EFFECTIVE USE OF CLASSROOM TECHNOLOGY IN THE CANADIAN FORCES: DETERMINING THE INSTRUCTORS' KNOWLEDGE OF AND ASCRIPTION TO USE OF TECHNOLOGY

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Effective Use of Classroom Technology in the Canadian Forces:

Determining the Instructors' Knowledge of and Ascription to Use of Technology

by

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Abstract

There is a common perception that Canadian Forces (CF) instructors do not effectively employ classroom technologies. Based upon initial research, it appeared that instructor training might be part of the problem. Accordingly, a study was conducted to look at CF instructors' knowledge of and ascription to the use of classroom technologies. Using a small convenience sample of CF instructors and interviews with Instructor Supervisors, Standards personnel and Training Development Subject Matter Experts the research concluded that CF instructors have insufficient knowledge and skill in the employment of classroom technologies. However, they have a positive attitude towards using technology. The study also found two barriers to effective employment of classroom technologies: a lack of training, and a lack of evaluative infrastructure. The study recommends further research to identify the required technology competency standard, determine any training requirements, and establish an evaluation framework.

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CHAPTER ONE: INTRODUCTION

Background

During the time of this research, the majority of training and education within the Canadian Forces (CF) was managed with the Canadian Forces Individual Training and Education System (CFITES). Within CFITES, the quality, quantity and resources of individual training and education[1] (IT&E) was managed in a systematic, performance-oriented manner that made optimum use of available resources to produce the required number of CF members with the appropriate qualifications at the right time to perform their assigned duties (Department of National Defence [DND], 2004). Within the CF, a Training Establishment (TE)[2] generally conducted IT&E. The TE was structured and organized to carry out the roles and functions that had been assigned to it. The structure of the establishment varied according to its role, size and functions (DND, 1997a). While roles and structures may have differed, TEs relied on a single common element in order to complete their mission, the instructor.

As in the civilian training and education community, the instructor was the interface between the student and the learning content. According to the Manual of IT & E, Volume 13 (DND, 1997a), the instructor was identified as the "backbone" of the TE with direct contact with learners. The instructor's responsibilities included activities such as: preparing lesson plans based on the Training Plan (TP); instructing based on the lesson plan; monitoring individual course member progress; advising the Standards

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[1] Individual training and education meant all instructional activities provided to CF members that impart the skills, knowledge and attitudes required to perform assigned duties (training) as well as exercise sound judgment and correctly interpret information (education).

[2] This was a CF school or college, operational unit or distributed learning centre responsible to design, develop, deliver and evaluate instructional programs, as directed by higher authority.

section of student difficulties; providing remedial instruction; maintaining good order and discipline in the classroom; administering tests and performance checks as required; maintaining learner progress files; and providing information to Standards section personnel on the design of IT&E.

CF Instructors held what has been described as perhaps the most important job in a peacetime armed force (DND, 1997a). CF IT&E was focused towards successful fulfilment of the mission. This often entailed a very high degree of skill and knowledge. Further, for many of the graduates of CF IT&E, it was likely that they would have been required to use their skills and knowledge in high risk, life-threatening situations under extreme environmental and psychological conditions. The consequence of error was believed to constitute mission failure that could lead to serious injury or death to either the individual or others. Accordingly, the CF instructor needed to ensure that the student had been trained to the required standard to provide the graduate with the best possible opportunity to complete the tasks assigned.

Working against this aim was that fact that the CF instructor was not viewed as a training and education professional. The required knowledge and skills to be an instructor could be learned and practiced (DND, 1997a). Therefore, a number of specialty courses had been developed to provide instructional knowledge and skill.

The typical instructor received five days of training in preparation to assume their new role. Occasionally, an instructor may not have received any training at all. In short, this translated to individuals who generally were not prepared for every eventuality and tended to lack initial confidence. However, since most instructors were tasked to conduct training related to their primary occupation, the lack of instructional

experience was sometimes offset by their expertise in the material. As noted in the Manual of IT&E, Volume 13 (DND, 1997a), there was also a support infrastructure established around the instructor which included development assistance, preparation assistance, supervision, training development advisors, standards support, and, where appropriate, locally produced or specialty training to meet unique needs of the occupation or the TE.

One of the areas where it appeared that the CF was not appropriately supporting the instructor was in the training required for use of the latest educational technology. Given that there was a significant military legacy and substantial investment in training technologies, this was somewhat paradoxical. It was common knowledge within the training and education community that the military had been a major player in advancing the state of the art in educational technologies (Office of Technology Assessment, 1998). Much of the early and ongoing work in programmed instruction, computer-assisted instruction, simulation, instructional systems design and intelligent tutoring systems had been advanced as a result of significant military contributions (Fletcher & Chatelier, 2000). The CF was no exception, having made a significant investment in the design, development and implementation of numerous technological innovations to improve the efficiency and effectiveness of training. Many of the challenges facing the training system were driven by the explosive growth in technology and in new approaches to warfare (DND/CF Symposium Working Group, 2000). The CF training system had responded in support of this growth. CF schools and classrooms were generally considered to be "technology rich" by industry standards. There was a wide range of training technologies employed, from portable computers (PCs) to full

mission simulators. There was also sufficient technical and leadership support for the integration of technology into the classroom:

> The CF has put a lot of this technology into place, it has accumulated an enviable knowledge base on its practical application in a training environment. In short, there is a surprising amount of stability in the midst of change, with the CF poised to build on previous success. (DND/CF Symposium Working Group, 2000, p. 41)

Technology had been acquired and placed in training establishments with the requisite support infrastructure.

Comparatively, the CF had a tremendous advantage over most academic institutions in the level of technological support for learning, as the investment in the introduction of these technological training solutions was considerable. Despite this investment in technology, it appeared that instructor training had not kept pace with technological change. Anecdotal information and personal observation indicated that many CF instructors tended to use classroom technology in a very traditional sense, using simple multimedia presentations to support lecture-type instruction.

As previously indicated, CF instructors were not training professionals. They would normally have had five or more years of service and were considered to be experienced and competent in their occupation. Most CF instructors had been provided training in basic instructional techniques. This training had focused on lesson plan development and delivery using lecture and demonstration instructional methodologies. There had been limited instruction in the use of technology. According to the

occupational specialty specification (OSS) Instructional Techniques (AHCH[3]) (DMHRR, 2004a), the instructors had been required to independently operate training equipment, employ training aids, and had a comprehensive knowledge of electronic presentation media. However, the training that had been provided to meet this specification had not gone into depth on the effective use of technology.

A considerably smaller percentage of the instructor population had participated in Advanced Instructional Techniques training (AIMU[3]) (DMHRR, 2004b). This training had focused on more interactive methodologies such as small group activities, case study, and guided discussion. However, it had not extended training in the use of technology for instruction. Finally, approximately 1% of the CF instructors had participated in training focused on particular methods that used technology (DND Human Resource Management System, 2006). Specifically, the Simulator/Trainer Instructor Course (AIUQ[3]) (DMHRR, 2003), and the Distributed Learning Instructor Course (AIMO[3]) (DMHRR, 2001), addressed specific forms of technology and required skilled use of that technology in order to achieve the objectives, but had not dealt with the available classroom technology. Other application-specific training had also been offered. This training had not been conducted with instruction in mind. Rather, this training focused on routine use of standard software applications, such as word processing, presentation or spreadsheet applications.

As demonstrated, although technology was widely employed in the CF, there had been very limited training for CF instructors in the use of technology in the classroom. Lack of training was one potential cause for the low level of instructor engagement in

[3] AHCH, AIMU, AIUQ and AIMO are four letter course codes used for categorization of military courses.

technology. However, it would have been a mistake to assume that this was the only cause. There were a number of other issues. For example, it was widely understood that instructor beliefs about teaching and learning play a critical role in the successful use of technology in the classroom (Czerniak, Lump, Haney & Becky, 1999; Demetriadis et al., 2003). The common view held was that instructors needed adequate training in the technology, but they also needed to understand its relevance (Knowles, 1984) and how to integrate it seamlessly into the curriculum. In short, they needed to know how to apply the technology, but they also needed to believe that its use could lead to more effective instruction and create a better learning environment.

Purposes of the Study

At the time of the study, there had been no CF studies to capture this information and help form a clearer picture of the instructional environment. Legassie's (1999) study had focused on the trainee's reaction to use of training technology in the Canadian Navy. One aspect of his study measured the attitudes of instructors. Of the instructors surveyed, he found that the majority were confident or very confident with technology and that they also maintained a favourable impression regarding use of technology. He recommended further study in this area, but none was conducted.

If there were issues that needed to be addressed with respect to the instructors' training, education, or attitudes, there was no data beyond the peripheral investigation by Legassie (1999). Since the data in this previous study was dated and only dealt with instructors in broad terms, it was insufficient to provide a more telling description of the changing situation. Accordingly, further study was warranted to establish what might be the prevalent views of instructors on the use of technology in the CF classroom. The

aim of this study was therefore to identify the CF instructors' knowledge of and ascription to use of technology in the CF classrooms.

Significance of the Study

This study was justified on three accounts. First, there was an operational imperative. The majority of CF training was performance-oriented and was particularly concerned with enhancing CF capabilities to engineer reliable training outcomes (Fletcher & Chatelier, 2000). All instruction was therefore focused on essential skills, knowledge, and attitudes required to meet operational requirements and Departmental performance goals. (DND, 1997b). This meant instructors were accountable to produce graduates who could reliably meet the standard expected on the job. The instructors were also expected to create an environment in which the students could effectively learn. Any degraded instructional performance could have had serious impacts on the student's ability to learn and the graduate's ability to perform the job. Ultimately, this could have jeopardized attainment of the operational objective. So, there was a need to ensure effective instruction.

Second, there was a financial imperative in that the CF had a financial and organizational investment in training, from which there was an expected return on investment (ROI). The ROI was demonstrated in terms of quality and quantity of student throughput from TEs. As within the civilian community, there was increased requirement for accountability (Beaty, 2006), due to greater discourse on student-centred learning, increasing operational requirements, and a greater demand on existing resources. There was also increasing interest in the quality of the student experience and

efficiency of the process. If any of the required elements within the training system were not effective, it would have impacted on the quality and/or quantity of students and, consequently, it would have reduced the ROI.

Third, there was a cultural imperative. The CF's dependence on training technologies would continue to grow (DND/CF Symposium Working Group, 2000). Modern warfare was becoming more technologically based, and there was increasing pressure within the military to integrate technological elements into training. Instructors needed to be comfortable with the new technology and integrate it into their daily work. A further cultural dynamic was that the new generation of recruits were more technologically savvy and had diverse learning experiences. Without proper employment of the available technologies, some recruits were being left with the perspective that CF training was archaic and this cast doubt upon the instructors' credibility. While the CF had been moving forward, it appeared that the instructors had been slow to adopt new technologies and had not been keeping pace with the remainder of the CF culture. Instructors needed to adapt and technologically evolve with the remainder of the CF in order to remain credible, both within the CF and within the training and education community at large.

CHAPTER TWO: RELATED LITERATURE

Introduction

A review of related literature showed that the Canadian Forces (CF) was not the only organization where technology was not necessarily effectively employed in the classroom setting. Ayers and Grisham (2003) asserted that regardless of the tremendous investment in technology, the vast majority of classes in many of the academic institutions were proceeding as they have for generations. McNabb, Valdez, Nowakowski, and Hawkes (1999) stated that the majority of the civilian training and education community was still casual or non-users of technology. The Office of Technology Assessment Report on Teachers and Technology (1995) painted a similar picture on teachers' use of technology. It was not that the training and education community had not adopted technology. Similar to the CF, many education and training organizations had invested heavily in technology. However, merely introducing technology into the instructional environment would not change the teaching and learning process (infoDev, 2005). Within the CF and many other training and education settings, the presence of technology had not impacted instruction beyond the predominant use of technology for the simple visual presentation of information. This minimal use of classroom technology had simply tended to reinforce traditional pedagogical practice (infoDev, 2005).

One of the reasons for the failure of many educational practitioners to adopt technology appeared to be related to organizational barriers (Ayers & Grisham, 2003; Butler & Sellbom, 2002; Chizmar & Williams 2001). These barriers typically included

a lack of organizational support, reliable equipment, resources, and training and professional development.

