Exploring Distance Learning for Crew Resource Management Training in Military Aviation

Dissertation

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by

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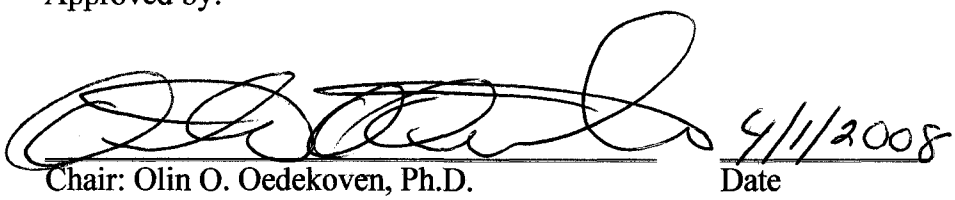

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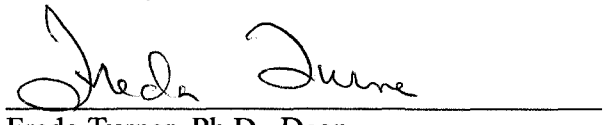

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Abstract

Exploring Distance Learning for Crew Resource Management Training

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Northcentral University, March 2008

Crew resource management (CRM) training in aviation emphasizes the social and cognitive skills in connection with technical skills for safe and efficient flight operations. Because of ambiguous definitions and training concepts, CRM has not yet proven its effectiveness. The purpose of this mixed methodology study was to explore and examine distance learning programs for CRM training in the German Air Force (GAF) employing a customized questionnaire developed from previous research in both fields. Descriptive data analysis showed acceptance of distance learning programs among GAF respondents in the technical and in the self-directed learning domain but a lack of technical infrastructure, personal benefits, and motivation. Besides a positive attitude to CRM training, experienced personnel indicated a conspicuous neutral attitude in the domains perception of management, training and checking, teamwork, rules and roles, leadership style, and management of stress and fatigue. The statistically significant positive medium correlation between acceptance of distance learning and attitude to CRM training revealed a promising indicator for effective CRM distance learning programs. Managing identified deficits might contribute to a constructive distance learning environment and a positive CRM and safety culture in the GAF and in other high risks organizations.

Acknowledgements

Completing a dissertation study is an adventure requiring motivation and resilience over a long period of time while discovering and undergoing various mental phases. I am very lucky to know some exceptionally fine people who helped me on this journey.

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Finally, and most importantly, I would like to thank my best friend and wife, Dr. Simone Bruemmer, for her unconditional support, encouragement, patience, and sacrifice. Thank you for being the best part of my life.

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Chapter 1: Introduction

After researchers at the National Aeronautics and Space Administration (NASA) "identified the human error aspects of the majority of air crashes as failures of interpersonal communications, decision making, and leadership" (Helmreich, Merritt, & Wilhelm, 1999, p. 19) in the late 1970s, crew resource management (CRM) programs evolved to make flying safer. Salas, Prince, et al. (1999), Flin, O'Connor, and Mearns (2002), and the Manual of FAA Crew Resource Management (2004) indicated that 60% to 80% of aviation accidents and incidents relate to human error in the cockpit. "Long-term NASA research has demonstrated that . . . problems are associated with poor group decision making, ineffective communication, inadequate leadership, and poor task or resource management." (FAA Crew Resource Management, 2004, p. 4)

The most important subject in aviation is safety followed by efficiency and productivity (Salas, Rhodenizer, & Bowers, 2000). The multidisciplinary field of human factors intends to optimize human performance, reduce human error, and make flying safer (FAA Crew Resource Management, 2004). Besides improving flight safety, military commanders are further interested in enhancing mission effectiveness (Prince & Salas, 1993) "The goal of CRM training is to develop the social and cognitive skills that are exercised together with technical, systems-related, skills in order to achieve safe and efficient aviation" (MacLeod, 2005, p. 8). According to the Manual of FAA Crew Resource Management, CRM training should concentrate on situation awareness, communication skills, teamwork, task allocation, and decision-making to optimize the human/machine interface.

Researchers revealed that CRM training programs lack optimization as a safety and efficiency tool in aviation (Salas et al., 2000; Salas, Wilson, Burke, & Wightman, 2006). MacLeod (2005) supported this finding and criticized the low transportability of CRM. Salas, Prince et al. (1999) published that the reason for this problem is the lack of standardization in CRM training programs. After analyzing the history of CRM training programs, the literature suggests that CRM training programs remain in the process of improvement because they have not reached their full potential. Even though CRM training programs are widely accepted throughout commercial and military settings, there have not escaped doubts about their effectiveness on aviation safety (Salas, Prince et al., 1999; Salas et al., 2006). Acceptance requires aviation organizations to improve and redesign CRM training programs in connection with the latest training methods and human resource management tools (FAA Crew Resource Management, 2004).

Statement of the Problem

According to the International Air Transport Association (IATA), the key problem with current crew resource management (CRM) practice is that it does not reach everyone (Helmreich et al., 1999; MacLeod, 2005). Some pilots even reject the concepts of CRM and the attitude of some participants is worse after training (Helmreich et al.; Helmreich & Merritt, 2000). Instructional designers also fail to move the concept of CRM from the classroom to line operations and to transfer training sessions into daily operations (Helmreich et al.). According to Salas, Prince, et al. (1999) and Nullmeyer and Spiker (2003), general confusion and suboptimal programs have been created because there is no universally accepted agreement of what CRM training should include and how it should be accomplished.

Further analysis of the problem points out the lack of CRM culture inside and outside the cockpit in some aviation organizations. Even though there is no scientific evidence, reports of numerous cockpit crews support this statement indicating that CRM training and philosophy is often not encouraged by management (Salas, Burke, Bowers, & Wilson, 2001). To build an effective training tool, members of the entire organization must understand and embrace the team-building culture of CRM (Maurino, 1999; Thomas, 2004). The Manual of FAA Crew Resource Management (2004) published:

> Many carriers are discovering the value of expanding CRM training to reach various employee groups beyond flight crew and flight attendants. Dissimilar groups are being brought together in CRM training and in other activities. The objective is to improve the effectiveness and safety of the entire operations team as a working system. (p. 14)

In this mixed methodology study, the researcher explored and examined the potential acceptance of distance learning (DL) training programs as a delivery modality of a CRM training program for German Air Force (GAF) personnel involved in flight operations. The researcher explored and examined the GAF because restructuring and redesigning CRM training programs and implementing new training methods is part of the current GAF transformation process and postulated by GAF commanders (Chief of Staff of the German Air Force, 2006). The way the military is structured slowed down the entry of CRM training programs because "Their configuration does not lend itself to the easy adoption of a single program" (Prince & Salas, 1993, p. 339). Although military organizations are known for their rule-bound structures, military aviation is not a single entity but separated into the different services, divisions, and subdivisions (Prince & Salas). Regarding military CRM programs Prince and Salas stated:

> Individual commanding officers have considerable latitude in how they may run their commands. It is perhaps for this reason that no single program has been applied service-wide that is recognizable in all its

> applications. . . . Many of the programs are idiosyncratic, reflecting the singular ideas of one individual. . . . Since there is no clear definition or agreement on what constitutes aircrew coordination or how it should be taught, the training is highly individualistic. (p. 347)

Salas, Prince, et al. (1999) and Thomas (2004) reported that CRM definitions, training content, and training methods lack consistency and consensus in respect to training design, delivery, and evaluation within the entire aviation industry allowing too much ambiguity. Persons in charge in civil aviation and military aviation have identified the need to go beyond training of flight crews and to deliver CRM training for all personnel involved in flight operations (FAA Crew Resource Management, 2004; Flin et al., 2002; Chief of Staff of the German Air Force, 2006). Lu (2005) reported that since 1998 maintenance resource management (MRM) training has become mandatory in many industrialized countries. This policy coincides with the team-building culture proposed by Thomas, Maurino (1999), Lu, and FAA Crew Resource Management (2004). Because of high absenteeism from home and flexible work schedules CRM training does not reach all personnel involved flight operations. Reports from the International Air Transport Association supported this finding - the key problem with current CRM practice is that it does not reach everyone (Helmreich et al., 1999; MacLeod, 2005). MacLeod (2005) concluded that regarding CRM's low transportability "organizations have to reinvent CRM in the light of their own operation, regulatory environment, employees and so on" (p. 8).

Seeking CRM culture within the GAF requires a homogeneously accepted training program for all personnel involved in flight operations. A potential new training program based on the distance learning concept using the Internet might standardize CRM training throughout the GAF, reach all personnel involved in military flight

operations, improve training standards, and facilitate the expansion of a general accepted CRM culture within the GAF. Helmreich et al. (1999), Lu (2005), the Manual of FAA Crew Resource Management (2004) and the Chief of Staff of the German Air Force (2006) supported the systematic approach and stated that this process should foster the development of a joint training program for cockpit crew, aircraft dispatchers, maintenance personnel, and management.

Training participants should have a positive attitude towards the program because CRM is a concept that "emphasizes the need for clear and open communication . . . , including the process of conflict resolution and decision making" (Manningham, 1995, p. 67). A positive attitude requires personal commitment and willingness to participate in CRM training programs by each individual involved in flight operations. Thomas (2004) suggested, "You must constantly energize the program for it to keep working" (p. 52). Wiley (2002) published that in order to keep aviation crews interested and focused on CRM, programs need reinvention from time to time. Therefore, besides developing new CRM training programs, it is advisable to conduct research on trainees' attitude to CRM training.

Background and Significance of the Problem

Crew resource management training has been utilized for more than 20 years in commercial and military aviation (Salas et al., 2006). Training became mandatory for military flight crews in the early 1990s and mandatory for commercial flight crews in 1998 (Salas et al.). According to Salas, Prince et al. (1999), Flin et al. (2002), and the Manual of FAA Crew Resource Management (2004), almost 60% to 80% of aviation accidents and incidents still relate to human error. Studies in military aviation, however,

revealed that CRM training decreased USAF accident and incident rates as well as the accident rate by 81% for US Navy A-6 Intruder crewmembers (Flin et al.).

According to the Manual of FAA Crew Resource Management (2004), "The multidisciplinary field of human factors is devoted to optimizing human performance and reducing human error" (p. 2) within the entire aviation domain. After analyzing 189 final accident reports from the National Transportation Safety Board (NTSB), Lu, Wetmore, and Przetak (2006) identified 10 groups as direct hazards in aviation: Flight operations, ground crew, turbulence, maintenance, foreign object damage (FOD), flight attendant, air traffic control, manufacturer, passenger, and Federal Aviation Administration. Leaders of many other industries (i.e. health care, nuclear power domains, offshore oil production, shipping etc.) have taken note of CRM and are adopting training programs from the aviation industry (Flin et al., 2002; France et al., 2005; Salas et al., 2006). According to Salas et al., CRM training programs have not yet proven their effectiveness. The review of multiple CRM training programs in the aviation domain revealed that training "led to positive attitudes, learning, behavioral changes on the job, and (potentially) safety in organization, although the results were not quite clear" (Salas et al., 2006, p. 404). Salas et al. also reviewed the effectiveness of CRM training in other domains like medicine, offshore oil production and maintenance, shipping/maritime, and nuclear power. Even though no study was uncovered that suggested CRM training does not work, approximately 50% of the studies indicated mixed results, making the effectiveness questionable (Salas et al.).

The purpose of the mixed methodology dissertation study was to examine if CRM can be delivered by distance learning strategies to support safe and efficient flight

operations in the GAF. Raisinghani et al. (2005) published that a groundbreaking study by the FAA in 1999 revealed a beneficial reduction in pilot error accident rate from its staggering 87% level in 1999 after combining personal computer-based aviation training devices with emerging technologies. Other industries have made use of online learning strategies as well and are utilizing the Internet to expand the reach of training. Chen and Shaw (2006) stated that 76% of the entire online learning market in year 2000 was represented by the information technology skills training market and the worldwide corporate online learning market might grow with an annual growth rate of 35.6% to $18 billion by 2006. According to Newton and Ellis (2005), learners and teachers in the education and knowledge-based domains have largely effected the development of the online learning environment and research has been limited to commercial based research companies with a US focus. "There is a need for more exploratory case study research into the processes involved in adopting and adapting e-learning in different learning contexts" (Newton & Ellis, 2005, p. 385).

Like other complex domains, the GAF requires an innovative and contemporary training design to implement CRM (Chief of Staff of the German Air Force, 2006). The researcher explored and examined if distance learning programs can deliver CRM training for the GAF in a methodical and objective process of gathering, recording, and analyzing data for future decision-making (Zikmund, 2003). The intention is to start a systematic path in the development process of a customized CRM training program for the GAF using the distance learning concept – having comprehensive CRM knowledge, competence to learn, motivation to conduct CRM training, and a viable CRM culture with the GAF will lead to flight safety and efficiency as shown in Figure 1.

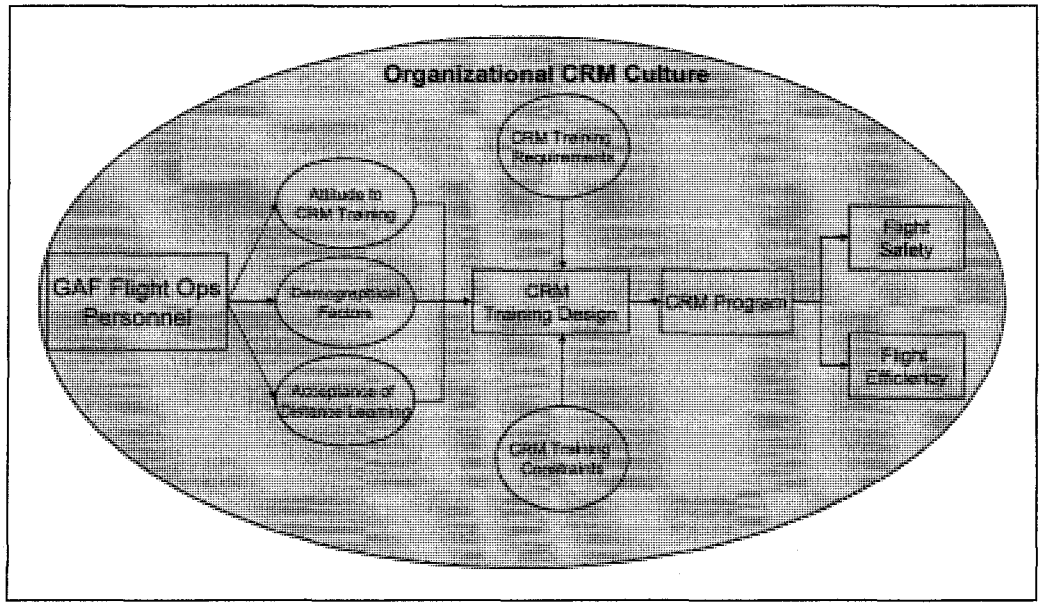

Figure 1. Systematic path in the development process of a customized CRM training program for the GAF

Research Questions/Hypotheses

The focus of this mixed methodology study was to explore and examine if distance learning programs can deliver crew resource management (CRM) training for German Air Force (GAF) personnel involved in military flight operations to increase training effectiveness. For this purpose a survey was conducted with GAF personnel involved in flight operations like flight crew, maintenance personnel, support personnel, and leadership personnel using a newly framed multidimensional paper and pencil questionnaire based on the Distance Learning Readiness Assessment (DLRA) scale (Guglielmino & Guglielmino, in press) and the Flight Management Attitude Questionnaire 2.0 (FMAQ) (Merritt, Helmreich, Wilhelm, & Sherman, 1996).

Implementing this new delivery process will require the acceptance of distance learning programs as an instructional CRM training method. Trainees' attitude to CRM

training is another factor that influences training effectiveness and ranks as an indicator of a viable CRM culture within the GAF. The connection between acceptance of distance learning and attitude to CRM training is a prerequisite for CRM programs to be delivered by distance learning. Without the acceptance of distance learning and without a positive attitude to CRM training, CRM training cannot be delivered by distance learning.

The epistemological interest is what strategies might be used to implement and deliver CRM training by distance learning to increase training effectiveness. To answer the question the following sub-questions and hypotheses were proposed:

1. What, if any, acceptance of distance learning programs exists among GAF personnel involved in flight operations?
2. What, if any, attitude exists among GAF personnel involved in flight operations to conduct CRM training?
3. What, if any, relationship exists between the acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations?

$H_{0\text{-}3}$: No correlation exists between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations.

$H_{A\text{-}3}$: A correlation exists between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations.

Definition of Terms

German Air Force (GAF) personnel involved in flight operations. German Air Force personnel involved in flight operations includes flight crew, maintenance personnel, support personnel, and leadership personnel working in a GAF air wing (Chief of Staff of the German Air Force, 2006).

Crew resource management (CRM). Crew resource management is a method for improving personal interaction between personnel involved in flight operations so that safety and efficiency are increased. Core values are cultural and social interaction, error management, risk management, decision-making, and situational awareness (Salas et al., 2000).

Distance learning (DL). Distance learning is a system and a process tailored to meet the needs of specific groups of people. It allows learners and instructors/tutors to connect with distributed learning resources. The characteristics are: (1) interaction between learner and instructor/tutor and between learners, (2) separation of time and/or place between instructor/tutor and learners, and (3) interaction between the learner and learning resources using one or more media (Chen & Shaw, 2006). Even though the use of electronic media is not necessarily required for distance learning, this study concentrates on the Internet-based learning resources.

Attitude to CRM training. The complex mental state of each individual involved in flight operations regarding beliefs, feelings, values, personal commitment, and willingness to participate in CRM training programs. Attitude can be positive, negative, ambivalent, or any stage in between.

Summary and Conclusion

Flin et al. (2002) published, "Safety research has shown that human error and team work failures, as opposed to mechanical malfunction, are major causal factors in industrial accidents" (p. 68). Military and commercial aviation acknowledged the problem and implemented Crew resource management (CRM) training programs in the 1980s (Wiley, 2002). According to Maurino (1999), "the history of CRM appears to be one of extreme success: With barely enough age to vote, CRM has already been assigned a significant role as contributor to the safety and efficiency of the aviation system" (p. 215). Other domains like medicine, offshore oil production and maintenance, shipping, and nuclear power industry have adopted the concept of CRM and implemented CRM training for their workforce (France et al., 2005; Salas et al., 2000; Salas et al., 2006).

People working in aviation have to deal with irregular working hours, problems of fatigue and disruption of diurnal rhythms (Garland, Wise, & Hopkin, 1999). Flight crews as well as non-flying personnel obtain training to the highest standards in respect to safety and efficiency in military flight operations. It is the responsibility of GAF commanders to maintain this high standard and to develop innovative training programs in conjunction with the latest training technologies. The Chief of Staff of the German Air Force (2006) identified CRM training as a valuable tool to train personnel involved in GAF military flight operations.

Working in a highly flexible work environment limits the use of traditional training programs like classroom training courses. According to Helmreich et al. (1999) and MacLeod (2005), current CRM practice has the problem that it does not reach everyone. This problem is omnipresent in aviation industry. Some aviation personnel

even reject the concepts of CRM and training sessions fail to translate into daily operations (Helmreich et al.; MacLeod). Salas, Prince et al. (1999) published, "the lack of agreement regarding what CRM training should include and how it should be accomplished has led to confusion and, in many cases, adoption of a theoretical and suboptimal programs" (p. 163).

The mixed methodology dissertation study might be an instrument to identify whether distance learning is an accepted tool for the development of an effective training program leading to a viable CRM culture within the German Air Force and other organizations implementing the concept of CRM. Research results in respect to the acceptance of distance learning programs and the motivation of personnel to conduct CRM training might support the decision making process of military and organizational leaders. Research results might also show various domains a methodology to identify the prevalent CRM culture within their organization and a potential way to implement innovative training programs.

It is expected that the results of the research conducted will contribute to the body of research already conducted by other scholars regarding the ongoing development process of CRM training programs. Martens, Gulikers, and Bastiaens (2004) published that researchers are progressively trying to link instructional strategies, motivational processes, and learning outcomes. Research evidence, however, is still 'embryonic'.

Crew resource management cannot eliminate error and assure full safety in a high-risk environment such as aviation (Helmreich et al., 1999). "CRM is one of an array of tool that organizations can use to manage error." (Helmreich et al., 1999, p. 30)

Maurino (1999) stated, "CRM is too valuable a tool to be squandered by misunderstandings, misperceptions, incompetence, or plain ignorance" (p. 216).

Chapter 2: Literature Review

Introduction to Crew Resource Management

According to the Manual of FAA Crew Resource Management (2004), the Joint Aviation Authorities (1998), and the Chief of Staff of the German Air Force (2006), developing, implementing, reinforcing, and assessing crew resource management (CRM) training for flight crew and other personnel is essential to flight safety in commercial and military aviation. The CRM initiative was started in the late 1970s after National Aeronautics and Space Administration (NASA) research "identified the human error aspects of the majority of air crashes as failures of interpersonal communications, decision making, and leadership" (Helmreich et al., 1999, p. 30). Flin et al. (2002), Lu et al. (2006), and the Manual of FAA Crew Resource Management published that 60% to 80% of aviation accidents and incidents relate to human error like poor group decision making, ineffective communication, inadequate leadership, and poor task or resource management. Salas et al. (2006) supported this finding and stated:

> Wiegmann and Shappell (2000) examined a breakdown of the factors contributing to U.S. Navy and Marine Corps accidents and found that in approximately 60% of the accidents between 1991 and 2000, a CRM failure in the cockpit was a factor. Similarly, an examination of accidents during 1991 and 2000 indicated that approximately 41% of Part 121 (i.e., aircraft conducting domestic commercial or flag operations) and 23% of Part 135 (i.e., aircraft conducting commuter or on-demand operations) accidents involve a breakdown in CRM by the flight crew. (p. 393)

Prince and Salas (1993) published that "the U.S. Army estimate of crew coordination-caused accidents was considerably higher in 1989 than it had been in 1973 (40% versus 11%) and much of this increase was due to inadequate identification of coordination as an accident cause in the 1970s" (p. 338).

According to Merritt (2000), CRM training is promoted globally, mandated in all 185 member states of the International Civil Aviation Organization (ICAO), and has been extended beyond cockpit crew to cabin crew, dispatchers, and maintenance personnel (MacLeod, 2005). Since 1998, Maintenance Resource Management (MRM) training has become mandatory for aviation mechanics in many industrialized countries (Lu, 2005). After commercial and military aviation purported more than 20 years of successful CRM training in aviation, other high-consequence domains have begun to implement CRM training for their workforces (Salas et al., 2006).

Research revealed that CRM training programs lack optimization as a safety and efficiency tool in aviation (Salas et al., 2006). MacLeod (2005) supported this finding and criticized the low transportability of CRM. Salas, Prince et al. (1999) published that the reason for this problem is the lack of standardization in training programs. Instructional designers also fail to move the concept of CRM from the classroom to line operations and to transfer training sessions into daily operations (Helmreich et al., 1999). Researchers from the International Air Transport Association (IATA) identified that CRM does not reach everyone (Helmreich et al.; MacLeod). There is a requirement to improve and redesign CRM training programs in connection with the latest training methods and human resource management tools (FAA Crew Resource Management, 2004). Innovative instructional strategies should foster improved teamwork by combining learning objectives, content, tools, and methods that are consistent with accepted learning theories (Salas et al., 2000).

Analyzing the literature revealed that trainees' attitude to CRM training is an additional key factor and prerequisite to implement the core values underlying the

concept of CRM training into the GAF. Salas et al. (2000) claimed that training success is usually measured upon variables like instructional approach, media, training method, and training design. However, there are factors that need to be managed before, during, and after CRM training in order to train CRM effectively because these factors outside the program itself have the potential to influence training outcomes as well (Salas et al.). There are pre-training factors like organizational climate, continuous learning culture, supervisor support, and supervisor participation in goal setting prior to training (Salas et al.). Additionally, Salas et al. identified a number of factors related to the trainee itself. These factors are the trainees' choice to participate in training, expectations for training, pre-retraining experiences, pre-training motivation, and self-efficacy. Tai (2006) stated, "Individuals with substantial self-efficacy will have more training motivation to attend a training program and to learn more" (p. 54). Self-efficacy is positively associated with training motivation and trainees with high self-efficacy will increase training motivation that improves training effectiveness (Tai). Analyzing the pre-training factors and the factors related to the trainee itself revealed that the trainee's attitude to CRM training or motivation to conduct training appears to plays an important role for CRM training success. According to Noe and Wilk (1993), "Motivation to learn was the only attitudinal variable to have a consistent, significant, positive influence on different outcomes related to development activity." (p. 301). Shellnut (1996) published, "motivation has been neglected in instructional technology . . . and there is not just one measure but many for the several elements of motivation, such as curiosity, expectancy, relevancy, and satisfaction" (p. 1). It appears that trainee's attitude to CRM training is a prerequisite for a viable CRM culture and necessary for training success.

According to (Salas et al., 2000), CRM training tools are most effective if they are consistent with accepted theories of learning and if they offer important information about CRM behaviors, active practice, and feedback. Designing effective CRM training programs requires a comprehensive understanding of the instructional systems design process (Salas et al.).

Human Factors in Aviation

According to (Garland et al., 1999), "Technical innovations and automation introduce changes in the control of aircraft as vehicles and as traffic, and the numerous human roles and jobs in the air and on the ground that support aviation" (p. xiii). Human factors in aviation are dealing with human's capabilities, limitations, and behaviors to optimizing human performance and reducing human error (FAA Crew Resource Management, 2004; MacLeod, 2005). Methods and principles of the behavioral and social sciences, engineering, and physiology are incorporated into this multidisciplinary field (FAA Crew Resource Management). Integrating that knowledge into the systems we design is mandatory to enhance safety, performance, and to increase the comfort level of the operators of the systems (Koonce, 1999). The domain of human factors plays a vital role in the process of technical advancement and it is expanding independently of aviation (Garland et al.). Aviation human performance is continuously expanding with more topics, applications, and with a greater variety of techniques making it a developing and dynamic force (Garland et al.). Garland et al. (1999) published:

> Aviation has often been among the first contexts to apply new technologies safely and successfully. It has therefore also been among the first to encounter and resolve the human factors issues associated with them. . . . The full range of the human factors consequences of new technologies has not always been foreseen, and may not always have been predictable while the technologies were being developed or when they

> were first introduced, but at last there seems to be a growing recognition of what the full range of these consequences is likely to be and a greater willingness to take account of them during development. (p. xiv)

Even though human factors are identified as the most contributing factor to aircraft accidents, the safety literature expressed that this was not always the case in accident causation "but emerged as a residual problem as aircraft became more reliable" (Hobbs, 2004, p. 335). Research revealed that the early development stage of aviation machines led to more accidents caused by technical failures. "As time passes however, the situation is reversed, as technical failures become less common and human factors take on more importance. . . . The human factor is sometime referred to as the 'last frontier' of safety." (Hobbs, 2004, p. 335) Research conducted by Hobbs using Australian civil aviation accident statistics, however, did not support the last frontier view of human factors. Regarding aviation accidents, pilot factors featured more frequently than aircraft factors in the past and in present days (Hobbs). "Early American civil aviation statistics also indicate that compared to technical failures, human failures were a common cause of accidents" (Hobbs, 2004, p. 338). Hobbs (2004) stated:

> It must be acknowledged that a conclusion of "human error" is never an adequate explanation for an accident. Although the action of a person may be the immediate precursor of an accident, a mix of task, equipment, and environmental factors may also be involved. . . . Although the nature of aviation changed dramatically over the first 100 years of powered flight, the primary place of people as determinants of safety remained remarkably constant. (p. 340)

Team Performance and Training

After a fatal aircraft accident in 1978, the National Transportation Safety Board (NTSB) reported poor communication within the flight crew as a causal factor (MacLeod, 2005). According to the Manual of FAA Crew Resource Management (2004), the field of human factors is researching variables that influence individual performance

and variables that influence team or crew performance. "Many problems encountered by flightcrews have very little to do with the technical aspects of operating in a multi-person cockpit. . . . Problems are associated with poor group decisionmaking, ineffective communication, inadequate leadership, and poor task or resource management." (FAA Crew Resource Management, 2004, p. 4) Cannon-Bowers and Salas (1998) stated that a critical aspect of task performance is team performance and training.

Salas, Dickinson, Converse, and Tannenbaum (1992) reported that even after more than 50 years of team research there is still lack of consensus about what a team is. Clark (2005) supported this statement and reported that it is critical to be clear about the definition of a team. The team definition offered by Salas et al. (1992) and supported by Clark is related to highly structured and interdependent teams that can be found in complex domains. Salas et al. (1992) published:

> A team is defined as a distinguishable set of two or more people who interact, dynamically, interdependently, and adaptively toward a common and valued goal/objective/mission, who have each been assigned specific roles or functions to perform, and who have a limited life-span of membership. . . . The central point of the definition is that task completion requires: (a) a dynamic exchange of information and resources among team members, (b) coordination of task activities (e.g., active communication, back-up behaviors), (c) constant adjustments to task demands, and (d) some organizational structuring of members. The element of time is also critical for understanding teams. Most teams perform for a limited life-span that can last for a few hours (e.g., the duration of a flight for an air crew) to several days or months (e.g., a military tactical team). (p. 4)

According to McGreevy (2006) and Broom (2002), teams have been around for a very long time and the importance of working together as a team is stressed in almost every profession. Salas et al. (1992) stated that due to technological developments tasks are often too large for one individual to perform in isolation because they impose high mental and physical demands on the individual. "In general sense people talk of team

work in positive ways when they want to emphasize the virtues of co-operation and the need to make use of the various strengths of employees" (McGreevy, 2006, p. 259). The best decision for a workgroup is made when the group members pool their available resources (McGreevy; Broom). Tannenbaum, Smith-Jentsch, and Behson (1998) supported this statement and pointed out the team's capacity to promote learning among team members. "Teams work to solve jointly-owned problems that no one member is expert in and that is only by pooling the expertise of all the constituent members to solve a problem" (McGreevy, 2006, p. 259). Working in a team can improve quality of work, encourage innovation, take advantage of the opportunities provided by technological advances, and improve employee motivation (McGreevy). According to McGreevy fostering teamwork in an organization requires senior management commitment and change in the organization's culture to a more participative style of management. "The development of team working cannot be viewed as a finite project with a beginning and an end. It is important to have an overall vision." (McGreevy, 2006, p. 264)

Researchers in the early 1990s revealed that teams tend to develop skills that are associated with the technical aspects of the task (taskwork) and skills associated with the team aspect of the task (teamwork). Teamwork skills are consistent across tasks and are directly related to the team's effectiveness (Cannon-Bowers & Salas, 1998). Cannon-Bowers and Salas (1998) published, "Seven dimensions of team behavior seemed to best describe expert team performance. These include: mission analysis, assertiveness, adaptability/flexibility, situational awareness, decision making, leadership, and communication" (p. 26). The construction of team training programs as well as the development of performance measures in training is largely effected by these factors

(Cannon-Bowers & Salas). Tannenbaum et al. (1998) supported this finding and published that enhanced selection or individual training of team members can improve team effectiveness.

According to Clark (2005), "Interdependent teams are most motivated when they trust both the expertise and collaborativeness of other team members as well as the determination of weaker members on their team to invest maximum effort to build their expertise" (p. 16). Team members must also believe that team performance is constantly and fairly evaluated in conjunction with their own contributions to the team (Clark). The level each individual identifies with the team largely effects the team member's contribution to the team (O'Connor, 2006). O'Connor reported that the individual's identity within a team, however, is very important.

Cannon-Bowers and Salas (1998), Serfaty, Entin, and Johnston (1998), Tannenbaum et al. (1998), Blickensderfer, Cannon-Bowers, and Salas (1998), and Salas et al. (2000) stated that the shared mental model theory might potentially enhance team performance. The mental model theory derives from the area of cognitive psychology allowing people to predict and explain system behavior and to understand the relationship between system components and events (Blickensderfer et al., Tannenbaum et al.). To reach optimal team performance, "Team members must be familiar with the knowledge, skills, attitudes, preferences, and other task-relevant attributes of their teammates" (Cannon-Bowers & Salas, 1998, p. 19). Having a shared mental model of a system will improve training performance and enable people to learn better (Cannon-Bowers & Salas).

Conducting cross training appears to be effective training tool to improve team performance and is consistent with the team performance literature and the shared mental model theory (Blickensderfer et al., 1998; Cannon-Bowers & Salas, 1998; Serfaty et al., 1998; Tannenbaum et al., 1998). "The idea behind cross training is that team members can learn about the demands of the task from the perspective of their teammates. This should enable them to better anticipate the behavioral and information needs of the teammates." (Cannon-Bowers & Salas, 1998, p. 31) According to Cannon-Bowers and Salas, the same statement is true for interpositional knowledge training giving team members a higher degree of shared knowledge about the roles and responsibilities of their teammates.

Tannenbaum et al. (1998) published, "Each time a team engages in activity (whether that activity is a team training event or simply the normal performance of team responsibilities), the potential exists for team members to learn about their interactions and to enhance their subsequent performance" (p. 247). To foster learning from their experience, team development should not be limited to structured interventions alone (Tannenbaum et al.). Tannenbaum et al. stated that besides learning from other team members' experiences, team learning in environments that require high levels of attention should take place prior to peak stress events because team members often allocate most of their cognitive resources to the task itself. "To optimize team learning, teams need to prepare before engaging in task performance (i.e., pre-brief) and then provide feedback to one another after engaging in task performance (i.e., post-action reviews)" (Tannenbaum et al., 1998, p. 250). Kozlowski (1998) identified the increased need for cognitive and behavioral capabilities for effective team members because teamwork is contextually

based. According to Kozlowski, basic skills can be developed using conventional training setups like the classroom whereas adaptive skills are unfolded and refined in the performance environment. "This means shifting more training to the performance context and developing new training strategies and techniques that can be integrated into the work environment." (Kozlowski, 1998, p. 116) Following this new strategy does not require more on-the-job training (OJT) but re-conceptualizing the way professionals think about training systems, the goals of training, and the delivery modalities of training (Kozlowski). To foster teamwork across a wide array of domains and to build teams that are more effective, Arthur, Wall, and Halligan (2003) suggested giving help, support, and assistance to do so. McKinney, Barker, Davis-Sacks, and Smith (2005) published that aviation is an excellent domain to learn from in respect to teamwork because aviation represents an important knew dimension of the future of organizations - a lifetime of participation on short-duration, short-task teams.

