s) is(are) best matched with.
5. Write the category number(s) you chose in the corresponding cell on the RATER document.
    - Notice that a participant may have written more than just one item that s/he felt worked well, or more than one item that s/he felt didn't work well. Each item should be given one, and *only* one, corresponding category number. Thus, some cells will have more than one number in them.
        - Write the numbers down in the same order as the items are listed in.
        - Sometimes separate items are from the same category (e.g., "Getting to know team mates, being prepared for our meetings" might both go into category #1 – Groupwork [social aspects, and coordination]). When this is the case, you should mark down the same category # for each separate item (e.g., "1,1").
        - If a general statement is elaborated on, do not count the general statement, only count the elaborations. For example: "Most of what my team did worked well. We were always able to arrange a good time for all three of us to meet [category #5 – time/scheduling] and agree on

how to go about accomplishing the task [category #1 – groupwork/cooperation]." The second sentence elaborated on WHY the group worked well. In this instance, you would write down 5, 1.

- ♦ Tip: periods and commas often distinguish items – although this is not always the case, sometimes two sentences are about the same item.
- ♦

- Some participants did not list anything. You will find a dash (-) in the corresponding cell on the RATER document. No action is required of you.
- Be aware that some answers in the "worked well" column are really things that ***didn't*** work well, and vice-versa. Count them as such by placing the category number for the item that was listed in the "worked well" column into the "didn't work well" column (or vice-versa). Make a note of the column swap by circling the number.
- When you see notations in square brackets, it indicates that they are *my* words [Trina], not the participants' words.

Calculate Reliability

3. Compare the two rater's responses and write down the number of matches (both raters chose the same number, both raters circled the same item [regardless of agreement on the category]), and disagreements.
4. Divide the number of agreements by the total number of decisions (matches plus disagreements) to obtain the inter-rater reliability.

Disagreements

6. Discuss disagreements and come to a mutually acceptable category. Make a note of what the final decision is on one of the rater's RATER documents.

Appendix V

Participants' Computer Familiarity Summary Tables

Table V7

Frequency of Text Messaging

How often do you use any instant messaging CHAT PROGRAM (e.g., MSN Messenger)?	Frequency		Percentage	
	FTF	CMC	FTF	CMC
Never	3	1	10.00%	3.33%
Yearly	3	0	10.00%	0.00%
Monthly	1	0	3.33%	0.00%
Weekly	2	4	6.67%	13.33%
Once per day	6	8	20.00%	26.67%
More than once per day	15	17	50.00%	56.67%
n	30	30	30	30
N	60		60	

Table V8

Type of Text Messaging

What instant messaging CHAT PROGRAM do you use?	Frequency		Percentage	
	FTF	CMC	FTF	CMC
None	3	1	10.00%	3.33%
MSN Messenger	27	28	90.00%	93.33%
Yahoo	0	0	0.00%	0.00%
ICQ	0	0	0.00%	0.00%
America On Line (AOL)	0	1	0.00%	3.33%
n	30	30	30	30
N	60		60	

Table V9

Frequency of Campus Computer Lab Use

How often do you usually use the **campus** computer lab(s)?				
	Frequency		Percentage	
	FTF	CMC	FTF	CMC
Never	5	4	16.67%	13.33%
Yearly	4	5	13.33%	16.67%
Monthly	8	6	26.67%	20%
Weekly	11	12	36.67%	40%
Once per day	1	2	3.33%	6.67%
More than once per day	1	1	3.33%	3.33%
n	30	30	30	30
N	60		60	

Table V10

Awareness of UVic Computer Department's T-Drive Service

Are you aware that UVic had designated memory space for you on the **T-drive**?				
	Frequency		Percentage	
	FTF	CMC	FTF	CMC
No.	25	19	83.33%	63.33%
Yes, but I have never used it.	2	3	6.67%	10.00%
Yes and I've used it in the past.	3	8	10.00%	26.67%
Yes and I use it regularly.	0	0	0.00%	0.00%
n	30	30	30	30
N	60		60	

Table V11

Type of Operating System Used at Home

If you own a computer, indicate what **operating system** you use.	Frequency		Percentage	
	FTF	CMC	FTF	CMC
Windows XP	21	14	70.00%	46.67%
Windows 2000	3	4	10.00%	13.33%
Windows 98	2	2	6.67%	6.67%
Windows NT	0	1	0.00%	3.33%
Windows Me	1	1	3.33%	3.33%
Windows 95	1	1	3.33%	3.33%
Mac OS X 10.3 or later	0	4	0.00%	13.33%
Mac OS 9.2.2 or later	0	1	0.00%	3.33%
I don't know	2	2	6.67%	6.67%
n	30	30	30	30
N	60		60	

Table V12

Type of Internet Connection Used at Home (Speed)

If you own a computer, indicate what type of **internet connection** you have	Frequency		Percentage	
	FTF	CMC	FTF	CMC
None	1	0	3.33%	0.00%
Dial-up (slow phone line)	0	0	0.00%	0.00%
Cable	14	15	46.67%	50.00%
ADSL (fast phone line)	8	8	26.67%	26.67%
ResNet (UVic Residences-fast)	7	6	23.33%	20.00%
I don't know	0	1	0.00%	3.33%
n	30	30	30	30
N	60		60	