From the CF's perspective, many of these barriers had been overcome (Department of National Defence (DND)/CF Symposium, 2000). Yet, the existing level of use by CF instructors was generally at *Awareness* on Moersch's (1995) Level of Technology Implementation (LoTi) scale. Awareness was typified where the use of computers was generally one step removed from the classroom teacher. While computers and their associated applications may have been used for personal productivity or administrative purposes, they generally had little or no relevance to the individual teacher's instructional program.

An important objective for the literature review was then to: help define the dynamics in the adoption of technologies, including those related to instruction; discuss issues relevant to individual acceptance and use; identify potential instructor needs; and review potential standards and measures of use.

Adoption of Technology

In researching technology use, it was important to understand the context of adoption of technology within an organization. The following will review some of the literature on adoption of technology within an organization and within the instructional environment.

In his seminal work *Diffusion of Innovations,* Rogers (1995) presented his views on the adoption of innovations within an organization or group over time. He discussed individual roles assumed in the adoption process through innovators, to early adopters, then to early majority, followed by the late majority and the laggards. He described

innovators as those who seek out innovation out of personal need or interest. They were the individuals who introduced new ideas into their organization or social system. The *early adopters* were those receptive to new ideas and were the first segment of the organization to adopt an innovation on a large scale. They tended to move the innovation from the periphery and test the innovation for use within the organization. They were often sought out for their advice on the innovation. The next group were the *early majority.* They waited for the response and acceptance by the early adopters before adopting it themselves. The final two groups were described as the *late majority* and the *laggards*. These groups normally comprised half of the population in any given organization or group and adopted the innovation only when it became necessary. Understanding these various individual roles in the adoption process aided in appreciating the perspective of the individual CF instructors, and helped define where the general population was located along this continuum of adoption.

Johnson, Gatz, and Hicks (1997) introduced perspectives on adoption and specifically related it to technology transfer. They defined technology transfer in terms of movement of technology from the site of origin to the site of use, and discussed issues concerning the acceptance and use of the technology by the ultimate end user. They presented a model of technology transfer where the technological activity was introduced based on user needs and developer goals. The technological activity was then filtered through the many potential barriers that might have impeded the transfer and diffusion process, and was then finally transferred or adopted into the organization. They asserted that adoption was not successful until the technology had been transferred, accepted, and used by the end user. The success of the transfer depended on

a number of aspects, but they suggested the way in which the technology was transferred might have had a bearing on adoption, acceptance and consequent use.

Swanson (1994) specifically discussed information system (IS) adoption and diffusion within organizations. He described IS innovation as "innovation in the organizational application of digital computer and communications technologies" (p. 1072). He also indicated that IS innovations can be mapped on two basic dimensions: business impact, and technological and organizational feature composition (where organizational features represent the new human work or the changes to work represented by the IS innovation). He also helped to define IS adoption in more specific terms by distinguishing between process and product innovation. One of the concepts that Swanson introduced was the role of the secondary adopter in the diffusion of IS within an organization. Ramiller and Swanson (2003) defined secondary adoption as adoption by end-users, contingent on the wider organization's decision to adopt. This was a particularly relevant concept in education and training settings where IS had been acquired with the intent of improving either efficiency or effectiveness of instruction, but where the educators had not been engaged and the technology had not been acquired with instruction specifically in mind.

Zmud and Apple (1990) presented a more detailed Information Technology (IT) implementation model. It was a staged model, based on Lewin's (1952) change model, and accounted for post-adoption behaviours in the implementation of IT. The first of the five stages was *initiation*, which encompassed responding/researching the potential problem or opportunity. The second stage was *adoption*, where the decision was made and resources were invested in the IT. The third stage was *adaptation*, where the IT was

installed, maintained, trained and available for use. The fourth stage was *acceptance*, which was typified by an organization that was committed to the IT, and where there was evident use. The fifth stage was *routinization*, where the application of IT was encouraged and was no longer out of the ordinary. The sixth and final stage was *infusion*, where the IT resulted in increased organizational effectiveness and was used to its fullest potential (Zmud & Apple, 1990). In their view, mere adoption did not mean that the organization was using the technology or innovation to its potential. Their model provided additional insight into the potential progression of implementation of technology within an organization, and established general criteria upon which organizations could measure the success of adoption.

For the purposes of this study, the emphasis was on the instructional environment. Two particular models were relevant. First, Moersch (1995) created a Levels of Technology Implementation (LoTi) Framework, as summarized in Table 2.1. This more detailed framework provided a basis for organizations to gauge a teacher's adoption and integration of technology.

Table 2.1 - Moersch's Levels of Technology Implementation (LoTi)

Level	Brief Description
Nonuse	A perceived lack of access to technology-based tools or a lack of time to pursue electronic technology implementation. Existing technology predominantly text-based.
Awareness	Use of computers is generally one step removed from the classroom teacher. Computer-based applications have little or no relevance to the individual teacher's instructional program.
Exploration	Technology-based tools serve as a supplement to existing instructional programs. It is employed either for extension activities or for enrichment exercises.
Infusion	Technology-based tools augment selected instructional events.
Integration (mechanical)	Technology-based tools are mechanically integrated and aid the teacher in the daily operation of the instructional curriculum.
Integration (routine)	Technology-based tools are easily and routinely integrated. It is perceived as a tool to identify and solve authentic problems relating to an overall theme/concept.
Expansion	Technology is extended beyond the classroom. Classroom teachers actively elicit technology applications and networking from external organizations to expand student experiences.
Refinement	Technology is perceived as a process, product, and tool for student use. Technology provides a seamless medium for info queries, problem solving, and product development. Students have ready access and understanding of available tools.

Second, Lengel and Lengel (2006) also referred to integration of technology within an instructional setting. Referencing the Apple Classrooms of Tomorrow (ACOT) study, they described the five stages through which a teacher progressed to attain optimum use of technology in the learning environment:

1. entry - awareness but do not get involved,
2. adoption - adopts those tools that make sense to them, normally associated with personal productivity,
3. adaptation - uses with students, typically one or two applications only and an additionally layer onto existing teaching,
4. appropriation - uses as many as available to address curriculum concerns and sometimes missing curriculum requirements in their zeal, and

5. innovation - selective use of technology and a return to a curriculum focus where the technology is being integrated into instruction where it enhances learning.

Regardless of the natural progression identified, they alluded to the tendency of leadership to ask teachers to adapt before going through all of the stages of adoption. They drew a parallel to Piaget's Stages of Development, indicating that the process is evolutionary, proceeding from the lowest to the highest and that stages could not be skipped. They also indicated that it was not all inclusive: "You can reach the innovation stage with one set of technology tools but when a new tool appears on the horizon you are likely to react from an entry standpoint" (Lengel & Lengel, 2006, p. 16).

As shown, adoption of an innovation within an organization tends to progress through stages and not all individuals adopt an innovation at the same time. Many dynamics impact on the speed with which an organization adopts an innovation. The models presented established the means to describe the level of adoption within an organization in broad terms. In particular, Moersh's (1996) Level of Technology Implementation and Lengel and Lengel's (2006) stages of technology integration applied specifically to the instructional environment.

Individual Acceptance and Use

In the study of information technology implementation in organizations, there has been a proliferation of competing explanatory models of individual acceptance of information technology (Venkatesh et al., 2003). At the core of each of these concepts was the inherent dynamic that individual factors impact on the level of adoption of any

technology. The following review some theories and perspectives related to the individual acceptance and use of technology.

In discussion of individual acceptance of technology, an individual's concerns about any given technology had been identified as a significant influencing factor in the degree of acceptance and use (Hall & Loucks, 1978, as cited in Johnson et al.,1997; Venkatesh, 1999; Xia & Lee, 2000). As discussed with the adoption models above, individuals have different concerns about innovations and proceed through various stages before they fully accept the change (Hall and Loucks, 1978, as cited in Johnson et al., 1997).

Davis, Bagozzi, and Warshaw (1989) noted in their research that end users were often unwilling to use available computer systems even if their use would generate significant performance gains. To help explain this dynamic, they conducted research using Davis' Technology Acceptance Model shown at Figure 2.1 (1986, as cited in Davis et al., 1989). Their research provided three main insights:

1. computer use could be reasonably predicted from people's intentions,
2. perceived usefulness was a major determinant of people's intentions to use computers. Perceived usefulness was defined as the users belief that using the specific technology would increase their performance, and
3. perceived ease of use was a significant secondary determinant of people's intentions to use computers. Ease of use identifies the degree to which the prospective user expects the technology be free of effort.

In short, Davis et al. (1989) asserted that the technology must be perceived as useful by the end user and must also be perceived as easy to use. These perceptions impact on the

end-users' attitude towards the use of the technology and their ultimate use of the technology.

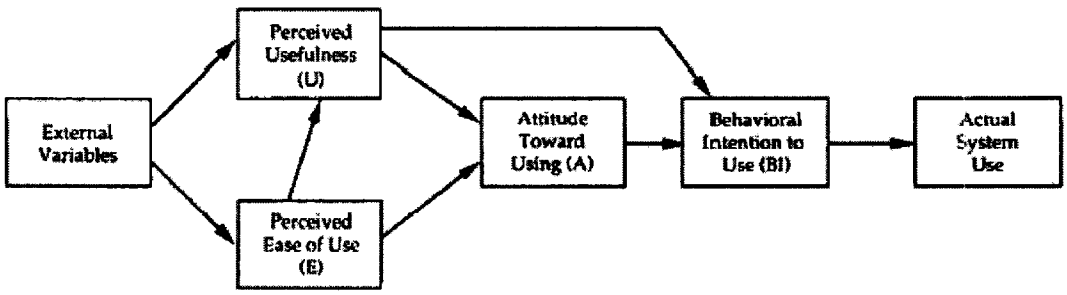

Figure 2.1 - Davis' technology acceptance model

Pursell (1993) also suggested that the appropriateness of a technology influences the transfer of an innovation. He indicated that appropriate technologies were inexpensive, easily maintained, suitable for small-scale application, compatible with one's need for creativity, and were relatively easy to learn to use (Pursell, 1993). "Appropriate technologies are those that match the needs and wants of the individual or group receiving the technology" (Johnson, et al. 1997, p. 43).

Rogers (1995) discussed similar dynamics identifying five characteristics, as perceived by individuals, which helped to explain the rate of adoption and acceptance of an innovation:

1. relative advantage - the degree to which an innovation is perceived as better than the idea it supersedes.
2. compatibility - the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of the potential adopters,

3. complexity - the degree to which an innovation is perceived as difficult to understand and use,
4. trialability - the degree to which an innovation may be experimented with on a limited basis, and
5. observability - the degree to which the results of an innovation are visible to others.

Another aspect of individual adoption introduced by Rogers (1995) was the social dynamic of acceptance and adoption through Generalization 8-18 that stated "An individual is more likely to adopt an innovation if more of the other individuals in his or her personal network have adopted previously" (p. 322).

In their work towards developing a unified view of user acceptance of IT, Venkatesh, Norris, Davis and Davis (2003) merged the relevant aspects of user acceptance models. They presented three basic concepts underlying user acceptance models: individual reactions to using information technology, intentions to use information technology, and actual use of information technology. These concepts were used as the basis for development of their Unified Theory of Acceptance and Use of Technology (UTAUT). Their subsequent research identified three direct determinants of intention to use (performance expectancy, effort expectancy, and social influence) and two direct determinants of usage behaviour (intention and facilitating conditions). They posited that the UTAUT underscored the potential relevance of social influence and highlighted the importance of contextual analysis in developing strategies for technology implementation within organizations.

In specific reference to teaching and instruction, there was a great deal of literature that asserted that a teacher's beliefs are strong indicators of their classroom practices; this includes their use of technology. (Czerniak et al., 1999; Dirkx, Kielbaso & Smith, 2004; Kotrlik & Redmann, 2005; Mooij & Smeets, 2001; Pajares, 1992; Wang, 2002). Zhao and Cziko (2001) supported this view and emphasized that teachers and instructors must believe that technology can more effectively achieve or maintain a higher-level goal than what has been used, that using technology will not degrade other higher level goals considered more important than the one being maintained, and that they have the ability and resources to use technology. They further suggested that if these conditions are not met, teachers may introduce the technology into the classroom, but may not effectively use it.

Individual acceptance and use, as defined by the literature, was predicated on a number of factors largely based on organizational influence and individual perceptions of how the technology will impact on them. Individuals needed to understand, accept, and ultimately define the applicability on the introduced technology within their own personal context. This was shown to be equally true in the teaching and instruction context.