The Evolution of CRM

According to Garland et al. (1999), "the history of CRM appears to be one of extreme success: With barely enough age to vote, CRM has already been assigned a significant role as contributor to the safety and efficiency of the aviation system" (p. 215) and CRM has saved numerous lives and airlines (Manningham, 1995). Salas, Fowlkes, Stout, Milanovich, and Prince (1999) published, "Crew Resource Management (CRM) has been the most widely used instructional strategy to enhance teamwork skills within aviation" (p. 326). With all enthusiasm, the relationship between CRM and improved safety is still vague (Garland et al., 1999; McLeod, 2005). Thomas (2004) claimed that the effect of CRM training on an organization's safety record has not been proven beyond

doubt and the systematic and multilevel evaluation efforts should be conducted to demonstrate the true effectiveness of CRM training. Researchers revealed that CRM programs change attitudes about flight deck management in a positive direction. Training participants state that CRM is effective and important. According to Helmreich et al. (1999), ratings of human factors-related performance in line operations . . . show significant improvement following CRM training.

Crew resource management training was born during a workshop called *resource management on the flight deck* sponsored by the National Aeronautics and Space Administration (NASA) in 1979 (Helmreich et al., 1999). The workshop was conducted after NASA research identified the involvement of the human error aspect in the majority of air crashes in the late 1970s (Helmreich et al.; Helmreich, Wilhelm, Klinect & Merritt, in press). Nullmeyer and Spiker (2003) reported that despite the short history of CRM training five different training generations have been reported "with each generation representing a substantial shift in training philosophy" (p. 78).

The first generation CRM programs heavily focused on psychological testing and concepts of leadership trying to enhance managerial effectives (Helmreich et al., 1999; Wiley, 2002). Programs were conducted in seminar settings and they tried to correct deficiencies in individual behaviors, such as a lack of assertiveness by juniors and authoritarian behavior by captains" (Helmreich et al., 1999, p. 20). The first generation lacked overall acceptance and resulted in resistance from some pilots (Helmreich et al.).

The second generation of CRM training evolved in the late 1980s and *cockpit resource management* turned into crew resource management because the cockpit is part of the team effort in the aviation industry (Helmreich et al., 1999). Concepts like team

building, situation awareness, stress management, and briefing culture became more and more important as well as breaking the error chain in the decision making process (Wiley, 2002). General acceptance in the industry increased but critics about irrelevant psychological knowledge continued (Helmreich et al.).

The third generation of CRM training originated in the early 1990s when it began to proceed down multiple paths. "Training began to reflect characteristics of the aviation system in which crews must function, including such multiple input factors as organizational culture that determine safety" (Helmreich et al., 1999, p. 21). During this process, CRM was integrated with technical training like. Besides training on how to use automation, training also concentrated on specific skills and behaviors useful for cockpit crews as well as flight attendants, dispatchers, and maintenance personnel to function more effectively (Helmreich et al.; Wiley, 2002). Even though this generation of CRM was recognized and accepted beyond flight crews, it had "the unintended consequences of diluting the original focus on the reduction of human error" (Helmreich et al., 1999, p. 22).

The implementation of the fourth generation of CRM in the 1990s made CRM an integral part of the flight training giving the impression to solve the problem of human error. This was accomplished by introducing the Advanced Qualification Program (AQP) allowing airlines to develop innovative training that fits their own needs (Helmreich et al., 1999). "As part of the integration of CRM, several airlines have begun to proceduralize the concepts involved by adding specific behaviors to their checklists." (Helmreich et al., 1999, p. 22) One could get the impression that implementing CRM as an integral part of all flight training could reduce human error making and many U.S.

airlines believe that the AQP approach is a major improvement and could make CRM training obsolete. However, empirical data are not yet available and crews are still making error (Helmreich et al.; Wiley, 2002).

Wiley (2002) published that the primary goal of the first through forth CRM generation was error prevention. "Although not explicitly said, the idea was that with enough training and education and slide shows, errors would be eradicated. The 'fifth generation' CRM training represented a major shift in thinking." (Wiley, 2002, p. 71) According to Helmreich et al. (1999) and Helmreich and Merritt (2000), today's fifth generation of CRM training programs try to normalize error and generate strategies for an error management that is more broadly accepted culturally. The reason for returning back to the original concept of CRM as an error avoidance strategy derives from research on organizational safety and high-technology systems safety breakdowns (Helmreich et al.). According to Wiley people are still making mistakes regardless of how much training they received. Even though error management has been pursued in early CRM programs this concept had been largely lost over the years. Helmreich et al. (1999) published, "The fifth generation of CRM is the premise that human error is ubiquitous and inevitable – and a valuable source of information. . . . CRM can be seen as a set of error countermeasures with three lines of defense." (p. 27) According to Helmreich et al., the first line of defense is to avoid the error through the application of the concepts and behaviors learned in training like maintaining situational awareness. The second line of defense is to identify and trap errors before they become significant. The third and last line of defense is to mitigate the consequences of error that do occur (Helmreich et al.; Helmreich & Merritt).

Defining CRM

Engel (2000), Salas et al. (2000), and Aeronautics and Space (2006) defined CRM as the utilization of all available human, informational, and equipment resources toward the goal of safe and efficient flight. This requires the interaction with each other, with groups, and with the technology (Salas et al.). To reach this objective, "CRM training emphasizes the need for clear and open communication between cockpit crewmember, including the process of conflict resolution and decision making." (Manningham, 1995, p. 67) Salas, Prince et al. (1999) acknowledged that besides technical aspects (flying the aircraft effectively), aviation systems need nontraditional competencies such as teamwork. However, CRM suffers from definitional ambiguity. Some think that CRM training should concentrate on behavioral skills without giving clear descriptions and representation of those skills (Salas et al.). Others believe that "CRM training should focus on attitudes toward teamwork, pilot personality, and social interactions" (Salas et al., 2000, p. 490). Regardless of any particular definition, Salas et al. as well as the Manual of FAA Crew Resource Management (2004) believed that CRM training is capable to improve aviator performance.

According to MacLeod (2005), the general accepted goal of CRM within the human factors field is "to develop the social and cognitive skills that are exercised together with technical, system-related, skills in order to achieve safe and efficient aviation" (p. 8). Analyzing different regulatory authorities' guidance on the design and delivery of CRM, however, revealed differences regarding the focal point of training. MacLeod (2005) reported that the U.S. Federal Aviation Authority (FAA) instructions regarding CRM concentrate on the "application of team management concepts to address

the challenge of optimizing the human/machine interface and the accompanying interpersonal activities" (p. 6). Officers of the U.K. Civil Aviation Authority (CAA) advised to concentrate on crewmembers' attitudes and behavior while officers of the European Joint Aviation Authority (JAA) emphasized communication and management skills instead of error management (MacLeod).

Crew resource management (CRM) today is accepted as an instructional strategy making the effective use of all available resources like people, equipment, and information to minimize risk and manage human error in order to achieve a safer and efficient flight (Aeronautics and Space, 2006; Salas et al., 2006; Helmreich et al., in press). Helmreich et al. (in press) stated, "The latest CRM programs explicitly focus on error and its management. Crew resource management training, in its current state, can best be described as one of the critical interventions that can be employed by organizations in the interest of safety." (p. 1) Naikar and Saunders (2003) published that current CRM programs provide training in non-technical skills for error management.

While former CRM programs focused on error prevention, today's error management effort derived from the realization that human error is inevitable and a "consequence of the same cognitive mechanisms that allow humans to operate flexibly under demanding conditions" (Naikar & Saunders, 2003, p. 171). According to Naikar and Saunders, work systems have boundaries of safe operation. When the boundaries of safe operation are crossed, the system reaches an undesired or unsafe state and accidents or incidents can result (Naikar & Saunders). Naikar and Saunders (2003) stated, "This is inevitable in competitive work environments where the pressure to achieve system objectives within tight resources and operating constraints leads to systematic migration

toward the boundaries" (p. 171). Naikar and Saunders described two approaches for error management. One approach is to design error-tolerant interfaces that highlight the boundaries of safe operations allowing the operator to return the system to the safe area. The latest CRM generation conducts error management by observing normal line operations and pinpointing areas for organizational improvement (e.g. modifying standard operating procedures, changing the nature and scope of technical training, altering scheduling practices, and establishing or enhancing safety departments) (Naikar & Saunders). Strategies for CRM like maintaining vigilance and crosschecking team members, reviewing and modifying plans and leadership, and communication skills are suitable to make the system aware of threats to safety. The strategies are capable to train people in non-technical skills and in core behaviors for managing error effectively (Naikar & Saunders).

Aviation is not the only operational environment that relies on teamwork and CRM philosophies. Many other domains like aviation maintenance, air-traffic control, medicine, offshore oil production and maintenance, maritime shipping, and nuclear power have adopted the CRM concept as an organizational strategy to minimize risk, manage human error, and to train teams more effectively (France et al., 2005; Liu, 2006; Salas et al., 2000; Salas et al., 2006). Arthur et al. (2003) and Grogan et al. (2004) reported that the CRM concept was transferred to the health-care environment in 2002 to improve team working and patient safety. The reason was to manage and prevent error since medical error is the eighth most common cause of death in the United States (Sexton, Thomas, & Helmreich, 2000). Programs that evolved in the medical domain are called anesthesia crisis resource management (ACRM) or emergency medicine crisis

resource management (EMCRM) (Reznek et al., 2003). The Manual of FAA Crew Resource Management (2004) published, "CRM training is one way of addressing the challenge of optimizing the human/machine interface and accompanying interpersonal activities. These activities include team building and maintenance, information transfer, problem solving, decisionmaking, maintaining situation awareness, and dealing with automated systems." (p. 2)

To pursue the error management approach and to gain acceptance, organization must communicate their formal understanding that errors are inevitable. Organizations should adopt a non-punitive approach to error and implement strategies to understand the roots of errors and to deploy effective countermeasures instead of blame and punish those who err (Helmreich et al., 1999). Helmreich et al. suggested implementing a non-jeopardy reporting system allowing employees to report safety concerns and errors.

Cultural Aspects of CRM

According to MacLeod (2005), "Safety and culture are terms we use freely in aviation. . . . Each individual creates safety and culture for themselves within their workplace. Our training needs to support that process and direct it along the preferred path." (p. 55) Helmreich et al. (in press) and MacLeod stated that it is essential to understand the operating environment before implementing an error management philosophy into an organization. Research revealed the lack of acceptance of CRM programs even though training had been successfully applied into the US and Western cockpit environment. Helmreich et al. (in press) published that CRM programs were "applied mindlessly to non-Western pilot groups and non-pilot groups such as Flight Attendants, maintenance personnel, dispatch, and even to nuclear power plant and

refinery operations" (p. 2). Research indicated that (a) the professional cultures of the flight crew, (b) the cultures of organizations, and (c) the national cultures surrounding individuals and their organizations appear to be relevant for flight safety as well as to the success and failure of CRM programs (Helmreich et al., in press; Salas et al., 2001).

The strong professional culture in the aviation domain showed great consistency among 15.000 pilots in over 20 countries and is rooted in the pride and love of the work. On the negative side, perceived invulnerability like denial of vulnerability to stressors such as fatigue, danger, and personal problems may lead to a disregard for safety measures, operational procedures, and teamwork (Helmreich & Merritt, 2000; Helmreich et al., in press).

Research regarding the connection of organizational culture and safety revealed that the organization's commitment to training, reinforcement of safe practices, and the establishing of open lines of communication between operators and management reduce the probability of error and contribute to safety (Helmreich et al., in press; Merritt, 2000). McKinney et al. (2005) reported that organizational culture influences communication processes leading to openness, inquisitiveness, candor, attentiveness, respect, support, and tension reduction. According to Helmreich et al. (in press), "the organizational culture is important because when it is strong and positive, pilots and other groups may more readily accept new concepts such as CRM and its associated training" (p. 5). Helmreich and Merritt (2000) stated that it is unrealistic to believe that CRM training programs are capable to counter all of the latent failures in a complex organizational system. "Organizations may adopt a proactive stance toward safety in the service of a

safety culture or they may give only perfunctory and reactive responses to threats to safe operations" (Helmreich & Merritt, 2000, p. 111).

The third cultural aspect is national culture (Helmreich et al., in press). Even though the cockpit should be a culture-free environment because of the universal endeavor to reduce error, national culture plays an important role in how aircrews manage the flight deck (Helmreich & Merritt, 2000). Recent research revealed that differences in national culture like Power Distance (acceptance by subordinates of unequal power relationships), Individualism-Collectivism (benefits for the individual versus harmony within the group), and Uncertainty Avoidance (written procedures are needed for all situations and given rules should never be broken) have implications for safety (Helmreich et al.). Since each national culture has positive and negative implications, national cultures cannot be grouped into *good* and *bad* cultures in the human error context. However, Helmreich et al. (in press) reported, "There are organizational cultures that actively discourage safety initiatives and eschew efforts to build a safety culture" (p. 8). The presence of a strong professional and national culture in connection with the diligence of regulatory agencies appears to be the last line of defense in such organization (Helmreich et al.).

CRM in Military Aviation

According to (Prince & Salas, 1993), military aviation has played a central role in the history of flight and in aircrew training. Crew resource management programs and training, however, evolved from the civil aviation after NASA research discovered the need for training aircrew beyond technical flying skills. The increased public interest in

aviation safety as a result of losing several hundred lives in a single accident supported this process (Prince & Salas). Prince and Salas (1993) reported:

> While NASA researchers were documenting problems in cockpit management for airline crews, the military had no significant research effort . . . nor did military mishap statistics clearly suggest the need for training to improve human interactions in the cockpit. . . . Military accidents rarely have an impact on public mind, since they usually involve small numbers of people. This lack of specific evidence of human error and absence of public pressure made it highly unlikely that military leaders would be interested in the possible solution to a problem they did not think they had. (p. 338)

On the other hand, military leaders have recognized the importance of crews working together for many years because teams are often better equipped to accomplish dangerous tasks (Salas, Fowlkes, et al., 1999). Flin et al. (2002) stated, "Studies in military aviation have indicated that CRM training decreased the accident rate in the US Navy and USAF" (p. 70). However, the military's organizational structure did not allow a fast adaptation of CRM programs (Prince & Salas, 1993). Although military organizations are known for their rule-bound structures, military aviation is not a single entity but separated into the different services, divisions, and subdivisions (Prince & Salas). Prince and Salas reported that military CRM programs are often reflecting the singular ideas of one individual since military structures give the individual commanding officer a great amount of flexibility in how to run his command. The lack of a universally accepted definition of what constitutes aircrew coordination and how it should be taught make CRM training highly individualistic in the military environment (Prince & Salas).

The loss of highly trained military personnel or a multimillion-dollar airplane does not have a shocking impact on public but "replacing a pilot or an aircraft is an expense best avoided" (Prince & Salas, 1993, p. 339). The Chief of Staff of the German Air Force (2006) supported this statement and demanded high priority and focus on safe

and efficient flight operations. Researchers revealed that while commercial aviation's primary goal for instituting CRM training is improved safety, the military is additionally interested in mission effectiveness (Prince & Salas). Nullmeyer and Spiker (2003) researched the link between CRM training and mission performance and discovered very consistent links between the two. According to Nullmeyer and Spiker (2003), "CRM is indeed a strong predictor of mission performance." (p. 92) Nullmeyer and Spiker further identified consistent behavioral patterns among research participants and exceptional mission performance ratings using qualitative observation data. Because none of these behaviors was included in existing CRM training, Nullmeyer and Spiker (2003) concluded, "CRM course content needed to reviewed to determine if the most important areas are being covered" (p. 92).

A CRM workshop sponsored by NASA and the military identified three general categories of differences between military and commercial aviation: (a) the task, (b) the people, and (c) the organization (Prince & Salas, 1993). The military task differs from commercial aviation in respect to task environment, mission task, decision goals, time elements, mission alterations, and equipment. Because the military provides ab initio training for a large number of personnel, military crews often deal with at least one inexperienced individual. Furthermore, promotions and rapid turnovers make crews in the military environment less knowledgeable about the organization's policy (Prince & Salas). The third difference between military and commercial aviation is the organizational composition dealing with problems in rank and position in the command structure, additional military duties, and training requirements. "Virtually every military

flight in peacetime is a training flight; the military can be thought of as an organization whose major activity is training." (Prince & Salas, 1993, p. 346)

Salas et al. (2000) stated that the military spends an incomparable amount of resource in the research and development of team training, team performance, and training technology. Additionally, research regarding aviation teams within the military is generalizable to the commercial sector because many military aviators start a career in commercial aviation after leaving active duty. Even though differences exist between military and commercial aviation both aim to create of a safety culture within each organization with a strong commitment to training, safe practices, and open lines of communication between operational personnel and management regarding threats to safety (Helmreich et al., in press; Chief of Staff of the German Air Force, 2006; MacLeod, 2005).

Technical CRM Training

According to the Chief of Staff of the German Air Force (2006), Helmreich et al. (in press), and the Manual of FAA Crew Resource Management (2004), CRM training is conducted in three steps (initial indoctrination/awareness training, recurrent practice and feedback, and continual reinforcement) and should be integrated into daily operations. MacLeod (2005) reported, "CRM training needs to be driven by a clear understanding of what constitutes efficient and safe workplace performance" (p. 55). For the effective training design, a complete and accurate competence framework is required and the understanding of what prevents people to act or behave in a certain way (McLeod).

Aviation training historically focused on the technical aspects of flying, on the individual's performance within the system (FAA Crew Resource Management, 2004),

and on error prevention (Naikar & Saunders, 2003). Non-technical skills for error management have not been addressed effectively even though they are fundamental to flight safety (FAA Crew Resource Management; MacLeod, 2005; Naikar & Saunders). MacLeod criticized that besides disregarding students' needs, CRM training programs lack acceptance because they separate the hard and soft skill domain. To establish an effective error management philosophy and training programs, non-technical training and technical training must go hand in hand (Helmreich et al., in press; McLeod).

According to Kozlowski (1998), traditional training concentrated on the individual and toward the reproduction of skills. There is little opportunity to cross the boundaries of safe operation and to practice the detection of cues necessary for the recovery into the safe area once the boundaries have been crossed (Naikar & Saunders, 2003). The technical training approach in error prevention can lead to novel ways of training. It would require the system to leave the boundaries of safe operation in a training scenario and practice dealing with the evolving situation (Naikar & Saunders). According to Naikar and Saunders, the proposed technical training approach to error management may have validity in military aviation. Naikar and Saunders (2003) reported:

> Aircrew should be given the opportunity to not follow a procedure or parts of a procedure in a training simulator and to practice detecting and recovering from the error. Some empirical support for this approach is available from studies in the area of human-computer interaction (Dormann and Frese 1994; Frese and Altmann 1989; Frese, Brodbeck, Heinbokel, Mooser, Schleiffenbaum and Thiemann 1991). These studies showed that trainees who were encouraged to make errors while learning computer programs perform better on test tasks than do trainees who were required to follow procedures or instructions. (p. 173)

Research results revealed that when trainees are encouraged to make error they develop knowledge of the system outside the safe boundaries and learn strategies for

recognizing errors and dealing with the resulting situation (Naikar & Saunders, 2003). The proposed technical training approach is consistent with research findings about expert decision making in high-risk operation (e.g. fire fighters, military commanders, and paramedics). "In time critical, high-workload situations, experts can use their prior experience to make rapid and effective decisions by matching situations to 'templates' of cues, diagnoses and solutions that have worked in the past" (Naikar & Saunders, 2003, p. 173). Training personnel in technical skills for error management should incorporate (a) identifying critical events in an accident or incident mission, (b) conducting an analysis regarding the chain of events/decisions, and (c) identifying and incorporating strategies into training programs. A validation of the proposed training approach is required (Naikar & Saunders).

Non-Technical CRM training

Knowledge and technical training does not change safe workplace behavior for error management (MacLeod, 2005). According to McLeod (2005), "Work is a collaborative process in which human actors apply technical and social skills in order to function effectively in achieving production goals. Safety and efficiency are outcomes of that process." (p. 7) McLeod stated that the objective in non-technical training is to develop competence within individuals to change measurable behavior. Research conducted by Salas, Fowlkes, et al. (1999) among 96 naval aviators revealed that CRM training might be effective for training well-defined teamwork behaviors. Salas et al. (2000) stated that CRM behaviors or guidelines how to train CRM behaviors have not been standardized.

Since different operational groups have special critical behaviors, MacLeod (2005), the Manual of FAA Crew Resource Management (2004), and France et al. (2005) suggested identifying behaviors essential for collaborative working within the specific groups. McLeod identified four collaborative behavior skills for the aviation domain: (1) task management, (2) communication, (3) keeping the big picture, and (4) strategic view. According to McLeod, it is essential to establish a complete and accurate competence framework of individual as well as collaborative workplaces in order to design effective CRM training.

Flin et al. (2002) conducted research in the aviation and offshore domain and identified six categories on non-technical skills for CRM training: (a) situation awareness, (b) decision making, (c) communication, (d) team working, (e) personal resources, and (f) supervision/leadership. According to the Manual of FAA Crew Resource Management (2004), there are three behavioral makers that need to be integrated into aviation CRM training: (a) communications processes and decision behavior, (b) team building and maintenance, and (c) workload management and situation awareness. Flin and Martin (2001) identified two CRM skills – cognitive skills (e.g. decision making, situation awareness, and workload management) and social skills (e.g. leadership and team work). "These concepts appear to be used fairly consistently, but labeling differs across research studies, airlines, and fleets" (Flin and Martin, 2001, p. 103). Flin et al. (2002) stated:

> The widespread adoption of CRM training . . . is encouraging, but while the principles of CRM are applicable to many team work situations, if a CRM training programme is to be successfully adapted, the training materials must be customized for the particular domain, on the basis of the requisite psychological research. (p. 76)

MacLeod (2005) reported that psychologists have driven CRM development so far because the domain mainly deals with the traditional areas of psychology and ergonomics. According to MacLeod, models and research areas outside the traditional psychological/engineering field should be considered as well to give CRM a broader spectrum. Sociological models might help to get insights into the motives of individuals while the research area of anthropology might give clues as to why human societies function the way they do.

Designing CRM Training

CRM training is a collection of instructional strategies that foster improved teamwork by using training tools like simulators, lectures, and videos to improve teamwork knowledge, skills, and attitudes (Salas et al., 2006). However, there is a great variety of training delivery strategies as "the result of combining learning objectives, content, tools, and methods" (Salas et al., 2000, p. 491). According to Salas et al. (2000), CRM training tools are most effective if they are consistent with accepted theories of learning and if they offer important information about CRM behaviors, active practice, and feedback. Designing effective CRM training programs requires a thorough understanding of the instructional systems design process. Keller (1987) stated that the designer of instructional systems should conduct an own learner analysis to determine effective strategies to get and sustain interest, provide relevance, produce confidence, and enhance satisfaction.

Designing optimal CRM training appears to be an ongoing endeavor. Even though administrative requirements for CRM training are given, the methods for curriculum design, development, and evaluation are still ambiguous (Salas et al., 2001). According to

Salas, Prince, et al. (1999) and Nullmeyer and Spiker (2003), general confusion and suboptimal programs have been created because there is no universally accepted agreement of what CRM training should include and how it should be accomplished. Salas et al. (2006) stated:

> Despite what is known about the science of training, organizations seem to ignore the available relevant literature (see Salas, Fowlkes, Stout, Milanovich, & Price, 1999) that could guide and manage their CRM training efforts. That is, the explanation, application, and integration of what has been learned about the science of training needs to make its way to the design, implementation, evaluation, and institutionalization of CRM training programs. (p. 408)

Salas, Prince, et al. (1999) suggested a four-step methodology in the design and delivering CRM training – (a) identifying operational/mission requirements, (b) assessing team training needs and coordination demand, (c) identifying teamwork competencies and knowledge, skills, and attitudes (KSAs), and (d) determining team training objectives.

Salas et al. (2001, 2006) examined multiple CRM training programs in aviation and other areas. Crew resource management training is liked across numerous domains and has a positive impact on training attitude (Reznek et al., 2003; Salas et al., 2001). Inconsistencies exist in whether trainees' attitude or behavior changed (Salas et al., 2001). Instructional designers also fail to move the concept of CRM training from the classroom to line operations and to transfer training sessions into daily operations (Helmreich et al., 1999). Salas et al. (2001) published, "In order for training to be truly effective, it must affect participant learning, learning must transfer to behavior, and behavior must transfer to a difference at the organizational level" (p. 656). Kozlowski (1998) stated:

> Traditional training approaches tend to be oriented toward individuals, not teams, and complex systems; toward simple reproduction of skills acquired in training, not adaptation of new situations; and toward training as a special activity that occurs off-site, and not as a natural ongoing process that occurs in the workplace. There is a need to reorient the perspective of training systems – what they should do, how they do it, who does it, and where it is done – to meet these emerging needs. (p. 149)

According to Salas et al. (2000), CRM training should focus on team training in complex environments by using a variety of well-tested training tools like simulators, lectures, videos, event-based training, cross-training, and assertiveness and leadership training. "Organizations (military and civilian alike) continue to implement CRM training without relying heavily on the body of knowledge available in the literature about team training, teamwork, and training" (Salas et al., 2000, p. 492). From the instructional design perspective, Häkkinen and Tynjälä (2005) suggested the use of different kinds of simulations as an integral part of e-learning.

Kozlowski (1998) reported that basic skills and technical training could be developed in the conventional training environment like the classroom. Classroom training provides declarative (factual) knowledge so the trainee knows what to perform (Salas et al., 2000). To transform declarative knowledge into procedural knowledge (knowing how to perform a task) requires practice or rehearsal that is not provided in lecture-based training programs. In traditional classroom training trainees do not learn how and when to use the knowledge (Salas et al., 2000).

According to (Kozlowski, 1998), cognitive and behavioral capabilities for the non-technical training are fully developed and refined in the performance environment. "This means shifting more training to the performance context and developing new training strategies and techniques that can be integrated into the work environment." (Kozlowski, 1998, p. 116) Kozlowski stated that adaptive skills should be taught using

variability and novelty across different training experiences and environments instead of solely concentrating on procedures used in technical training. Training participants should develop learning strategies, meta-cognitive and self-regulatory skills, knowledge structure, efficacy, and motivational skills at the individual and team level (Kozlowski). Salas et al. (2000) published, "The literature suggests that incorporating know principles of practice and feedback into the design and delivery of training programs can strengthen CRM training" (p. 496). Since it is impossible to develop training for every eventuality, training must be designed to support training and learning at the team level. "This means conceptualizing the team as an adaptive network of roles, within which team members can revise, refine, and control their interdependencies as deeded to meet performance demands. The team itself becomes a self-learning system." (Kozlowski, 1998, p. 121) Tannenbaum et al. (1998) supported this statement and reported that learning from supervisors and peers is as important as experiential learning. According to Tannenbaum et al. (1998), "Training researchers have acknowledged that training cannot serve as the sole source of learning and performance enhancement. . . . Research reveals that individuals typically attribute less than 10% of their competency development to formal training." (p. 249) Salas et al. (2000) suggested to implement techniques from the social learning theory by observing others who are demonstrating a task or by conducting role-playing exercises. Allowing trainees to observe and rate both positive (correct) and negative (incorrect) behaviors leads to a more optimized behavioral modeling training and to improved behavior. According to Salas et al., the scenario-based training approach appears to be an effective team training strategy because it gives the trainee the opportunity for learning, practicing, and receiving feedback.

Jentsch and Bowers (1998) reported that several researchers have measured the reactions of aircrews participating in low-fidelity simulation like the Navy's Table-Top Aircrew Coordination Training System (TTACTS). Research results pointed out that 90% of the participants agreed or strongly agreed that the proposed training system was useful for CRM. Other researchers reported that pilots in general accept the use of PC-based simulations like the TTACTS. According to Jentsch and Bowers (1998), there is the notion "that aviators of various backgrounds find the contents of low-fidelity simulations acceptable and realistic" (p. 246).

Baker, Prince, Shrestha, Oser, and Salas (1993) and Salas et al. (2001) published that multiple research have identified the capability of low-fidelity simulation via PC-based computer games to deliver CRM skills and allow to practice and evaluate critical CRM behaviors. In their study, Baker et al. used inexpensive, tabletop computer-based simulations for CRM training with 112 military aviators who used the program to fly different scenarios as crews of two. "For the total sample and across all the subgroups, more than 90% of the aviators agreed or strongly agreed that the tabletop system could be used for CRM-skills training" (Baker et al., 1993, p. 148). Baker et al. concluded that computer games are readily available, are inexpensive, and have the capacity to engage the player in CRM skill training. "The potential training value of this type of simulation is promising, with its low cost and easy availability" (Baker et al., 1993, p. 154).

Designing effective CRM training systems requires a "shift in orientation from off-site, single-episode, individual-level skills delivery to multiple-episode, on-line, multilevel systems" (Kozlowski, 1998, p. 116). Kozlowski is convinced that training must focus on the development of adaptive individual and team skills and shifted toward

the work environment. Training programs should offer the opportunity to be delivered as needed in order to satisfy skill demands when they arise.

Introduction to E-Learning

Information and communication technology plays a vital role in the information society especially in the educational context (Byers, 2005; Häkkinen & Tynjälä, 2005). Our rapidly changing, knowledge-intensive, and technology-oriented working life demands life-long learning and continuous development of competence. New technology like computers and the World Wide Web can help to find solutions to these challenges (Häkkinen & Tynjälä) but on the other hand also create the necessity for life-long learning in order to keep employees current (Byers).

Krüger and Siegmund (2002) stated that the traditional classroom training with one teacher in front of the class is outdated as the only teaching method. In this arrangement, the teacher is usually the active part in the training process and it appears that the teacher learns more than the students do because they remain passive (Krüger & Siegmund). Chen and Shaw (2006) reported that the big difference between traditional face-to-face (F2F) learning and e-learning is that e-learning is user-centered instead of instructor centered. Duan, Hosseini, Ling, and Gay (2006) published, "E-learning is having a significant and positive impact on education. In order to understand how theoretical knowledge can be applied to real-world problems, experimental practical exercises are essential." (p. 99) Chen and Shaw (2006) published:

> Benefits of substituting online learning for F2F learning include (1) self-paced instruction; (2) the ability to incorporated text, graphics, audio and video into the training; (3) opportunity for high levels of interactivity; (4) a written record of discussions and instructions; (5) low-cost operation; and (6) access to a worldwide audience (Aniebonam, 2000). In addition, online learning can remove a certain degree of space and time limitations,

> speed up the learning process for motivated learners, lower economic costs of attending F2F classes and have higher information accessibility and availability. (p. 89)

On the other hand, it is wrong to believe that technology alone is capable to increase learning activity and that e-learning can substitute classroom training (Krüger & Siegmund, 2002). Learner's personal needs, quantity of information available, as well as time and budget guidelines for training requires alternative training methods. This makes innovative e-learning solutions indispensable (Klemke, Kröpelin, & Kuth, 2003; Krüger & Siegmund).

"The Internet's proliferation creates a wealth of opportunities to deploy alternative online learning environments to facilitate many users in their learning process." (Chen & Shaw, 2006, p. 88) According to Duan et al. (2006), the Internet and Web-related technologies bring many changes to the education domain. They have a positive affect on people's lives and work globally. Lee, Cheung, and Chen (2005) published that especially the new generation uses the Internet on a daily routine. Lee et al. (2005) stated:

> A collaborative study revealed, 93% of college students have access to the Internet. A recent study also found that young people are highly active Internet users. . . . 60% go online to download music, 72% get information for school work, and 28% go online for instant messaging with their friends. Because of their high degree of Internet penetration and adoption, the Internet is potentially an excellent medium for teaching and learning. Despite the excellent potential of the Internet as a learning medium, its value will not be realized if teachers and students do not accept it for teaching and learning . . . Thus there is a need to investigate the student acceptance of an Internet-based learning medium. (p. 1095)

Häkkinen and Tynjälä (2005) identified a rapid change in technology but not in the basic process of learning. Chen and Shaw (2006) stated that 76% of the entire online learning market in year 2000 was represented by the information technology skills

training market and the worldwide corporate online learning market might grow with an annual growth rate of 35.6% to $18 billion by 2006. The reason for this tendency might be the fact that "in today's information age, most of a company's value exists not in factories, products and other physical assets, but instead in its employees' intelligence, skills, and ideas" (Schletter, 2003, p. 56).

Schletter (2003) published that training models remain in the industrial age even though the knowledge age has already arrived. According to Cegarra-Navarro and Sabater-Sánchez (2005) many organizations have connections to the Internet but managers do not know or do not appreciate the benefits of technology systems for individuals and teams and ignore the problem of human integration. Many organizations even offer pay-for-performance schemes resulting in self-serving behavior and poor organizational commitment (Schletter). According to Moon, Birchall, Williams, and Vrasidas (2005), with all the perceived benefits for e-learning like 24/7 delivery, personalization, interactivity, networking of geographically distant learners, instant feedback, "e-learning courses have been criticized for their lack of pedagogic underpinning" (p. 371).

Various learning media have evolved to support e-learning. Computer Based Training (CBT) teaches the learner with CD-ROM or floppy disk in conjunction with a computer. Web Based Training (WBT) is transferring material through the Internet, training videos, or business TV (Krüger & Siegmund, 2002). Julien (2005) called this one way type of learning tele-teaching where synchronic information are exchanges between the learner and the tutor. According to Julien, tele-teaching creates time and location issues because of rigid time and space constraints. Krüger and Siegmund published that

the use of media for self-directed learning resulted in dropout rates greater than 50% because of boredom and the lack of personal contact. The methodical solution for this problem was the implementation of personal interaction with a designated tutor (Krüger & Siegmund). Depending on the distance between the learner and tutor there are various e-learning scenarios. Computer based instruction supports the teacher in the instructional process and is used for different scenarios during classroom training like simulation. Distance learning is a methodical solution in the e-learning environment fostering the interaction between learner and tutor (Krüger & Siegmund). Blended learning is the newest training method and supports traditional classroom training as well as e-learning components (Julien; Kies-Wunsch, 2003; Krüger & Siegmund; Volkmer, 2003). According to Häkkinen and Tynjälä (2005), Kies-Wunsch and Volkmer, this methodical mix is the key for learning efficiency and learning satisfaction because research revealed that using e-learning solutions without supportive classroom sessions is less efficient.

Defining Distance Learning

In contrast to blended learning, distance learning concentrates on the use of the available e-learning components without traditional classroom training and is usually conducted using online communication and information technology to transmit and receive various materials through voice, video, and data (Chen & Shaw, 2006; Krüger & Siegmund). Skalnik (2003) stated that online learning places high demands on the participants requiring self-motivation, self-discipline, and endurance. The continuous work with learning material and the feedback of the tutor allows the learner to develop a comprehensive understanding of the learning material leading to high quality learning outcomes (Skalnik). According to Cegarra-Navarro and Sabater-Sánchez (2005),

feedback is an important aspect in the learning process because it reduces uncertainty. "Feedback helps learners adjust what they are doing so they are more successful" (Cegarra-Navarro & Sabater-Sánchez, 2005, p. 278).

According to Volkmer (2003), the driving factors for distance learning programs are the increased availability of private and organizational Internet access, the demand for short and module based high quality learning programs, and the demand for learning programs that are implemented into the work environment. This demand pushes the integration of online learning programs for further training in various domains.

Distance learning supports synchronous and asynchronous learning between the learner and the tutor. Synchronous learning can be conducted using video conferencing and chat functions. Asynchronous learning relies on the use of electronically stored learning material (Chen & Shaw, 2006; Krüger & Siegmund, 2002). To support synchronous and asynchronous learning most online distance learning systems provide "services like searching, downloading, and delivering learning content, which includes text, audio, animation, applets, flash, or video clips to their users in order to enhance learning experiences" (Duan et al., 2006, p. 67). There are many Internet-based education programs available in universities and industrial organizations like Blackboard from Blackboard Inc., Swift Author from Gemini Inc., Macromedia Authorware from Macromedia Inc., and TopClass Publisher from WBT Systems (Duan et al.). Distance learning systems are referred to as Learning Content Management Systems (LCMS). Duan et al. (2006) published:

> A learning Content Management System (LCMS) is a 'multi-user environment where learning developers create, store, reuse, manage, personalize, and deliver digital learning content from a central object repository' (elearningpost, n.d.), . . . manage students and learning events

> and collate data on learner progress, . . .[and] simplify the creation and administration of online content (articles, reports, pictures, etc.) used in publications. (p. 88)

According to Heckerott (2003), distance learning requires the interaction between the learner and the tutor because it is not sufficient to provide learning material online. Research revealed that less than 50% of the employees in large organizations make use of available online learning programs without motivational strategies that support the transfer of knowledge into daily routine. Knowledge transfer is increased using online learning strategies and the personal interaction with the designated tutor (Heckerott). Heckerott (2003) stated, "The interaction between learner and tutor is vital for learning success" (p. 23). The role of the tutor is not comparable to the traditional classroom teacher since he or she is less involved in communicating knowledge. The tutor is more like a coach or moderator especially in training programs that are interlocked with daily operations. Current technology allows creating virtual teams, "all online but at different physical locations, and present them with scenarios and observe how they react . . . and discuss issues with a professor via videoconference" (Raisinghani et al., 2005, p. 24).

Collaborative Learning

Krüger and Siegmund (2002) stated, "The spatial displacement of learner and tutor is only a part of possible learning scenarios. The second important aspect is the interaction in the learning process. Research revealed that the learner has to be integrated into the learning process." (p. 24) Collaborative learning appears to be the key to success because the focus is on the group learning process (Julien, 2005; Krüger & Siegmund). Häkkinen and Tynjälä (2005) and Raisinghani et al. (2005) reported that computer-supported collaborative learning will be creating a powerful learning and communication environment by enhancing peer interaction and working in groups. Key features are the

sharing and dissemination of knowledge and expertise among members of the learning community. "The main teaching method consists in working with a virtual group which may be anywhere in the world. It is the group which learns, acquires new knowledge, shares information and best practices and exchanges learning experiences." (Julien, 2005, p. 293) In this process, groups of about five learners work on a specific task and are supported by the tutor. Skalnik (2003) published that learning in the online environment over a period of weeks or months fosters the development of virtual teams. Learners get to know each other and discover the various aspects of communication, the handling of resistance, and team building processes. Learners are more deeply involved with the working material because of the self-guided learning process and the communication of interim solutions with other learners during the learning phase (Krüger & Siegmund). "Collaborative learning can be characterized by high sustainability regarding the learning material . . . and learners are more motivated and show more fun during learning sessions" (Krüger & Siegmund, 2002, p. 24). Häkkinen and Tynjälä reported that well-designed e-learning environments gives the learner room for knowledge building and epistemic practices in collaboration with others.

Motivational Aspects of Distance Learning

Lee et al. (2005) published, "The new generation has incorporated the Internet into their daily life" (p. 1095) and statistics have shown that students and youth utilize the Internet primarily for fun and enjoyment. Research revealed that 72% check email regularly, 73% get information for school assignments, and 28% participate in instant messaging with friends (Lee et al.). Lee et al. reported that Internet-based learning is an excellent medium for teaching and learning. Teachers and students, however, have not

realized the Internet's value as a learning medium. Investigating the acceptance of Internet-based learning especially among the younger generation appears to be necessary in order to build future training systems.

Heckerott (2003) stated that after organizational leaders identified the advantages of e-learning solutions they tried to implement e-learning programs as the sole alternative for training. Learner readiness and the prevailing learning culture within the organization were not considered (Häkkinen & Tynjälä, 2005; Heckerott). Organizations need an open dialogue philosophy and management needs to offer opportunities to share knowledge as an organizational learning culture (Häkkinen & Tynjälä). According to Schletter (2003), organizational culture and training initiatives can significantly enhance organizational performance but must go hand in hand with employee motivation. Regarding learner readiness, Molvig (2002) and Rentroia-Bonito, Jorge, and Ghaoui (2006) published that employees need to know why they need what they are being trained to do and when they need it. "When training has clear benefits, employees naturally gravitate toward it. . . . Training should further the employee's career goals, help the company meet its business goals and enhance the company's odds for success" (Molvig, 2002, p. 68). Ryan and Deci (2000) reported that people in general are curious, vital, and self-motivated. "They are agentic and inspired, striving to learn, extend themselves, master new skills, and apply their talents responsibly" (Ryan & Deci, 2000, p. 68). Many individuals, however, reject growth and responsibility. To increase learning effectiveness and acceptance behaviors organizations need to understand how motivation works and what might affect motivation.

Motivating organizational teams appears to be even more challenging than motivating a single individual because individuals within teams operate with different goals, values, beliefs, and expectations (Clark, 2005). "Yet the variety of team member personalities can be a positive force if each performer contributes his or her unique capabilities when and where needed" (Clark, 2005, p. 13).

According to Ryan and Deci (2000), social contexts appeared to be a factor supporting motivation and personal growth "resulting in people being more self-motivated, energized, and integrated in some situations, domains, and cultures than in others" (p. 68). The feeling of being part of a learning-group should be considered in designing distance learning programs. Developers should make an effort to match conceptual models (Rentroia-Bonito et al., 2006). Organizational leaders further have to demonstrate that they value training by recognizing employees who complete training programs (Molvig, 2002). Researching motivation has been a central issue for years not only in the field of psychology but in the business world as well: Motivation produces (Ryan & Deci).

According to Linstrom (2006) and Rentroia-Bonito et al. (2006), the most important step in teaching is motivation because it is critical to improve acceptance behaviors and increase learning effectiveness. It is also one of the most overlooked steps in adult education (Linstrom). Generating the initial point of interest determines "whether students will thrive and learn or just take up space in the classroom" (Linstrom, 2006, p. 30). Designing boring, defectively prepared, and poorly delivered training results is no motivation for students to participate (Linstrom; Molvig, 2002). Lee et al. (2005) investigated Internet-based learning programs' usefulness (extrinsic motivation),

enjoyment (intrinsic motivation), and ease of use in relation to learners' attitude towards the programs and the intention to use Internet-base learning programs. The researchers identified perceived usefulness (extrinsic motivation) and perceived enjoyment (intrinsic motivation) of learning programs as the key factors affecting students' attitude and willingness to use e-learning programs. The ease of use of such programs did not show a significant impact on student attitude toward the usage of e-learning programs because "learning to use the Internet is generally considered easy" (Lee et al., 2005 p. 1102). Rentroia-Bonito et al. (2006) supported the findings and stated "The highest agreement among participants regarding their important motivation-to-e-learn variables happened on accessibility of learning content form everywhere, contribution to competence development, and usefulness of content" (p. 27). According to Lee et al., besides usefulness and fun, special attention should be paid to extrinsic motivational factors (hygienic factors) in designing Internet-based learning programs. Researchers revealed that extrinsic rewards as well as threats, deadlines, directives, pressured evaluations, and imposed goals have the potential to undermine intrinsic motivation (Ryan & Deci, 2000). In their research, Martens et al. (2004) revealed that in respect to intrinsic motivation students with high intrinsic motivation often outperformed students with low intrinsic motivation in an e-learning environment. Highly motivated students did not do more but rather different things resulting in more explorative study behavior. According to Martens et al., the use of e-learning methods is based on constructivism in which learners become responsible for managing their own learning process. "Self-regulated learners are motivated, independent, and meta-cognitively active participants in their own learning." (Martens et al., 2004, p. 368) These findings hold up the need to generate innovative and

state of the art learning programs that support learner's motivation to conduct distance learning.

Organizational Aspects of Distance Learning

Learning in the organizational environment takes place at different interacting levels like the individual learning level, group learning level , and organizational learning level itself (Cegarra-Navarro & Sabater-Sánchez, 2005; Häkkinen & Tynjälä, 2005). "Changes in individual and group behavior without a corresponding change in organization cognition . . . create tension between and individual's beliefs and an organization's action." (Cegarra-Navarro & Sabater-Sánchez, 2005, p. 279) According to Cegarra-Navarro and Sabater-Sánchez, organizational learning is not the simple sum of the learning of its members and when individuals leave the organization, knowledge learned by individuals or in groups does not necessarily leave with them. Cegarra-Navarro and Sabater-Sánchez suggested institutionalizing learning by implementing routines, structures, and strategies to counteract the tension between the different learning levels.

Despite the popularity of e-learning solutions, systematic research has not been conducted on adult learning and on organizational learning for the design of e-learning systems for organizational use (Häkkinen & Tynjälä, 2005). Häkkinen and Tynjälä (2005) published:

> In order to transform individual learning processes into organizational processes, organizations need both recognition of the significance of sharing knowledge and opportunities for individuals to share their experiences (Lehesvirta, 2004). . . . E-learning communicates with participants who come from different fields, positions, cultures or levels of expertise, also make possible for people to cross boundaries and this way to develop new understanding and new ways of communication. This requires that people develop new conceptual tools and "boundary objects"

> for sharing meanings (Boland and Tenkasi, 1995; Engeström et al., 1995; Star and Griesemer, 1989). Boundary crossing and conceptual development usually need to be facilitated by experienced tutors or consultants. (p. 323)

According to Servage (2005), the *one-size-fits-all* approach does not work in the e-learning environment because the individual "learning style is a complex evolution dependent upon a learner's self-awareness and strengths, weaknesses, and locus of control . . . Technology does not build fruitful, productive working relationships; people do" (p. 312).

The knowledge of e-learning and the development of online learning programs so far largely derived from the experiences of learners and teachers in the education and knowledge-based domains because they employ communication technology to create online learning environments (Newton & Ellis, 2005). According to Newton and Ellis (2005), "There is a need for more exploratory case study research into the processes involved in adopting and adapting e-learning in different learning contexts" (p. 385).

Newton and Ellis (2005) conducted research regarding adult learning and e-learning in the Australian Army as a hierarchical and authoritarian organization. Research results showed that there are difficulties in transferring knowledge of learning innovations in one context to another, including learning culture, social interactions, and motivational aspects. "Understanding the inherent features of the learning context is important when considering e-learning implementation. . . . [Additionally], the importance of aligning e-learning implementation with organizational culture, organizational structure, organizational priorities and learners' needs" (Newton & Ellis, 2005, p. 386) has been identified by case study research. Newton and Ellis (2005) published that the increasing military operational demands in connection with ongoing

pressures on e-learning development points out an increased "need for research to understand effective e-learning in this context" (p. 395).

In their research, Raisinghani et al. (2005) explored the aviation domain regarding the expectations and behaviors of business aviation pilots toward distance learning programs. Raisinghani et al. concluded that web-based training is capable to provide training to the aviation domain by offering high-speed broadband connections delivering video/audio on demand and live video conversations. According to Raisinghani et al., training efficacy, training compatibility, and perceived usefulness are seen as the top three determinants regarding online training in the business aviation domain. "Pilots' expectations of online learning are high, but not overly demanding of current and emerging technology" (Raisinghani et al., 2005, p. 35) and there is a high degree of confidence in available resources and personal ability to perform online learning.

Designing Distance Learning Programs

Computer technologies have changed educational approaches and environments. Instructional design used to focus on instructor-led programs conducted in training centers (Byers, 2005). To fit the new paradigm, instructional designers "need to consider and implement multi-level alignments, identify and satisfy the stakeholders involved in all phases of the instructional design process, and attend the principles suggested in the literature" (Byers, 2005, p. 346). Chen and Shaw (2006) stated, "The ultimate goal of learning has not changed, that is, to transfer knowledge to students and allow them to apply the acquired knowledge in real situation" (p. 89).

According to Julien (2005), the development of e-learning solutions requires the development and delivery of e-services that interlink the learner, the service provided, the

physical support, and the e-trainer. Julien published that in the past there was too much focus on the technical aspects of the distance learning environment. Servage (2005) supported this finding and stated that the focus in instructional technology design is on technical issues and not on the adult learning principles necessary for an effective learning design. Designing effective distance learning programs, however, requires the illumination of other fields related to distance learning like (a) the pedagogical resources appropriate to pedagogical activities, (b) the system management, (c) the methods of collaboration and interactive environments, (d) the quality procedures and policy, and (e) the e-trainer activities, tasks, and skills (Julien). Byers (2005) published that besides satisfying the five major phases of instructional system design (analysis, design, development, implementation, and evaluation), the development of web-based instructions additionally requires the incorporation of the three steps of web-based instructional design: (a) information design (defining the product), (b) interaction design (describing how it should work), and (c) presentation design (describing how it should look).

The challenge in distance learning is to assist learners to improve their knowledge transfer capabilities (Chen & Shaw, 2006). One method is the behavior modeling approach employing demonstration and hands-on experience strategies. Research in the field of information technology identified the behavior modeling approach superior over the exploration approach (teaching through practice on relevant examples) or the instruction approach (teaching characteristics) (Chen & Shaw). In the behavior modeling approach trainees "learn to establish their behavior model by observing and imitating other individuals' behaviors or through the enforcement of the media and environment"

(Chen & Shaw, 2006, p. 90) leading to better training results than learning by trial-and error.

Chen and Shaw (2006) conducted a longitudinal field experiment researching the behavioral modeling approach in three learning environments – face-to-face training, online synchronous training, and online asynchronous training. According to Chen and Shaw, the behavior modeling approach has been proven as the most effective training approach in the face-to-face environment because of several advantages like instructor demonstration, immediate correction, and feedback. Chen and Shaw (2006) concluded that regarding best performance or knowledge transfer "no significant difference in learning outcomes could be detected across the three learning environments" (p. 88) and "it may be almost as effective to use online training (synchronous or asynchronous) as it is to use a more costly face-to-face training in the long term" (p. 99).

Lee et al. (2005) stated that instructors, course designer, and academic institutions should try to make learning through e-learning programs useful and fun by (a) varying the types of content, (b) creating fun, (c) providing immediate feedback, and (d) encouraging interaction. Häkkinen and Tynjälä (2005) reported that many e-learning initiatives failed because of lack of personalization, lack of collaboration and interactivity, and lack of learner-oriented programs. The goal is to build programs that allows "participants to use their practical, experiential knowledge and integrate it with theoretical, conceptual knowledge. . . . They may develop new understanding of their everyday problems, and consequently, may become aware of a need to transform their practices" (Häkkinen & Tynjälä, 2005, p. 325).

According to Byers (2005), the flexibility of access and the capacity for instant, centralized updating makes online training very attractive in a rapid changing environment. However, Servage (2005) identified that the *anytime anywhere* approach for distance learning is not always valued among employees. Servage (2005) published:

> The collapse of time space barriers is a boon to multinational corporations who struggle to deliver consistent training to a workforce scattered across countries and time zones (Henry, 2002; Welsh et al., 2003). However, there are negative consequences as well. Some authors point to information burnout and resentment of employees expected to carry work-related learning home with them (OECD, 1996), or simply suffer from "Internet Fatigue" due to relentless online exposure (Albrecht and Gunn, 2002). (p. 311)

Employees often feel that the lines between work and home blur. According to Servage (2005), it is wrong to believe that the omnipresent availability of information and online learning programs is automatically leading to employees' willingness to spend more time for distance learning training.

It can be concluded that designing effective distance learning programs for organizational learning appears to be worthwhile because they have "the potential to support cognitive, social, motivational, and affective processes of learning" (Häkkinen & Tynjälä, 2005, p. 330). According to Byers (2005), "For this type of project the training developers must organize, motivate, and maintain a team of divers people who also have a stake in the project's positive outcome" (p. 357). The success in the development of new online training programs largely depends on the combined efforts of various personnel like resource providers, trainees' supervisors, and developers of previous content, analysts of previous training needs, and the trainees themselves (Byers). According to Häkkinen and Tynjälä, innovative pedagogical solutions and state of the art software design are also essential for an effective online training design because both are

inter-depended and require the collaborative effort of both experts in learning and experts in software design.

Available low cost Learning Content Management Systems (LCMS) are capable to support distance learning programs and manage organizational processes. They permit employees to get an overview of their personal training needs and available training programs. This self-steering ability allows employers, employees, and training experts to perform long-term skill management (Duan et al., 2006) as well as holistic competence management as an effective and efficient practice for personnel development (Klemke et al., 2003). Regardless of any innovative training systems and design, the most important task is to understand the end users and to deliver training systems that satisfy their needs (Byers, 2005; Klemke et al.). Rentroia-Bonito et al. (2006) suggested that according to research results "useful content, competence development, instructor support, previous experiences with e-learning, and access to content seem to be a minimum set of requisites to consider when designing e-learning experiences" (p. 31).

Summary

The human factors field has been identified as the most contributing factor to aircraft accidents throughout aviation history (Hobbs, 2004). Research regarding crew resource management (CRM) training indicated that training programs have the potential as a valuable tool to improve team performance and to improve safety in aviation and in other domains (Salas et al., 2006). According to Salas, Prince et al. (1999) and Nullmeyer and Spiker (2003), general confusion and suboptimal programs have been created because there is no universally accepted agreement of what CRM training should include

and how it should be accomplished. An additional problem is the lack of CRM culture inside and outside the cockpit in some aviation organizations.

Salas et al. (2000) recommended conducting research regarding advanced training technology such as intelligent tutoring systems and computer assisted coaching to overcome this deficiency. Additionally, training department, top management, and program facilitators should provide resources for the design of innovative CRM programs to demonstrate organizational commitment and support for CRM training. Cegarra-Navarro and Sabater-Sánchez (2005) supported this finding and stated that implementing CRM into an organization requires fostering the learning process of the individual and organizational commitment to start a learning process.

Chen and Shaw (2006) stated, "The Internet's proliferation creates a wealth of opportunities to deploy alternative online learning environments to facilitate many users in their learning process" (p. 88). Distance learning is a methodical solution in the e-learning environment fostering the interaction between learner and tutor (Krüger & Siegmund, 2002). Integrating the learner into the learning process and focusing on the group learning process is called collaborative learning (Julien, 2005; Krüger & Siegmund). According to Häkkinen and Tynjälä (2005) and Raisinghani et al. (2005), computer-supported collaborative learning will be creating a powerful learning and communication environment by enhancing peer interaction and working in groups.

Despite the popularity of e-learning solutions, systematic research has not been conducted on adult learning and on organizational learning for the design of e-learning systems for organizational use (Häkkinen & Tynjälä, 2005). Newton and Ellis (2005) conducted research on e-learning in the Australian Army and Raisinghani et al. (2005)

explored the aviation domain regarding the expectations and behaviors of business aviation pilots toward distance learning. Research results revealed that there are difficulties in transferring knowledge of learning innovations in one context to another, including learning culture, social interactions, and motivational aspects (Newton & Ellis). On the other hand, expectations of online learning are high and there is a high degree of confidence in available resources and personal ability to perform online learning (Raisinghani et al.).

Chapter 3: Methodology

Overview

In this mixed methodology study, the researcher explored and examined if distance learning programs can deliver crew resource management (CRM) training for German Air Force (GAF) personnel involved in military flight operations. The researcher followed the case study design employing a paper and pencil questionnaire in a single GAF air wing.

This chapter provides a review of the research problem, the statement of research questions, and the description of research design. The research instrument, the selected participants, the procedure, the data processing plan, and the methodological assumptions and limitations will be discussed before ending with the ethical assurances statement.

Restatement of the Problem

According to the International Air Transport Association (IATA), the key problem with current crew resource management (CRM) practice is that it does not reach everyone (Helmreich et al., 1999; MacLeod, 2005). Some pilots even reject the concepts of CRM and the attitude of some participants is worse after training (Helmreich et al.; Helmreich & Merritt, 2000). Instructional designers fail to move the concept of CRM from the classroom to line operations and to transfer training sessions into daily operations (Helmreich et al.). According to Salas, Prince et al. (1999) and Nullmeyer and Spiker (2003), general confusion and suboptimal programs have been created because there is no universally accepted agreement of what CRM training should include and how it should be accomplished. In this study, the researcher explored and examined the potential acceptance of distance learning (DL) training programs as a delivery modality

of a CRM training program for German Air Force (GAF) personnel involved in flight operations.

Further analysis of the problem points out the lack of CRM culture inside and outside the cockpit in some aviation organizations. Even though there is no scientific evidence, reports of numerous cockpit crews support this statement indicating that CRM training and philosophy is often not encouraged by management (Salas et al., 2001). To build an effective training tool, members of the entire organization must understand and embrace the team-building culture of CRM (Maurino, 1999; Thomas, 2004).

Salas, Prince et al. (1999) and Thomas (2004) reported that CRM definitions, training content, and training methods lack consistency and consensus in respect to training design, delivery, and evaluation within the entire aviation industry allowing too much ambiguity. Civil aviation and military aviation have identified the need to go beyond training of flight crews and to deliver CRM training for all personnel involved in flight operations (Chief of Staff of the German Air Force, 2006; FAA Crew Resource Management, 2004; Flin et al., 2002). This policy coincides with the team-building process proposed by Thomas, Maurino (1999), Lu (2005), and the Manual of FAA Crew Resource Management. In this study, the researcher explored and examined the attitude to CRM training among GAF personnel involved in flight operations as a prerequisite for the design and implantation of effective training programs and for a viable CRM culture.

Statement of Research Questions/Hypotheses

The focus of this mixed methodology study was to explore and examine if distance learning programs can deliver crew resource management (CRM) training for German Air Force (GAF) personnel involved in military flight operations to increase

training effectiveness. Changing deliver modality requires the acceptance of distance learning programs as an instructional CRM training method.

Trainees' attitude to CRM training is another factor that influences training effectiveness and ranks as an indicator of a viable CRM culture within the GAF. The association between acceptance of distance learning and attitude to CRM training is a prerequisite for CRM programs to be delivered by distance learning. Without the acceptance of distance learning and without a positive attitude to CRM training, CRM training cannot be delivered by distance learning.

The epistemological interest is what strategies might be used to implement and deliver CRM training by distance learning to increase training effectiveness. To answer the question the following sub-questions and hypotheses were proposed:

1. What, if any, acceptance of distance learning programs exists among GAF personnel involved in flight operations?
2. What, if any, attitude exists among GAF personnel involved in flight operations to conduct CRM training?
3. What, if any, relationship exists between the acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations?

$H_{0\text{-}3}$: No correlation exists between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations.

H_{A-3}: A correlation exists between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations.

The ultimate goal of the research is to improve the existing safety culture within the GAF and to explore and examine if distance learning might offer another way of providing a multidimensional methodology to conduct safe and efficient flight operations. The researcher expected that there is high motivation and a positive attitude to CRM training among GAF personnel because all personnel working in the flight operation environment have the unified interest in safe flight operations.

The focus of the research was to initiate a development process for a customized CRM training concept using distance learning as an instructional approach. Seeking CRM culture within the GAF calls for a homogeneously accepted training program for all personnel involved in flight operations. A potential new training program based on the distance learning concept using the Internet might standardize CRM training throughout the GAF, reach all personnel involved in military flight operations, improve training standards, and facilitate the expansion of a general accepted CRM culture within the GAF. Helmreich et al. (1999), Lu (2005), and the Manual of FAA Crew Resource Management (2004) supported the systematic approach and stated that this process should foster the development of a joint training program for cockpit crew, support personnel, maintenance personnel, and management. Even though research was conducted among personnel involved in GAF flight operations, it was expected that research results might provide new insights as to if distance learning programs in general

for all German military personnel might be a cost effective methodology of training delivery.

Research findings might also point out the need for further investigation regarding new learning concepts and the restructuring of military training. It was expected that the applied methodology might be identified as suitable for the implementation of other distance learning programs in the GAF. It was also expected that the applied methodology might be identified as suitable for the implantation of CRM training programs in other domains.

Description of Research Design

The exploratory research followed the case study design using the mixed-methods approach by combining quantitative and qualitative research for data collection and analysis in order to gain a comprehensive inductive understanding of the acceptance of distance learning and the attitude to CRM training programs (Trochim, 2001). The research was conducted in three phases including the survey development phase, the piloting phase, and the data collection phase. Primary research instrument was a structured three part multi-item paper and pencil questionnaire based on a 5- point Likert-type ordinal scale allowing single-option answers only. The objective was to collect primary empirical data for descriptive data analysis and to explore and examine if a relationship exists between the acceptance of distance learning programs and attitude to CRM training. The goal was to achieve a deep understanding of the topic describing the research area of interest with great richness (Trochim, 2001). "The primary advantage of the case study is that an entire organization or entity can be investigated in depth and with meticulous attention to detail. . . . Researchers, however, have no standard procedures to

follow." (Zikmund, 2003, p. 116) A description of the research design is shown in Figure 2.

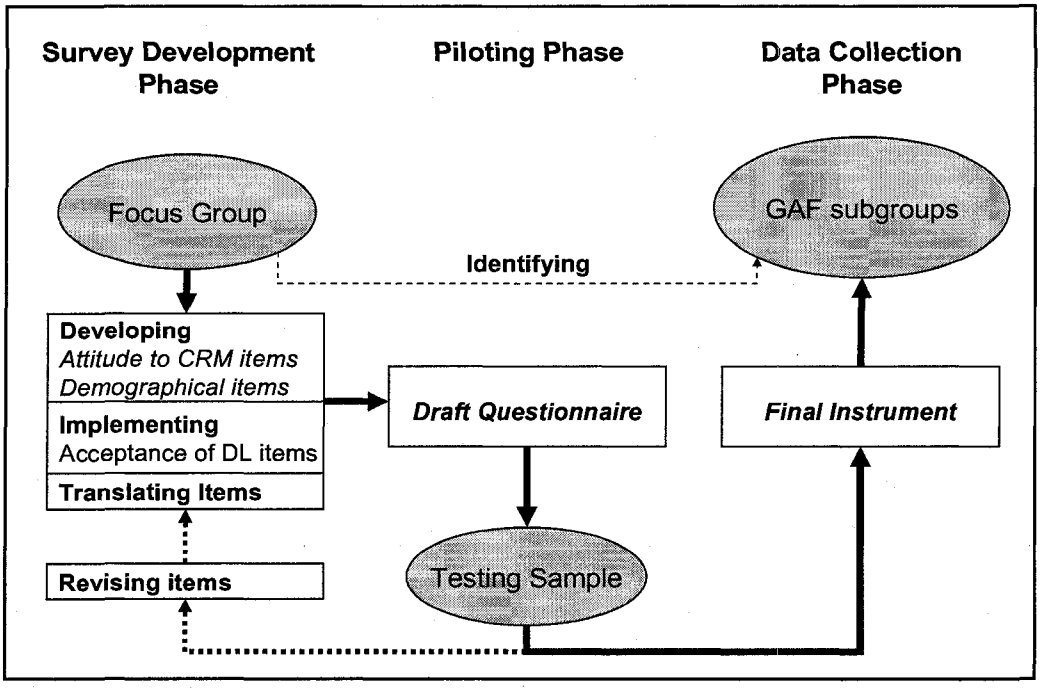

Figure 2. Description of the research design.

For the survey development phase a purposive sample of CRM experts within the selected GAF air wing was identified for a focus group interview. Zikmund (2003) stated, "A focus group interview is an unstructured, free-flowing interview with a small group of people" (p. 117). The purpose of non-probability sampling technique was utilized to allow experienced individuals to select the sample based upon some appropriate characteristic of the sample members (Zikmund, 2003, p. 382). According to Trochim (2001), "Purposive sampling can be useful in situations where you need to reach a targeted sample quickly and where sampling for proportionality is not the primary concern." (p. 56)

The researcher and the selected GAF air wing's CRM training officer to participate in the focus group interview identified three additional individuals (a CRM facilitator, the air wing's chief flight safety officer, and the air wing's chief flight standardization officer) to form the focus group of five members. The focus group had five objectives. Firstly, members identified GAF personnel involved in flight operations as the primary target group for the data collection phases. The second task was to develop the attitude to CRM survey items based on previous research conducted in the field of attitudes in aviation. The third task was to identify the demographical items for the survey with special attention to GAF personnel involved in flight operations. The fourth task was to translate the survey into the German language and the fifth task was to revise the final instrument after the piloting phase. Developed demographical items and items for the attitude to CRM training were combined with the items for acceptance of distance learning (available instrument) to form the final research instrument.

The new research instrument was administered to a testing sample (purposive sample) of 20 GAF personnel based on availability during the piloting phase. Research participants from the testing sample were asked to attend in a continuation-training meeting during normal duty hours and to fill out the draft questionnaire. Research participants were also asked to discuss questions about any unclear item. The purpose of the piloting phase was to ensure adequate validity of the draft instrument and to ensure all questions were clear and understood. Together with the focus group interview this procedure yielded adequate construct validity for the final research instrument. "In face validity, you look at the operationalization and see whether on its face it seems like a good translation of the construct" (Trochim, 2001, p. 67). Trochim further stated, "In

content validity, you essentially check the operationalization against the relevant content domain for the construct" (p. 67). During the piloting phase, research participants had only very few questions regarding the questionnaire and only minor revisions of the draft instrument were made before the release of the final questionnaire.

Main data collection took place during the data collection phase to explore the questions regarding acceptance of distance learning and attitude to CRM training among GAF personnel involved in flight operations identified by the focus group. This rather large population consists of subgroups like flight crew personnel, maintenance personnel, support personnel, and leadership personnel. Due to the case study design, only a single GAF wing was investigated. Since all subgroups were present within a single GAF air wing it can be concluded that a single GAF air wing is representative for all air wings within the GAF due to similarities in personnel structure. All subgroups involved in flight operations went through the same training process standardized for the entire GAF. Purposive samples were drawn from the subgroups based on availability during normal duty hours in order to obtain a large number of responses (Zikmund, 2003).

According to Trochim (2001), "validity can be defined as the best available approximation to the truth of a given proposition, inference, or conclusion" (p. 20). For qualitative research, generalizing results does not make sense because it is "telling the story from the participant's viewpoint" (Trochim, 2001, p. 153). The quantitative portion of the mixed methodology, however, aims to summarize data and reaching generalizations (Trochim). "That's why there is so much value in mixing qualitative and quantitative research" (Trochim, 2001, p. 153). According to Zikmund (2003), research results from case studies should be seen as tentative. "Generalizing from a few cases can

be dangerous, because most situations are atypical in some sense" (Zikmund, 2003, p. 116). Even though mixed methodology research generates detailed information in the original language of the research participants, the quality of research establishes good transferability (Trochim). Selecting the case study design allows the researcher to obtain detailed information on the topic as well as quantitative data. Data from a single air wing are representative for all air wings within the GAF due to training standardization. Drawing a large sample from a single air wing within the GAF establishes good transferability allowing GAF commanders to transfer research results to a different context for future decision-making. Research results contribute to generate new theories or hypotheses for future quantitative research development in CRM training design. Trochim (2001) further stated that internal validity is only relevant in studies that try to identify cause-effect relationships and not in observational or descriptive studies.

Operational Definitions of Variables

The dependent variable (Y), *acceptance of distance learning,* was operationally defined as an instructional CRM training method to measure CRM training effectiveness. According to Salas et al. (2000), variables like instructional approach, media, training method, and training design can measure CRM training success. "Furthermore, the organizational climate and continuous learning culture have been shown to be positively related to post training behaviors on the job." (Salas et al., 2000, p. 497)

The independent variable (X), *attitude to CRM training,* was operationally defined as a measure for factors outside training programs as a prerequisite for a viable CRM culture and necessary for training success. Salas et al. (2000) suggested that the way to achieve CRM training effectiveness should be exploited since factors outside the

selected training programs could potentially influence training outcome. According to Salas et al., one of the conceptual factors outside training programs are pre-training motivation and self-efficacy that can influence CRM training effectiveness. Salas et al. further stated that successful CRM training depends on factors like management support for training, a climate that supports learning, and trainees' expectations and prior experiences with CRM training.

A potential limitation to the study is that the variable attitude to CRM training could also be defined as dependent variable in terms of increasing motivation or willingness to conduct CRM training through distance learning. For the purpose of this study attitude to CRM training was treated as independent variable.

The scales used to measure the strength of the variables are one-dimensional (Trochim, 2001) allowing an easier identification of strategies that might be employed to implement and deliver CRM training by distance learning. Either GAF personnel involved in flight operations accept distance learning or they do not and they have a positive attitude or they have a negative attitude to CRM training. According to Zikmund (2003), the defined variables can be described as hypothetical because they are "not directly observable but . . . measured through indirect indicators" (p. 308). Trochim pointed out the importance of scaling and the need to develop instruments that allow the researcher to create quantitative metric units. Research participants were asked to rate multiple statements representing the defined variables on a structured 5-point Likert-type ordinal scale to get quantitative scores indicating the strength of the defined variables (Zikmund). Each item represented a characteristic of the variable's attitudinal domain and "the total score is the summation of the weights assigned to an individual's response"

(Zikmund, 2003, p. 313). Zikmund (2003) defined the Likert-type scale as "a measure of attitudes designed to allow respondents to indicate how strongly they agree or disagree with carefully constructed statements that range from very positive to very negative toward an attitudinal object" (p. 312).

The disadvantage of this procedure, however, is that the summated rating method does not allow a precise interpretation of what a single summated score means in respect to the respondent's attitude toward the variable because various response patterns might sum up to the same total score. Different combinations of statements might reflect different attitudes with identical total scores (Zikmund). Implementing a piloting phase and comparing results to findings discovered by other researchers minimized this problem and yielded adequate construct validity.

The third variable problem does represent potential problems and limitations in the non-experimental method identifying cause and effect relationships (Cozby, 2006). Since the study is of descriptive nature, the third-variable problem can be neglected.