The Instructors' Needs

As identified, one of the key factors leading to individual acceptance was the individual's perception of how the technology will impact on them (Johnson et al., 1997; Rogers, 1995; Zhao & Cziko, 2001). Within the teaching and instruction context, the focus should be on the instructor and the technology applied to meet their human ends (Berdayes, 2000). The literature identified a number of elements that help to create an

environment that is favourable to the teachers' acceptance and use of technology. Some of the more important elements are discussed below.

Instructors should first be prepared for the changing role with the integration of technology. Jones, Valdez, Nowakowski, and Rasmussen (1995) commented that the new workplace requirements for learning were incompatible with traditional instruction that assumed the teacher was the information giver and the student a passive recipient. McNabb et al. (1999) supported this view indicating that in the learning environment of the 21st Century, the teacher's role needed to evolve from this traditional form of instruction to coaching, monitoring, and verifying student achievement of learning goals. Carr (2003) also asserted that organizations must move from a teaching paradigm to a learning paradigm and this required a change in the role of the instructor.

In addition to the changing roles, the Teacher Technology Competency Committee (1997) from the University of Texas at Austin concluded from a summarization of available research that the instructor must be comfortable with, and knowledgeable about, computers and the technology employed. Moersch (1995) stated that self-efficacy theory suggests individuals with a low level of self-efficacy often choose a level of innovation that they believe they can handle, which may or may not have been the best or most effective option. He also stated that, conversely, individuals with high levels of self-efficacy were most inclined to accept change and choose the best option. Anxiety or fear about the technology may limit participation and learning. The environment should reduce potential anxiety or fear and provide the necessary training or development to help instructors increase their level of self-efficacy. This sentiment was echoed by Mooij and Smeets (2001) who commented "if teachers are not confident

in their ability or competence to handle computers this may hamper their willingness to introduce technology in their classroom'' (p. 266). One of the best means identified of improving self-efficacy was through training. Wozney, Venkatesh, and Abrami (2006) supported the view that technology-related training plays a crucial role in developing teacher's competency with computer applications, as well as influencing teachers' attitudes towards computers. Xia and Lee (2000) expanded on exactly what the goals of the training should include. They stated that "training programs should be used to enable users to gain conceptual and procedural knowledge that is necessary for the users to overcome the knowledge barriers and to realistically process the persuasive information provided" (p. 380). They also noted that it was important that users' perceptions and attitudes were monitored and managed over time so that appropriate measures could be taken to cope with changes resulting from increased use. Peifer (n.d.) additionally suggested that instructors and teachers should be provided guidance, prompting and contextualization. Specifically, he indicated that teachers needed to: have awareness of the technology available and its potential capabilities in the classroom, have certain competencies that would, at a minimum, permit them to explore the potential of the technology, and believe that the technology will actually improve the learning or make their job easier.

Smith-Skripps (2005) identified that it was also crucial that institutional support and resources be available for the technology, and that the users needed to be assured that a supportive environment exists. Gayeski (1997) emphasized the importance of the social impact of the way the applications were proposed and constructed, noting that the technology introduced must be compatible with current values and systems. Therefore,

there needs to be an appreciation of the social and corporate structure; the instructor should know the technology contributes to the organization's success.

While an organization can adopt a particular technology, it does not necessarily mean that it will be accepted and used. End user perceptions on the particular technology and how it fits into their realm of work were identified as key to successful integration. As shown, some of the factors that impacted the end user perceptions were: the understanding they have of their new role, how technology impacted on that role, the level of training and support provided, and the potential personal, professional and organizational benefits.

Technology Competencies Standards

Many of the models introduced above help an organization gauge the level of integration and use of technology. The organization may be able to define the level of use. However, in order for this information to be meaningful to the organization, the level of individual use should be measured against the organizational requirement. This could be established through a set of norms or standards. There were a number of sets of standards established within the training and education community. For brevity's sake, only four examples will be discussed to demonstrate common elements.

The International Society for Technology in Education (ITSE) (2004) created the comprehensive National Education Technology Standards-Teachers (NETS-T) standard recognized throughout the training and education community. The NETS-T was a generic set of standards designed to apply in the PK-12, College, and University environments. The NETS-T were created based on the assumption that essential

conditions existed such as administrative and policy support. The NETS-T performance indicators provided specific outcomes to be measured in six standards areas:

1. technology operations and concepts – teachers demonstrate sound understanding of technology operations and concepts,
2. planning and designing learning environment and experiences – teachers plan and design effective learning environments and experiences supported by technology,
3. teaching, learning and the curriculum – teachers implement curriculum plans that include methods and strategies for applying technology to maximize student learning,
4. assessment and evaluation – teachers apply technology to facilitate a variety of effective assessment and evaluation strategies,
5. productivity and professional practice – teachers use technology to enhance their productivity and professional practice, and
6. social, ethical, legal and human issues – teachers understand the social, ethical, legal and human issues surrounding the use of technology in PK-12 schools and apply those principles in practice. (ITSE, 2004)

The Maryland Technology Consortium (n.d.) developed the Maryland Teacher Technology Standards intended to define technology outcomes and indicators required for all teacher candidates. Their standards consisted of categories similar to the NETS-T:

1. information access, evaluation, processing and application,

2. communication,
3. legal, social, and ethical issues,
4. assessment for administration and instruction,
5. integrating technology into the curriculum and instruction,
6. assistive technology, and
7. professional growth. (Maryland Technology Consortium, n.d.)

The final example is the Educator Technology Competencies Framework developed by the Teacher Technology Competency Committee at the University of Texas at Austin (1997). It was more generic and focused on four domains:

1. Basic Technology Operation,
2. Personal/Professional Use of Technology Tools,
3. Social, Ethical, and Human Issues, and
4. Application of Technology in Instruction. (Teacher Technology Competency Committee, 1997)

The above examples focused on teachers' requirements within the academic community. They all contained elements applicable to higher or adult education. CF requirements differed slightly from the standards established within the academic community. Purse (2005) adapted the Educators Technology Competencies Framework discussed above for the Training Development Officer, Basic Qualification Course Instructor. This took into account specific CF instructor requirements. The competency framework consisted of the following four domains:

1. technology operation - Instructional staff must be able to demonstrate the use of a multimedia computer system and peripherals in order to run programs, to

access, generate, and manipulate data, display information and communicate. This includes computer operations and use of technology tools and peripherals;

2. personal/professional use - Staff will apply tools for enhancing their own professional growth and productivity. They will use various forms of productivity software for communicating, collaborating, conducting research, and problem solving;
3. safe, secure and acceptable use - Instructional staff will display safe, secure and ethical use of technology as proscribed in DND Acceptable Use Policy, security regulations and CF Code of Ethics. Instructional staff will also monitor student use and take appropriate action when a student violates any of the above principles or regulations; and
4. integration of technology into instruction and learning - Instructional staff will apply computers and related technologies to support instruction in subject areas. They must plan and deliver instructional units that integrate a variety of software, applications and learning tools pertinent to the learning and subject area. Lessons developed must reflect effective grouping and assessment strategies for the targeted student population. (Purse, 2005)

In addition to the established standards, there should be some measure of performance against those standards. As Anderson et al. (1996) indicated that without evaluation, only gut-feelings can indicate if effort and resources expended have produced the desired results. So, it appears that some form of supportive evaluation

should be in place that bases performance measurement against those established standards.

While any training or educational organization can attempt to gauge individual acceptance and use of technology against generic models to help identify teacher or instructor expectations and determine the required level of performance, the literature supported that, typically, a set of standards would be required. While there were differences in the standards discussed, there were common elements applicable to most training and education organizations.

Implications for the Research Instruments

The bulk of the literature review, which dealt with adoption, acceptance, and use of technology, originated in the civilian sector. In civilian settings, limited or non-use had been attributed to a number of organizational barriers, including organizational support, reliable equipment, resources, and training and professional development. (Ayers & Grisham, 2003; Butler & Sellbom, 2002; Chizmar & Williams, 2001). It might have been assumed that the lessons learned within the civilian community apply equally to the CF; however, the CF was determined to be unique in many respects.

Firstly, many of the technical and administrative barriers that were evident within the civilian community were not present in the CF. There was strong leadership support for technology use (DND/CF Symposium, 2000). Secondly, CF instructors have typically been selected as instructors due to their job knowledge and not their instructional ability; they were not considered professional educators or trainers. They had also received very little training in preparation for their role of as instructor

(DMHRR 2004a & 2004b). Further, the amount of exposure to technology that they had received prior to assuming their instructional position was based on their occupation or previous positions. Consequently, there was significant variation in the level of technological competence amongst CF instructors. Thirdly, most CF instructors had been employed as an instructor for three to four years. Therefore, the time that they were exposed to technology while employed as an instructor was limited. Given the significant workload and personnel constraints, this also meant that there was little additional time for professional development or training. Finally, different occupations had maintained different views on the importance of the role of instructor. Not all instructor positions were viewed in a favourable light, as they took the individual from their primary occupation. As a result, individual motivation towards the job of instructor varied. So, the civilian-based studies offered some insight into possible causes and solutions. However, they could not be directly transferred to the CF context without further study. Nevertheless, the literature assisted in developing a context for analysis of the CF situation.

There was considerable discussion on the importance of beliefs and perceptions regarding use (Davis et al., 1989; Johnson et al., 1997; Rogers, 1995; Venkatesh, 1999; Xia & Lee, 2000). As discussed, CF personnel had generally accepted technology for routine use. However, the adoption, acceptance and use of technology within the CF instructor cadre were not as apparent. Therefore, the research needed to investigate the CF instructor's beliefs and concerns regarding the use of technology. Closely related to this research area was the concept of self-efficacy as it was identified as an important determiner of the level of use (Moersch, 1995; Mooij & Smeets, 2001). Accordingly,

the research was also required to ascertain the CF Instructor's self-efficacy in the use of technology in the classroom.

Wozney, Venkatesh, and Abrami (2006) and Xia and Lee (2000) supported the view that technology-related training plays a crucial role in developing a teacher's competency with computer applications as well as influencing teachers' attitudes towards computers. So, some measure of the training received compared to feelings and perceptions was also important to the research.

Rogers (1995), Swanson (1996), Gayeski (1997) and Smith-Skripps (2005) discussed the potential that perceived organizational and social support could have on acceptance and use of technology. Accordingly, the research required some measure of the CF instructors' perceptions of the support provided for the use of technology.

Finally, the literature on adoption of technologies and the civilian experience of teachers' acceptance and use of technologies, as identified by Moersh (1995) and Lengel and Lengel (2006), were used as a baseline to help to define how CF instructors were progressing in the adoption, acceptance, and use of technologies. In order to refer back to this baseline, the research needed to include some means of gauging the CF instructors' current use of technologies. The literature also established a need for standards upon which to measure an individual's level of use compared to organizational requirements. While there is no published technology competency framework for CF instructors, the extent of any standard, evaluation, or measurement was also an area for study.

CHAPTER 3: METHODOLOGY

The Research Setting

Research in the Canadian Forces (CF) is generally intended to address specific mission requirements and those human issues that may impact on attainment of the CF mission. This research was aimed at providing greater insight into instructor's ascription to and use of technology in the classroom. It specifically studied the CF instructors' knowledge, skills, and attitude in employing classroom technologies. This study not only provided a basis from which to conduct further study on the instructors' needs, but added to the body of knowledge in technology use in CF training and education.

This research was supported and authorized by the Commandant of the CF Training Development Centre (CFTDC). The CFTDC had been identified as the Centre of Excellence and primary training centre for CF instructors. The Commandant CFTDC was designated as the owner, was an intended recipient of the research, and had the power to act on the research findings.

The study was a qualitative research effort which used non-parametric statistics. This study was achieved with involvement from key stakeholders such as CF instructors, CF standards personnel, and civilian and military training development subject matter experts (SMEs).

There were two limitations on the study. First, no funding was allocated for any of the research. Second, in accordance with direction provided by Director Human Resources Research and Evaluation (DHRRE) (2006), the actual research period was limited to March 01, 2006 to April 16, 2006. To get a more in-depth understanding of

the respondents' perceptions, the study was delimited to a convenience sample. The survey was delimited to CF instructors who participated in CFTDC training or were employed at CFB Borden during the research time frame. As instructors from across the country participated in the CFTDC training, this ensured a broad cross section of perspectives. The interviews were delimited to local staff employed within the CF Support Training Group (CFSTG) at CFB Borden.

Description of the Target Population

The research relied on non-probability, convenience sampling as there was no requirement to generalize beyond the affected population (CF instructors). The sampling was purposive to ensure that respondents had sufficient subject matter experience and knowledge to provide informed responses to the questions. The target population for the questionnaire was CF instructors and their supervisors, with a minimum rank of Master Seaman/Master Corporal and a minimum time in an instructional position of 1 year. It was also desired to have a proportionate mix of French-language and English-language instructors from both genders, and individuals from the three environmental groups (Navy, Army, and Air Force).

The target population for the interviews was CF instructor supervisors with a minimum time in an instructional position of 1 year, CF standards personnel with a minimum time in a standards position of 1 year and experience in monitoring instruction, and training development subject matter experts (SMEs). Note that all instructor supervisors and most standards personnel were, or had been, employed as instructors. The training development SMEs, may or may not have been employed in an

instructional position, but had specific responsibilities for instructor development within their organizations.

Methodology

Based on the aim of the study, preliminary investigation, and some of the information from the literature review, four lines of inquiry were developed concerning the CF instructors' knowledge of and ascription to use of classroom technology: perceptions on use, feelings of self-efficacy, levels of competency, and level of training received. The limitations, delimitations, research questions and target audience dictated the methods to pursue these lines of inquiry.

To remain within the limitations and meet the aim of the research, a questionnaire was developed and administered to the CF instructors. The author developed the questionnaire, with questions derived from the four lines of inquiry. The questionnaire was trialed for validity and reliability using a small sample of CFTDC instructors. The questionnaire is at Appendix 1. The study also required input from instructor supervisors, standards staff and training development experts to obtain authoritative information on instructor requirements, the perceived performance, and what was believed to be the organizations definition of effective use of classroom technology. As there were few potential respondents, given the limitations, and the research was attempting to obtain opinions on a variety of issues from different perspectives, the instrument selected for this portion of the study was an interview. The interview plan was also broadly based on the aforementioned lines of inquiry. The interview plan is attached at Appendix 2. Each of the instruments were reviewed by

three levels of DND authority and approved for use by the CF Research Authority, Director Human Resources Research and Evaluation (DHRRE, 2006).

Data Collection

The questionnaire was distributed by the author and suitably briefed delegates who administer the Advanced Instructional Techniques (AIT) or Instructor Supervisor (IS) courses conducted by CFTDC. The questionnaire was also distributed to a number of instructors within the immediate geographical area of Canadian Forces Base (CFB) Borden. The author or the delegated representatives then collected the questionnaires for data compilation and analysis.

The interviews were conducted one-on-one. The author conducted the interviews to reduce the level of variation in the interview process. The interview design was semi-structured, using pre-determined questions to stimulate inquiry into specific subject areas. The questions related directly to the issues in which the participant had some level of experience and/or expertise. Open-ended follow-on questions were used to allow participants to expand on a specific or related subject area. Further probing questions were occasionally used to help clarify a participant's statements or comments. The interviews lasted 30 to 60 minutes, depending on the level of interaction. Notes were taken during the interviews and then responses were collated and categorized in a tabular format for analysis.

Data Tabulation and Analysis

The emphasis of this research was on collection of descriptive statistics that would help describe the instructors' current level of desire, ability, and means for use of

classroom technology. The author used Microsoft Excel® for tabulating frequency and correlation data and used VassarStats® statistics calculator for the Kruskall-Wallis (KW) test for analysis of variance of ranks by group. The following details the data analysis processes.

The questionnaire data were developed to collect qualitative responses. The data were non-parametric as there was no assumption of normal distribution. The first treatment of the data was analyzed, and tables and figures generated with Microsoft Excel®. A break down of the first level of analysis by question category of all respondents is provided in Table 3.1.

Table 3.1 - Analysis by question category of all respondents

Data Category	Data Type	Analysis	Tool Used
Demographic Data	Nominal	Description of sample. (Environmental affiliation will be used to categorize sample for 2nd treatment.)	Frequency Chart
Qualifications & Experience	Nominal	Used for description of sample. (Qualification will be used for categorization of sample for 2nd treatment.)	Frequency Chart
Section 3 – Concerns on Use of Technology (Questions 1-6)	Ordinal	Identify level of agreement or satisfaction in each area of inquiry. This will help to describe knowledge of and ascription to use of technology.	Frequency Chart
Section 4 – Beliefs in Use of Technology (Questions 7-10)	Ordinal	Identify level of agreement or satisfaction in each area of inquiry. This will help to describe ascription to use of technology.	Frequency Chart
Section 5 – Technology Competencies (Questions 11-33)	Nominal	Categorization of sample with respect to technology operations. This will help to describe knowledge of use of technology.	Frequency Chart

Section 6- Instructional Use (Questions 34-38)	Ordinal	Identify level of agreement or satisfaction in each area of inquiry. This will help to describe use of and ascription to use of technology.	Frequency Chart

The second treatment of the data was an analysis of variance within two major groups consisting of three sub-groups each. The Kruskall-Wallis (KW) analysis of variance by ranks was chosen for analysis of this data because there was no expectation of normal distribution, each of the major groups consisted of three sub-groups, each of the groups were of unequal size, and the samples within the groups were independent. So, there was no expectation of normal distribution (Drew, 1980). A further consideration was that the total number of samples within each group was at least five, allowing the sampling distribution of H to be taken as a reasonably close approximation of the sampling distribution of chi-square with df = k—1. Accordingly, the critical value from the chi-square distribution with 2 degrees of freedom is 5.991 for a test at the 5% level. If H is greater than 5.991 and $P < .05$, then one can conclude that there is a significant difference in the ranked views amongst the groups. The two major groups were:

1. Environmental affiliation - Navy, Army, or Air Force; and
2. Instructional qualification:

    a. Basic – to include Basic Instructional Techniques (BIT), Primary Leadership Qualification (PLQ), Basic Officer Qualification (BOQ), General Military Instructional Techniques (GMIT), Learning and Career Centre (LCC) Instructional Techniques, or civilian equivalent,

b. Advanced – to include Advanced Instructional Techniques (AIT), Instructor Supervisor (IS), or civilian equivalent, and
c. Technology-based – Distributed Learning Instructor (DLI), e-Learning Design (eLD), Simulator/Trainer Instructor (SIM), Flight Instructor Course (FIC), or civilian equivalent.

An hypothesis was formulated for each major group. For the environmental affiliation, there was no alternative hypothesis developed. It was believed that the null hypothesis (H_0) would not be rejected in that there would be no significant difference between the three environmental affiliations. For the instructional qualification group, an alternative hypothesis (H_1) was developed that stated that the technology-based qualified instructors would demonstrate significantly more positive perspectives on the use of technology than either of the basic or advanced groups, thus causing the H_0 to be rejected.

The interviews were conducted based upon the interview plan at Appendix 2 and collected qualitative data. The interviews solicited what was deemed to be expert opinions from instructor supervisors, standards personnel and training development SMEs, regarding the perception of instructor competency in and use of technology in CF classrooms. Data were categorized within a table based upon responses and subsequently tallied within each category. The subsequent frequency analysis of comments by category provided additional insight into what was the expert interpretation on the current level of classroom technology use and what could be described as "effective use." The interviews also identified related training or

professional development opportunities that were not identified through the literature review. The interviews results were compared to the survey results to discern the differences between what the organizational experts perceived and what the instructors had indicated.

Summary

The research methodology was specifically developed to gain insight into the CF instructors' knowledge of and ascription to the use of technology in the classroom. To provide a more balanced perspective, participants were selected from both the instructor cadre and a core of instructor supervisors, standards personnel and training development SMEs. The methods used were chosen based upon the availability of the target audience and the nature of the research required. As neither the resources nor the funding could be secured for a broader study, a convenience sample was used. Even though it was understood that the results of the research could not be applied to the general population, it would provide additional insight into the larger CF issue.

CHAPTER FOUR: RESULTS AND FINDINGS

Description of the Surveyed Study Population

Section One and Two of the questionnaire solicited demographic information related to rank, primary language and language of instruction, instructor qualifications and instructional experience. The surveyed population consisted of 52 instructors from across the Canadian Forces (CF) from a variety of ranks as shown in Table 4.1.

Table 4.1 - Instructors by rank

Rank	Quantity
Master Corporal (MCpl)/Master Seaman (MS)	11 (21%)
Sargeant (Sgt)/Petty Officer 2nd Class (PO2)	17 (31%)
Warrant Officer(WO)/Petty Officer 1st Class (PO1)	11 (21%)
Master Warrant Officer (MWO)	2 (4%)
Captain (Capt)/Lieutenant (Navy) (Lt[N])	11 (21%0
Major (Maj)/Lieutenant-Commander (LCdr)	0 (0%)
Lieutenant-Colonel (LCol)/Commander (Cdr)	1 (2%)
Column Total	52 (100%)

The gender breakdown was 43 (82%) male, 9 (17%) female. The linguistic breakdown of the sample was 40 (77%) primarily English speaking and 12 (13%) primarily French speaking. Additionally, 45 (86%) indicated that English was their language of instruction and 7 (13%) indicated French was their language of instruction. Of the French speaking alone, 7 (58%) indicated that French was their language of instruction.

As shown at Figure 4.1, the population was further broken down into environmental affiliation. This was generally reflective of the CF population.

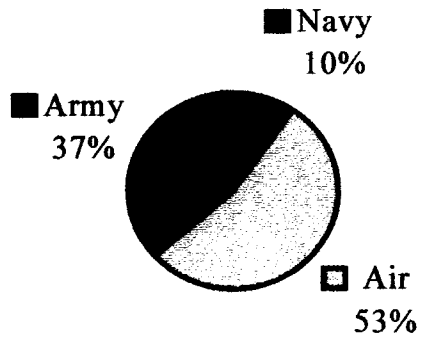

Figure 4.1 - Population by environmental affiliation

Qualification

For the purposes of this study the respondents were placed into three categories based on qualification:

1. Basic - this consisted of training and/or education that provided the respondent with basic instructional and lesson planning techniques. The focus was primarily on lecture or demonstration style delivery of instruction. Since the respondents were all instructors at a CF training establishment, they were all minimally qualified to this level. Qualifications in this category consisted of: Basic Instructional Techniques (BIT), Primary Leadership Qualification (PLQ), Basic Officer Qualification (BOQ), General Military Training Instructor (GMTI), Learning and Career Centre (LCC) Instructional Techniques course, locally produced training (at a training establishment), civilian equivalent, or other;

2. Advanced - this consisted of training and/or education that provided respondents with more advanced instructional methods and supervisory level training. The focus was on instructional methods that require greater interaction or student involvement and the ability to evaluation other instructors. Qualifications in this category consisted of: Advanced Instructional Techniques (AIT), Instructor Supervisor (IS), Intermediate Leadership Qualification (ILQ), or other; and

3. Technology-based - this consisted of training and/or education that provided the respondents skills and knowledge to effectively conduct instruction using one or multiple types of technology. Qualifications in this category consisted of: Distributed Learning Instructor (DLI), e-Learning Design (eLD), Flight Instructor's Course, Simulator/Trainer Instructor's Course, or other.

The breakdown by the highest level of instructor qualification is shown at Figure 4.2.

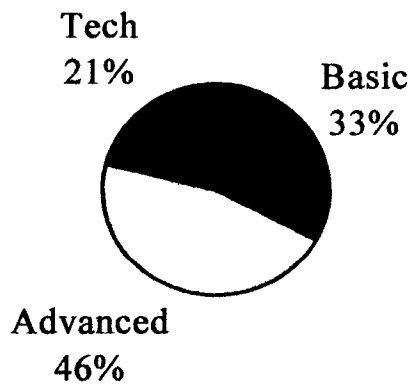

Figure 4.2 - Breakdown by highest level of instructor qualification

Instructional Experience

The respondents represented varying levels of experience where 16 (31%) had less than one year, 14 (27%) had two to three years, 9 (17 %) had four to five years, and 13 (25%) had six years or more of instructional experience. Figure 4.3 shows the breakdown by instructional experience.