Description of Materials and Instruments

After identifying the variables – acceptance of distance learning and attitude to CRM training – the operational definition for the single key attributes was performed by developing the items for the three part multi-item questionnaire representing demographical details and characteristics of the defined variables' attitudinal domains. To identify items for the acceptance of distance learning variable, research conducted in this field was analyzed. Guglielmino and Guglielmino (in press) developed a multi-item instrument based on a 5-point Likert-type ordinal scale called the Distance Learning Readiness Assessment (DLRA) scale. The instrument derived from the Self-Directed

Learning Readiness Scale (SDLRS) developed by Guglielmino in 1977. The SDLRS measures the complex of skills, attitudes, and characteristics that contain the participant's current level of readiness to manage his or her own learning (Guglielmino & Guglielmino, 2006). Guglielmino and Guglielmino pointed out the high internal reliability of 0.87 (Cronbach's Alpha) and the high validity of the SDLRS based on numerous reviews and research studies conducted with the instrument. According to Guglielmino and Guglielmino (in press), learner success in the e-learning environment is largely affected by two major components of readiness for e-learning – technical readiness and readiness for self-directed learning. "In an attempt to more closely target the two major components of readiness for e-learning . . . the Distance Learning Readiness Assessment (DLRA) – which incorporates items from the SDLRS with new items related to technical readiness – was developed" (Guglielmino & Guglielmino, in press). The relatively new DLRA instrument is currently being field-tested and has not been validated (Guglielmino & Guglielmino, in press). Oladoke (2006) used the DLRA instrument in a study measuring self-directed learning among online learners. The DLRA instrument was analyzed for construct validity using SPSS® statistical software (Oladoke). Oladoke further conducted a reliability analysis of the instrument (Cronbach's Alpha coefficient of 0.71) indicating high instrument reliability. "Norm data for the DLRA were not available for comparison. This is because the DLRA is still in the field testing stages" (Oladoke, 2006, p. 77). According to Cozby (2006), "Validity of a measure is built up over time as numerous studies investigate the theory of the particular construct being measured." (p. 100) Using the DLRA for the presented case study (item 64 through 95) contributes to the validation process and supports construct validity. The

final research instrument for the variable acceptance of distance learning and the assignment of the items for the domain technical readiness (TXR) and the domain self-directed learning readiness (SDLR) are shown in Appendix E.

The DLRA instrument is available in the English language only and outlined in Appendix A. Even though all GAF personnel involved in flight operations obtained English language training during primary education and professional training, the research provided a German version of the instrument to avoid obscurities and misunderstandings (Appendix F). Detailed instructions regarding the translation process are outlined in Appendix B and were given by the instrument's author. The instrument is protected by international copyright laws and was released after the translation process and after satisfying the treatment requirements according Appendix C.

The presented research further measured the variable attitude to CRM training among GAF personnel involved in flight operations. For the questionnaire items prior research on flight management attitudes was analyzed. Research on cross-cultural attitudes toward performance in commercial flight operations began in 1992 and resulted in the 82 items Flight Management Attitudes Questionnaire 1.0 (FMAQ) based on a 5-point Likert-type ordinal scale. Federal Aviation Administration Grant (FAA) 92-G-017, FAA Grant 99-G-004, and NASA Grant NAGW 4561 supported the research with Robert L. Helmreich as principal investigator (Merritt et al., 1996; Wilhelm, Helmreich, & Merritt, 2001). The instrument contains items form the Cockpit Management Attitude Questionnaire (CMAQ) based on NASA research on CRM, from analysis of National Transport Safety Board accidents reports, Aviation Safety Reporting System incident reports, and from observations of line and simulator operations. The CMAQ indicated

high reliability and included three factors – (a) Command responsibility, (b) communication and coordination, and (c) recognition of stressor effects and "has been shown to be a valid predictor of effective and ineffective crew performance" (Merritt et al., 1996, p. 1). According to Merritt et al. (1996), "The CMAQ has been used extensively for more than 10 years, as both a baseline measure of pilots' attitudes and a pre- and post-training measure of attitude change, and retaining the items has allowed important longitudinal trend analyses to continue" (p. 1). The FMAQ 1.0 also contains 16 items from the Hofstede's Values Survey Module and addresses organizational climate and commitment (e.g. views of Power Distance) and attitudes toward passengers. Additional questions regarding attitudes toward automation were implemented into the FMAQ 1.0 questionnaire (Merritt et al.). Continued research resulted in the development of the FMAQ 2.0 version with items representing the domains organizational climate, safety attitudes and safety culture, work values, senior management and flight operations management, training and checking, flight management attitudes (CRM), and automation attitudes. The latest "FMAQ 1.0 (USA/Anglo) differs from the FMAQ 2.0 (International) in that item revisions were based on psychometric analyses of the Anglo pilot group only. (. . . countries in which English is the primary, and often, only language spoken)" (Merritt et al., 1996, p. 2). Regarding the FMAQ, Helmreich et al. (in press) stated:

> Surveys provide insights into perceptions of the safety culture and illuminate aspects of teamwork among flight crews and other organizational elements including maintenance, ramp, and cabin. At the most detailed level, survey data also indicate the level of acceptance of fundamental concepts of CRM among line crews. They also show where differences may have developed between operational units of organizations, such as fleets and bases. (p. 15)

The presented research made use of the FMAQ 2.0 for the development of the attitude to CRM items. According to Merritt et al. (1996) and Wilhelm et al. (2001), the

use of the FMAQ 2.0 is not restricted allowing any researcher to use the questionnaire and any material in support of writing his or her own FMAQ report. An example of the FMAQ 2.0 is provided in Appendix D.

During the survey development phase a purposive sample of five CRM experts within the selected GAF air wing were identified for a focus group interview. Subject experts were asked to identify the relevant domains and associated items important for GAF personnel involved in flight operations based on the FMAQ 2.0 questionnaire using open-ended questions to the whole group. Focus group participants were also asked to rephrase the items if necessary to fit the research. Results enabled the researcher to establish a customized research instrument with the identified domains for the variable attitude to CRM training outlined in Table 1. The final research instrument and the assignment of items to the relevant domains are shown in Appendix E.

Table 1

Domains for the Variable Attitude to CRM Training

Main Domains	Sub-Domains
Institutional Issues (InstIss)	Organizational Climate (OrgCli)
	Safety Culture (SafeCul)
	Perception of Management (PercMng)
	Training and Checking (TngChe)
	Teamwork (TeamWo)
Work Management (WorkMng)	Threat and Error Management (ThrErrMng)
	Command Attitudes (ComAtt)
	Rules and Roles (RulRol)
	Leadership Styles (LeadSty)
	Stress and Fatigue (StressFat)
Work Values (WorkVal)	

Focus group members further identified and defined the demographic factors for the research instrument. The research instrument did not allow the identification of participants. The focus group members defined demographic data relevant for the proposed research during the survey development phase using background information raised in the DLRA and the FMAQ instrument as a guideline. Table 2 outlines the demographic factors and the associated attributes.

Table 2

Demographic Factors and Attributes

Demographic Factors	Attributes
Gender	Male or Female
Age	Numeric
Rank	Military Rank
Years in Service	Numeric
Experience in Present Position	Numeric
Operational Function	Leadership Personnel, Aircrew, Aircraft Technical Personnel, Support Personnel/Other
Education[a]	Hauptschul-Degree, Realschul-Degree, Abitur/Fachabitur-Degree, University/College-Degree, No Degree
Level of Computer Competency	Beginner, Intermediate, Expert
Level of Experience with On-Line Courses	Beginner, Intermediate, Expert

[a]The German school system is not directly transferable to the U.S. school system. The Hauptschul-Degree, Realschul-Degree, and Abitur/Fachabitur-Degree represent the U.S. high school degree at different levels.

All research items were translated into the German language to overcome potential non-response error and to avoid confusion due to participants' language difficulties. Translation procedures used for the DLRA instrument and outlined in Appendix B were used for all other items accordingly. The developed questionnaire also

contains easy to read descriptions discussing the research participation and detailed instructions how to fill out the instrument. The German version of the final research instrument is presented in Appendix F.

Selection of Participants

The researcher surveyed GAF personnel involved in flight operations. For the purpose of this study, the participants were defined as personnel accountable for the safe conduct of military flight operations and eligible to participate in a comprehensive GAF CRM training. This rather large population consists of subgroups like flight crew personnel, maintenance personnel, support personnel, and leadership personnel. While the vast majority of flight crew in the GAF consists of military officers (junior officers and staff officers), other subgroups have regular military hierarchies with airmen, non-commissioned officers (junior NCOs, senior NCOs), officers (junior officers, staff-officers), and civilian support personnel. The military structure also gives a well-defined age distribution ranging from the age of 18 to the age of 59 for military personnel and the age of 18 to the age of 65 for civilian personnel.

Due to the case study design, only a single GAF wing was investigated. Since all subgroups are present within a single GAF air wing it can be concluded that a single GAF air wing is representative for all air wings within the GAF due to similarities in personnel structure. All subgroups involved in flight operations went through the same training process standardized for the entire GAF. Drawing a large sample from a single air wing within the GAF should yield good transferability.

Prior to conducting the research, the researcher obtained written approval from the selected air wing's chain of command (Appendix G). The next step was to identify

and categorize all subgroups involved in flight operations within the selected air wing. One task of the focus group during the survey development phase was to identify the subgroups within the selected GAF air wing using the air wing's organization chart. Focus group members identified subgroups that are directly involved in military flight operations, accountable for the safe conduct of flight operations, and eligible for future CRM training in order to increase flight safety and efficiency. Purposive samples were drawn from the identified subgroups based on availability during normal duty hours in order to obtain a large number of responses (Zikmund, 2003). This technique does not provide reliable estimates for the population and does not allow making valid inferences on the quantitative part for research question three. In this mixed methodology study, however, the researcher did not intend to make inferences or judgments about a population based on a sample but tried to establish good transferability. This allowed the researcher to select the sample founded on convenience and judgment (Zikmund). According to Zikmund (2003), "There is a judgmental rule of thumb for selecting minimum subgroup sample size. It has been suggested that each subgroup that is to be analyzed separately should have a minimum of 100 units." (p. 429). For the data collection phase 137 participants involved in flight operations were identified and informed about the research procedure.

Procedures

Data were collected by administering a paper and pencil version of the three-part questionnaire to the identified subgroups using purposive samples. For this purpose, the researcher scheduled 12 continuation-training meetings (CT-meeting) with the identified subgroups within the selected air wing during a three week period. Continuation training

meetings took approximately 60 minutes and were scheduled during normal duty hours upon consultation with military commanders. Available personnel attended the meetings and the researcher introduced CRM training in military aviation during a 15-minute briefing followed by a 5-minute introduction about the research topic and the research procedure. A spare-timeframe of five minutes was allowed for questions during the presentation. After the presentation, personnel were asked to voluntarily participate in the study and to give their written consent to participate before working on the questionnaire.

There was no physical or psychological risk for the participants. Questionnaire design ensured adequate privacy because data collected does not allow the direct identification of research participants and the consent forms were separated from the questionnaire upon completion. Collected demographical data, however, might allow the identification of research participants by direct military commanders. Therefore, the researcher ensured strict confidentiality and information were not made available to anyone outside the study.

Participants needed a maximum of 35 minutes to answer the questions. Since the researcher was present during the data collecting procedure, respondents were able to ask questions for clarification if they did not understand the meaning of a given question. This procedure eliminated non-response error. A description of the research procedure is shown in Figure 3.

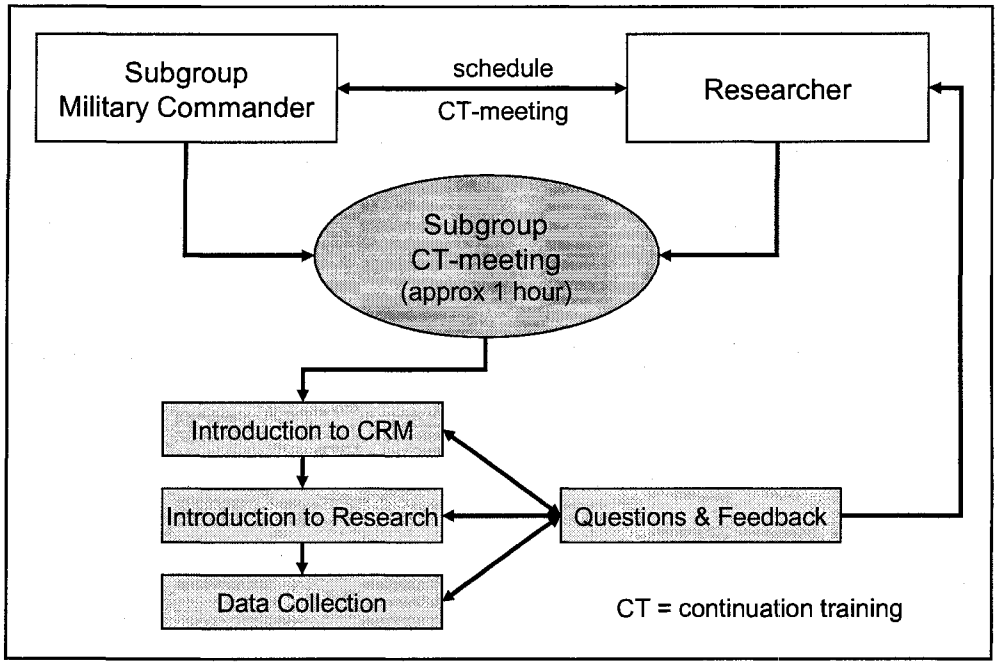

Figure 3. Description of the research procedure.

Since the researcher was also the primary investigator there was the potential of problems because of differences in military rank between the researcher and the research participants leading to social desirability bias. According to Zikmund (2003), social desirability bias can occur either consciously or unconsciously because the respondents wish to create a favorable impression in the presence of the researcher. Research participants might also have felt influenced by the military as an organization itself leading to auspices bias because of the primary investigator holding rank as Lieutenant Colonel.

According to Zikmund (2003), bias in the response of subjects caused by the influence of the organization conducting the study is called auspices bias. Social desirability bias and auspices bias has the potential to falsify research results or might lead to participation denial. The researcher addressed these issues prior to administering

the questionnaire in order to create an open and friendly environment for the data collecting procedure. Respondents needed to know that the German Air Force did not initiate the proposed study and that given answers will have no effect on their duty. The intention was to point out the importance of flight safety and to establish a shared mental model during the continuation training leading to voluntary participation. Research participants were offered to return to regular duty without any drawback if they wished not to participate after the introduction phase. No participant left the CT-meeting after the introduction phase and all available personnel filled out the questionnaire.

Discussion of Data Processing

The statistical analysis of collected data required the researcher to identify and classify each item of the proposed questionnaires (Zikmund, 2003). According to Zikmund, the process of assigning numerical symbols to the survey items is called coding. Coding allows the researcher to transfer data from the survey to the computer for further processing (Zikmund). Code keys for each item are presented in the final research questionnaire outlined in Appendix E.

Demographical data like gender, age, military rank, years in service, work experience level, operational function within the air wing, level of education, level of computer competency, and level of experience with on-line courses were measured on a nominal scale by assigning a number to the individual attributes. Values were entered into the Statistical Package for the Social Sciences (SPSS®) software for Windows.

Data for the variable acceptance of distance learning were collected with the 32-item DLRA instrument based on a 5-point Likert-type ordinal scale. The following code key was used: (1) I never feel like this, (2) I feel like this less than half the time, (3) Half

the time I feel this way, (4) I usually feel this way, (5) I feel like this all the time. Items 67, 75, and 83 were reversed for statistical analysis (Appendix E). Values were entered into SPSS® software for statistical analysis based on cumulative scores. Cumulative scores were grouped and ranked on a scale to represent acceptance of distance learning: no acceptance (32-64), low acceptance (65-96), acceptance (97-128), and high acceptance (129-160).

Cumulative scores for the variable's domains technical readiness and readiness for self-directed learning were further grouped and ranked on a scale regarding the overall attitude to each individual domain. The following ranking was used for technical readiness: no readiness (8 – 16), low readiness (17 – 24), readiness (25 – 32), and high readiness (33 – 40). The following ranking was used for the self-directed learning readiness: no readiness (24 – 48), low readiness (49 – 72), readiness (73 – 96), and high readiness (97 – 120).

Data for the variable attitude to CRM training were collected with the 63-item modified FMAQ questionnaire based on a 5-point Likert-type ordinal scale. Code keys for the questionnaire depend on the questions asked and were identified by the focus group during the survey development phase. The following code keys were used for item one through item eight: (1) very low, (2) low, (3) adequate, (4) high, (5) very high. For item nine through item 52: (1) disagree strongly, (2) disagree slightly, (3) neutral, (4) agree slightly, (5) agree strongly. For item 52 through 62: (1) of very little or no importance, (2) of little importance, (3) of moderate importance, (4) very important, (5) of utmost importance. For item 62 and 63 the respondent had to choose between four different leadership styles (Style1, Style 2, Style 3, Style 4). Items 26, 31, 32, 33, 34, 37,

38, 40, 44, and 50 were reversed for statistical analysis (Appendix E). Values for the items were entered into the SPSS® software for Windows and used for statistical analysis based on cumulative scores. Cumulative scores for the variable attitude to CRM training were grouped and ranked on a scale regarding the overall attitude to CRM training: negative attitude (63 -146), neutral attitude (147 - 230), and positive attitude (231 - 313).

Cumulative scores for the variable's main domains were further grouped and ranked on a scale regarding the overall attitude to each main domain. For institutional issues the following ranking was used: negative attitude (24 – 56), neutral attitude (57 – 88), and positive attitude (89 – 120). For the main domain work management attitude the following ranking was used: negative attitude (30 – 70), neutral attitude (71 – 110), and positive attitude (111 – 150). For the main domain work values, the following ranking was used: negative attitude (9 – 21), neutral attitude (22 – 33), and positive attitude (34 – 45).

Frequency summaries of the variable's sub-domains are also presented to gain a deeper understanding of the variable's attitudinal domain. Scores for the sub-domain were grouped and ranked on a scale to represent the respondents' attitude to each sub-domain. The following ranking was used for the sub-domain organizational climate: negative attitude (4 – 9), neutral attitude (10 – 14), and positive attitude (15 – 20). The following ranking was used for the sub-domain safety culture: negative attitude (6 – 14), neutral attitude (15 – 22), and positive attitude (23 – 30). The following ranking was used for the sub-domain perception of management: negative attitude (6 – 14), neutral attitude (15 – 22), and positive attitude (23 – 30). The following ranking was used for the sub-domain training and checking: negative attitude (6 – 14), neutral attitude (15 – 22), and

positive attitude (23 – 30). The following ranking was used for the sub-domain teamwork: negative attitude (2 – 4), neutral attitude (5 – 7), and positive attitude (8 – 10). The following ranking was used for the sub-domain threat and error management: negative attitude (7 – 16), neutral attitude (17 – 25), and positive attitude (26 – 35). The following ranking was used for the sub-domain command attitudes: negative attitude (6 – 14), neutral attitude (15 – 22), and positive attitude (23 – 30). The following ranking was used for the sub-domain rules and roles: negative attitude (2 – 4), neutral attitude (5 – 7), and positive attitude (8 – 10). The following ranking was used for the sub-domain leadership styles: negative attitude (3 – 6), neutral attitude (7 – 9), and positive attitude (10 – 13). The following ranking was used for the sub-domain attitude to stress and fatigue: negative attitude (12 – 28), neutral attitude (29 – 44), and positive attitude (45 – 60).

Data collected from the demographic questionnaire, acceptance of distance learning questionnaire, and the attitude to CRM training questionnaire were used for descriptive data analysis to answer the proposed research questions one and two, understand motivations, and draw assumptions (Trochim, 2001). Data retrieved from the frequency analysis tool, the descriptive analysis tool, and the cross-tabulation analysis tool provided by SPSS® were analyzed and interpreted. Histograms and bar charts from Microsoft Excel® software were used to support the descriptive data analysis procedure.

To answer research question three and to conduct hypotheses testing the correlation coefficient (Spearman rank-order correlation coefficient) was computed entering cumulative scores for both variables into the SPSS® software for Windows. This procedure allowed determining the relationship between the acceptance of distance

learning programs and attitude to CRM training. The Spearman rank correlation coefficient was used as a nonparametric measure of the correlation between the two variables because data were collected on an ordinal Likert-type scale (Zikmund, 2003). Even though the researcher expected that there was a positive relation with high motivation and a positive attitude to CRM training among GAF personnel, two-tailed testing was conducted to determine the relation between the variables (Zikmund). Cross-tabulation also helped determining the form of relationship between the two variables. The cross-tabulation analysis tool in particular allowed the reporting and interpretation of data by groups, categories, or classes to identify differences among groups and make comparisons (Zikmund, 2003). Histograms and bar charts from Microsoft Excel® software were used to support the data analysis procedure.

Methodological Assumptions, Limitations, and Delimitations

The major limitation of the dissertation is that only one single German Air Force air wing has been investigated. Because of the case study design and the purposive sampling technique used, generalizing research results across all GAF wings is not possible. The mixed methodology used for this study, however, might be used by other organizations to identify the proposed variables' attitudinal domains.

To ensure the quality of the purposive sample, the researcher had to be careful in scheduling the data collection phase. Special attention was given to times of high absenteeism because of holidays, vacation, and military exercises leading to a lack of available personnel. The air wing's continuous involvement in the ISAF (International Security Assistance Force) operations, however, leads to the permanent deployment of some personnel. Data collection was scheduled outside times of major personnel

exchange for this operation. The continuation training was scheduled outside high peak work phases like aircraft launch and landing phases in order to have maximum personnel available.

The study design allowed the interpretation of the defined variables using single values after adding up the item scores. The DLRA score, however, was used to measure the level of self-directed learning readiness across two domains – general technical readiness and readiness for self-directed learning. Other variables like environmental factors (e.g. content and design of the material) and personal issues might affect distance learning as well. The attitude to CRM training questionnaire items based on the FMAQ 2.0 measured domains like institutional issues (organizational climate, safety attitude/culture, perception of management, training and checking, and teamwork), work management attitudes (command attitudes, rules and roles, attitude toward stress and fatigue, leadership styles, and threat and error management), and work values.

The study did not support a distinction between the domains associated with both variables because both variables are measured one-dimensionally only. The purpose of this study was to identify the acceptance of distance learning as a strategy that might be used to implement and deliver CRM training and to measure GAF personnel's attitude to CRM training. The intention was to start a systematic path in the development process of a customized CRM training program for the GAF using the distance learning concept. Further research is necessary to implement such training programs.

It should be noted that the researcher measured acceptance of distance learning and attitude to CRM training at a single point in time. Both variables, however, might vary over time. A flight safety related incident or accident within the aviation domain

usually leads to an increased eagerness for safety programs among personnel involved in flight operations. Even though this increased readiness might be seen as tentative, conducting research during such an event might lead to blurred research results. No such incident was observed during the data collection phase.

Acceptance of distance learning might also increase over time through practice and reflection. The increased use of information technologies within the GAF might lead to an increased acceptance of learning programs. Research results for this variable should be seen as time sensitive in respect to transferability for future research or for long-term decision-making processes.

Ethical Assurances

The presented research is following the case study design investigating GAF personnel involved in flight operations. Ethical standards were followed by the principles of voluntary participation and informed consent (Trochim, 2001). Written approval was requested from military leaders before conducting the study and research participants were asked to give their consent to participate under the premise that there is no risk of physical or psychological harm. Participants were guaranteed the highest standard of confidentiality and the researcher made every attempt to comply with the ethical standards for conducting research with human participants. The researcher gained approval from the Ethics Committee of Northcentral University before research was conducted.

Summary

This chapter provided a comprehensive overview of the research methodology and procedures followed in order to explore and examine if distance learning is a

potential delivery modality for CRM training in military aviation. To get a comprehensive inductive understanding of the acceptance of distance learning and the attitude to CRM training variables the study followed the case study design.

The research was conducted in three phases including the survey development phase, the piloting phase, and the data collection phase. Primary research instrument was a structured three part multi-item paper and pencil questionnaire based on a 5- point Likert-type ordinal scale. The questionnaire was developed during a focus group interview with GAF subject experts and was based on previous research conducted in the field of distance learning readiness and research on cross-cultural attitudes toward performance in commercial flight operations. Prior to the data collection phase, the instrument was piloted using a testing sample.

Research participants were selected GAF personnel involved in military flight operations within a single GAF air wing. The identification of personnel eligible for future CRM training was performed during the focus group interview in the survey development phase. Selection of the 137 research participants was conducted using the purposive sampling technique in order to obtain a rich data set. Collected data were coded and processed using the Statistical Package for the Social Sciences (SPSS®) software for Windows to apply descriptive data analysis, frequency analysis, cross-tabulation analysis, and correlation analysis.

The presented study is a start to increase CRM training effectiveness for safe and efficient flight operations. It is further intended to provide insights and guidance for the development of innovative CRM training programs. Newly developed CRM training programs should include all personnel operating in a high-risk environment.

Chapter 4: Findings

Overview

The purpose of Chapter 4 is to present the results of the analysis of data based on the research questions. After a description of the demographic data of the purposive sample, data summaries for the single value representing the level of acceptance of distance learning programs, a cross-tabulation analysis, and a summary of the variable's two main domains are presented to answer the first research question. For this purpose the frequency analysis tool, the descriptive analysis tool, and the cross-tabulation analysis tool provided by SPSS® were utilized. Histograms and bar charts from Microsoft Excel® software were used to support the descriptive data analysis procedure.

The next step is to give data summaries for the single value representing the overall attitude to CRM training, a cross-tabulation analysis, and a summary of the variable's three different main domains and associated sub-domains to answer the second research question. For this purpose the frequency analysis tool, the descriptive analysis tool, and the cross-tabulation analysis tool provided by SPSS® were utilized. Histograms and bar charts from Microsoft Excel® software were used to support the descriptive data analysis procedure.

To describe the relationship between the acceptance of distance learning programs and attitude to CRM training, the single value representing each variable was used with the cross-tabulation function and the correlation coefficient function (Spearman rank-order correlation coefficient) available with SPSS®. The chapter concludes with an analysis and evaluation of the findings.

The focus of this mixed methodology study was to explore and examine if distance learning programs can deliver crew resource management (CRM) training for German Air Force (GAF) personnel involved in military flight operations to increase training effectiveness. Changing deliver modality requires the acceptance of distance learning programs as an instructional CRM training method.

Trainees' attitude to CRM training is another factor that influences training effectiveness and ranks as an indicator of a viable CRM culture within the GAF. The association between acceptance of distance learning and attitude to CRM training is a prerequisite for CRM programs to be delivered by distance learning. Without the acceptance of distance learning and without a positive attitude to CRM training, CRM training cannot be delivered by distance learning.

The epistemological interest is what strategies might be used to implement and deliver CRM training by distance learning to increase training effectiveness. To answer the question the following sub-questions and hypotheses were proposed:

1. What, if any, acceptance of distance learning programs exists among GAF personnel involved in flight operations?
2. What, if any, attitude exists among GAF personnel involved in flight operations to conduct CRM training?
3. What, if any, relationship exists between the acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations?

$H_{0\text{-}3}$: No correlation exists between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations.

$H_{A\text{-}3}$: A correlation exists between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations.

The ultimate goal of the research is to establish a safety culture within the GAF and to explore if distance learning might give another way of providing a multidimensional methodology to conduct safe and efficient flight operations.

Findings

During the three-week data collection phase, 137 survey instruments were handed to a purposive sample of GAF personnel involved in flight operations in 12 pre-scheduled continuation-training (CT) meetings. A 100.0% instrument return rate was achieved and all personnel attending the CT-meeting completed the questionnaire.

Demographical factors like gender, age, military rank, years in service, experience in present position, operational function within the GAF air wing, level of education, level of computer competency, and level of experience with on-line courses might be a factor in the acceptance of distance learning programs as an instructional training method and in attitude to CRM training. To improve the quality of the research demographical data were collected and analyzed using structured nominal response formats.

The frequency and percentage of GAF personnel respondents by the gender of the respondents are shown in Table 3. The majority of the available personnel were male

(97.1%) and four female (2.9%) GAF personnel attended the scheduled CT-meetings and completed the questionnaire.

Table 3

The Gender of GAF Personnel Respondents

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
Male	133	97.1	97.1
Female	4	2.9	100

The frequency and percentage of GAF personnel respondents by the age of the respondents are shown in Table 4. The majority of GAF personnel respondents were 31 to 41 years old (36.5%) and a small minority of the respondents was older than 50 years (10.2%). No personnel younger than 22 years participated in the study.

Table 4

The Ages of GAF Personnel Respondents

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
≤ 21 years	0	0.0	0.0
22 – 30 years	44	32.1	32.1
31 – 41 years	50	36.5	68.6
42 – 50 years	28	21.2	89.8
> 50years	14	10.2	100.0

The frequency and percentage of GAF personnel respondents by rank are shown in Table 5. The majority of respondents were senior NCOs (35.8%) and officers (32.1%). A small minority of GAF personnel respondents were airman (4.4%).

Table 5

The Rank of GAF Personnel Respondents

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
Civilian	26	19.0	19.0
Airman	6	4.4	23.4
Junior NCO	12	8.8	32.1
Senior NCO	49	35.8	67.9
Officer	44	32.1	100.0

The frequency and percentage of GAF personnel respondents by years in service are shown in Table 6. The majority of respondents had more than 10 years of experience (68.6%) and 50.4% had more than 15 years of experience in the GAF. A small minority of personnel indicated less than 2 years of experience in the GAF (2.9%).

Table 6

The Years in Service of GAF Personnel Respondents

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
< 2 years	4	2.9	2.9
2 – 4 years	9	6.6	9.5
5 – 10 years	30	21.9	31.4
11 – 15 years	25	18.2	49.6
≥ 15 years	69	50.4	100

The frequency and percentage of GAF personnel respondents by experience in present position are shown in Table 7. The majority of respondents indicated more than 5

years of experience in the current job (64.2%) and 42.3% had more than 7 years of experience. Some 8.8% of respondents indicated less than one year of job experience.

Table 7

The Job Experience Level of GAF Personnel Respondents

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
< 1 year	12	8.8	8.8
1 – 2 years	13	9.5	18.2
3 – 4 years	24	17.5	35.8
5 – 7 years	30	21.9	57.7
> 7 years	58	42.3	100.0

The frequency and percentage of GAF personnel respondents by operational function of the respondents are shown in Table 8. The majority of the respondents were support personnel (40.9%) and aircraft technical personnel (34.3%). Some 14.6% of the respondents were aircrew and 10.2% were leadership personnel. Some undefined respondents specified a dual function as leadership personnel and aircrew, technical personnel, or support personnel. Personnel with a dual function were classified as leadership personnel for statistical analysis as the more important operational function in terms of CRM culture within the GAF.

Table 8

The Operational Function of GAF Personnel Respondents

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
Leadership Personnel	14	10.2	10.2
Aircrew	20	14.6	24.8
Aircraft Technical Personnel	47	34.3	59.1
Support Personnel / Other	56	40.9	100.0

The frequency and percentage of GAF personnel respondents by level of education of the respondents are shown in Table 9. All participating GAF personnel are holding a degree (0.0% indicated no degree). The majority of respondents indicated a Realschul-Degree (46.7%). Some 10.9% of the respondents indicated to hold a graduate degree.

Table 9

The Level of Education of GAF Personnel Respondents

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
No Degree	0	0.0	0.0
Hauptschul-Degree	26	19.0	19.0
Realschul-Degree	64	46.7	65.7
Abitur / Fachabitur	32	23.4	89.1
University / College Degree	15	10.9	100.0

The frequency and percentage of GAF personnel respondents by the level of computer competency of the respondents are shown in Table 10. The majority of

respondents indicated expert level of computer competency (49.6%) and only 8.8% indicated beginner level of computer competency. Some 41.6% of the respondents showed an intermediate level of computer competency.

Table 10

The Level of Computer Competency

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
Beginner	12	8.8	8.8
Intermediate	57	41.6	50.4
Expert	68	49.6	100.0

The frequency and percentage of GAF personnel respondents by the level of experience with distance learning classes of the respondents are shown in Table 11. The majority of respondents indicated beginner level of experience with distance learning classes (65.7%). Some 28.5% specified intermediate level of experience and 5.8% of the respondents showed expert level of experience with distance learning classes.

Table 11

The Level of Experience with Distance Learning

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
Beginner	90	65.7	65.7
Intermediate	39	28.5	94.2
Expert	8	5.8	100.0

Research question one. The following sections provide descriptive statistics (means, standard deviation, frequencies, and cross-tabulation) relating to the first research question - What, if any, acceptance of distance learning programs exists among GAF personnel involved in flight operations? Data for the variable acceptance of distance learning programs were collected with the 32-item DLRA instrument based on a 5-point Likert-type ordinal scale. The following code keys were used: (1) I never feel like this, (2) I feel like this less than half the time, (3) Half the time I feel this way, (4) I usually feel this way, (5) I feel like this all the time. Items 67, 75, and 83 were reversed for statistical analysis.

The questionnaire for the variable acceptance of distance learning (item 64 through 95) was analyzed for internal consistency reliability using the reliability analysis function provided in the SPSS® software for Windows. Cronbach's Alpha was calculated for the instrument indicating a high internal reliability of 0.813 (Cronbach's Alpha). Data summaries for the single value representing the level of acceptance of distance learning programs, a cross-tabulation analysis, and a summary of the two domains are presented to gain a deep understanding of the variable's attitudinal domain. The frequency summary analysis of all 32 items and the assignment of items to the two domains are presented in Appendix J.

The frequency and percentage of the cumulative scores of the acceptance of distance learning items are shown in Table 12. Cumulative scores were collapsed to a 5-point interval starting with the lowest score and ending with the highest score to allow a better presentation of data for this report. The original cumulative scores for the acceptance of distance learning items are presented in Appendix H.

Table 12

Cumulative Scores for the Acceptance of Distance Learning Items

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
90	3	2.2	2.2
95	1	0.7	2.9
100	1	0.7	3.6
105	7	5.1	8.8
110	14	10.2	19.0
115	8	5.8	24.8
120	25	18.2	43.1
125	20	14.6	57.7
130	23	16.8	74.5
135	15	10.9	85.4
140	10	7.3	92.7
145	6	4.4	97.1
150	4	2.9	100.0
Total	137	100.0	100.0

The graphical distribution for the cumulative scores of the variable acceptance of distance learning is presented in Figure 4.