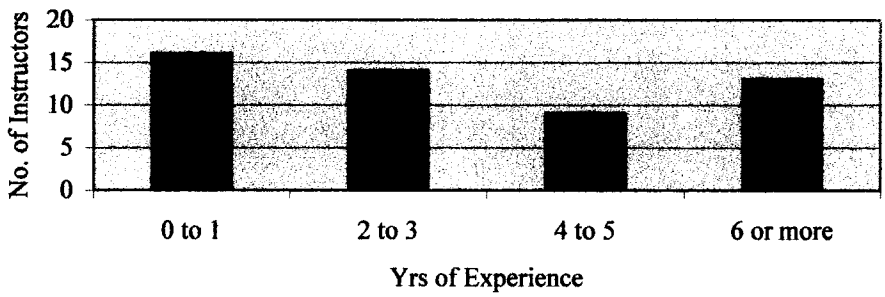

Figure 4.3 - Instructional experience in years

As shown at Table 4.2, most of the instructors had filled an instructional position within a CF training establishment more than once:

Table 4.2 - Number of instructional positions held[4]

No. of Positions	Quantity
1	21(42%)
2	11(22%)
3 or more	18 (36%)
Column Total	50 (100%)

Description of the Interviewed Study Population

The interviews were delimited to those personnel specifically employed within CF Support Training Group (CFSTG). The interviewees were representatives who

[4] Two respondents did not provide a response to this question.

filled roles as Instructor Supervisors (IS), Standards or training development subject matter experts (TD SMEs). In all, 18 interviews were conducted with personnel ranging in rank from Sgt/PO2 to Capt/Lt(N). Twelve IS, 2 Standards personnel, and 4 TD SMEs were interviewed.

Concerns Regarding the Use of Technology

Section Three of the questionnaire sought the respondents' opinion on the level of support they believed they have received and their general competency level in the use of learning and training technologies. In this case, competency was defined as the level of knowledge, skill and ability to perform a task. The results are broken down into two sections: training received and ability.

Two questions were posed regarding the training that they had received in preparation for the job as an instructor. Thirty-three (63.5%) declared that they were satisfied or very satisfied that the training had prepared them for their job as an instructor, 8 (15.4%) were neutral on the subject, and 11 (21.1%) were either somewhat or very dissatisfied. Regarding the level of training received on use of technology for instruction, 29 (55.8%) of respondents indicated that they were either satisfied or very satisfied, 5 (9.6%) were neutral and 18 (34.6%) were either somewhat or very dissatisfied. The Kruskall-Wallis (KW) test for the environmental grouping established that the H_0 was not rejected, in that there was no significant difference in ranked responses to these questions. However, when the instructional qualification group was asked, "How satisfied are you that your training has prepared you for your job as an instructor?" the KW test results caused rejection of H_0, as they indicated a

significant difference between the basic group and the remaining groups. The data are provided in Table 4.3.

Table 4.3 - Level of satisfaction that training has prepared them.

	Basic	Advanced	Tech-Based
n	17	24	11
Mean Ranks	18.5	27.6	36.5

Where $H = 9.65$, $df = 2$, and $P = 0.008$

Further, when the instructional qualification group was asked "How satisfied are you regarding the level of training that you received on the use of technology for instruction?" the KW test results caused rejection of the H_0, as they indicated a significant difference between the basic group and the remaining groups. The data are provided in Table 4.4.

Table 4.4 - Level of satisfaction that technology training has prepared them.

	Basic	Advanced	Tech-Based
n	17	24	11
Mean Ranks	18.6	30.6	29.6

Where $H = 6.81$, $df = 2$, and $P = 0.0332$

The interviews were somewhat more negative concerning the training and preparation for instructors. Regardless of role, the interview respondents were unanimous in their opinion that the instructors had not received sufficient training in the use of technology for instruction. One of the IS interviewed summarized the situation stating, "we give the students the tools to learn, but don't give the instructors the tools to teach" (MWO Rioux, interview, March 21, 2006).

This perspective was not, however, the situation in accordance with the documentation. As previously stated, most of the training and education within the CF

was performance oriented. As the Occupational Specialty Specifications (OSS) for Basic Instructional Techniques (DMHRR 2004a) and Advanced Instructional Techniques (DMHRR 2004b) qualifications indicated, personnel were required to have at least fundamental knowledge and skills in operate training equipment, electronic presentations, and identifying media and resources. An analysis of the training appeared to support this requirement. However, the training did not go beyond these specific elements.

Three questions were posed pertaining to the individual's ability to use technology for instruction related activities. In each case, the significant majority of the respondents indicated that they were either somewhat satisfied or very satisfied with their own abilities in these areas. The responses are detailed in Tables 4.5 through 4.7 below.

Table 4.5 - Ability to use technology in course administration.

Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Total
2 (4%)	4 (8%)	6 (12%)	31 (59%)	9 (17%)	52 (100%)

Table 4.6 - Ability to use technology in course material development.

Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Total
1 (2%)	2 (4%)	4 (8%)	32 (61%)	13 (25%)	52 (100%)

Table 4.7 - Ability to use technology during instruction or training.

Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied	Total
1 (2%)	5 (10%)	8 (15%)	21 (40%)	17 (33%)	52 (100%)

The KW tests for the environmental and instructional qualification groupings established that the H_0 was not rejected, as there was no significant difference in ranked responses to these questions.

The interview respondents marginally varied in their opinions on the instructors' ability to use technology for instruction. In general, they believed that instructors were prepared for traditional "stand and deliver" instruction. However, there was a very large majority that believed instructors were not adequately prepared for use of technology for instruction.

Beliefs Regarding The Use of Technology In Support of Instruction

Section Four of the questionnaire was intended to gauge the instructors' beliefs and feelings regarding the use of learning and training technology in support of all aspects of instruction. All respondents indicated that, at least to some degree, they believed technology could create a better learning environment, that they had a desire to do so, and that their institution supported these efforts. The results are in tables 4.8 through 4.11 below.

Table 4.8 - Technology can create a better learning and training environment.

Not at all	To some degree	To a good degree	Completely	Total
-	9 (17%)	31 (60%)	12 (23%)	52 (100%)

Table 4.9 - Use technology to create an effective learning environment.

Not at all	To some degree	To a good degree	Completely	Total
-	11 (21%)	31 (60%)	10 (19%)	52 (100%)

Table 4.10 - Organization/school supports learning and training technology in the classroom.

Not at all	To some degree	To a good degree	Completely	Total
-	10 (19%)	23 (44%)	19 (37%)	52 (100%)

Table 4.11 - Want to use technology for creating an effective learning environment.

Not at all	To some degree	To a good degree	Completely	Total
-	9 (17%)	31 (60%)	12 (23%)	52 (100%)

The KW tests for the environmental and instructional qualification groupings established that the H_0 was not rejected, as there was no significant difference in ranked responses.

The interviews generated somewhat different perceptions. As the Instructor Supervisors (IS) were the only ones who have a direct responsibility to supervise the instructors, they were queried about the instructors' willingness to use technologies.

There was no overarching agreement with perceptions reaching from reluctant to very willing. One aspect raised by two IS in separate interviews was that there appears to be a generational component to the acceptance and use of technology. Specifically, they suggested that the younger instructors were more willing to accept and use technology. Standards personnel were asked for data from student critiques and other evaluations pertaining to the instructors' use of technology, but they indicated there were no specific data collected on this subject. Interview respondents were unanimous in their opinion that there was insufficient organizational support for instructors to acquire the required skills and knowledge. A broad range of barriers were discussed with the emphasis on seven specific barriers:

1. lack of time to pursue professional development or training,
2. lack of training and education opportunities,
3. insufficient time for preparation of training,
4. lack of measures to determine success or areas for improvement,
5. an environment of fear, where there is a hesitancy to do what they think is right because it is not the norm and it may impact on their annual performance evaluations,
6. cultural attitude of "its OK to just get it done" or satisficing, and
7. lack of rewards for performing well as an instructor or pursuing professional development.

Technology Use and Competencies

Section 5 of the questionnaire asked respondents to indicate their frequency of use of particular technologies as either: never, rarely, sometimes or often. Results are at table 4.12. They were then asked to indicate their feeling of competency, along a four-point scale from beginner to expert. These results are at Table 4.13.

Table 4.12 - Frequency of use

Tech or Function	Never	Rarely	Sometimes	Often	Total[5](%)
Keyboarding		1	7	42	50 (100)
Word Processing	2	7	7	34	50 (100)
Email			3	47	50 (100)
Scheduling	2	5	17	26	50 (100)
Presentation software	1	1	12	36	50 (100)
Database	4	15	20	11	50 (100)
Spreadsheet	4	12	22	12	50 (100)
Internet navigation	2	8	7	33	50 (100)
Collaborating	26	13	5	6	50 (100)
Video camera	20	20	9	1	50 (100)
Video recording	25	19	5	1	50 (100)
Digital photography	19	15	10	6	50 (100)
Digital recording	29	17	3	1	50 (100)
Digital displays	34	11	2	3	50 (100)
Scanning	16	21	12	1	50 (100)
Developing graphics	28	13	7	2	50 (100)
Digital image editing	26	11	11	2	50 (100)
Sound editing	42	3	4	1	50 (100)
Video editing	38	10	1	1	50 (100)
Creating web pages	37	9	2	2	50 (100)
Flash media	35	11	2	2	50 (100)
Creating hyperlinks	23	9	13	5	50 (100)

[5] Two respondents did not complete all questions in this section and have therefore not been included.

Table 4.13 - Feelings of competency.

Tech or Function	Never	Rarely	Sometimes	Often	Total[6](%)
Keyboarding	2	19	21	8	50 (100)
Word Processing	6	11	24	9	50 (100)
Email		4	28	18	50 (100)
Scheduling	7	13	22	8	50 (100)
Presentation Software	2	11	29	8	50 (100)
Database	10	23	14	3	50 (100)
Spreadsheet	10	20	15	5	50 (100)
Internet navigation	4	9	20	17	50 (100)
Collaborating	30	10	8	2	50 (100)
Video camera	24	15	8	3	50 (100)
Video recording	27	14	7	2	50 (100)
Digital photography	20	11	15	4	50 (100)
Digital recording	27	13	9	1	50 (100)
Digital displays	37	9	3	1	50 (100)
Scanning	19	14	16	1	50 (100)
Developing graphics	28	12	8	2	50 (100)
Digital image editing	31	11	7	1	50 (100)
Sound editing	41	5	4		50 (100)
Video editing	40	7	3		50 (100)
Creating web pages	44	3	2	1	50 (100)
Flash media	36	11	1	2	50 (100)
Creating hyperlinks	13	14	16	7	50 (100)

Using CORREL, there was a .80 correlation coefficient between the frequency of use (sometimes and often) the feelings of competency (three[3] and expert). Respondents generally indicated that routine tasks and applications, such as keyboarding, word processing, managing electronic files and email, were used often and generally correlated to the highest level of competency. Non-routine tasks or applications that were seldom/never used showed the lowest feeling of competency. This is graphically displayed in comparing the relationship between moderate and high frequency use to moderate to high feelings of competence in Figure 4.3.

[6] Two respondents did not complete all questions in this section and have therefore not been included.

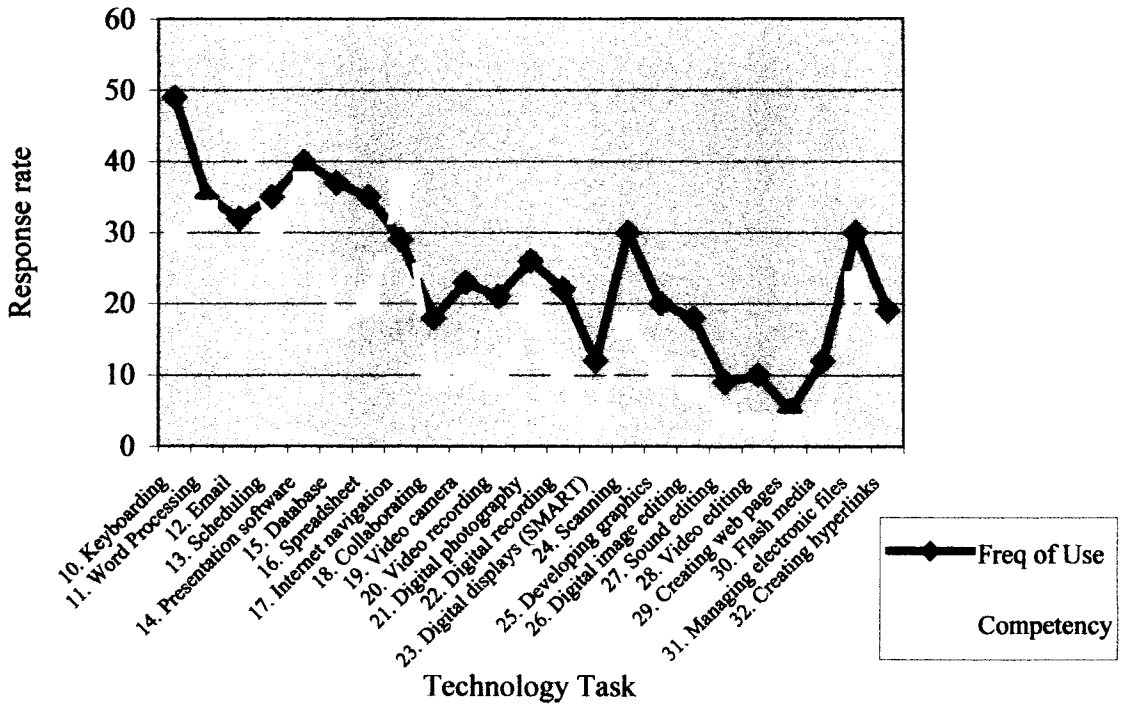

Figure 4.4 - Relationship between frequency of use and feelings of competence

Notwithstanding the above, it was noted that between 30-40% of respondents indicated that while they often performed the routine tasks, they still considered themselves beginners or slightly better. KW tests were not conducted regarding either of these questions.