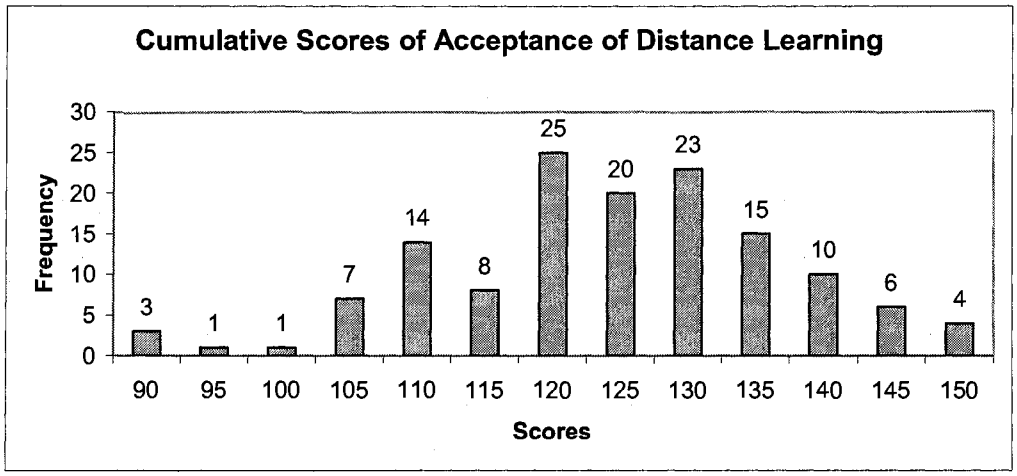

Figure 4. Cumulative scores for the variable acceptance of distance learning.

Descriptive statistics showed that the cumulative scores for the variable acceptance of distance learning ranged from a minimum of 90 to a maximum of 152. Data indicated a normal distribution, a mean score of 124.29, and a standard deviation of 12.495. Test data of the original Distance Learning Readiness Assessment (DLRA) instrument based on a field test of 362 cases from a variety of sites across the US and Canada indicated a mean score of 129.49 and a standard deviation of 14.547.

Cumulative scores were grouped and ranked on a scale to represent acceptance of distance learning programs among GAF personnel involved in flight operations. The following ranking was used: no acceptance (32-64), low acceptance (65-96), acceptance (97-128), and high acceptance (129-160).The grouped and ranked scores are presented in Figure 5 indicating the level of acceptance of distance learning among GAF personnel involved in flight operations.

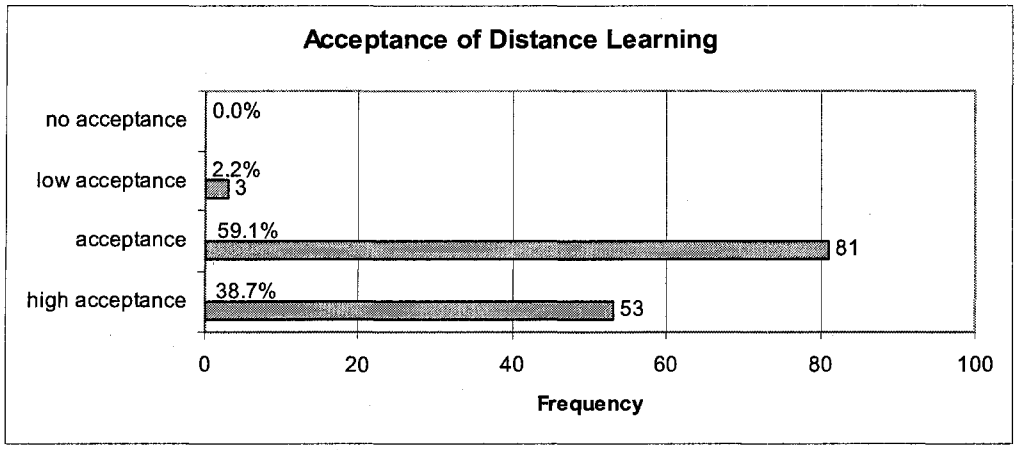

Figure 5. GAF respondents' acceptance of distance learning.

Data showed that 81 respondents indicated acceptance of distance learning as a training method (59.1%) and 53 respondents specified high acceptance of distance learning programs (38.7%). Three respondents indicated low acceptance (2.2%) and no GAF personnel involved in flight operations rejected distance learning as a training method (0.0%).

The next section provides cross-tabulation analysis using the variable acceptance of distance learning and demographic data. The tables show the summarized ranking scores for the variable's attitudinal domain and the demographic factors in relation to all respondents.

The frequency and percentage of GAF personnel respondents accepting distance learning by the gender of the respondents are shown in Table 13. The majority of the 133 male respondents (97.1%) indicated acceptance (57.7%) and 37.2% specified high acceptance. Three male respondents indicated low acceptance (2.2%) of distance learning programs. The four female respondents (2.9%) indicated acceptance (1.5%) and some 1.5% specified high acceptance of distance learning programs.

Table 13

Cross-tabulation Gender and Acceptance of Distance Learning

Gender		Low acceptance	Acceptance	High acceptance	Total
Male	Count	3	79	51	133
	% of Total	2.2%	57.7%	37.2%	97.1%
Female	Count	0	2	2	4
	% of Total	0.0%	1.5%	1.5%	2.9%
Total	Count	3	81	53	137
	% of Total	2.2%	59.1%	38.7%	100.0%

The frequency and percentage of GAF personnel respondents accepting distance learning by the age of the respondents are shown in Table 14. The majority of the 44 respondents between 22 and 30 years of age (32.1%) indicated acceptance (16.1%) and high acceptance (16.1%) of distance learning programs. The 50 respondents between 31 and 41 years of age (36.5%) indicated acceptance (22.6%) and high acceptance (13.9%) of distance learning. The majority of the 29 respondents between 42 and 50 years of age (21.2%) specified acceptance (14.6%) and high acceptance (5.1%). Two respondents in this age group indicated low acceptance (1.5%). The 14 respondents over 50 years of age (10.2%) indicated acceptance (57.1%) and high acceptance (35.7%). One respondent in this age group specified low acceptance (7.1%) of distance learning programs.

Table 14

Cross-tabulation Age and Acceptance of Distance Learning

Age		Low acceptance	Acceptance	High acceptance	Total
22 – 30 years	Count	0	22	22	44
	% of Total	0.0%	16.1%	16.1%	32.1%
31 – 41 years	Count	0	31	19	50
	% of Total	0.0%	22.6%	13.9%	36.5%
42 – 50 years	Count	2	20	7	29
	% of Total	1.5%	14.6%	5.1%	21.2%
Over 50 years	Count	1	8	5	14
	% of Total	0.7%	5.8%	3.6%	10.2%
Total	Count	3	81	53	137
	% of Total	2.2%	59.1%	38.7%	100.0%

The frequency and percentage of GAF personnel respondents accepting distance learning by rank of the respondents are shown in Table 15. The majority of the 26 civilian respondents (19.0%) indicated acceptance (11.7%) and high acceptance (5.8%). Two civilian respondents (1.5%) specified low acceptance of distance learning programs. The six airmen respondents (4.4%) indicated acceptance (2.9%) and high acceptance (1.5%). The majority of the 12 junior NCO respondents (8.8%) specified acceptance (5.8%) and high acceptance (2.9%). The 49 senior NCO respondents (35.8%) indicated acceptance (19.0%) and high acceptance (16.1%). One senior NCO specified low acceptance (0.7%) of distance learning programs. The majority of the 44 officers (32.1%)

indicated acceptance (19.7%) and high acceptance (12.4%) of distance learning programs.

Table 15

Cross-tabulation Rank and Acceptance of Distance Learning

Rank		Low acceptance	Acceptance	High acceptance	Total
Civilian	Count	2	16	8	26
	% of Total	1.5%	11.7%	5.8%	19.0%
Airman	Count	0	4	2	6
	% of Total	0.0%	2.9%	1.5%	4.4%
Junior NCO	Count	0	8	4	12
	% of Total	0.0%	5.8%	2.9%	8.8%
Senior NCO	Count	1	26	22	49
	% of Total	0.7%	19.0%	16.1%	35.8%
Officer	Count	0	27	17	44
	% of Total	0.0%	19.7%	12.4%	32.1%
Total	Count	3	81	53	137
	% of Total	2.2%	59.1%	38.7%	100.0%

The frequency and percentage of GAF personnel respondents accepting distance learning by time in service of the respondents are shown in Table 16. The four respondents with less than two years of time in service (2.9%) indicated acceptance (1.5%) and high acceptance (1.5%). The nine respondents between two and four years of time in service (6.6%) specified high acceptance (3.6%) and acceptance (2.9%). The 30 respondents between 5 and 10 years of time in service (21.9%) indicated high acceptance

(12.4%) and acceptance (9.5%). The 25 respondents between 11 and 15 years of time in service (18.2%) indicated acceptance (11.7%) and high acceptance (6.6%). The majority of the 69 respondents with more than 15 years of time in service (50.4%) specified acceptance (33.6%) and high acceptance (14.6%). Three respondents in this category (2.2%) specified low acceptance of distance learning programs.

Table 16

Cross-tabulation Time in Service and Acceptance of Distance Learning

Time in Service		Low acceptance	Acceptance	High acceptance	Total
Less than 2 years	Count	0	2	2	4
	% of Total	0.0%	1.5%	1.5%	2.9%
2 – 4 years	Count	0	4	5	9
	% of Total	0.0%	2.9%	3.6%	6.6%
5 – 10 years	Count	0	13	17	30
	% of Total	0.0%	9.5%	12.4%	21.9%
11 – 15 years	Count	0	16	9	25
	% of Total	0.0%	11.7%	6.6%	18.2%
More than 15 years	Count	3	46	20	69
	% of Total	2.2%	33.6%	14.6%	50.4%
Total	Count	3	81	53	137
	% of Total	2.2%	59.1%	38.7%	100.0%

The frequency and percentage of GAF personnel respondents accepting distance learning by experience in present position of the respondents are shown in Table 17. The 12 respondents with less than one year of job experience (8.8%) indicated acceptance

(4.4%) and high acceptance (4.4%). The 13 respondents between one and two years of experience in present position (9.5%) specified high acceptance (5.1%) and acceptance (4.4%). The 24 respondents between three and four years of experience in present position (17.5%) indicated acceptance (10.2%) and high acceptance (7.3%). The 30 respondents between five and seven years of experience in present position (21.9%) specified high acceptance (10.9%) and acceptance (10.9%). The majority of the 58 respondents with more than seven years of experience in present position (42.3%) specified acceptance (29.2%) and high acceptance (10.9%). Three respondents in this category (2.2%) were identified with low acceptance of distance learning programs.

Table 17

Cross-tabulation Job Experience and Acceptance of Distance Learning

Job Experience		Low acceptance	Acceptance	High acceptance	Total
Less than 1 year	Count	0	6	6	12
	% of Total	0.0%	4.4%	4.4%	8.8%
1 – 2 years	Count	0	6	7	13
	% of Total	0.0%	4.4%	5.1%	9.5%
3 – 4 years	Count	0	14	10	24
	% of Total	0.0%	10.2%	7.3%	17.5%

Table 17 continued

Job Experience		Low acceptance	Acceptance	High acceptance	Total
5 – 7 years	Count	0	15	15	30
	% of Total	0.0%	10.9%	10.9%	21.9%
More than 7 years	Count	3	40	15	58
	% of Total	2.2%	29.2%	10.9%	42.3%
Total	Count	3	81	53	137
	% of Total	2.2%	59.1%	38.7%	100.0%

The frequency and percentage of GAF personnel respondents accepting distance learning by operational function of the respondents are shown in Table 18. The majority of the 14 respondents identified as leadership personnel (10.2%) indicated acceptance (5.1%) and high acceptance (5.1%). The 20 respondents identified as aircrew (14.6%) specified acceptance (8.8%) and high acceptance (5.8%) of distance learning programs. The 47 aircraft technical personnel respondents (34.3%) indicated acceptance (18.2%) and high acceptance (13.9%). Three aircraft technical personnel respondents indicated low acceptance (2.2%). The majority of the 56 support personnel respondents (40.9%) specified acceptance (27.0%) and high acceptance (13.9%) of distance learning programs.

Table 18

Cross-tabulation Operational Function and Acceptance of Distance Learning

Operational Function		Low acceptance	Acceptance	High acceptance	Total
Leadership Personnel	Count	0	7	7	14
	% of Total	0.0%	5.1%	5.1%	10.2%
Aircrew	Count	0	12	8	20
	% of Total	0.0%	8.8%	5.8%	14.6%
Aircraft Technical Personnel	Count	3	25	19	47
	% of Total	2.2%	18.2%	13.9%	34.3%
Support Personnel/ Other	Count	0	37	19	56
	% of Total	0.0%	27.0%	13.9%	40.9%
Total	Count	3	81	53	137
	% of Total	2.2%	59.1%	38.7%	100.0%

The frequency and percentage of GAF personnel respondents accepting distance learning by education of the respondents are shown in Table 19. The majority of the 26 respondents with a Hauptschul-Degree (19.0%) indicated acceptance (12.4%) and high acceptance (5.1%). A small minority of two respondents indicated low acceptance (1.5%) of distance learning programs. The 64 respondents with a Realschul-Degree (46.7%) specified acceptance (27.0%) and high acceptance (19.0%). One respondent with a Realschul-Degree indicated low acceptance of distance learning (0.7%). The 32 respondents with an Abitur-Degree (23.4%) indicated acceptance (11.7%) and high acceptance (11.7%). The majority of the 15 respondents with a graduate degree (10.9%) specified acceptance (8.0%) and high acceptance (2.9%) of distance learning programs.

Table 19

Cross-tabulation Education and Acceptance of Distance Learning

Education		Low acceptance	Acceptance	High acceptance	Total
Hauptschul-Degree	Count	2	17	7	26
	% of Total	1.5%	12.4%	5.1%	19.0%
Realschul-Degree	Count	1	37	26	64
	% of Total	0.7%	27.0%	19.0%	46.7%
Abitur-Degree	Count	0	16	16	32
	% of Total	0.0%	11.7%	11.7%	23.4%
University/College Degree	Count	0	11	4	15
	% of Total	0.0%	8.0%	2.9%	10.9%
Total	Count	3	81	53	137
	% of Total	2.2%	59.1%	38.7%	100.0%

The frequency and percentage of GAF personnel respondents accepting distance learning by computer skills of the respondents are shown in Table 20. The majority of the 12 respondents with beginner computer skills (8.8%) indicated acceptance (6.6%) and 2.2% specified low acceptance. No respondent with beginner computer skills indicated high acceptance (0.0%) of distance learning programs. The 57 respondents with intermediate computer skills (41.6%) specified acceptance (33.6%) and high acceptance of distance learning (8.0%). The majority of the 68 respondents with expert computer skills (49.6%) indicated high acceptance (30.7%) and acceptance (19.0%) of distance learning programs.

Table 20

Cross-tabulation Computer Skills and Acceptance of Distance Learning

Computer Skills		Low acceptance	Acceptance	High acceptance	Total
Beginner	Count	3	9	0	12
	% of Total	2.2%	6.6%	0.0%	8.8%
Intermediate	Count	0	46	11	57
	% of Total	0.0%	33.6%	8.0%	41.6%
Expert	Count	0	26	42	68
	% of Total	0.0%	19.0%	30.7%	49.6%
Total	Count	3	81	53	137
	% of Total	2.2%	59.1%	38.7%	100.0%

The frequency and percentage of GAF personnel respondents accepting distance learning by distance learning skills of the respondents are shown in Table 21. The majority of the 90 respondents with beginner distance learning skills (65.7%) indicated acceptance (42.3%) and high acceptance (21.2%). A minority of 2.2% of the beginners indicated low acceptance of distance learning programs. The 39 respondents with intermediate distance learning skills (28.5%) specified acceptance (14.6%) and high acceptance (13.9%). The eight respondents with expert distance learning skills (5.8%) specified high acceptance (3.6%) and acceptance (2.2%) of distance learning programs.

Table 21

Cross-tabulation Distance Learning Skills and Acceptance of Distance Learning

Distance Learning Skills		Low acceptance	Acceptance	High acceptance	Total
Beginner	Count	3	58	29	90
	% of Total	2.2%	42.3%	21.2%	65.7%
Intermediate	Count	0	20	19	39
	% of Total	0.0%	14.6%	13.9%	28.5%
Expert	Count	0	3	5	8
	% of Total	0.0%	2.2%	3.6%	5.8%
Total	Count	3	81	53	137
	% of Total	2.2%	59.1%	38.7%	100.0%

The next section provides a frequency analysis of the cumulative scores for the technical readiness domain identified as part of the variable acceptance of distance learning. Scores were grouped and ranked on a scale to represent the respondents' technical readiness for distance learning. The following ranking was used: no readiness (8 – 16), low readiness (17 – 24), readiness (25 – 32), and high readiness (33 – 40).

Data in Figure 6 show the frequency and percentage of GAF personnel's technical readiness for distance learning. The majority of respondents indicated high technical readiness (44.6%) and 43.0% specified technical readiness for distance learning. Some 10.2% of GAF personnel indicated low technical readiness and a minority of 2.2% specified no technical readiness (2.2%) for distance learning.

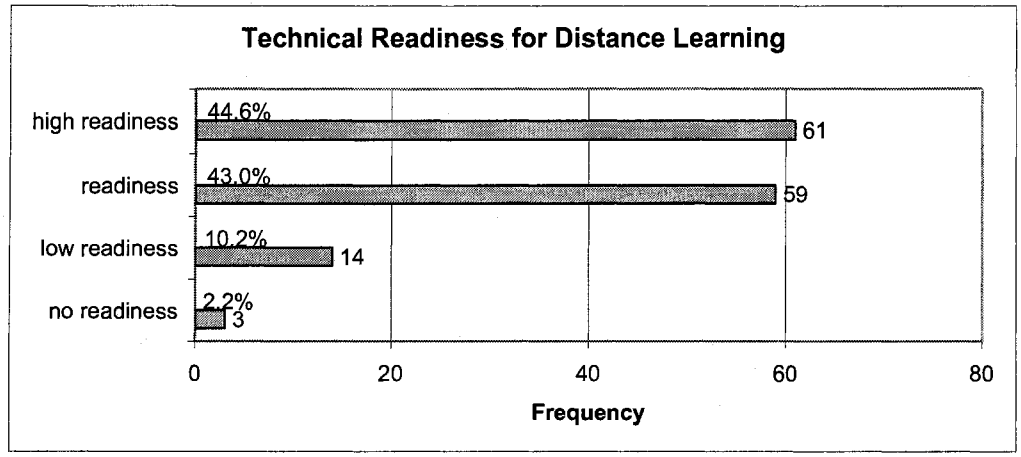

Figure 6. GAF respondents' technical readiness for distance learning.

The next section provides a frequency analysis of the cumulative scores for the self-directed readiness domain identified as part of the variable acceptance of distance learning. Scores were grouped and ranked on a scale to represent the respondents' readiness for self-directed learning. The following ranking was used: no readiness (24 – 48), low readiness (49 – 72), readiness (73 – 96), and high readiness (97 – 120).

Data in Figure 7 show the frequency and percentage of GAF personnel's readiness for self-directed learning. The majority of respondents indicated readiness (67.2%) and 32.8% specified high readiness for self-directed learning. No GAF respondent indicated low readiness (0.0%) or no readiness (0.0%) for self-directed learning.

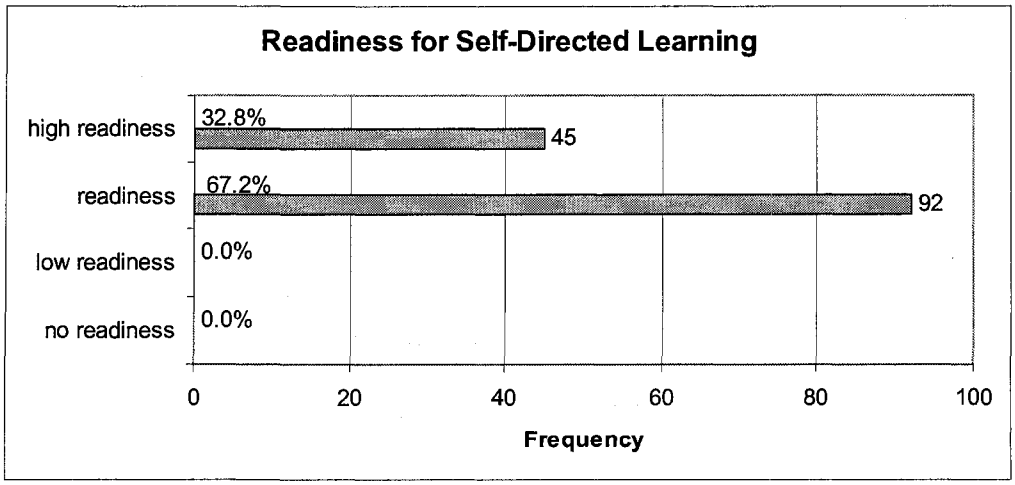

Figure 7. GAF respondents' readiness for self-directed learning.

Research question two. The following sections provide descriptive statistics (means, standard deviation, frequencies, and cross-tabulation) relating to the second research question - What, if any, attitude exists among GAF personnel involved in flight operations to conduct CRM training? Data for the variable attitude to CRM training were collected with the customized 63-item attitude to CRM training instrument derived from the original Flight Management Attitude Questionnaire (FMAQ) based on a 5-point Likert-type ordinal scale. The following code keys were used for item one through item eight: (1) very low, (2) low, (3) adequate, (4) high, and (5) very high. For item nine through item 52: (1) disagree strongly, (2) disagree slightly, (3) neutral, (4) agree slightly, (5) agree strongly. For item 52 through 62: (1) of very little or no importance, (2) of little importance, (3) of moderate importance, (4) very important, (5) of utmost importance. For item 62 and 63, the respondents had to choose between four different leadership styles (Style1, Style 2, Style 3, and Style 4). Items 26, 31, 32, 33, 34, 37, 38, 40, 45, and 45 were reversed for statistical analysis.

The attitude to CRM training questionnaire (item one through 63) was analyzed for internal consistency reliability using the reliability analysis function provided in the SPSS® software for Windows. Cronbach's Alpha was calculated for the instrument indicating a high internal reliability of 0.771 (Cronbach's Alpha). Data summaries for the single value representing the level of attitude to CRM training, a cross-tabulation analysis, and a summary of each main domain and sub-domain are presented to gain a deep understanding of the variable's attitudinal domain. The frequency summary analysis of all 63 items and the assignment of items to the main and sub-domains are presented in Appendix K.

The frequency and percentage of the cumulative scores of the attitude to CRM training items are shown in Table 22. Cumulative scores were collapsed to a 5-point interval starting with the lowest score and ending with the highest score to allow a better presentation of data for this report. The original cumulative scores for the attitude to CRM training items are presented in Appendix I.

Table 22

Cumulative Scores for the Attitude to CRM Training Items

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
185	1	0.7	0.7
205	1	0.7	1.5
210	4	2.9	4.4
215	13	9.5	13.9
220	9	6.6	20.4
225	10	7.3	27.7
230	16	11.7	39.4
235	19	13.9	53.3
240	27	19.7	73.0
245	13	9.5	82.5
250	10	7.3	89.8
255	8	5.8	95.6
260	3	2.2	97.8
265	2	1.5	99.3
270	1	0.7	100.0
Total	137	100.0	100.0

The graphical distribution for the cumulative scores of the variable attitude to CRM training is presented in Figure 8.

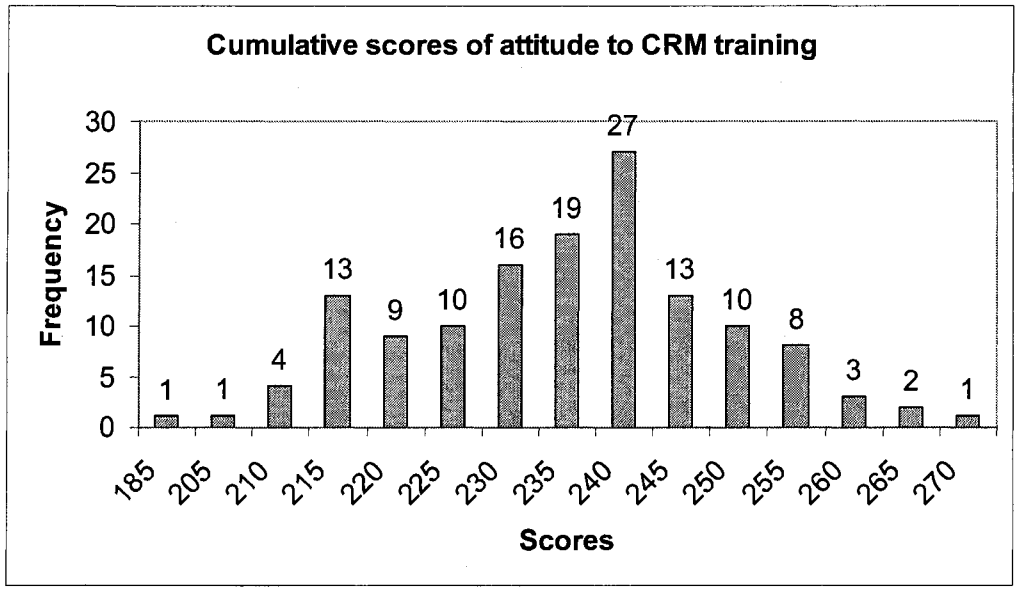

Figure 8. Cumulative scores for the variable attitude to CRM training.

Descriptive statistics showed that the cumulative scores for the variable attitude to CRM training ranged from a minimum of 186 to a maximum of 271. Data indicated a normal distribution, a mean score of 234.97, and a standard deviation of 14.178.

Cumulative scores for the variable were further grouped and ranked on a scale to represent the respondents' attitude to CRM training: (63-146) negative attitude, (147-230) neutral attitude, (231-313) positive attitude. The grouped and ranked scores are presented in Figure 9 indicating the overall attitude to CRM training among GAF personnel involved in flight operations.

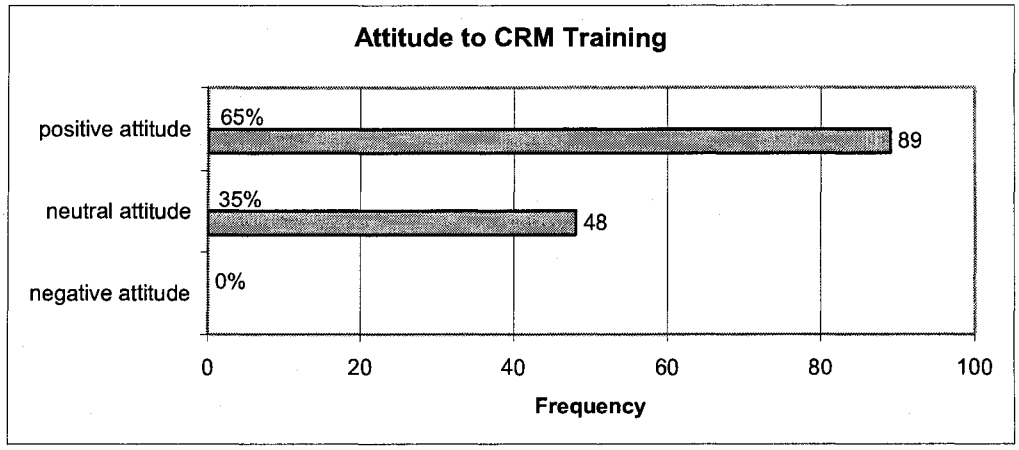

Figure 9. GAF respondent' attitude to CRM training.

Data showed that no GAF personnel involved in flight operations have a negative attitude to CRM training (0.0%) and 35.0% indicated to have a neutral attitude to CRM training. The majority of GAF personnel specified to have a positive attitude to CRM training (65.0%).

This section provides a cross-tabulation analysis using the variable attitude to CRM training and demographic data. The tables show the summarized ranking scores for the variable's attitudinal domain and the demographic factors in relation to all respondents.

The frequency and percentage of GAF personnel respondents with a positive or neutral attitude to CRM training by the gender of the respondents are shown in Table 23. The majority of the 133 male respondents (97.1%) indicated a positive attitude (64.2%) and a neutral attitude (32.8%) to CRM training. The four female respondents (2.9%) specified a neutral attitude (2.2%) and one female respondent indicated a positive attitude (0.7%) to CRM training.

Table 23

Cross-tabulation Gender and Attitude to CRM Training

Gender		Neutral attitude	Positive attitude	Total
Male	Count	45	88	133
	% of Total	32.8%	66.2%	97.1%
Female	Count	3	1	4
	% of Total	2.2%	0.7%	2.9%
Total	Count	48	89	137
	% of Total	35.0%	65.0%	100.0%

The frequency and percentage of GAF personnel respondents with a positive or neutral attitude to CRM training by age of the respondents are shown in Table 24. The majority of the 44 respondents between 22 and 30 years of age (32.1%) indicated a positive attitude (21.2%) and a neutral attitude (10.9%) to CRM training. The 50 respondents between 31 and 41 years of age (36.5%) indicated a positive attitude (22.6%) and a neutral attitude (13.9%). The majority of the 29 respondents between 42 and 50 years of age (21.2%) specified a positive attitude (12.4%) and a neutral attitude (8.8%). The 14 respondents over 50 years of age (10.2%) indicated a positive attitude (8.8%) and a neutral attitude (1.5%) to CRM training.

Table 24

Cross-tabulation Age and Attitude to CRM Training

Age		Neutral attitude	Positive attitude	Total
22 – 30 years	Count	15	29	44
	% of Total	10.9%	21.2%	32.1%
31 – 41 years	Count	19	31	50
	% of Total	13.9%	22.6%	36.5%
42 – 50 years	Count	12	17	29
	% of Total	8.8%	12.4%	21.2%
Over 50 years	Count	2	12	14
	% of Total	1.5%	8.8%	10.2%
Total	Count	48	89	137
	% of Total	35.0%	65.0%	100.0%

The frequency and percentage of GAF personnel respondents with a positive or neutral attitude to CRM training by rank of the respondents are shown in Table 25. The majority of the 26 civilian respondents (19.0%) indicated a positive attitude (13.1%) and a neutral attitude (5.8%) to CRM training. The six airmen respondents (4.4%) indicated a positive attitude (3.6%) and a neutral attitude (0.7%). The majority of the 12 junior NCO respondents (8.8%) specified a positive attitude (5.8%) and a neutral attitude (2.9%). The 49 senior NCO respondents (35.8%) indicated a positive attitude (19.7%) and a neutral attitude (16.1%). The majority of the 44 officers (32.1%) indicated a positive attitude (22.6%) and a neutral attitude (9.5%) to CRM training.

Table 25

Cross-tabulation Rank and Attitude to CRM Training

Rank		Neutral attitude	Positive attitude	Total
Civilian	Count	8	18	26
	% of Total	5.8%	13.1%	19.0%
Airman	Count	1	5	6
	% of Total	0.7%	3.6%	4.4%
Junior NCO	Count	4	8	12
	% of Total	2.9%	5.8%	8.8%
Senior NCO	Count	22	27	49
	% of Total	16.1%	19.7%	35.8%
Officer	Count	13	31	44
	% of Total	9.5%	22.6%	32.1%
Total	Count	48	89	137
	% of Total	35.0%	65.0%	100.0%

The frequency and percentage of GAF personnel respondents with a positive or neutral attitude to CRM training by the respondents' time in service are shown in Table 26. The four respondents with less than two years of time in service (2.9%) indicated a positive attitude (2.2%) and a neutral attitude (0.7%) to CRM training. The nine respondents between two and four years of time in service (6.6%) specified a positive attitude (5.1%) and a neutral attitude (1.5%). The 30 respondents between 5 and 10 years of time in service (21.9%) indicated a positive attitude (14.6%) and a neutral attitude (7.3%). The 25 respondents between 11 and 15 years of time in service (18.2%) indicated

a neutral attitude (9.5%) and a positive attitude (8.8%) to CRM training. The majority of the 69 respondents with more than 15 years of time in service (50.4%) specified a positive attitude (34.3%) and a neutral attitude (16.1%) to CRM training.

Table 26

Cross-tabulation Time in Service and Attitude to CRM Training

Time in Service		Neutral attitude	Positive attitude	Total
Less than 2 years	Count	1	3	4
	% of Total	0.7%	2.2%	2.9%
2 – 4 years	Count	2	7	9
	% of Total	1.5%	5.1%	6.6%
5 – 10 years	Count	10	20	30
	% of Total	7.3%	14.6%	21.9%
11 – 15 years	Count	13	12	25
	% of Total	9.5%	8.8%	18.2%
More than 15 years	Count	22	47	69
	% of Total	16.1%	34.3%	50.4%
Total	Count	48	89	137
	% of Total	35.0%	65.0%	100.0%

The frequency and percentage of GAF personnel respondents with a positive or neutral attitude to CRM training by experience in present position of the respondents are shown in Table 27. The 12 respondents with less than one year of job experience (8.8%) indicated a positive attitude (6.6%) and a neutral attitude (2.2%) to CRM training. The 13 respondents between one and two years of experience in present position (9.5%)

specified a positive attitude (7.3%) and a neutral attitude (2.2%). The 24 respondents between three and four years of experience in present position (17.5%) indicated a positive attitude (12.4%) and a neutral attitude (5.1%) to CRM training. The 30 respondents between five and seven years of experience in present position (21.9%) indicated a positive attitude (12.4%) and a neutral attitude (9.5%). The majority of the 58 respondents with more than seven years of experience in present position (42.3%) specified a positive attitude (26.3%) and a neutral attitude (16.1%) to CRM training.

Table 27

Cross-tabulation Job Experience and Attitude to CRM Training

Job Experience		Neutral attitude	Positive attitude	Total
Less than 1 year	Count	3	9	12
	% of Total	2.2%	6.6%	8.8%
1 – 2 years	Count	3	10	13
	% of Total	2.2%	7.3%	9.5%
3 – 4 years	Count	7	17	24
	% of Total	5.1%	12.4%	17.5%
5 – 7 years	Count	13	17	30
	% of Total	9.5%	12.4%	21.9%

Table 27 (continued)

Job Experience		Neutral attitude	Positive attitude	Total
More than 7 years	Count	22	36	58
	% of Total	16.1%	26.3%	42.3%
Total	Count	48	89	137
	% of Total	35.0%	65.0%	100.0%

The frequency and percentage of GAF personnel respondents with a positive or neutral attitude to CRM training by operational function of the respondents are shown in Table 28. The majority of the 14 leadership personnel respondents (10.2%) indicated a positive attitude (7.3%) and a neutral attitude (2.9%). The 20 aircrew respondents (14.6%) specified a positive attitude (10.9%) and a neutral attitude (3.6%) to CRM training. The 47 aircraft technical personnel respondents (34.3%) indicated a positive attitude (20.4%) and a neutral attitude (13.9%). The majority of the 56 support personnel respondents (40.9% specified a positive attitude (26.3%) and a neutral attitude (14.6%) to CRM training.

Table 28

Cross-tabulation Operational Function and Attitude to CRM Training

Operational Function		Neutral attitude	Positive attitude	Total
Leadership Personnel	Count	4	10	14
	% of Total	2.9%	7.3%	10.2%
Aircrew	Count	5	15	20
	% of Total	3.6%	10.9%	14.6%
Aircraft Technical Personnel	Count	19	28	47
	% of Total	13.9%	20.4%	34.3%
Support Personnel/ Other	Count	20	36	56
	% of Total	14.6%	26.3%	40.9%
Total	Count	48	89	137
	% of Total	35.0%	65.0%	100.0%

The frequency and percentage of GAF personnel respondents with a positive or neutral attitude to CRM training by education of the respondents are shown in Table 29. The majority of the 26 respondents with a Hauptschul-Degree (19.0%) indicated a positive attitude (10.9%) and a neutral attitude (8.0%). The 64 respondents with a Realschul-Degree (46.7%) specified a positive attitude (29.9%) and a neutral attitude (16.8%) to CRM training. The 32 respondents with an Abitur-Degree (23.4%) indicated a positive attitude (16.1%) and neutral attitude (7.3%). The majority of the 15 respondents with a graduate degree (10.9%) specified a positive attitude (8.0%) and a neutral attitude (2.9%) to CRM training.

Table 29

Cross-tabulation Education and Attitude to CRM Training

Education		Neutral attitude	Positive attitude	Total
Hauptschul-Degree	Count	11	15	26
	% of Total	8.0%	10.9%	19.0%
Realschul-Degree	Count	23	41	64
	% of Total	16.8%	29.9%	46.7%
Abitur-Degree	Count	10	22	32
	% of Total	7.3%	16.1%	23.4%
University/College Degree	Count	4	11	15
	% of Total	2.9%	8.0%	10.9%
Total	Count	48	89	137
	% of Total	35.0%	65.0%	100.0%

The next section provides a frequency analysis of the cumulative scores for the main domain institutional issues identified as part of the variable attitude to CRM training. The report further presents the associated sub-domains identified as organizational climate, safety culture, perception of management, training and checking, and teamwork. Scores for the main domain institutional issues were grouped and ranked on a scale to represent the respondents' attitude to the main domain. The following ranking was used: negative attitude (24 – 56), neutral attitude (57 – 88), and positive attitude (89 – 120).

Data in Figure 10 present the frequency and percentage of GAF personnel's attitude to institutional issues. The majority has a positive attitude (53.7%) and 46.3%

specified a neutral attitude to institutional issues. No GAF personnel involved in flight operations indicated a negative attitude to institutional issues (0.0%).

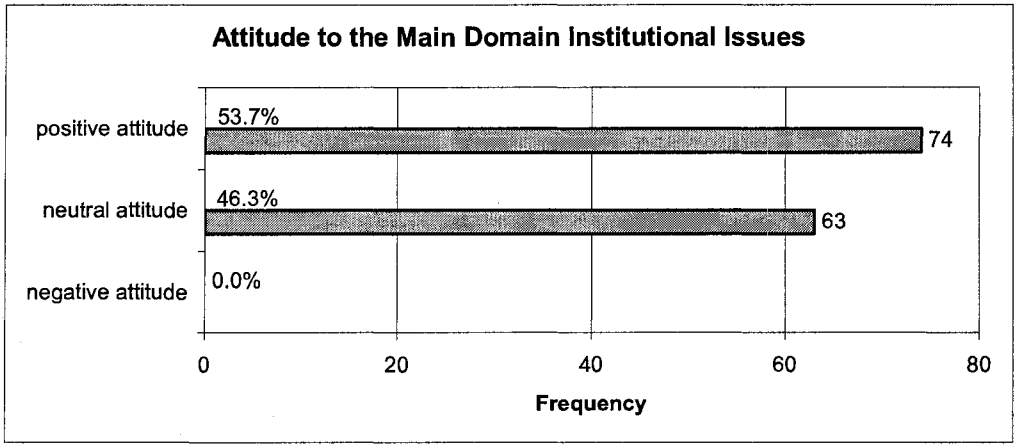

Figure 10. GAF respondents' attitude to the main domain institutional issues.

Frequency summaries for the associated sub-domains are presented to gain a deeper understanding of the variable's attitudinal domain. Scores for the sub-domain organizational climate were grouped and ranked on a scale to represent the respondents' attitude to organizational climate. The following ranking was used: negative attitude (4 – 9), neutral attitude (10 – 14), and positive attitude (15 – 20).

Data in Figure 11 show the frequency and percentage of GAF personnel's attitude to organizational climate. The majority has a positive attitude (80.3%) and 17.5% specified a neutral attitude to the organizational climate. Some 2.2% of GAF personnel involved in flight operations indicated a negative attitude to organizational climate.

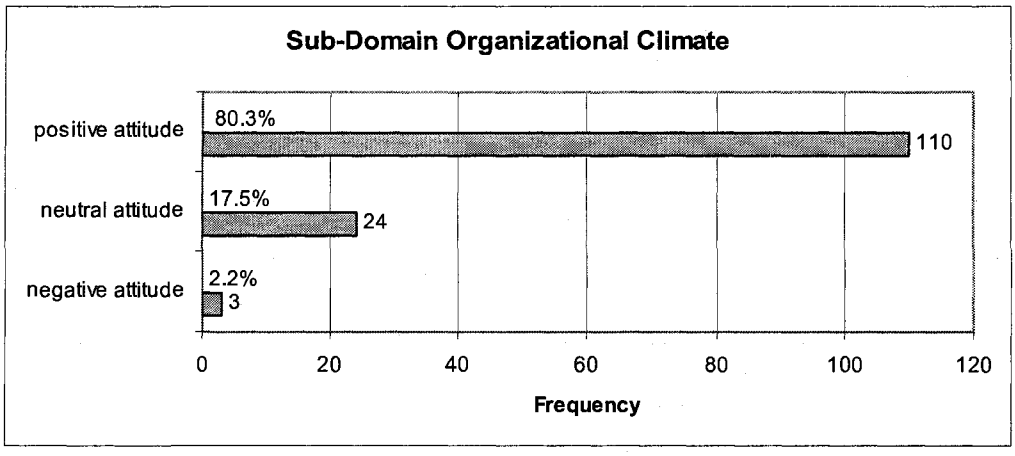

Figure 11. GAF respondents' attitude to the sub-domain organizational climate.

Scores for the sub-domain safety culture were grouped and ranked on a scale to represent the respondents' attitude to the air wing's safety culture. The following ranking was used: negative attitude (6 – 14), neutral attitude (15 – 22), and positive attitude (23 – 30).

Data in Figure 12 show the frequency and percentage of GAF personnel's attitude to safety culture. The majority has a positive attitude (65.7%) and 33.6% specified a neutral attitude to safety culture. Some 0.7% of GAF personnel involved in flight operations indicated a negative attitude to safety culture.

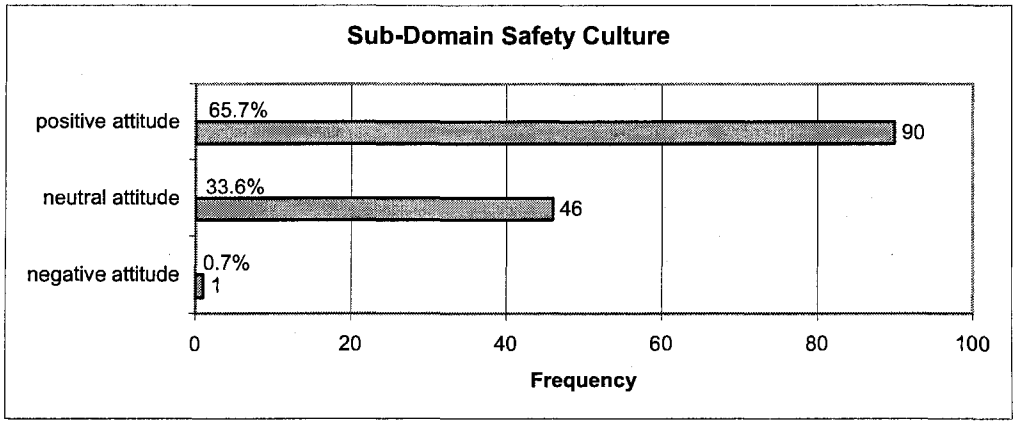

Figure 12. GAF respondents' attitude to the sub-domain organizational climate.

Scores for the sub-domain perception of management were grouped and ranked on a scale to represent the respondents' attitude to the air wing's management. The following ranking was used: negative attitude (6 – 14), neutral attitude (15 – 22), and positive attitude (23 – 30).

Data in Figure 13 show the frequency and percentage of GAF personnel's attitude to management. The majority has a neutral attitude (62.8%) and 31.4% specified a positive attitude to management. Some 5.8% of GAF personnel involved in flight operations indicated a negative attitude to management.

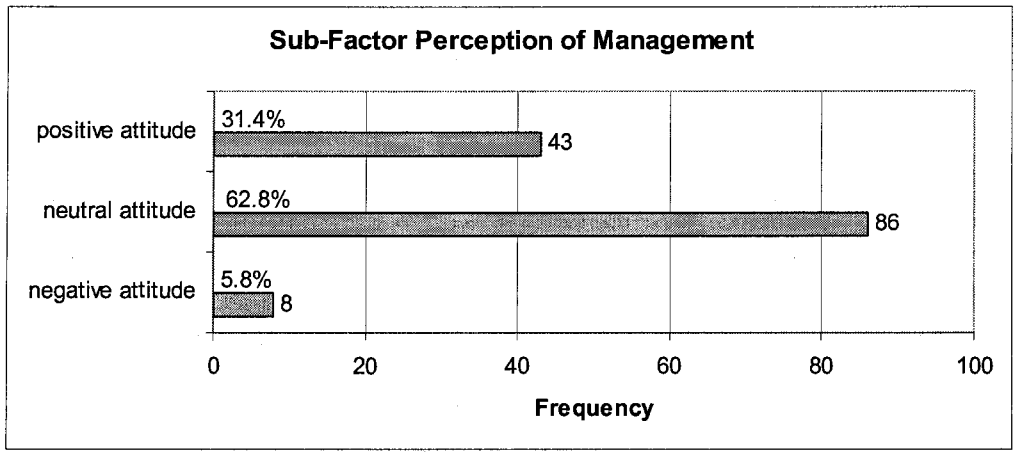

Figure 13. GAF respondents' attitude to the sub-domain perception of management.

Scores for the sub-domain training and checking were grouped and ranked on a scale to represent the respondents' attitude to training and checking policies. The following ranking was used: negative attitude (6 – 14), neutral attitude (15 – 22), and positive attitude (23 – 30).

Data in Figure 14 indicate the frequency and percentage of GAF personnel's attitude to training and checking. The majority has a neutral attitude (73.0%) and 25.5% specified a positive attitude to training and checking policies. Some 1.5% of GAF personnel involved in flight operations indicated a negative attitude to training and checking.

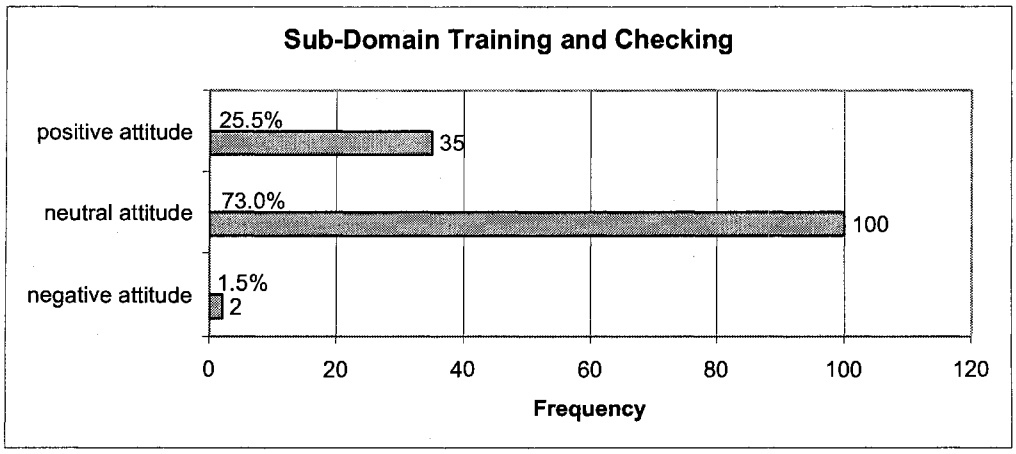

Figure 14. GAF respondents' attitude to the sub-domain training and checking.

Scores for the sub-domain teamwork were grouped and ranked on a scale to represent the respondents' attitude to the air wing's teamwork. The following ranking was used: negative attitude (2 – 4), neutral attitude (5 – 7), and positive attitude (8 – 10).

Data in Figure 15 show the frequency and percentage of GAF personnel's attitude to teamwork. The majority has a positive attitude (59.1%) and 36.5% specified a neutral attitude to teamwork. Some 4.4% of GAF personnel involved in flight operations indicated a negative attitude to teamwork.

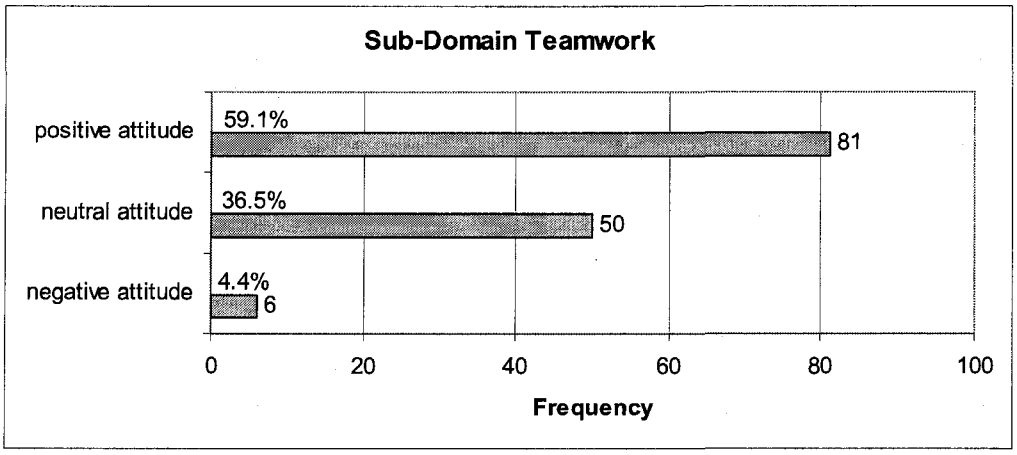

Figure 15. GAF respondents' attitude to the sub-domain teamwork.

The next section provides a frequency analysis of the cumulative scores for the main domain work management identified as part of the variable attitude to CRM training. The report further presents the associated sub-domains identified as threat and error management, attitude to command, rules and roles, leadership style, and the management of stress and fatigue. Scores for the main domain work management were grouped and ranked on a scale to represent the respondents' attitude to the main domain. The following ranking was used: negative attitude (30 – 70), neutral attitude (71 – 110), and positive attitude (111 – 150).

Data in Figure 16 show the frequency and percentage of GAF personnel's attitude to work management. The majority has a neutral attitude (55.5%) and 44.5% specified a positive attitude to work management. No GAF personnel involved in flight operations indicated a negative attitude to work management.

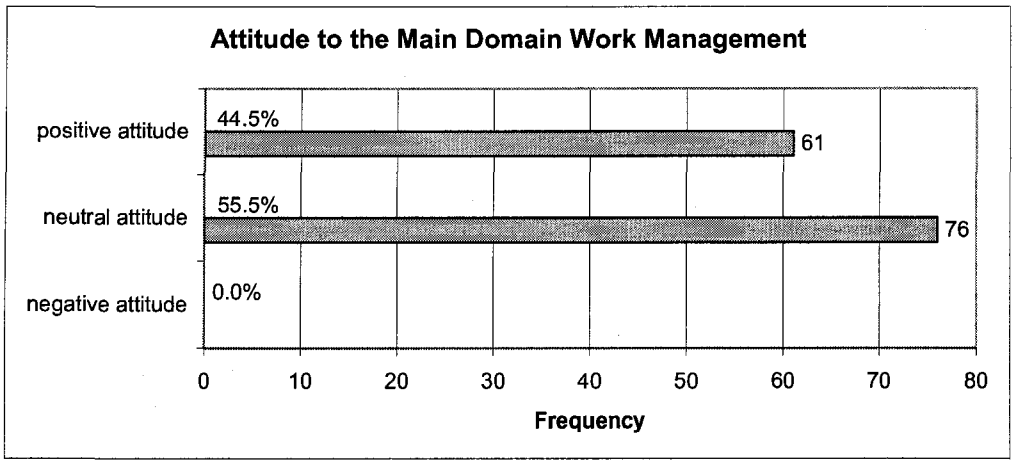

Figure 16.GAF respondents' attitude to the main domain work management.

Frequency summaries for the associated sub-domains are presented to gain a deeper understanding of the variable's attitudinal domain. Scores for the sub-domain threat and error management were grouped and ranked on a scale to represent GAF personnel's attitude to the sub-domain. The following ranking was used: negative attitude (7 – 16), neutral attitude (17 – 25), and positive attitude (26 – 35).

Data in Figure 17 show the frequency and percentage of GAF personnel's attitude to threat and error management. The majority has a positive attitude (94.2%) and 5.8% specified a neutral attitude to threat and error management. No GAF personnel involved in flight operations indicated a negative attitude to threat and error management.

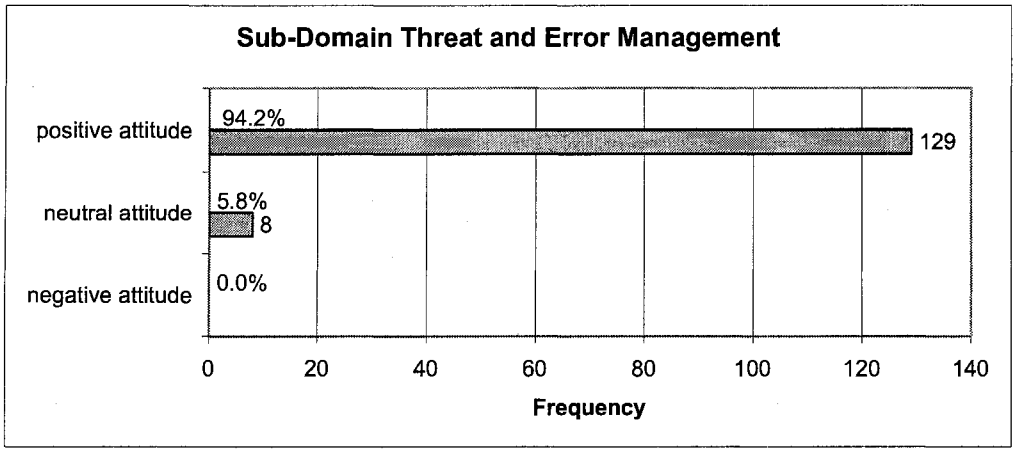

Figure 17. GAF respondents' attitude to the sub-domain threat and error management.

Scores for the sub-domain command attitude were grouped and ranked on a scale to represent the respondents' attitude to the sub-domain. The following ranking was used: negative attitude (6 – 14), neutral attitude (15 – 22), and positive attitude (23 – 30).

Data in Figure 18 show the frequency and percentage of GAF personnel's attitude to the air wing's command. The majority has a positive attitude (84.7%) and 15.3% specified a neutral attitude to the air wing's command. No GAF personnel involved in flight operations indicated a negative attitude to the sub-domain command.

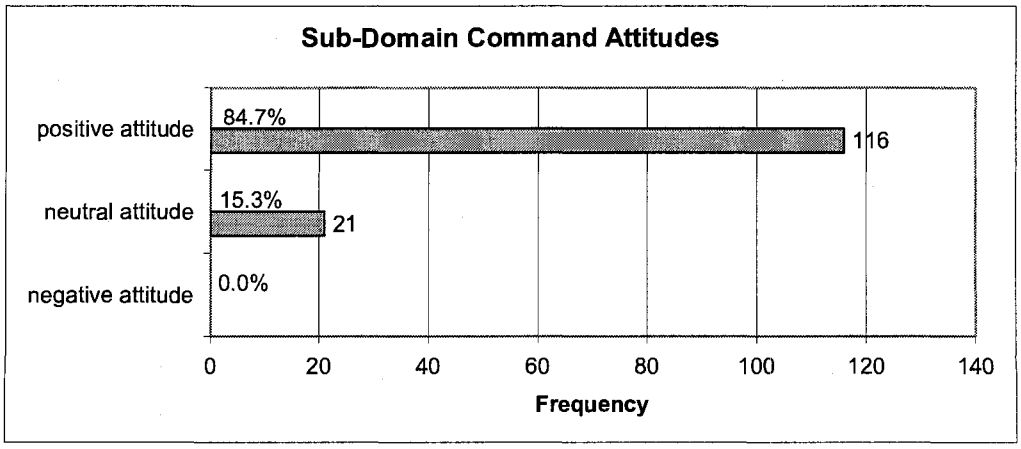

Figure 18. GAF respondents' attitude to the sub-domain command.

Scores for the sub-domain rules and roles were grouped and ranked on a scale to represent the respondents' attitude to the sub-domain. The following ranking was used: negative attitude (2 – 4), neutral attitude (5 – 7), and positive attitude (8 – 10).

Data in Figure 19 show the frequency and percentage of GAF personnel's attitude to rules and roles. The majority has a neutral attitude (53.3%) and 29.2% specified a positive attitude to rules and role. Some 17.5% of GAF personnel involved in flight operations indicated a negative attitude to rules and roles.

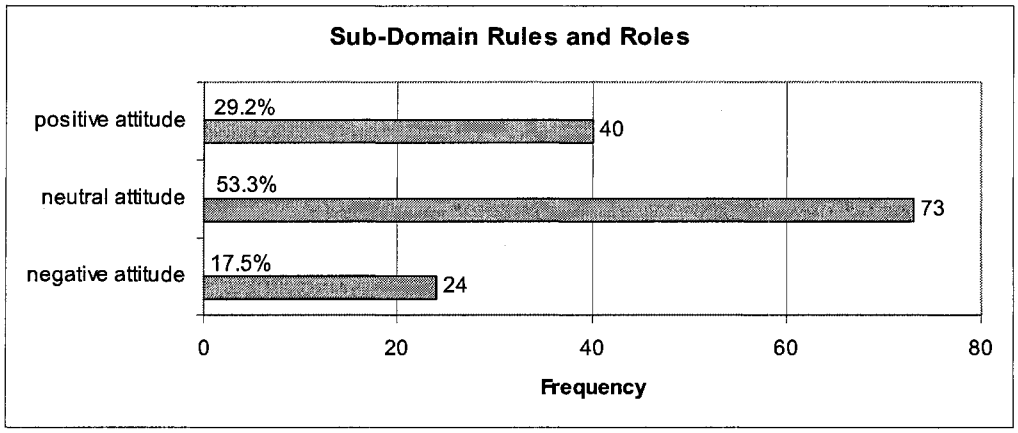

Figure 19. GAF respondents' attitude to the sub-domain rules and roles.

Scores for the sub-domain leadership style were grouped and ranked on a scale to represent the respondents' attitude to the sub-domain. The following ranking was used: negative attitude (3 – 6), neutral attitude (7 – 9), and positive attitude (10 – 13).

Data in Figure 20 show the frequency and percentage of GAF personnel's attitude to the leadership style. The majority has a neutral attitude (62.8%) and 25.5% specified a negative attitude to leadership styles. Some 11.7% of GAF personnel involved in flight operations indicated a positive attitude to leadership styles.

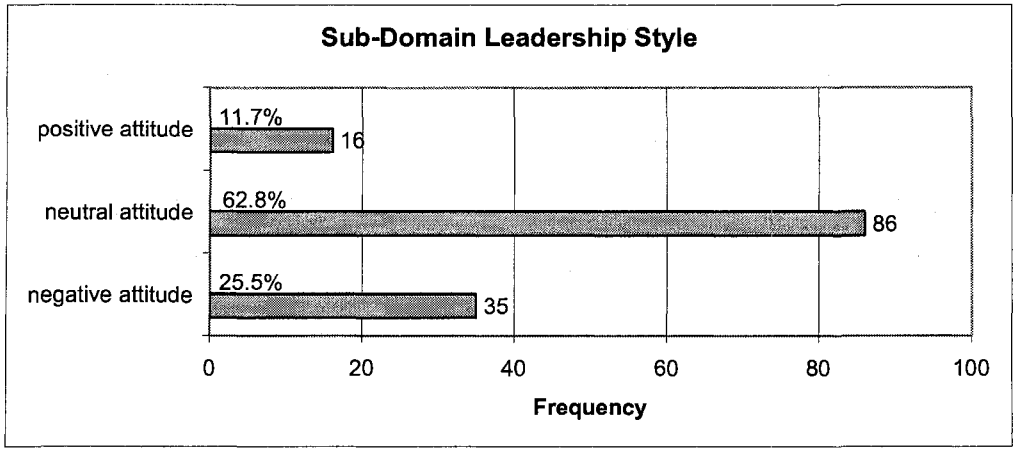

Figure 20. GAF respondents' attitude to the sub-domain leadership style.

Scores for the sub-domain attitude to stress and fatigue were grouped and ranked on a scale to represent the respondents' attitude to the management of stress and fatigue. The following ranking was used: negative attitude (12 – 28), neutral attitude (29 – 44), and positive attitude (45 – 60).

Data in Figure 21 show the frequency and percentage of GAF personnel's attitude to stress and fatigue. The majority has a neutral attitude (56.9%) and 43.1% specified a positive attitude to stress and fatigue. No GAF personnel involved in flight operations indicated a negative attitude to stress and fatigue.

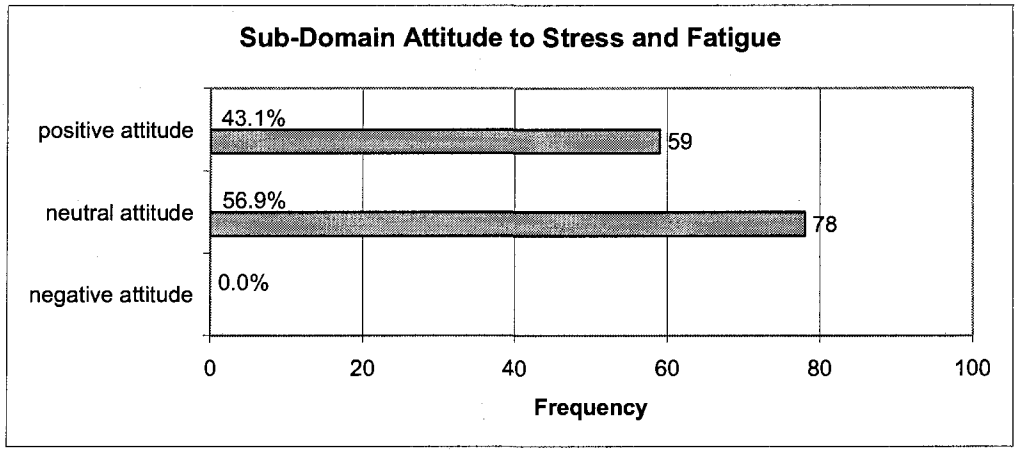

Figure 21. GAF respondents' attitude to the sub-domain stress and fatigue.

The next section provides a frequency analysis of the cumulative scores for the main domain work values identified as part of the variable attitude to CRM training. Scores were grouped and ranked on a scale to represent the respondents' attitude to the main domain. The following ranking was used: negative attitude (9 – 21), neutral attitude (22 – 33), and positive attitude (34 – 45).

Data in Figure 22 show the frequency and percentage of GAF personnel's attitude to work values. The majority has a positive attitude (90.5%) and 9.5% specified a neutral attitude to work values. No GAF personnel involved in flight operations indicated a negative attitude to work values.

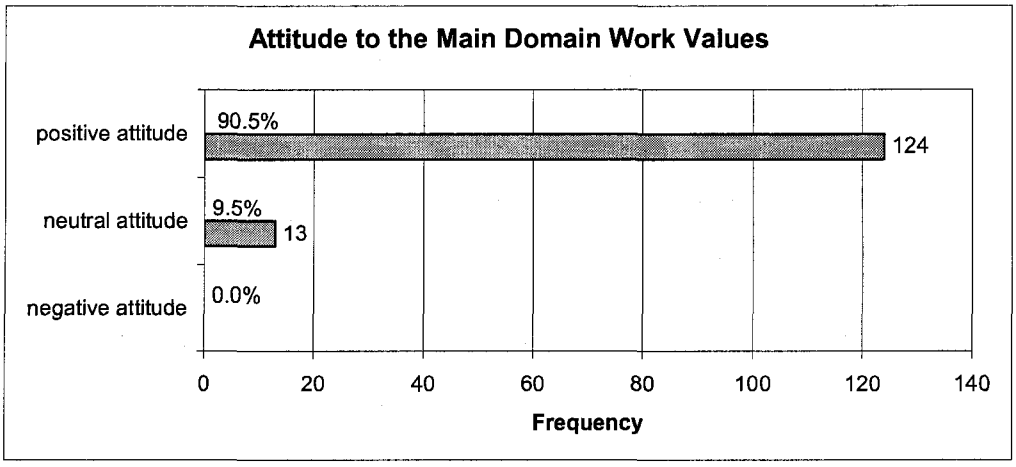

Figure 22. GAF respondents' attitude to the main domain work values.

Research question three. The following sections provide descriptive statistics (frequencies, cross-tabulation, and correlation analysis) relating to the third research question - What, if any, relationship exists between the acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations? To describe the relationship between the acceptance of distance learning programs and attitude to CRM training, the cumulative scores representing each variable were used for cross-tabulation analysis. Correlation coefficient computation (Spearman rank-order correlation coefficient) available with SPSS® was conducted for hypotheses testing.

This section provides a cross-tabulation analysis using the variables attitude to CRM training and acceptance of distance learning. An additional cross-tabulation analysis was conducted using the variable attitude to CRM training and the two demographic factors level of computer competency and level of experience with distance learning. The previously used ranking was utilized to represent attitude to CRM training

(negative attitude, neutral attitude, and positive attitude) and acceptance of distance learning (no acceptance, low acceptance, acceptance, and high acceptance).

The frequency and percentage of GAF personnel respondents with a positive or neutral attitude to CRM training by the acceptance of distance learning of the respondents are shown in Table 30. The majority of the 48 respondents with a neutral attitude to CRM training (35.0%) indicated acceptance of distance learning programs (27.7%). Some 6.6% indicated high acceptance and 0.7% specified low acceptance of distance learning programs. The majority of the 89 respondents with a positive attitude to CRM training (65.0%) specified high acceptance (32.1%) and acceptance of distance learning programs (31.4%). Some 1.5% of GAF personnel involved in flight operations and with a positive attitude to CRM training indicated low acceptance of distance learning programs.

Table 30

Cross-tabulation Attitude to CRM Training and Acceptance of Distance Learning

Attitude to CRM		Low Acceptance	Acceptance	High Acceptance	Total
Neutral Attitude	Count	1	38	9	48
	% of Total	0.7%	27.7%	6.6%	35.0%
Positive Attitude	Count	2	43	44	89
	% of Total	1.5%	31.4%	32.1%	65.0%
Total	Count	3	81	53	137
	% of Total	2.2%	59.1%	38.7%	100.0%

The frequency and percentage of GAF personnel respondents with a positive or neutral attitude to CRM training by computer skills of the respondents are shown in Table 31. The majority of the 48 respondents with a neutral attitude to CRM training (35.0%)

indicated intermediate computer skills (17.5%) and expert computer skills (14.6%). Some 2.9% with a neutral attitude to CRM training indicated beginner computer skills. The majority of the 89 respondents with a positive attitude to CRM training (65.0%) specified expert computer skills (35.0%) and intermediate computer skills (24.1%). Some 5.8 of the respondents with a positive attitude to CRM training indicated beginner computer skills.

Table 31

Cross-tabulation Attitude to CRM Training and Computer Skills

Attitude to CRM		Beginner Skills	Intermediate Skills	Expert Skills	Total
Neutral Attitude	Count	4	24	20	48
	% of Total	2.9%	17.5%	14.6%	35.0%
Positive Attitude	Count	8	33	48	89
	% of Total	5.8%	24.1%	35.0%	65.0%
Total	Count	12	57	68	137
	% of Total	8.8%	41.6%	49.6%	100.0%

The frequency and percentage of GAF personnel respondents with a positive or neutral attitude to CRM training by distance learning skills of the respondents are shown in Table 32. The majority of the 48 respondents with a neutral attitude to CRM training (35.0%) indicated beginner distance learning skills (27.0%). Some 5.8% indicated intermediate distance learning skills and 2.2% specified expert distance learning skills. The majority of the 89 respondents with a positive attitude to CRM training (65.0%) specified beginner distance learning skills (38.7%) and intermediate distance learning

skills (22.6%). Some 3.6% of the respondents with a positive attitude to CRM training indicated expert distance learning skills.

Table 32

Cross-tabulation Attitude to CRM Training and Distance Learning Skills

Attitude to CRM		Beginner Skills	Intermediate Skills	Expert Skills	Total
Neutral Attitude	Count	37	8	3	48
	% of Total	27.0%	5.8%	2.2%	35.0%
Positive Attitude	Count	53	31	5	89
	% of Total	38.7%	22.6%	3.6%	65.0%
Total	Count	90	39	8	137
	% of Total	65.7%	28.5%	5.8%	100.0%

The next section provides the description of the relationship between the variable attitude to CRM training and acceptance of distance learning utilizing the correlation coefficient function (Spearman rank-order correlation coefficient) available with SPSS®. The Spearman rank-order correlation coefficient was calculated using the cumulative scores for both variables. Both variables showed a normal distribution, however, data themselves were on an ordinal scale requiring nonparametric measures of the correlation between the two variables using Spearman rank-order correlation coefficient (r = rho). A correlation coefficient of $r = 0.342$ (137 valid cases) was calculated for both variables. The graphical distribution of the scores for the variable attitude to CRM training and acceptance of distance learning is presented in Figure 23.