Instructional Use

Section 6 of the survey requested respondents to identify their level of use of technology to support learning or instruction. When asked whether they have had the opportunity to employ learning and training technologies in the classroom, all respondents indicated that they have had the opportunity to varying degrees as shown in Table 4.14.

Table 4.14 - Have opportunity to employ.

Completely Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Completely Agree	Total
-	-	10 (19%)	23 (44%)	19 (37%)	52 (100%)

During the KW tests, the H_0 was not rejected, as there was no significant difference in ranked responses to this question between the environmental and instructional qualification groupings established.

When asked to indicate that whether they knew how to employ a variety of technologies during instruction and learning activities, two (4 %) indicated that they disagreed. As shown in Table 4.15, the remainder generally agreed.

Table 4.15 - Know how to effectively employ

Completely Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Completely Agree	Total
-	2 (4%)	12 (23%)	27 (52%)	11 (21%)	52 (100%)

During the KW testing within the environmental grouping, the H_0 was not rejected, as there was no significant difference in ranked responses to this question. However, when the instructional qualification group was asked about their level of agreement to the statement, "I know how to effectively employ a variety of technologies during instruction and learning activities", the KW test results indicated a significant difference between the basic group and the remaining groups, thereby causing rejection of H_0. The H_1 ,that there would be a difference between the basic and remaining groups, was therefore accepted. The data are provided in Table 4.16.

Table 4.16. Agreement regarding ability to effectively employ technologies.

	Basic	Advanced	Tech-Based
n	17	24	11
Mean Ranks	18.4	30.0	31.4

Where $H = 7.36$, $df = 2$, and $P = 0.0252$

Respondents were also asked to indicate their level of agreement to the statement that they had integrated technologies into learning and instruction, where appropriate. The results are in Table 4.17.

Table 4.17 - Integrate where appropriate

Completely Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Completely Agree	Total
-	-	13 (25%)	27 (52%)	12 (23%)	52 (100%)

Respondents were asked to indicate their level of agreement as to whether they had effectively used technology to improve learning and instruction in the classroom. The results are in Table 4.18.

Table 4.18 - Have used effectively.

Completely Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Completely Agree	Total
-	1 (2%)	7 (13%)	30 (53%)	14 (27%)	52 (100%)

Finally, respondents were asked if they had conducted a self-evaluation, or have had their use of learning and training technologies evaluated, to ensure that they were using them in the most effective manner. The results shown in Table 4.19 are more negative than previous responses, with 21% of the respondents claiming that they either somewhat or completely disagree.

Table 4.19 - Conduct or are subject to evaluation

Completely Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Completely Agree	Total
1 (2%)	10 (19%)	22 (42%)	13 (25%)	6 (12%)	52 (100%)

The KW testing caused the H_0 to not be rejected, as there was no significant difference in ranked responses to these last three questions within the environmental and instructional qualification groupings.

The interviews with the IS, Standards and TD SME are generally in discord with the survey results. One TD SME indicated that, generally, instructor use of technology was "rudimentary." This general belief was expressed in different terms by almost all interview respondents. Specific examples were also provided. For instance, one TD SME noted that instructors normally used video and audio materials as the primary instructional sources, as opposed to being integrated into instruction. The same individual also noted that instructors were not effectively using technology for knowledge management or classroom management functions. Also, the interview respondents generally indicated that the most prolific use of technology in the classrooms was the use of presentation media such as MS PowerPoint ®. This is supported by the results in Table 4-12. Table 4-13 also suggests that, in general, instructors felt competent in the use of presentation media. However, the prevailing opinion of the interview respondents was, that while they agreed that instructors know how to use this particular media, they indicated doubt as to whether it was being used effectively by instructors. A Standards representative, described the use of presentation

media as a "cut and paste mentality." Another IS and TD SME referred to the common instructional experience of "death by PowerPoint." Another TD SME described the use of MS PowerPoint as a "crutch." Finally, TD SMEs and IS indicated that where technology was emphasized, the focus sometimes appeared to be on the technology and not how it contributes to learning. The next chapter interprets these findings and offers recommendations for further research.

CHAPTER FIVE: SUMMARY AND CONCLUSIONS

Details of the Study

The aim of this study was to identify the Canadian Forces (CF) instructors' knowledge of and ascription to use of technology in the CF classrooms. The study was a qualitative research effort using non-parametric statistics. The first part of the research was a survey of a convenience sample of CF instructors to measure their beliefs, use of, and competency in classroom technologies. The sample size was limited by time and funding. The sample size was further delimited to those instructors participating in Canadian Forces Training Development Centre (CFTDC) training or located at Canadian Forces Base (CFB) Borden. All instructors had a minimum qualification of basic instructional techniques and many had advanced or technology-based training qualifications as well. The instructor population surveyed also had varying levels of instructional experience, represented all three environmental commands (Navy, Army, Air Force) and generally reflected the linguistic population of the CF. The questionnaire consisted of 38 questions, divided into six subject areas. The first two areas sought demographic information and instructional and training experience. The subsequent sections dealt with concerns on use of technology, beliefs on use of technology for instruction, frequency of technology use and perceived competency, and instructional use. The questionnaire was distributed and collected by either the author or a delegated representative. There were ultimately 52 respondents. However, two respondents did not complete the entire questionnaire.

Research interviews with instructor supervisors, standards personnel and training development experts were also conducted. The interviews gathered opinions and

personal insight from experienced training personnel on the CF instructors' use of and competency in the use of classroom instruction. The interviews were delimited to Canadian Forces Support Training Group (CFSTG) personnel. To reduce the variation in the question presentation and the interpretation of the responses, the author conducted all of the interviews. Eighteen interviews were conducted and provided data for this study.

The data from the questionnaires were collated and underwent two analytical treatments. The first was basic descriptive analysis of the responses and provided insight into the instructors' perceptions and competencies surrounding technology use in the classroom. The second was Kruskall-Wallis testing conducted to investigate potential relationships in two groupings. The first grouping consisted of environmental affiliation: Navy, Army, and Air Force. The second grouping consisted of instructional qualification: basic, advanced, and technology-based qualification. Two hypotheses were tested. For the environmental affiliation, it was believed that the null hypothesis (H_0) would not be rejected and that there would be no significant difference between the three environmental affiliations. The alternative hypothesis (H_1) was which stated there would be a significant difference between the groups. For the instructional qualification group, an alternative hypothesis was developed that stated that the technology-based qualified instructors would demonstrate significantly more positive perspectives on the use of technology than either of the basic or advanced groups; thus causing the H_0 to be rejected.

Conclusions from the Research

As indicated, the aim of the research was to identify the CF instructors' knowledge of and ascription to use of technology in the CF classrooms. Therefore, the study focused on CF instructor functions as they pertain to use of technology in the CF classroom. The four main lines of inquiry were:

1. What are the current knowledge and skill levels of CF instructors regarding the use of technology in the classroom?
2. What are CF instructors' attitudes regarding self-efficacy in the use of technology in the classroom?
3. What are CF instructors' attitudes regarding the use of technology in the classroom?
4. What do CF instructors perceive as the barriers to their effective use of technology in the classroom?

Conclusions for each of these lines of inquiry are addressed below.

Current knowledge and skill levels

The survey specifically dealt with the individual's ability to use technology for instruction related activities, specifically for course administration, course material development, and instruction. Roughly three quarters of the instructor respondents indicated that they were satisfied with their ability to use technology for instruction and instructional related activities. The analysis showed a .80 correlation between how often an instructor uses a particular application or piece of technology and individual feelings

of competence. This was expected; while it was not a foregone conclusion, the more a particular application is used, the more likely it is that the individual will be confident in its use. High levels of competence were generally associated to routine or common applications such as keyboarding, word processing, managing electronic files and email. However, over one third of the instructors indicated they still consider themselves beginners or slightly better in some of the most common and frequently used applications and technologies. The KW tests found no discernable differences between the environmental or instructional qualification groups.

All instructors surveyed had at least the Basic Instructional Techniques qualification (AHCH) (DMHRR, 2004a). Most instructors within the sample believed that they were sufficiently prepared for the job of instructing. When it came to use of technology in the classroom, most indicated they effectively employed technology. However, as there was no defined standard for use of technology in the classroom and no definition of "effective" provided, this information was not considered valid.

Self-efficacy

The results showed that all of the instructors indicated they had the opportunity to employ technologies in the classroom and integrated them where appropriate. Most also believed they effectively employed technology. However, a small percentage (4%) did not believe that they knew how to effectively employ technologies.

The KW testing results for the environmental group did not result in the rejection of the H_0. For the instructional qualification group, the KW test results supported neither hypothesis. In retrospect, a third hypothesis should have been developed. The

KW results demonstrated that while the anticipated difference existed between the basic qualified instructors and the technology-based group, it was not the case with the advanced qualified instructors. The advanced qualified instructors had similar results to those of the technology-based qualified instructors.

The interview respondents had a considerably higher negative perspective than the instructors themselves, when referring to instructors' use of technology within the classroom. The interview respondents generally described instructors' use of technology in the classroom as "rudimentary" and supported comments by other analogous phrases such as "death by PowerPoint®." These painted a clear image of the instructional emphasis in using technology. This more than any other data within this study highlighted a common perception regarding the typical CF instructor's use of this particular media. So, while the survey showed that many CF instructors used some of the routine applications regularly, and generally felt competent in their daily work, they appeared to have reverted to an entry skill level when a new application was introduced in the instructional context (Lengel & Lengel, 2006). In contrast to their employment of common office technologies, it appeared that the interview respondents generally held the view that instructors did not employ technology to any distinct advantage over traditional classroom media. One of the likely causes of the disparity between the survey participants and the interview participants was the presence of a response bias where, consciously or unconsciously, respondents misrepresented the truth (Zikmund, 2000). One of the inherent problems with asking the instructors to determine their own level of performance was that their assessment was based upon the existing schema. The instructors' responses may have been completely accurate from their perspective,

but this was meaningless if there was no common definition of "effective use" or an identified standard against which they could evaluate their performance. Using a colloquial phrase, instructors "cannot know what they do not know." The interview respondents primarily based their responses on observation with a better, qualified understanding of effective use of technology. They therefore spoke with more authority on the matter. The interview respondents were also from a variety of different backgrounds and had observed CF instructors from different positions within the training system. Despite their varied perspectives, the interview respondents held more or less common views on the instructors' use of technology in the classroom.

This was a concern primarily because all of the instructors surveyed were at least the rank of Master Corporal and have a minimum number of five years service. Given the increasing reliance on technology and computer use within the CF (DND/CF Symposium Working Group, 2000), there was an organizational assumption that these instructors should have had sufficient training and experience. This assumption was vocalized during some of the interviews. Two of the interviews specifically referred to the use of technology being a generational issue, i.e. the younger instructors were coming into the military with these skills and were quite comfortable with technology. Statistics Canada (2001) identified that indeed, use of technology, specifically Internet use, decreases with age. Since the CF has been identified as a micro-culture within Canadian society, it was expected that it would have demonstrated similar adoption of technology. However, the CF had a business and operational imperative that did not exist within Canadian society. Technology implementation within the CF was the result of authoritative innovation decision (Rogers, 1995) driven by these imperatives. So, CF

personnel did not choose to adopt technology for their work processes. Rather, as secondary adopters (Swanson, 1996), they were required to accept and use technology out of necessity. The CF has not been able to wait for the education system and society in general to provide job-ready candidates, and accordingly established a training system to ensure that its personnel were job-ready.