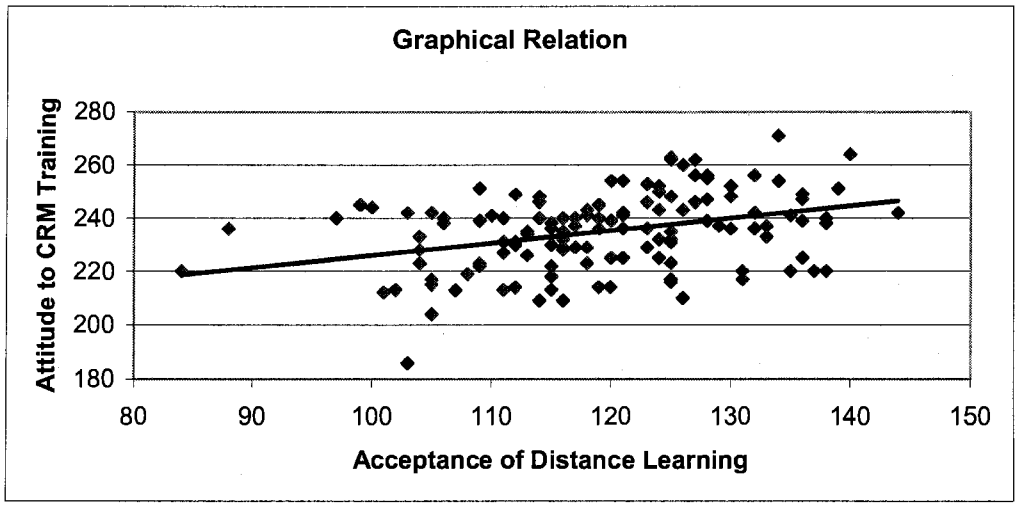

Figure 23. Graphical relation for the variable attitude to CRM training and acceptance of distance learning.

For the statistical significance test of the correlation coefficient (rho) the obtained value ($r_s = 0.342$) is compared to the normal distribution (significance level $\alpha = 0.01$) using the Z statistic $z = r_s \sqrt{n-1}$ (Aczel & Sounderpandian, 2006). For 137 participants (N = 137) the obtained value of $z = 3.988$ is statistically significant at the 0.01 level of significance (two-tail) as it exceed the tabled critical value of 2.576 (Aczel & Sounderpandian).

Analysis and Evaluation of Findings

During the 12 pre-scheduled continuation-training (CT) meetings 137 survey instruments were handed to a purposive sample of GAF personnel involved in flight operations and a 100.0% instrument return rate was achieved. The purposive sampling technique allowed the researcher to collect responses from GAF personnel identified by the focus group and to obtain an equal distribution among the targeted group.

Most military commanders and subgroup commanders were knowledgeable about

CRM training and showed a unified high interest in the research topic and in new ways of delivering CRM training and, therefore, flight safety. German Air Force personnel attending the CT-meetings also indicated interest in the topic even though some of them had no prior knowledge about CRM training or distance learning programs. The high response rate supported this statement and the positive attitude to new ways of delivering CRM training since all personnel involved in flight operations have the unified interest in safe flight operations.

Only four female GAF respondents were available for the research. German Air Force female personnel are mainly represented in the general medical service of the air wing not identified as a primary target for CRM training in this context. A few female respondents were identified as aircraft technical or support personnel. Most GAF personnel respondents involved in flight operations were male with less than 41 years of age, more than 10 years of time in service, and a job experience level of more than 5 years. The analysis of respondents' rank within the air wing structure supported this finding because the majority is holding rank as officer and senior NCO. The finding coincides with the general tenor of a GAF air wing being viewed as a high-technological environment where long training periods are needed for personnel to reach high job qualifications. Long training periods mean that GAF personnel involved in flight operations is usually not subject to rapid turnovers often found in military structures (Prince & Salas, 1993) allowing personnel to be more knowledgeable about the organization's policy regarding CRM training.

The distribution of educational qualifications among GAF personnel respondents coincides with respondents' job positions and indicates no conspicuous distribution. To

enter the German services applicants must have at least a Hauptschul-Degree. To become an officer in the German Air Force requires at least a Realschul-Degree and pursuing a university/college degree is usually associated with the officer career requiring the Abitur-Degree as an entry qualification.

Working in a high-technological environment requires the use of computers. Most GAF respondents indicated at least intermediate (41.6%) to expert (49.6%) computer skills. This finding is important and a prerequisite for the implementation of distance learning programs. Only a small minority of respondents assessed their current computer skills at the beginner level.

Analyzing respondents' distance learning skills revealed that the majority of GAF respondents rated themselves as distance learning beginners (65.7%) and only very few respondents specified expert distance learning skills (5.8%). Since there are only very few distance learning programs available in the German Air Force up to this point, current job-qualification training programs are conducted with traditional face-to-face classroom training. However, our rapidly changing, knowledge-intensive, and technology-oriented working life demands life-long learning and continuous development of competence. New technology like computers and the World Wide Web can help to find solutions to these challenges (Häkkinen & Tynjälä, 2005). Sustainable experience with distance learning programs can currently be obtained only with the initiative of one's own making use of distance learning programs offered from institutions outside the German Air Force.

Research question one asked, *what, if any, acceptance of distance learning programs exists among GAF personnel involved in flight operations*? According to Salas

et al. (2000), variables like instructional approach, media, training method, and training design can measure CRM training success. "Furthermore, the organizational climate and continuous learning culture have been shown to be positively related to post training behaviors on the job." (Salas et al., 2000, p. 497) The variable acceptance of distance learning was used to measure CRM training effectiveness. The purpose was to identify if distance learning is as an instructional CRM training method to increase training effectiveness. As per definition, distance learning concentrates on the use of the available e-learning components without traditional classroom training and is usually conducted using online communication and information technology to transmit and receive various materials through voice, video, and data (Chen & Shaw, 2006; Krüger & Siegmund, 2002).

Even though no formal distance learning program is available for the training of GAF personnel involved in flight operations, research results revealed that the majority of the GAF respondents involved in flight operations indicated acceptance (59.1%) or even high acceptance (38.7%) of distance learning programs across the different job positions and across the different levels of education. Only a very small minority showed low acceptance (2.2%). It appears that GAF respondents are generally aware of the advantages of distance learning programs and the computer-supported collaborative learning and communication environment. The large acceptance of distance learning programs indicated a positive organizational climate and an optimistic continuous learning culture. Both have been shown to be positively related to post training behaviors on the job (Salas et al., 2000).

Further analysis revealed that the acceptance or even high acceptance of distance learning programs is across all ranks but mainly with respondents below 41 years of age (68.6%), with more than 5 years of time in service (90.5%), and more than 5 years of job experience (64.2%). While especially the younger generation incorporated the Internet into their daily life for fun and enjoyment (Lee et al., 2005), it appears that the use of computers and the Internet for distance learning among identified GAF respondents might derive from a different understanding. Identified personnel has large experience in the GAF's safety sensitive flight operations environment knowing that knowledge sharing, further training, and job qualification measures are directly related to the individual performance and, therefore, flight safety. The statement is supported by answers given to item 57. A majority of 65.7% found it very important to know everything about their job and have no surprises and 24.8% found this trait important. German Air Force personnel's response to item 60 showed that 68.6% found it very important to have ultimate perfection at the workplace and 24.8% found ultimate perfection important. Answers for item 93 showed that 73.0% think learning in one's own responsibility (20.4% feel like this half the time), 75.9% of the respondents can think of many different ways to learn new things (item 86), and 86.9% enjoy learning new things (item 81). Häkkinen and Tynjälä (2005) and Raisinghani et al. (2005) pointed out the importance of sharing and dissemination knowledge and expertise among members of the learning community and Julien (2005) stated, "It is the group which learns, acquires new knowledge, shares information and best practices and exchanges learning experiences" (p. 293). Current technology allows creating virtual teams, "all online but at different physical locations, and present them with scenarios and observe

how they react . . . and discuss issues with a professor via videoconference" (Raisinghani et al., 2005, p. 24). It appears that GAF personnel involved in flight operations has the unified interest in advancing work related knowledge and, therefore, accepting distance learning as a potential training method. German Air Force respondents have identified "the wealth of opportunities to deploy alternative online learning environments to facilitate many users in their learning process" (Chen & Shaw, 2006, p. 89). German Air Force respondents have further identified the flexibility of access and the capacity for instant updating opportunities (Byers, 2005).

Technical competence and readiness are vital prerequisites for the successful implementation of distance learning programs. Investigating the technical readiness domain for the variable acceptance of distance learning revealed that GAF respondents indicated high technical readiness (44.6%) and readiness (43.0%) for distance learning. Some 10.2% specified low technical readiness or no technical readiness (2.2%) for distance learning. The positive reactions to questions like *I like using the computer* (71.5% feel like this) or *I can quickly find information I need on the Internet* (78.5% feel like this) revealed that technical readiness might not be related to respondent's willingness to use technical equipment for distance learning or respondents' lack of technical expertise. Respondents with expert computer skills (49.6%) and intermediate computer skills (41.6%) indicated acceptance and high acceptance of distance learning. According to Volkmer (2003), the driving factors for distance learning programs are the increased availability of private and organizational Internet access. Answers to the questions *I have easy access to the equipment I need for distance learning* (24.8% do not

feel like this) or *When I need technical support, I can get it* (19.0% do not feel like this) point out the potential lack of a technical infrastructure for distance learning in the GAF.

The individual's readiness for self-directed learning is the second domain for the variable acceptance of distance learning. Online learning places high demands on the participants like self-motivation, self-discipline, and endurance (Skalnik, 2003). Research results regarding the readiness for self-directed learning showed that the majority of GAF respondents indicated readiness (67.2%) and high readiness (32.8%) for self-directed learning. This statement is supported by GAF respondents' answer to item 79 – *If there is something I want to learn I can find a way to learn it.* Results revealed that 84.7% feel like this and 13.8% feel like this half the time indicating high self-motivation for learning among GAF personnel involved in flight operations. Answers regarding the question *I am good at learning things by myself* (78.9% feel like this) indicated self-discipline and endurance emphasizing GAF respondents' readiness for self-directed learning.

Self-motivation for distance learning alone, however, is not enough. According to Schletter (2003), organizational culture and training initiatives must go hand in hand with employee motivation. According to Linstrom (2006) and Rentroia-Bonito et al. (2006), the most important step in teaching is motivation because it is critical to improve acceptance behaviors and increase learning effectiveness. Employee motivation is also one of the most overlooked steps in adult education (Linstrom). Despite the good results regarding the acceptance of distance learning and the readiness for self-directed learning, 27.7% of GAF respondents indicated that they do not feel motivated to learn through distance learning and 32.1% feel motivated only half the time. Respondents might have identified the lack of incentives or clear personal benefits to learn through distance

learning. Molvig (2002) published, "When training has clear benefits, employees naturally gravitate toward it. . . . Training should further the employee's career goals, help the company meet its business goals and enhance the company's odds for success" (p. 68). The lack of incentives and personal benefits for distance learning shows that the GAF does not make full use of the existing potential regarding the prevailing distance learning culture among respondents.

It should be noted that the increased use of information technologies within the GAF might lead to an increased acceptance of distance learning programs. Research results for this variable should be seen as time sensitive in respect to transferability for future research or for long-term decision-making processes.

Research question two asked, *what, if any, attitude exists among GAF personnel involved in flight operations to conduct CRM training*. Salas et al. (2000) stated that successful CRM training depends on factors like management support for training, a climate that supports learning, and trainees' expectations and prior experiences with CRM training. The variable attitude to CRM training was used to measure factors outside the training programs as a prerequisite for a viable CRM culture and necessary for training success.

Crew resource management training supports the utilization of all available human, informational, and equipment resources toward the goal of safe and efficient flight operations by interacting with each other, with groups, and with the technology (Aeronautics and Space, 2006, Engel, 2000; Salas et al., 2000). To obtain a deeper understanding of the variable's attitudinal domain, the variable attitude to CRM training was classified into three main domains exploring GAF respondents' attitude to

institutional issues, attitude to work values, and attitude to work management. Respondents' attitude to the main domain institutional issues was further classified by the attitude to the sub-domains organizational climate, safety culture, perception of management, training and checking, and teamwork. German Air Force respondents' attitude to the main domain work management was further classified by the attitude to the sub-domains threat and error management, command, rules and roles, leadership style, and stress and fatigue.

Research results revealed that the majority of the respondents indicated a positive attitude (65.0%) and 35.0% indicated a neutral attitude to CRM training. No GAF personnel indicated a negative attitude (0.0%) to conduct CRM training. The results might indicate that the selected GAF air wing has a viable CRM culture required for the effective implementation of a comprehensive CRM training program for all personnel involved in flight operations.

It was expected that no personnel indicated a negative attitude to CRM training, however, one third of the investigated air wing respondents indicated a neutral attitude to CRM training in a safety sensitive work environment. A neutral attitude to CRM training might indicate a lack of awareness for CRM training and a lack of CRM culture.

There were not conspicuous differences indicated within the research results regarding respondents' gender, age, or education concerning the attitude to CRM training and the majority of all groups specified a positive attitude and a smaller percentage indicated a neutral attitude. Analyzing the attitude to CRM training in relation to time in service and job experience revealed that the respondents with a longer time in service and more job experience indicated an increased neutral attitude to CRM training. A neutral

attitude to CRM training was specified by GAF personnel with more than 11 years of time in service (25.6%) and with more than five years of job experience (25.6%). A small minority of 9.5% of all respondents indicated a neutral attitude to CRM training and had less than 10 years of time in service and less than four years of job experience. According to MacLeod (2005), "Safety and culture are terms we use freely in aviation. . . . Each individual creates safety and culture for themselves within their workplace. Our training needs to support that process and direct it along the preferred path." (p. 55) Previous CRM training in the GAF might have not supported the process of guiding the direction of the individual's safety and CRM culture resulting in a proportionally more neutral attitude to CRM training among the more experienced personnel. This statement is supported by the finding that identified personnel with a neutral attitude is holding rank as senior NCO (16.1%) and rank as officer (9.5%). Furthermore, four of the 14 identified leadership personnel and five of the 20 aircrew indicated a neutral attitude to CRM training. Especially aircrew were expected to have an exceptionally positive attitude to CRM training because of continues mandatory CRM training obtained. The lack of a unified and mandatory CRM training for all personnel involved in flight operations might be an explanation for GAF respondents' neutral attitude to CRM training. Without a mandatory CRM training, GAF personnel involved in flight operations will not learn the concepts of CRM or even internalize CRM guidelines.

Investigating the main domain work values for the variable attitude to CRM training revealed that 90.5% have a positive attitude to work values and only 9.5% indicated a neutral attitude. German Air Force personnel respondents rated items regarding their personal values and goals in an ideal job environment as very important

indicating a positive work attitude, high expectations regarding professionalism, and a balanced relationship with the social environment.

Research results for the main domain institutional issues revealed that 54.0% indicated a positive attitude and 46.0% specified a neutral attitude to institutional issues. It appears that nearly half of the GAF respondents might have some problems with their work environment. Analysis of the sub-domains for the main domain institutional issues revealed that there are no problems regarding organizational climate since 80.2% of GAF respondents indicated a positive attitude to the organizational climate. However, only 65.7% indicated a positive attitude to the air wing's safety culture that is too low for a safety sensitive environment. Answers regarding teamwork showed that only 59.1% indicated a positive attitude to the air wing's teamwork practice that is again too low in an environment where teamwork is mandatory for safe and efficient flight operations. Some 62.8% specified a neutral attitude and even 5.8% indicated a negative attitude to the sub-domain perception of management. Results showed that there might be a lack in the management's lead role as a CRM disseminator and as a role model of a viable CRM culture. Regarding the sub-domain training and checking some 73.0% indicated a neutral attitude and 1.5% indicated a negative attitude to the ruling training and checking practice. Results revealed that current training and checking programs and procedures might lack optimization.

The high percentage of respondents with a neutral attitude to the main domain institutional issues might be related to the neutral or even negative attitude to the sub-domains perception of management and training and checking. According to Salas et al. (2000), successful CRM training depends on factors like management support for

training, a climate that supports learning, and trainees' expectations and prior experiences with CRM training. Those factors have a direct impact on the safety culture of an organization. Research regarding the connection of organizational issues and safety revealed, that the organization's commitment to training, reinforcement of safe practices, and the establishing of open lines of communication between operators and management reduce the probability of error and contribute to safety (Helmreich et al., in press; Merritt, 2000).

Research results for the main domain attitude to work management revealed that the majority of the GAF respondents (55.5%) have a neutral attitude and 44.5% indicated a positive attitude to the air wing's work management. The neutral attitude requires further analysis to identify deficits in the work management domain as an integral part of a viable CRM culture. Analysis of the sub-domains showed that GAF respondents have a positive attitude to command (84.7%) and a positive attitude to threat and error management (94.2%) illustrating the military environment. Military personnel in general is accustomed to clear command structures and knows the proper channels how to react to and deal with threat and error. Further investigation of the associated sub-domains revealed a neutral attitude (53.3%) or even negative attitude (17.5%) to issues related to rules and roles. Respondents also specified a neutral attitude (62.8%) and negative attitude (25.5%) to the leadership style and 56.9% indicated a neutral attitude to the handling of stress and fatigue. The proportionally high percentage of respondents with a neutral attitude to the main domain work management might be related to a neutral or even negative attitude to the sub-domains rules and roles, leadership style, and the handling of stress and fatigue. Each identified area is a potential risk to flight safety and

mission effectiveness and points out a deficit in CRM culture within the selected GAF air wing. Even with no scientific evidence, reports from the operational environment indicated that CRM training philosophy is often not encouraged by management and the lack of CRM culture inside and outside the cockpit in aviation organizations (Salas et al., 2001). Research results presented in this study support this notion. For flight safety and mission effectiveness, it has to be in the military's interest to create a safety culture within the organization. This should be based on a strong commitment to training, safe practices, and open lines of communication between operational personnel and management regarding threats to safety (Chief of Staff of the German Air Force, 2006; Helmreich et al., in press; MacLeod, 2005). According to Helmreich et al. (in press), "The organizational culture is important because when it is strong and positive, pilots and other groups may more readily accept new concepts such as CRM and its associated training" (p. 5). Especially the wrong management of stressors such as fatigue, danger, and personal problems may lead to a disregard for safety measures, operational procedures, and teamwork (Helmreich & Merritt, 2000; Helmreich et al., in press). To build an effective training tool, members of the entire organization must understand and embrace the team-building culture of CRM (Maurino, 1999; Thomas, 2004).

Research question three asked, *what, if any, relationship exists between the acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations*? The null and the alternate hypotheses were stated as follows:

$H_{0\text{-}3}$: No correlation exists between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations.

$H_{A\text{-}3}$: A correlation exists between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations.

Without the acceptance of distance learning and without a positive attitude to CRM training, CRM training cannot be delivered by distance learning. The interest in distance learning programs for CRM training originated from research conducted by Salas, Prince et al. (1999) and Thomas (2004). Salas, Prince et al. and Thomas reported that CRM definitions, training content, and training methods lack consistency and consensus in respect to training design, delivery, and evaluation within the entire aviation industry allowing too much ambiguity.

Research results showed that GAF personnel involved in flight operations with a positive attitude to CRM training indicated high acceptance (32.1%) or acceptance (31.4%) of distance learning programs. This finding is supported by the calculation of the Spearman rank-order correlation coefficient using the cumulative scores for both variables to explain the relation between the variables. According to Cohen (1988), the calculated correlation coefficient (rho) of $r_s = 0.342$ indicated a medium positive correlation between both variables. Results further indicated statistical significance at the 0.01 level of significance. The null hypothesis for research question three is, therefore, rejected and the alternative hypothesis is accepted. There is a relationship between

acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations.

It appears that GAF respondents with a positive attitude to CRM training showed more acceptance of distance learning programs. This relationship, however, does not indicate whether higher acceptance of distance learning might lead to a more positive attitude to CRM training or vice versa. German Air Force personnel with a positive attitude to CRM training and openness to distance learning programs might value CRM training or have already learned the positive effects of such training. Research conducted by Salas et al. (2000) revealed that organizational climate (a sub-domain of the defined variable attitude to CRM training) and "continuous learning culture show to be positively related to post training behaviors on the job" (p. 497).

Computer skills are an integral part for the successful performance of distance learning programs. The cross-tabulation analysis between attitude to CRM training and computer skills indicated that GAF respondents with a positive attitude to CRM training (65.0%) showed expert computer skills (35.0%) and intermediate computer skills (24.1%). Even among respondents with a neutral attitude to CRM training (35.0%), 17.5% indicated intermediate and 14.6% specified expert computer skills. It appears that GAF personnel respondents involved in flight operations have adequate computer skills as an essential prerequisite for the successful implementation of CRM distance learning programs. This statement is supported by GAF respondents' technical readiness for distance learning. High technical readiness was indicated by 44.5% of the respondents and 43.1% indicated technical readiness for distance learning.

Another requirement for the successful implementation of CRM distance learning programs is distance learning skills. German Air Force respondents with a positive attitude to CRM training and, therefore, potential candidates for the immediate implementation of CRM distance learning programs showed only beginner level (38.7%) and intermediate level (22.6%) distance learning skills. Research results revealed that even though acceptance of distance learning was identified among GAF personnel involved in flight operations, actual distance learning skills were not indicated.

The association between acceptance of distance learning and attitude to CRM training is a prerequisite for CRM programs to be delivered by distance learning. Research results showed that there is a connection between both variables and designing effective distance learning programs for organizational learning might be worthwhile because they have "the potential to support cognitive, social, motivational, and affective processes of learning" (Häkkinen & Tynjälä, 2005, p. 330).

Summary

The focus of this mixed methodology dissertation study was to explore and examine if distance learning programs can deliver crew resource management (CRM) training for German Air Force (GAF) personnel involved in military flight operations to increase training effectiveness. The implementation of such programs requires GAF personnel to accept distance learning, a viable CRM culture with a positive attitude to CRM training among GAF personnel, and a connection between the two variables.

Data from a purposive sample of 137 GAF personnel from a single GAF air wing were collected with a customized research instrument showing high internal reliability of 0.813 (Cronbach's Alpha) for the instrument measuring acceptance of distance learning

and 0.771 (Cronbach's Alpha) for the instrument measuring attitude to CRM training. Most GAF personnel respondents were male with less than 41 years of age, more than 10 years of time in service, and a job experience level of more than 5 years.

The majority of GAF respondents indicated acceptance (59.1%) and high acceptance (38.7%) of distance learning programs but mainly across respondents below 41 years of age, more than 5 years of time in service, and more than 5 years of job experience. High technical readiness for distance learning was specified by 44.5% and 43.1% indicated technical readiness, however, only 56.9% specified to have easy access to the equipment necessary for distance learning showing a lack of technical infrastructure for distance learning programs. Regarding self-directed learning readiness, 32.8% of the respondents indicated high readiness and 67.2% showed readiness for self-directed learning. German Air Force respondents' experience with distance learning programs, however, was rated low (65.7% beginners) showing the demand for qualification measures and the need for the implementation of distance learning programs. Despite the technical and self-directed readiness for distance learning among respondents, 27.7% of GAF respondents do not feel motivated and 32.1% feel motivated only half the time to learn through distance learning that might show a lack of incentives or clear personal benefits.

German Air Force respondents specified a positive attitude (65.0%) to CRM training. However, 35.0% of GAF respondents with more than 11 years of time in service and more than five years of job experience indicated a neutral attitude to CRM training. Even some presumed CRM experts like leadership personnel and aircrew specified a neutral attitude to CRM training. Previous GAF CRM programs might not support the

process of guiding the direction of the individual's safety and CRM culture resulting in a proportionally more neutral attitude to CRM training among experienced personnel. Results might also point out the lack of a unified and mandatory CRM training for all GAF personnel involved in flight operations.

Research results regarding the main domain work values for the variable attitude to CRM training revealed that 90.5% showed a positive attitude to work values. Respondents might have a positive work attitude, high expectations regarding professionalism, and a balanced relationship with the social environment.

The analysis of the main domain institutional issues revealed that 54.0% indicated a positive attitude and 46.0% specified a neutral attitude to institutional issues. The neutral attitude might be related to respondents' perception of the air wing's management (62.8% neutral attitude and 5.8% negative attitude) as well as training and checking practices (73.0% neutral attitude and 1.5% negative attitude).

Data for the main domain work management indicated 76.0% of the respondents with a neutral attitude and only 61.0% with a positive attitude. The more neutral attitude to work management might be mainly related to the attitude to leadership style (25.5% negative attitude and 62.8% neutral attitude), the establishing and enforcing of rules and roles (17.5% negative attitude and 53.3% neutral attitude), and the management of stress and fatigue (56.9% neutral attitude).

The analysis of the three main domains and the associated sub-domains for the variable attitude to CRM training revealed that potential deficits might be associated with institutionalized and work management issues resulting in a latent risk to flight safety and

mission effectiveness. Results regarding the main domain work values revealed no distinctive features.

Research results further showed that GAF personnel with a positive attitude to CRM training also indicated acceptance (31.4%) or even high acceptance (32.1%) of distance learning programs. The medium positive correlation of $r = 0.342$ (Spearman rank-order correlation coefficient) supported this finding. Testing the statistical significance showed that there is a relationship between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations.

From those respondents with a positive and neutral attitude to CRM training, 91.3% indicated expert level or at least intermediate level computer skills. Distance learning skills among GAF personnel with a positive attitude to CRM training, however, is underdeveloped and 22.6% indicated intermediate level skills and 38.7% specified beginner level skills. For the successful implementation of CRM distance learning programs, GAF personnel has to be qualified in conducting distance learning.

Chapter 5: Conclusions and Recommendations

This chapter provides a summary of the previous chapters of the study including a brief review of the most important literature, a summary of the methodology, and a summary of the major research findings. The conclusions section addresses the research problem and each research question is answered based on the findings together with a discussion about the implications of the findings for practice. The recommendations section provides a discussion for the practical use of the findings and suggestions for future research in the areas of CRM training and distance learning.

Summary

The most important subject in aviation is safety followed by efficiency, productivity (Salas et al., 2000), or mission effectiveness in the military environment (Prince & Salas, 1993). After National Aeronautics and Space Administration (NASA) researchers "identified the human error aspects of the majority of air crashes as failures of interpersonal communications, decision making, and leadership" (Helmreich et al., 1999, p. 19), CRM programs evolved and have been utilized for more than 20 years in aviation. They were designed to develop the social and cognitive skills that are exercised together with technical, systems-related, skills in order to achieve safe and efficient flight operations (MacLeod, 2005). Many other industries (i.e. health care, nuclear power domains, offshore oil production, shipping etc.) have taken note of CRM and are adopting training programs from the aviation industry (Flin et al., 2002; France et al., 2005; Salas et al., 2006). Researchers, however, revealed that CRM training programs have not yet proven their effectiveness, lack optimization as a safety tool, and lack standardization (McLeod; Salas et al., 2000; Salas et al., 2006) because of no universally

accepted agreement of what CRM training should include and how it should be accomplished (Nullmeyer & Spiker, 2003; Salas, Prince, et al., 1999). Salas, Prince, et al. and Thomas (2004) reported that CRM definitions, training content, and training methods lack consistency and consensus in respect to training design, delivery, and evaluation within the entire aviation industry allowing too much ambiguity. Further analysis of the problem points out the lack of CRM culture inside and outside the cockpit and in some organizations CRM is often not encouraged by management (Salas et al., 2001). To build an effective training tool, members of the entire organization must understand and embrace the team-building culture of CRM (Maurino, 1999; Thomas). Civil aviation and military aviation have identified the need to go beyond training of flight crews and to deliver CRM training for all personnel involved in flight operations (Chief of Staff of the German Air Force, 2006; FAA Crew Resource Management, 2004; Flin et al., 2002). This policy coincides with the team-building process proposed by Thomas, Maurino (1999), Lu (2005), and the Manual of FAA Crew Resource Management. Leaders in aviation organizations have to improve and redesign CRM training programs in connection with the latest training methods and human resource management tools (FAA Crew Resource Management).

Because of high absenteeism from home and flexible work schedules CRM training does not reach all personnel involved in flight operations. Reports from the International Air Transport Association supported this finding - the key problem with current CRM practice is that it does not reach everyone (Helmreich et al., 1999; MacLeod, 2005). MacLeod concluded that regarding CRM's low transportability

"organizations have to reinvent CRM in the light of their own operation, regulatory environment, employees and so on" (p. 8).

In this mixed methodology study, the researcher explored and examined if distance learning programs can deliver CRM training for GAF personnel involved in military flight operations. Seeking CRM culture within the GAF requires a homogeneously accepted training program for all personnel involved in flight operations. A potential new training program based on the distance learning concept using the Internet might standardize CRM training throughout the GAF, reach all personnel involved in military flight operations, improve training standards, and facilitate the expansion of a general accepted CRM culture within the GAF. Helmreich et al. (1999), Lu (2005), the Manual of FAA Crew Resource Management (2004) and the Chief of Staff of the German Air Force (2006) supported the systematic approach and stated that this process should foster the development of a joint training program for cockpit crew, maintenance personnel, support personnel, and management. Raisinghani et al. (2005) published that a groundbreaking study by the FAA in 1999 revealed a beneficial reduction in pilot error accident rate from its staggering 87% level in 1999 after combining personal computer-based aviation training devices with emerging technologies. Organizational leaders of other industries have made use of online learning strategies as well and are utilizing the Internet to expand the reach of training. To fit the new paradigm, instructional designers "need to consider and implement multi-level alignments, identify and satisfy the stakeholders involved in all phases of the instructional design process, and attend the principles suggested in the literature" (Byers, 2005, p. 346). According to Julien (2005), the development of e-learning solutions

requires the development and delivery of e-services that interlink the learner, the service provided, the physical support, and the e-trainer. The challenge in distance learning is to assist learners to improve their knowledge transfer capabilities (Chen & Shaw, 2006). Regardless of any innovative training systems and design, the most important task is to understand the end users and to deliver training systems that satisfy their needs (Byers; Klemke et al., 2003).

Changing CRM deliver modality requires the acceptance of distance learning programs as an instructional CRM training method. Trainees' attitude to CRM training is another factor that influences training effectiveness and ranks as an indicator of a viable CRM culture within the GAF. The association between acceptance of distance learning and attitude to CRM training is a prerequisite for CRM programs to be delivered by distance learning. Without the acceptance of distance learning and without a positive attitude to CRM training, CRM training cannot be delivered by distance learning. The epistemological interest is what strategies might be used to implement and deliver CRM training by distance learning to increase training effectiveness. To answer the question the following sub-questions and hypotheses were proposed:

1. What, if any, acceptance of distance learning programs exists among GAF personnel involved in flight operations?
2. What, if any, attitude exists among GAF personnel involved in flight operations to conduct CRM training?
3. What, if any, relationship exists between the acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations?

$H_{0\text{-}3}$: No correlation exists between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations.

$H_{A\text{-}3}$: A correlation exists between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations.

The ultimate goal of the research was to improve the existing safety culture within the GAF and to explore if distance learning might provide another way of providing a multidimensional methodology to conduct safe and efficient flight operations.

The present exploratory research followed the case study design using the mixed methodology for data collection and analysis in order to gain a comprehensive inductive understanding of the acceptance of distance learning and the attitude to CRM training programs. The objective was to collect primary empirical data for descriptive data analysis and to explore and examine if a relationship exists between the acceptance of distance learning programs and attitude to CRM training.

According to Salas et al. (2000), variables like instructional approach, media, training method, and training design can measure CRM training success. "The organizational climate and continuous learning culture have been shown to be positively related to post training behaviors on the job." (Salas et al., 2000, p. 497) The variable acceptance of distance learning programs was used to measure CRM training effectiveness.

Factors outside CRM training programs like pre-training motivation and self-efficacy have a potential influence on CRM training effectiveness (Salas et al., 2000).

Salas et al. stated that successful CRM training depends on factors like management support for training, a climate that supports learning, and trainees' expectation and prior experiences with CRM training. The variable attitude to CRM training was used to measure factors outside the training programs as a prerequisite for a viable CRM culture and necessary for training success.

The research was conducted in three phases including the survey development phase, the piloting phase, and the data collection phase. Primary research instrument was a structured three part multi-item paper and pencil questionnaire based on a 5- point Likert-type ordinal scale allowing single-option answers only. The questionnaire was developed during a focus group interview with GAF CRM subject experts and was based on previous research conducted on cross-cultural attitudes toward performance in commercial flight operations (Helmreich et al., in press) and on research in the field of distance learning readiness (Guglielmino & Guglielmino, in press). The items for the variable acceptance of distance learning concentrated on the two domains technical readiness and readiness for self-directed learning. For the items related to the variable attitude to CRM training the focus group identified three main domains (attitude to institutional issues, attitude to work management, and attitude to work values). For the main domain institutional issues, the focus group identified five sub-domains representing the respondents' attitude to organizational climate, safety culture, perception of management, training and checking, and teamwork. For the main domain work management, the focus group identified five sub-domains representing the respondents' attitude to threat and error management, command, rules and roles, leadership styles, and

management of stress and fatigue. Prior to the data collection phase, the instrument was piloted using a testing sample.

Research participants were available GAF personnel involved in military flight operations within a single GAF air wing. The identification of personnel eligible for future CRM training was performed during the focus group interview in the survey development phase. Selection of the 137 research participants was conducted using the purposive sampling technique in order to obtain a rich data set. Collected data were coded and processed using the Statistical Package for the Social Sciences (SPSS®) software for Windows to apply descriptive data analysis, frequency analysis, cross-tabulation analysis, and correlation analysis.

Research results revealed that GAF respondents involved in flight operations have a joined interest in advancing their work related knowledge and, therefore, accepting distance learning as a potential training method. German Air Force respondents have identified "the wealth of opportunities to deploy alternative online learning environments to facilitate many users in their learning process" (Chen & Shaw, 2006, p. 89), the flexibility of access, and the capacity for instant updating opportunities (Byers, 2005). Häkkinen and Tynjälä (2005) and Raisinghani et al. (2005) pointed out the importance of sharing and dissemination knowledge and expertise among members of a learning community. Julien (2005) stated, "It is the group which learns, acquires new knowledge, shares information and best practices and exchanges learning experiences." (p. 293) Current technology allows creating virtual teams, "all online but at different physical locations, and present them with scenarios and observe how they react . . . and discuss issues with a professor via videoconference" (Raisinghani et al., 2005, p. 24).