Regardless of the potential causes or cultural dynamics within the CF, the instructors surveyed generally believed that they effectively employed classroom technologies. The more informed and objective observations of the interview respondents did not concur with this assessment. If it was considered that the interview respondents had properly addressed what constituted effective use, then there was likely a general misperception within the CF instructor cadre on effective use. Consequently, the data pertaining to self-efficacy may not be indicative of the actual level of competence.

Attitudes Regarding Use Of Classroom Technologies

The survey results indicated that the instructors generally reacted favourably to using technology in the classroom. Most respondents believed that technology could create a better and more effective learning environment and over 80% wanted to use technology to create an effective learning environment. They also viewed the organizations as generally supportive in the use of technology in the classroom.

The interview respondents indicated that they observed a continuum of commitment to technology from reluctant to very willing. While not conclusive, this may indicate that what the instructors believed and what they demonstrated were not

necessarily related. Some of the instructors' behaviour may have reflected the conditions of work, barriers to effective use of technology, anxiety in using technology, fear of failure, or any number of causes that were not investigated. Notwithstanding, it was concluded that the majority of instructors surveyed hold a positive attitude toward the use of technology, and this should be leveraged to ensure a more effective learning environment.

Barriers to Effective Use

Three potential barriers were explicitly addressed within the questionnaire: the level of training received, the instructor's attitudes and perceptions, and the level of institutional support. Each will be addressed in succession.

Training

One of the suggested barriers to effective use was lack of training. As stated in the findings, 63.5% of the instructors indicated that they were satisfied that the training had prepared them for their job as an instructor. Just over 20% were either somewhat or very dissatisfied with their initial instructor training. The next question measured the level of satisfaction towards the level of training received on the specific use of technology for instruction. Just over half (55.8%) of the respondents indicated that they were satisfied or very satisfied. This compares to over one-third of the instructors who indicated that they were somewhat or very dissatisfied with the training received on technology for instruction. Even though this was a convenience sample of a small population, it is significant that many considered their level of training insufficient. The

KW testing on instructor qualification confirmed the hypothesis, as basic qualified instructors ranked both areas considerably lower than either advanced or technology-based qualified instructors. The interview respondents unanimously indicated that instructors did not get sufficient training. It was significant that many of the basically trained instructors were not satisfied with their training in this area, and their supervisors held a similar view.

CF training was performance oriented and was structured so that all personnel who successfully completed the training would be able to perform the required tasks on the job. As identified, some training in technology occurred during CF instructor training. Yet one third of the surveyed population did not believe they were appropriately prepared, and the interview respondents corroborated this finding. It was therefore concluded that, while the CF has provided some training on the use of specific classroom technologies, the existing training has not met the requirements. It was therefore determined that further investigation is required to determine any potential deficiencies in the training.

Instructor Perceptions and Beliefs

As discussed above, those surveyed generally had a positive disposition toward the use of technology in the classroom. The interview respondents indicated that they observed a continuum of commitment to technology from reluctant to very willing. No specific conclusions can be drawn regarding the disparity on views. However, if the interview respondents' observations were taken as fact, there may have been numerous reasons why instructor behaviour did not reflect what they believe. For example, a

heavy workload may have precluded learning and planning for use of technology or, as discussed, the individual's feelings of self-efficacy may have given rise to self-doubt and resulted in limited or non-use. It does not serve to speculate on this matter, but suffice to say that instructors surveyed were generally supportive of the use of technology in the classroom and believed it can help create an effective learning environment. Consequently, instructors' attitudes and beliefs were not considered to be a significant barrier to effective use.

Institutional Support

In general, the questionnaire results found that the majority of respondents believed the organization supported the use of technology in the classroom. However, one shortcoming was noted from the survey. Instructors were asked to indicate whether they conducted self-evaluation or were the subject of evaluation on their use of learning and training technologies. Only 37% indicated that they agreed. The remainder either disagreed or were neutral on the issue.

At the time of this study, the CF was following a systems approach to training; all training was defined, produced, and maintained through an iterative and interactive series of steps, leading from the definition of a requirement to the verification that the requirement had been satisfied (DND, 1997). Evaluation was a critical element to ensuring that the training was effective and the instruction was improving where required. In this case, the survey respondents indicated that, in some cases, evaluation in the area of technology use was not occurring or training evaluation was not occurring. Therefore, there was potential for problems or instructional weaknesses to persist and,

consequently, impact learning and training. This apparent lack of evaluation for the instructional use of technology has jeopardized the development of instructors and the improvement of instruction, and was therefore considered to be a potential barrier to effective use of classroom technologies.

In summary, of the three potential barriers investigated, instructor training and evaluation were considered as relevant and worthy of further investigation.

Summary

This study was stimulated by a perception that CF instructors were not effectively using classroom technology. Through a questionnaire and interviews, the research attempted to provide insight into the CF instructors' knowledge of and ascription to use of technology in the classroom. The research generally concluded that, while the instructors surveyed appeared to be motivated and wished to use technology within the classroom, they simply did not do so. While no specific conclusions could be drawn, it was established that there are two primary barriers that may be preventing instructors from effectively using technology. First, there is a need for more training in how to effectively employ classroom technologies. Second, there is no established standard for use of technology or an evaluation framework through which instructors can either be assessed or conduct self-assessment.

Recommendations for Further Research

There are four areas worthy of further research stemming from this study. First, many of the issues raised in this study went unresolved as there was no operational

definition of effective use of classroom technologies nor did the study identify a set of technology competencies for CF instructors. While Purse (2005) developed a Technology Competencies Framework for Training Development Officer instructors, this does not translate directly to CF instructor competencies. The appropriate CF authorities should research the specific CF instructor technology requirements with the aim of establishing a set of technology competency standards.

Second, as identified during the interviews, there may be a generational component to use of technology in that younger instructors are more comfortable with technology and older instructors are more reluctant to use technology. This was not specifically investigated. However, as there is a perception that it exists, it is worthy of further investigation as it could provide additional insight to the situation.

Third, the study did not investigate any specific shortcomings with the training or professional development, but focused on the instructors' perspective. Yet, training was identified as a concern with survey and interview respondents. Once CF instructor technological competencies have been defined, further research should be conducted to compare the existing CF instructor training against these competencies to determine if there are any shortcomings.

Finally, once there is a technology competency standard and any deficiencies in training have been addressed, the CF should investigate potential evaluation frameworks that could be used to support continuous improvement for instructor and training performance.

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APPENDIX ONE

INSTRUCTOR QUESTIONNAIRE

Questionnaire

Instructions

This questionnaire consists of 38 questions. It is divided into six (6) subject areas. The instructions for each section are provided at the beginning of each section. It should take approximately 30 minutes to complete. Upon completion, the same individual who distributed it will collect the questionnaire.

Definition

For the balance of the questionnaire, learning and training technologies means those tools that you use to support learning, instruction and course administration. They include:

- computers and associated applications,
- computer-based training,
- computer-based simulations,
- digital equipment,
- video or television equipment,
- Internet/Intranet,
- networks (local, regional or wide), and
- data storage devices (Computer disks, Zip drives, memory sticks, hard drives, etc.)

Section 1 - Demographic information

This section is to collect demographic data and is used solely for statistical purposes; it will not be used for any other purpose than to help categorize the data collected in the remainder of the questionnaire. Fill in the information in the space to the right of each item.

Rank: .

Environmental Affiliation: .

Gender: .

Primary Language: .

Primary Language of Instruction: .

Section 2 - Instructional Training and Experience

This section is to determine your current level of instructional training and experience.

Part 1 – Formal instructional training completed. This is defined as that training received that was specific to skills and knowledge that you needed to perform your job as an instructor. Place an "X" in the boxes beside the training that you have received. For the "other" response, please provide a brief description of the training or education received

Basic Instruction

- ☐ Basic Instructional Techniques (AHCH)
- ☐ Primary Leadership Qualification (including instructional techniques)
- ☐ Basic Officer Qualification (including instructional techniques)
- ☐ General Military Instructional Techniques (AHCS)
- ☐ Instructional Techniques (Learning and Career Centre)
- ☐ Locally conducted instructional techniques course
- ☐ Other (provide name) .

Advanced Instruction

- ☐ Advanced Instructional Techniques (AIMU)
- ☐ Instructor Supervisor (AHCJ)
- ☐ Intermediate Leadership Qualification (including facilitation)
- ☐ Other (provide name) .

Technology-Based Instruction

- ☐ Distributed Learning Instructor (AIMO)
- ☐ e-Learning Design
- ☐ Flight Instructor's Course (FIC)
- ☐ Simulator/Trainer Instructor's Course (AIUQ)
- ☐ Other (provide name) .

Part II – Instructional experience. This is defined as the amount of time in years employed as an instructor or educator both within and outside of the CF. Provide the information to the right of the item.

Total Number of Years Instructing: .

Number of Instructional positions held: .

Section 3 - Concerns regarding the use of technology in the classroom

This section is to get your opinion on the level of support that you believe you have received and your general competency level and in the use learning and training technologies. Competency is defined as the level of knowledge, skill and ability to perform a task. Place an "X" in the box above your chosen response to the questions below.

1. How satisfied are you that your training has prepared you for your job as an instructor?

☐	☐	☐	☐	☐
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied

2. How satisfied are you regarding the level of training that you received on the use of technology for instruction?

☐	☐	☐	☐	☐
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied

3. How satisfied are you with your ability to use technology to assist you in course administration? (e.g. creating schedules, developing course reports, planning activities, etc.)

☐	☐	☐	☐	☐
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied

4. How satisfied are you with your ability to use technology to assist you in course materials development? (e.g. lesson plans, presentations, simulations, handouts, etc.)

☐	☐	☐	☐	☐
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied

5. How satisfied are you with your level of competence in the use of technology during instruction or training? (e.g. presentation applications, computer based-training, use of office software in support of instruction, etc.)

☐	☐	☐	☐	☐
Very Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Very Satisfied

Section 4 - Beliefs regarding the use of technology in support of instruction

This section is to gauge your beliefs and feelings regarding the use of learning and training technology in support of all aspects of instruction. Place an "X" in the box above your chosen response to the questions below.

7. To what degree to you think technology can create a better learning and training environment?

☐ Not at all ☐ To some degree ☐ To a good degree ☐ Completely

8. To what degree do you think you use technology to create an effective learning environment?

☐ Not at all ☐ To some degree ☐ To a good degree ☐ Completely

9. To what degree do you think your organization/school supports learning and training technology in the classroom?

☐ Not at all ☐ To some degree ☐ To a good degree ☐ Completely

10. To what degree do you want to use technology for creating an effective learning environment?

☐ Not at all ☐ To some degree ☐ To a good degree ☐ Completely

Section 5 – Technology Use and Competencies

This section relates to your frequency of use and feeling of competency in various technologies.

In this questionnaire, frequency of use is measured in three categories as either:

a. Rarely – range of use is not at all to less than once a month. This normally means that you do not conduct the stated task in the performance of your job;

b. Sometimes – range of use is at least once a month. This means that you occasionally perform the task in relation to your job; or

c. Often – range of use is anywhere from daily to weekly use. This means that you regularly use the technology in the performance of your job.

On the left hand side of the table below, you will note these three categories. For each of the tasks within the table, identify the frequency that you perform that task by placing an "X" in the appropriate box to the left of that task.

Competency is defined as the level of knowledge, skill and ability to perform a task. In this questionnaire, your competency level is measured on a continuum from beginner (1) to expert (4).

Beginner – A beginner:
- uses only basic functions of the application or software,
- has received no formal training,
- requires assistance to use most functions, and
- only uses the application when directed/required and has difficulty.

Expert – An expert:
- uses most of the elements of the application or software,
- has received either advanced formal or informal training or spent extensive period of time becoming self-taught,
- requires no assistance in any of the functions and is typically used as a subject matter expert, and
- uses the application or software as designed at every opportunity and also explores new ways to employ it.

Beside each phrase there is a scale from 1 to 4. For each term/phrase indicate your level of competency. Check the box that you believe is your level of competency in that particular area. If you don't know, circle the 0 in the unk column (unknown).

	Frequency			**Task**	**Competency Level** Beginner.....Expert				
	Rarely	**Sometimes**	**Often**		**0**	**1**	**2**	**3**	**4**
11.	☐	☐	☐	Keyboarding	☐	☐	☐	☐	☐
12.	☐	☐	☐	Word processing	☐	☐	☐	☐	☐
13.	☐	☐	☐	Using Email	☐	☐	☐	☐	☐
14.	☐	☐	☐	Scheduling (task or calendar) software	☐	☐	☐	☐	☐
15.	☐	☐	☐	Using presentation software (PowerPoint)	☐	☐	☐	☐	☐
16.	☐	☐	☐	Using a database	☐	☐	☐	☐	☐
17.	☐	☐	☐	Using spreadsheet	☐	☐	☐	☐	☐

	Frequency			Task	Competency Level Beginner.....Expert				
	Rarely	Sometimes	Often		0	1	2	3	4
18.	☐	☐	☐	Internet navigation	☐	☐	☐	☐	☐
19.	☐	☐	☐	Collaborating (WebCT, Blackboard)	☐	☐	☐	☐	☐
20.	☐	☐	☐	Using a video camera	☐	☐	☐	☐	☐
21.	☐	☐	☐	Video recording	☐	☐	☐	☐	☐
22.	☐	☐	☐	Digital photography	☐	☐	☐	☐	☐
23.	☐	☐	☐	Digital recording	☐	☐	☐	☐	☐
24.	☐	☐	☐	Using Digital displays (SMART board, LCD monitor)	☐	☐	☐	☐	☐
25.	☐	☐	☐	Scanning	☐	☐	☐	☐	☐
26.	☐	☐	☐	Developing graphics	☐	☐	☐	☐	☐
27.	☐	☐	☐	Digital image editing	☐	☐	☐	☐	☐
28.	☐	☐	☐	Sound editing	☐	☐	☐	☐	☐
29.	☐	☐	☐	Video editing	☐	☐	☐	☐	☐
30	☐	☐	☐	Creating web pages	☐	☐	☐	☐	☐
31	☐	☐	☐	Using Flash media	☐	☐	☐	☐	☐
32	☐	☐	☐	Managing electronic files	☐	☐	☐	☐	☐
33	☐	☐	☐	Creating hyperlinks	☐	☐	☐	☐	☐

Section 6 – Instructional Use

The last section is to determine how you have used technology in the past to support learning or instruction. A number of statements follow. Place an "X" in the box above your selected response to each statement..

34 I have the opportunity to employ learning and training technologies in my classroom.

☐	☐	☐	☐	☐
Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree

35. I know how to effectively employ a variety of technologies during instruction and learning activities.

☐	☐	☐	☐	☐
Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree

36. I integrate technologies into instruction and learning activities where appropriate.

☐	☐	☐	☐	☐
Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree

37. I have effectively used technology to improve learning and instruction in my classroom.

☐	☐	☐	☐	☐
Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree

38. I either conduct a self-evaluation or have my use of learning and training technologies evaluated to ensure that I am using them in the most effective manner.

☐	☐	☐	☐	☐
Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree

APPENDIX TWO

INTERVIEW PLAN

Interview Plan

Aim

The interviews associated with this study are to gather specific opinions from subject matter experts on current use of technology in CF classrooms and the definition of "effective use."

Target Population

The target population for the interviews is:

- CF instructor supervisors with a minimum time in an instructional position of 1 year,
- CF standards personnel with a minimum time in a standards position of 1 year and experience in monitoring instruction, and
- Training development subject matter experts.

Environment

The interviews will take two forms depending on the geographic location of the participants. Interviews in the South and Eastern Ontario regions will be conducted in person at their place of work if practicable. All other interviews will be conducted via telephone.

In all cases, it will be requested that the interview be conducted in a quiet, private location, free from distractions. If suitable, the participant's office space will be used to increase their comfort level. It is intended to conduct the interviews in a professional, but relaxed manner.

Consent

Each participant will be requested to sign a letter of consent (Appendix B). Participants will be informed that their comments may be quoted in the study. The investigator will ensure that written approval is obtained from the participant prior to citing them in the final report.

Structure

The interviews will be conducted one-on-one. The interview design is semi-structured. The investigator will use pre-determined questions to stimulate inquiry into the specific subject areas. Follow-on questions will be open-ended and allow participants to expand on the subject area. Further probing questions may be used to help clarify a participant's statements or comments.

Interview questions will be directly related to the issues in which the participant will have some level of experience and/or expertise. Accordingly, the interview questions will be placed in three categories:

- Instructor Supervisor,
- Standards personnel, and
- Training Development SME.

Recording of Responses

The investigator will inform participant's that he will be taking notes throughout the interview process to record important information or key phrases. There is no requirement to use a recording device for this study.

Conduct of the Interview

The interviews will be conducted in accordance with the attached Interview Guide. Each interview is anticipated to take between 30 - 60 minutes depending on the level of participant interaction.

Interview Guide

Reference: A-P9-000-013/PT-000 Preparation and Conduct of Interviews in Training Preparation

- ❑ Ensure Interview Guide Available with note-taking materials
- ❑ Arrive early or phone on time
- ❑ Ensure appropriate environment established

Introduction

- ❑ Introduce self
- ❑ Set participant at ease
- ❑ Explain purpose of interview, provide background
- ❑ Review consent form with participant, confirm their understanding and have them sign the form
- ❑ Indicate that you will be taking notes throughout

Interview Questions are divided into the three categories of Instructor Supervisor, Standards Personnel, and Training Development SME.

Instructor Supervisor: Please answer the following based on your own personal experiences and observations.		
No.	Question	Response
1.	How many instructors do you supervise?	
2.	How long have you been an instructor supervisor?	
3.	What training/education have you had to prepare you for this position?	
4.	How often do you observe your subordinate instructors?	
5.	In general, are your instructors prepared for using the available technologies?	
5a.	If yes, provide examples.	
5b.	If no, what deficiencies have you observed?	
6.	What local training or education opportunities exist for instructors regarding use of technology in the classroom?	
7.	What is your impression regarding the instructors' willingness to use the available technologies?	
8.	What criteria do you ascribe to the "effective use" of technology in the classroom?	
9.	What barriers do you think exist to effective use of technology in the classroom?	
10.	Are there any other points regarding this subject that you would like to address?	

Standards Personnel: Please answer the following based on your own personal experiences and observations.		
No.	Question	Response
1.	How long have you worked in the Standards Section?	
2.	How often do you conduct instructor observation?	
3.	What training/education have you had to prepare you for this position?	
4.	In general, do you think that the instructors effectively use available technologies in the classroom?	
4a..	If yes, provide examples.	
4b.	If no, what deficiencies have you observed?	
5.	What have student critiques indicated regarding the use of classroom technologies?	
6.	What data is available on the use of technology in the classroom?	
7.	What criteria do you ascribe to the "effective use" of technology in the classroom?	
8.	What barriers do you think there may be related to the effective use of technology in the classroom?	
9.	Are there any other points regarding this subject that you would like to address?	

Training Development SME: Please answer the following based on your own personal experiences and observations.		
No.	Question	Response
1.	How long have you worked at the school?	
2.	How many years of experience do you have in the training community?	
3.	To what degree have you observed the instructors?	
4.	What is your impression regarding instructors' use of technology in the classroom?	
5.	What professional development opportunities currently exist in the school or region that would assist the instructors in becoming more proficient in the use of classroom technologies?	
6.	What criteria do you ascribe to the "effective use" of technology in the classroom?	
7.	What barriers do you think there may be related to the effective use of technology in the classroom?	
8.	Are there any other points regarding this subject that you would like to address?	

Conclusion

- ❑ Summarize points from the interview
- ❑ Confirm summary is accurate
- ❑ Re-state what will happen with the interview information
- ❑ Provide your contact information
- ❑ Thank participant for their time and information

APPENDIX THREE

LETTER OF TRANSMITTAL

DHRRE authorizes the administration of this survey within DND/CF in accordance with CANFORGEN 145/02 ADMHRMIL 079 UNCLASS 131028Z DEC 02. authorization number: 440/06.

I am a Master's Student in the Faculty of Education at Memorial University of Newfoundland and my Thesis Advisor is Dr. George Hache. I will be conducting a study to identify the instructors' knowledge of and ascription to the use of technology in the classroom.

The study will incorporate a questionnaire to be completed by CF instructors and interviews with instructor supervisors, standards staff and training development experts. The questionnaire will be distributed on a single occasion to identified instructors in a variety of CF training environments. The questionnaire will be deployed personally by the researcher or through a delegated Canadian Forces Training Development Centre (CFTDC) representative. The questionnaire should take approximately 30 minutes. On completion, the researcher or representative will collect the questionnaire.

There are no risks associated to completing this questionnaire as the information within the questionnaire will be confidential and only used for the purposes of this study. The interviews will be conducted on the understanding that the responses may be published within the study and are not, therefore, confidential. Participation in either the questionnaire or the interviews is completely voluntary. Anyone who decides to participate has the right to withdraw from the study without prejudice at any time and can also refrain from answering whatever questions they wish. Interview participants will be required to complete the attached letter of consent.

The researcher and the Commandant CFTDC will protect the confidentiality of your responses to the extent disclosed above permissible under Canadian Law.

You should be aware that under the Access to Information Act, Canadian citizens are entitled to obtain copies of research reports and research data (including the database pertaining to this project) held in Federal government files. Similarly, under the Privacy Act, Canadian citizens are entitled to copies of all information concerning them that is held in Federal government files including research databases. Prior to releasing requested information, the Directorate of Access to Information and Privacy (DAIP) screens the data to ensure that individual identities are not disclosed.

To further safeguard your anonymity and privacy, you should not write your name, service number or personal record identifier anywhere on this questionnaire. Second, you should ensure that any written comments you may offer are sufficiently general that you cannot be identified as the researcher.

APPENDIX FOUR

RESEARCH CONSENT FORM

Consent Form

I am a Master's Student in the Faculty of Education at Memorial University of Newfoundland and my Thesis Advisor is Dr. George Hache. I will be conducting a study to identify the gap in skill, knowledge, and attitudes regarding effective use of training technologies in the classroom and design interventions that address the gap.

The study will incorporate a survey of CF instructors and interviews with instructors, their supervisors, Standards staff and training development experts. The survey will be a questionnaire that will be distributed on a single occasion to identified instructors in a variety of CF training environments.. The questionnaire should take approximately 30 minutes. There are no risks associated to completing this questionnaire as the information within the questionnaire will be confidential and only used for the purposes of this study. The interviews will be conducted on the understanding that the responses may be published within the study and are not, therefore, confidential. Participation in either the survey or the interviews is completely voluntary. Anyone who decides to participate has the right to withdraw from the study without prejudice at any time and can also refrain from answering whatever questions they wish

Upon completion of the study, the data from the questionnaire and interviews will be stored on a computer disk for three years by the author of the study. An electronic copy and paper copy of the study will remain on file at the Canadian Forces Training Development Centre and a paper copy will also be available at Memorial University, Faculty of Education. Should any of the participants wish to have a copy of the research results, they are to write to:

The Commandant
Canadian Forces Training Development Centre
633 Dieppe Road
PO Box 1000 Stn Main
Borden ON L0M 1C0

This study has been reviewed the Faculty and Memorial University and it conforms to the ethical guidelines of both the Department of National Defence and Memorial University of Newfoundland.

Participants have the right to inquiry about the study with the investigator, the Thesis Advisor or the University. They also have the right to make inquiries to the Associate Dean, Graduate Programmes at the University.

I, _____ understand the purpose of the study and my rights in relation to the study. I also understand that the study is completely voluntary and that I may withdraw at any time or may refrain from answering any questions that I do not wish to answer. I understand that if I participate in the survey, that the

resulting data is confidential and will only be used for the purposes of this study. My signature below indicates my consent to participate in this study.

Name (Print)	Signature	Date

As the appointed representative of the Department of National Defence, I understand the purpose and intent of this study. I have been informed of the methods to be used and give my consent for the conduct of this study.

Name (Print)/Position	Signature	Date

The proposal for this research has been approved by the Interdisciplinary Committee on Ethics in Human Research at Memorial University. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 737-8368.