The driving factors for distance learning programs, however, are the increased availability of private and organizational Internet access, short and module based high quality learning programs, and learning programs that are integrated into the work environment (Volkmer, 2003). Even though GAF respondents indicated high readiness and readiness in the technical readiness domain, research results revealed the lack of a technical infrastructure or technical concepts to conduct distance learning. In the self-directed learning domain, all GAF respondents showed readiness and high readiness for self-directed learning. German Air Force respondents, however, indicated that they do not feel motivated to learn through distance learning. No distinct motivation might indicate a lack of incentives or clear personal benefits to learn through distance learning.

Results for the variable attitude to CRM training revealed that the majority of GAF respondents have a positive attitude to CRM training (65.0%). Even though it was expected that no respondent indicated a negative attitude to CRM training, 35.0% of the investigated GAF personnel showed a neutral attitude to CRM training in a safety sensitive work environment. A neutral attitude to CRM training might be an indicator for the lack of awareness for CRM training and a missing CRM culture. Further investigation of the variable attitude to CRM training was conducted by analyzing the variable's main domains and sub-domains to gain a deeper understanding of the prevailing CRM culture in the selected GAF air wing.

Research results for the main domain work values showed that GAF respondents experienced a positive work attitude, high expectations regarding professionalism, and a balanced relationship with the social environment. Regarding respondents' perception to the main domain institutional issues, data revealed a more neutral attitude because of the

prevailing neutral and negative attitude to work management and a neutral and slightly negative attitude to training and checking practices. This finding coincides with Salas et al. (2001) who stated that even though there is no scientific evidence, reports of numerous cockpit crews support that CRM training and philosophy is often not encouraged by management. According to Salas et al. (2000), successful CRM training depends on factors like management support for training, a climate that supports learning, and trainees' expectations and prior experiences with CRM training.

Results for the main domain work management indicated a prevailing neutral attitude among GAF respondents mainly because of the neutral and slightly negative attitude to leadership style, the attitude to rules and roles, and the management of stress and fatigue. Prior research regarding the connection of organizational issues and safety, however, revealed that the organization's commitment to training, reinforcement of safe practices, and the establishing of open lines of communication between operators and management reduce the probability of error and contribute to safety (Helmreich et al., in press; Merritt, 2000).

The evaluation and analysis of research question three revealed that there is a medium positive correlation of $r = 0.342$ (Spearman rank-order correlation coefficient). Statistical significance testing showed that there is a relationship between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations. German Air Force respondents with a positive attitude to CRM training also specified acceptance of distance learning programs. Research conducted by Salas et al. (2000) showed that organizational climate (a sub-domain of the defined variable attitude to CRM training) and "continuous learning

culture show to be positively related to post training behaviors on the job" (p. 497). Even though GAF respondents indicated expert to intermediate computer skills for CRM distance learning programs, GAF respondents' distance learning skills are underdeveloped due to the lack of available training programs within the GAF. Research findings, however, indicated that CRM programs based on the distance learning concept might have "the potential to support cognitive, social, motivational, and affective processes of learning" (Häkkinen & Tynjälä, 2005, p. 330).

Conclusions

Leaders in civil aviation and military aviation have identified the need to go beyond training of flight crews. According to the Chief of Staff of the German Air Force (2006), the Manual of FAA Crew Resource Management (2004), and Flin et al. (2002) CRM training has to be conducted for all personnel involved in flight operations.

Seeking CRM culture within the GAF requires a homogeneously accepted training program for all personnel involved in flight operations. A potential new training program based on the distance learning concept using the Internet might standardize CRM training throughout the GAF, reach all personnel involved in military flight operations, improve training standards, and facilitate the expansion of a general accepted CRM culture within the GAF. This requires that training participants have a positive attitude towards the program because CRM is a concept that "emphasizes the need for clear and open communication . . . , including the process of conflict resolution and decision making" (Manningham, 1995, p. 67).

Research question one. The first research question related to the acceptance of distance learning among GAF personnel involved in flight operations. While the large

majority of GAF respondents indicated acceptance or even high acceptance of distance learning programs only a small minority specified low acceptance. Research findings showed that the high acceptance of distance learning among GAF personnel is a positive prerequisite for the successful implementation of CRM distance learning programs for GAF personnel involved in flight operations. Implementing CRM distance learning programs might minimize the main problem with current CRM training programs raised by the International Air Transport Association (IATA) - today's programs do not reach everyone (Helmreich et al., 1999; MacLeod, 2005).

Results further allowed the conclusion that implementing distance learning programs for CRM training might contribute to the creation of a standardized CRM training for all personnel involved in flight operations. For the design of such programs instructional designers "need to consider and implement multi-level alignments, identify and satisfy the stakeholders involved in all phases of the instructional design process, and attend the principles suggested in the literature" (Byers, 2005, p. 346). Distance learning programs would allow instructors, course designer, and the GAF to make CRM learning through distance learning useful and fun by varying the types of content, providing immediate feedback, and encouraging interaction (Lee et al., 2005). Research results further allowed concluding that with the acceptance of distance learning programs for CRM training the GAF has opportunities that allows "participants to use their practical, experiential knowledge and integrate it with theoretical, conceptual knowledge. . . . They may develop new understanding of their everyday problems, and consequently, may become aware of a need to transform their practices" (Häkkinen & Tynjälä, 2005, p. 325). The contemporary distribution of information, training, and safety practices

controlled and steered by CRM experts might support safety practices and the creation of a viable CRM culture for GAF personnel involved in flight operations.

Research results also showed that despite the high acceptance of distance learning the GAF lacks an overall distance learning concept. There is no existing formal and mandatory distance learning program that allows GAF personnel involved in flight operations to experience the concepts or learn the advantages of distance learning. Furthermore, the lack of incentives and personal benefits to participate in such programs is counterproductive in terms of implementing and fostering an organizational distance learning culture. German Air Force respondents also indicated the lack of a technical infrastructure that is counterproductive for the implementation of CRM distance learning programs or any other distance learning programs in the German armed forces.

Research results lead to the conclusion that the majority of personnel in the German armed forces might accept distance learning. The research instrument deployed appears to be capable of acquiring a snapshot of the acceptance of distance learning among all personnel in the German armed forces across the technical readiness domain and readiness for self-directed learning domain. The instrument, however, appears to be suboptimal for the investigation of motivational aspects of organizational learning. Operationalizing distance learning in the German armed forces requires the acceptance of users and the organization's commitment to implement distance learning. To make use of the presumed potential and the opportunity to employ distance learning programs for all personnel, the German armed forces should develop a conceptual and a technical framework for distance learning that also includes personnel that does not comply with

the conditions for distance learning. This statement is true for all other domains and organizations implementing distance learning programs for training.

Research question two. The second research question related to the attitude to CRM training among GAF personnel involved in flight operations. Research results showed that the majority of the investigated personnel involved in flight operations indicated a positive attitude to CRM training. However, 35.0% of the respondents indicated a neutral attitude to CRM training that is too high to be ignored in the safety sensitive work environment of a GAF air wing requiring further differentiation and investigation regarding the air wing's CRM culture. Salas et al. (2001) stated that previous research pointed out the lack of CRM culture inside and outside the cockpit in some aviation organizations. Helmreich et al. (1999), Lu (2005), the Manual of FAA Crew Resource Management (2004) and the Chief of Staff of the German Air Force (2006) already pointed out the need for a viable joint CRM culture among cockpit crew, maintenance personnel, support personnel, and management. According to Salas et al. (2006), other domains like medicine, offshore oil production and maintenance, shipping/maritime, and nuclear power have identified the same need.

The variable attitude to CRM training was measured one-dimensionally but research results revealed the complexity of the variable's attitudinal domain and the difficulty of measuring CRM culture after the identification of the variable's main and sub-domains. According to Helmreich et al. (in press) and MacLeod (2005) it is essential to understand the operating environment and the terms safety and culture before implementing supportive programs. However, there are only limited data available on CRM and safety culture within the GAF and no ready for use research instrument was

identified in the literature to reach a deep understanding of the topic and measure CRM culture. Even though the Chief of Staff of the German Air Force (2006) identified the need for CRM training, research results showed that the GAF has no clear definition of what a viable CRM culture is and how it might be measured. To overcome this problem, focus group participants and subject experts from the selected air wing were asked to identify the main and sub-domains and the associated items that appear to affect a viable CRM culture and that allow measuring it.

Research results showed that GAF respondents had an exceptionally positive attitude to the identified main domain work values and goals. It can be concluded that GAF personnel involved in flight operations might have been selected and trained for their job with the same mental model regarding work values and goals. Cannon-Bowers and Salas (1998), Tannenbaum et al. (1998), and Salas et al. (2000) stated that the shared mental model theory has the potential to enhance team performance.

Research results regarding the main domain institutional issues indicated a more neutral and negative attitude in the sub-domains training and checking, perception of management, and teamwork. Because of the sub-domains' complexity the research did not allow to draw conclusions for each identified sub-domain. It can be concluded, however, that each sub-domain appears to play a vital role for the prevailing CRM culture and might be a valid measure for the CRM domain. Improving areas like management, training and checking, and teamwork might have a positive effect on CRM and safety culture. Research revealed that except flight crew no GAF personnel involved in flight operations has to participate in a mandatory CRM training program. Management and all other personnel have only limited opportunity to learn the concepts

of CRM and, therefore, deliberately disseminate, and live CRM on a daily routine. Especially the multiplying factor and the role model effect of leadership personnel participating in a mandatory CRM training program might lead to an improvement of the CRM culture.

Research results regarding the main domain work management showed a more neutral and negative attitude to leadership styles, rules and roles, and management of stress and fatigue. Because of the sub-domains' complexity the research did not allow to draw conclusions for each identified sub-domain. It can be concluded, however, that each sub-domain appears to play a vital role for the prevailing CRM culture and might be a valid measure for the CRM domain. Improving areas like leadership styles, the management of rules and roles, and the management of stress and fatigue might have a positive effect on CRM and safety culture. The management of rules and roles and stress and fatigue can be improved by the evaluation and revision of current guidelines and procedures. Improving leadership styles, however, constitutes a more complex problem. Implementing leadership awareness training as an integral part of a new GAF CRM training program might support this process and support the development of an overall mental model for GAF personnel involved in flight operations.

It can be concluded that the deployed instrument for the variable attitude to CRM training in connection with the associated main and sub-domains appears to be capable to measure the prevailing CRM culture of complex organizations like the GAF. Implementing customized programs for organizations that foster CRM training, however, requires the commitment to acknowledge the complexity across various domains, the decisive impact on safety, and the willingness to enforce changes in training. MacLeod

(2005) concluded that regarding CRM's low transportability "organizations have to reinvent CRM in the light of their own operation, regulatory environment, employees and so on" (p. 8).

Research question three. The third research question related to the connection between acceptance of distance learning and attitude to CRM training to achieve training effectiveness. Research results showed that there is a medium positive correlation with r = 0.342 (Spearman rank-order correlation) between both variables. Statistical significance testing further showed that there is a relationship at the 0.01 level of significance between acceptance of distance learning programs and attitude to CRM training to achieve training effectiveness among GAF personnel involved in flight operations. It can be concluded that GAF respondents involved in flight operations with a positive attitude to CRM training also showed acceptance of distance learning programs. It appears to be worthwhile to pursue distance learning as an alternative way of providing a multidimensional methodology to conduct safe and efficient flight operations. Seeking CRM culture within the GAF requires a homogeneously accepted training program for all personnel involved in flight operations. Salas et al. (2000) supported this statement and published that CRM training tools are most effective if they are consistent with accepted theories of learning and if they offer important information about CRM behaviors, active practice, and feedback. Designing effective CRM training programs requires a comprehensive understanding of the instructional systems design process (Salas et al.).

Research findings further showed that there might be potential for the supportive development and implementation of both the distance learning concept and the CRM concept within the German armed forces. The implementation of mandatory CRM

training programs might be accomplished with mandatory distance learning programs based on the latest instructional systems design processes constituting a benefit for both concepts. The immediate feedback options associated with state of the art distance learning programs allows an immediate feedback opportunity for newly developed CRM training programs. Results from such programs might be used for optimizing and steering CRM training requirements and training needs allowing a flexible reaction to potentially misdirected training trends. Distance learning programs further provide the opportunity to build customized CRM training programs tailored for the individual target group among identified personnel involved in flight operations while building and maintaining a basic mental picture for all personnel. A shared mental picture is essential for the individual's identity with the team and the team building character of CRM training (O'Connor, 2006). Crew resource management training programs based on the distance learning concept might allow the easy implementation of cross training and inter-positional training programs for German armed forces personnel without building costly and time consuming face-to-face classes. "The idea behind cross training is that team members can learn about the demands of the task from the perspective of their teammates. This should enable them to better anticipate the behavioral and information needs of the teammates." (Cannon-Bowers & Salas, 1998, p. 31)

Connecting both concepts also has the advantage to acknowledge today's fifth generation CRM training programs by providing error management strategy training. State of the art distance learning programs allow the combination of technical and non-technical training and the implementation of simulation programs that enable the trainee to cross the boundaries of safe operation and to practice the detection of cues necessary

for the recovery into the safe area once the boundaries have been crossed (Naikar & Saunders, 2003). Conducting technical and non-technical training under the guidance of a qualified distance learning tutor ensures immediate feedback and maximum training effectiveness. This kind of training reflects the latest CRM training concepts and goes hand in hand with current distance learning strategies.

It can be concluded that CRM distance learning programs might deliver effective training systems that satisfy the needs of the GAF and the needs of GAF personnel involved in flight operations (Byers, 2005; Chief of Staff of the German Air Force, 2006; FAA Crew Resource Management, 2004; Klemke et al., 2003) and support a positive CRM and safety culture. The implications of the present research findings might not only apply to the German armed forces but for other domains and organizations employing CRM training strategies as well.

Recommendations

The intention of this research was to initiate a development process for a customized CRM training concept for the GAF identifying distance learning as an instructional approach. Another focus was to identify the applied methodology as suitable for the implementation of new distance learning programs in the GAF and other organizations and to identify the methodology as suitable for the implementation of CRM or critical skills training programs in other domains.

This mixed methodology study followed the case study design to gain a comprehensive understanding of the problem, lead future studies in the right direction, and to give management information to determine a course of action. Research findings, however, are not limited to the GAF or the military environment and might have

implications to other organizations. For this purpose, recommendations are divided into the recommendations within the organization section and the business applications section and are based on research findings and from the review of the literature.

Recommendations within the organization. Research findings regarding acceptance of distance learning in the German Air Force showed a large potential in the technical readiness and self-directed learning readiness domain among GAF personnel involved in flight operations pointing out the need for further investigation. The following recommendations are given for the implementation of distance learning into the GAF.

1. German Air Force commanders should acknowledge distance learning as an instructional method for all GAF personnel by defining and building a distance learning culture. Research showed that implementing a customized distance learning culture in the GAF requires operationalizing the technical readiness domain, the self-directed learning readiness domain, the motivational domain, and the technical infrastructure domain.
2. German Air Force commanders should conduct empirical research regarding the acceptance of distance learning based on the presented study to obtain evidence regarding the prevailing self-directed learning readiness domain and the technical readiness domain.
3. German Air Force commanders should conduct research on the motivational domain as a prerequisite for the acceptance of distance learning and a viable distance learning culture within the GAF. The learner centered focus of distance learning programs requires the investigation of extrinsic and intrinsic motivation

since they are critical for the success of organizational learning in terms of the individual's goals, values, beliefs, and expectations.

4. Investigating the technical infrastructure domain of distance learning should be conducted by examining the organizational technical infrastructure and the individual technical infrastructure of GAF personnel. Limited financial resources do not allow the distribution of technical distance learning equipment to all GAF personnel. The use of organizational technical equipment is also limited due to the anytime and anywhere approach of an Internet based distance learning concept. The individual's readiness and willingness to use his or her private technical infrastructure for organizational distance learning next to available governmental equipment should be evaluated before making further investments into the organizational technical infrastructure. Evaluating the use of GAF personnel's technical infrastructure should go hand in hand with the evaluation of the motivational domain since incentives are necessary to support the use of privately owned hard- and software.
5. German Air Force instructional designers should refine the presented acceptance of distance learning research instrument and develop a customized research instrument incorporating the motivational domain, the technical infrastructure domain, the technical readiness domain, and the self-directed learning readiness domain. The goal is to receive empirical evidence for a comprehensive understanding of the prevailing distance learning culture within the GAF.
6. It is recommended to make use of and invest in available distance learning programs utilizing the anytime and anywhere approach of the Internet not only

to satisfy the prevailing demand for distance learning but to gain a deeper understanding for the implementation of advanced distance learning programs for education and training in the GAF.

7. Available distance learning programs within the GAF should be revised and implemented into mandatory education and training programs. German Air Force personnel should be able to practice and train the distance learning methodology to build and improve competencies in the self-directed learning readiness domain and the technical readiness domain essential for a viable GAF distance learning culture.
8. It is recommended to establish a comprehensive distance learning concept for the GAF based on empirical evidence. German Air Force instructional designers "need to consider and implement multi-level alignments, identify and satisfy the stakeholders involved in all phases of the instructional design process, and attend the principles suggested in the literature" (Byers, 2005, p. 346) before implementing distance learning into the GAF and before receiving a return of investment. Figure 24 illustrates a potential development process for a customized organizational distance learning concept for the GAF.
9. It is recommended to build and establish a distance learning culture for the entire German armed forces since education and training is required for all military personnel.

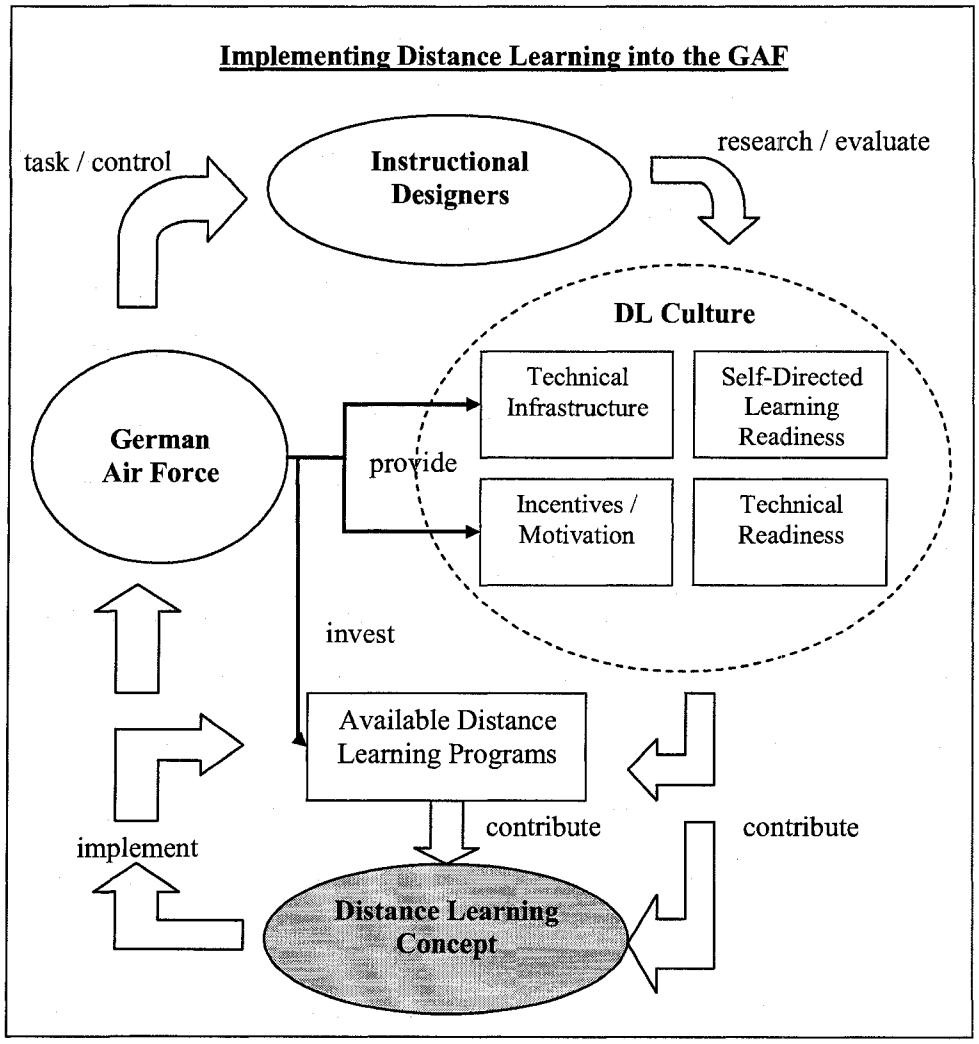

Figure 24. Process of implementing a customized distance learning concept for the GAF.

Research findings regarding attitude to CRM training within the GAF showed a need for further investigation in the interest of a viable CRM and safety culture and a need for action in the interest of flight safety and flight efficiency. The following recommendations are given to improve CRM training and to upgrade and establish a CRM and safety culture in the GAF.

1. German Air Force commanders should acknowledge the need for defining organizational CRM culture as a shared mental model before the purposeful implementation of a CRM training concept. Implementing a CRM training concept without defining a GAF CRM culture and without identifying the domains that require training might lead to the rejection of concepts and ineffective training programs.
2. Crew resource management experts and instructional designers should identify domains essential for a viable GAF CRM culture. This process might be accomplished based on the research instrument and the methodology presented in this study. The domains institutional issues, work management, and work values in connection with the identified sub-domains appear to be a valid basis for defining CRM culture in the GAF.
3. Crew resource management experts should develop a research instrument based on the presented study to validate the identified domains and to establish a GAF CRM culture catalog accepted by all GAF personnel involved in flight operations. The research instrument should be capable of identifying domains that need special attention and lead to customized CRM training programs.
4. All eligible GAF personnel should be introduced to the targeted CRM culture to establish a shared mental picture regarding the purpose of CRM training. German Air Force personnel should further be introduced to the identified domains that require training in order to obtain a general understanding for the training initiative as an initial start for the team-building process.

5. It is recommended operationalizing the GAF CRM culture catalog for the development of a customized GAF CRM training concept and for the development of CRM training modules.
6. Training modules should be based on the identified CRM main and sub-domains. Especially training modules for the sub-domains rules and roles, leadership, and management of stress and fatigue might be a valuable contribution to existing CRM training programs and might have the potential to improve current CRM culture in the GAF in the interest of flight safety. Other CRM domains should be trained on a regular basis to establish and extend CRM culture among GAF personnel involved in flight operations.
7. German Air Force commanders should direct and control CRM culture and CRM training through an expert group by a continuous evaluation process allowing the timely identification of problem domains and training requirements. It is recommended that the CRM expert group conduct research on a regular basis to identify changes in CRM culture and to direct training needs by administering the customized research instrument to a random sample of GAF personnel involved in flight operations. Figure 25 illustrates a potential development process for a customized CRM training concept for the GAF.

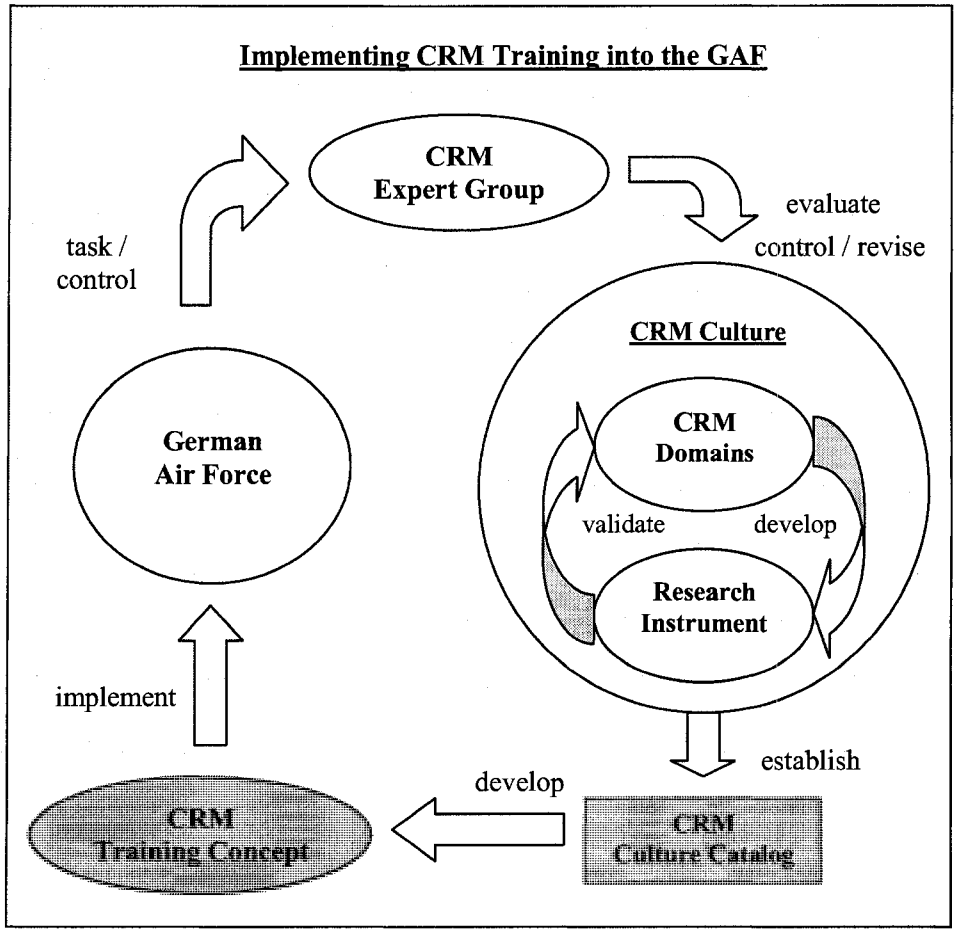

Figure 25. Process of implementing a customized CRM concept for the GAF.

8. Crew resource management training does not affect GAF personnel involved in flight operations alone since flight operations are also conducted in the German Navy and the German Army. Other domains within the German military might be eligible for a customized CRM training program as well. Recommendations should be extended to all fields seeking critical skills training within the German armed forces.

Research findings regarding the connection between acceptance of distance learning and attitude to CRM training in this study indicated a medium positive

relationship but not a causal relationship. Prior research conducted in this field, however, indicated a causal relationship between both concepts (Raisinghani et al., 2005). The following recommendations are given for the implementation of CRM distance learning programs in the GAF.

1. German Air Force commanders should build and run a CRM distance learning trial and conduct attendant research to obtain supportive evidence regarding the delivery of CRM training by distance learning. The goal is to understand and predict relationships between the distance learning concept and the CRM concept.
2. It is recommended to start qualifying CRM experts to apply the distance learning methodology. Qualifying CRM trainers as distance learning tutors releases innovations regarding the synergetic use of both concepts and allows the professional implementation of CRM distance learning programs.
3. It is recommended to implement CRM training modules into the distance learning concept making use of CRM trainers, distance learning instructional designers, and the available distance learning infrastructure within the GAF.
4. An Internet based CRM distance learning trial should be conducted with selected GAF leadership personnel involved in flight operations. The goal is to learn the concepts of CRM, to identify the advantages of CRM training based on distance learning, and to act as CRM multipliers and role models for all personnel involved in flight operations.
5. Distance learning should also be made available for other domains within the German armed forces seeking critical skills training. It is recommended to

identify areas eligible for critical skills training within the German armed forces and to implement customized critical skills distance learning modules for training.

Business applications. Research results further revealed applications to the business community. According to the Manual of FAA Crew Resource Management (2004), the Joint Aviation Authorities (1998), and the Chief of Staff of the German Air Force (2006), developing, implementing, reinforcing, and assessing crew resource management training for flight crew and other personnel is essential to flight safety in commercial and military aviation. The airline industry might benefit from the presented research since safety training requirements are similar to the airline industry and the military. To implement a comprehensive distance learning concept and CRM training programs based on distance learning into the airline industry it is recommended to follow the suggestions given in the recommendations within the organization section. The following recommendations are given for the implementation of e-learning programs into other organizations.

1. Chen and Shaw (2006) reported that the big difference between traditional face-to-face (F2F) learning and e-learning is that e-learning is user-centered instead of instructor centered and Duan et al. (2006) published, "E-learning is having a significant and positive impact on education" (p. 99). To make use of the advantages associated with e-learning it is recommended implementing e-learning as a learning alternative into any organization offering training programs. Affected personnel, however, should accept the desired methodology as a prerequisite for a viable e-learning culture. It is recommend to conduct

research based on the presented study to investigate the acceptance of e-learning across the self-directed learning readiness domain, the technical readiness domain, the motivational domain, and the technical infrastructure domain before the implementation of any e-learning concept. Deficits identified in any of the domains should be evaluated in how they might affect the organization's desired e-learning culture.

2. It is recommended to build an organizational framework for the desired e-learning culture by providing a supportive technical infrastructure concept that should go hand in hand with a motivational concept. Customized research for the motivational domain should identify extrinsic and intrinsic factors essential for e-learning. Customized research on the technical infrastructure domain should identify the learners' willingness to use personal hard- and software for organizational learning in order to minimize cost for the organizational technical infrastructure.
3. Potential deficits in the self-directed learning readiness and technical readiness domain should be eliminated by providing initial qualification training or supportive measures before the implementation of any e-learning program.
4. The e-learning tutor is a key element in organizational e-learning. It is recommended to qualify tutors and integrate them in the development process of a customized e-learning concept together with instructional designers.

The following recommendations are given for the implementation of critical skills training and the implementation of a safety culture into the business community.

1. It is recommended to make use of the methodology presented in this study for the implementation of e-learning for critical skills training in any organization. The use of the anytime and anywhere approach of an Internet based e-learning concept allows the organization to reach all eligible personnel, to build and establish a safety culture, to standardize and direct training needs, and to support the teambuilding concept. This can be accomplished by creating a shared mental model among all eligible personnel within the organization offering cross training and inter-positional training programs.
2. Organizational leaders should identify domains essential for a viable safety culture and personnel eligible for critical skills training. Instructional designers should then develop a research instrument based on the identified domains allowing the identification of the prevailing safety culture and areas that need special attention and training.
3. It is recommended to make use of the methodology presented in this study in any team orientated high-risk organizations seeking a viable safety and continuous learning culture. Organizations interested in this study might be found in the aviation industry, health care, nuclear power domains, offshore oil production, and shipping.

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Appendix A

Distance Learning Readiness Assessment (DLRA)

Distance Learning Readiness Assessment (DLRA)

Instructions: This is a questionnaire designed to gather data on distance learning preferences and attitudes towards learning. There are no right or wrong answers. After reading each item, please indicate the degree to which you feel that each statement is true of you. Please read each choice carefully and circle the number of the response which best expresses your feelings.

There is no time limit for this questionnaire. Try not to spend too much time on any one item, however. Your first reaction to the question will usually be the most accurate.

Use this key in answering the questions below:

1. **I never feel like this.**
2. **I feel like this less than half the time.**
3. **Half the time I feel this way.**
4. **I usually feel this way.**
5. **I feel like this all the time.**

Items:

1. I am confident of my ability to use e-mail.
2. I like to learn new ways of communicating over the internet.
3. I am comfortable writing at the computer.
4. I have difficulty opening and attaching e-mail files.
5. I like using the computer.
6. I can quickly find information I need on the internet.
7. I have excellent reading skills.
8. I can express my ideas well in writing.
9. I am confident of my ability to use correct grammar and punctuation.
10. I have easy access to the equipment I need for distance learning.
11. When I need technical support, I can get it.
12. I need a lot of face to face interaction when learning.
13. I am willing to ask for help when I need it.
14. I am highly motivated to learn through distance learning.
15. I am good at organizing my time for learning.
16. If there is something I want to learn I can find a way to learn it.
17. I am good at learning things by myself.
18. I enjoy learning new things.
19. If there is something I have decided to learn I can find time for it, no matter how busy I am.
20. Understanding what I read is a problem for me.
21. I know when I need to learn more about something.
22. I learn well from written materials.

23. I can think of many different ways to learn about something new.
24. I try to think about how the things I am learning will fit in with the plans I have for myself.
25. I enjoy looking for the answer to a hard question.
26. When I decide to find out something, I do it.
27. I can make myself do what I think I should.
28. I am really good at solving problems.
29. I become a leader in learning groups.
30. My learning is my responsibility--no one else can do it for me.
31. I know where to go to get information when I need it.
32. I like to try new things, even if I am not sure how they will turn out.

Appendix B

Translation Guidelines for the DLRA

Translation Guidelines for the Distance Learning Readiness Assessment (DLRA)

In return for the management of the translation process, you will receive authorization to use the DLRA online in your research at a reduced cost of $2.00 per administration. Dr. Lucy M. Guglielmino will, of course, retain all rights to the translation of the DLRA; she will continue to be the only person who can authorize use of any version of the DLRA in any language. You will need to include a copyright notice on all copies reproduced.

The translation process for the Distance Learning Readiness Assessment (DLRA) is as follows:

1. At least three individuals fully fluent in the target language and in English translate the scale separately. They should be cautioned to use the simplest possible language to convey the concepts, attempting to keep the reading level as low as possible without losing the meaning. PLEASE NOTE: ALL VERSIONS AND ALL COPIES OF THE TRANSLATION MUST BEAR THE COPYRIGHT NOTICE:

2. These three individuals then confer on any differences in translation, arriving at an agreement.

3. At least two individuals fully fluent in the target language and in English separately translate the new version back into English. Again, they should be asked to use the simplest possible language to convey the meaning.

4. Problems noted can be resolved by the original translators and the back translators through a telephone conference call, e-mail, or regular mail if a personal meeting is not possible.

5. The translated instrument must first be tried out on a small number of subjects (approximately 25). The individual conducting the field test will need to solicit feedback from the subjects, asking them to report any difficulties or lack of understanding. Any problems found at this stage should again be resolved using the input of at least two of the translators or back-translators, who are already aware of previous discussions about alternate wording.

6. A report of this process, including names, addresses, and means of contacting the translators and field-test facilitator, and a copy of the translation is submitted to Guglielmino and Associates.

7. Once the version is authorized by Dr. Guglielmino, the researcher receives a letter of permission from Guglielmino and Associates authorizing use of the agreed-upon number of copies for the full field test. PLEASE NOTE: Additional copies may not be reproduced without Dr. Guglielmino's authorization. The instrument may not be placed online or sent as an electronic file without Dr. Guglielmino's authorization. It is intellectual property protected by international copyright laws.

Lucy M. Guglielmino, Ed.D.

Appendix C

DLRA Letter of Agreement

Letter of AGREEMENT

I understand that the translation of the Distance Learning Readiness Assessment is complicated and time-consuming process, but it is necessary in order to ensure an accurate translation. I agree to follow the procedures, to make sure that the copyright notice is placed on all copies of the DLRA, and to make sure that no use is made of the instrument without authorization from Dr. Lucy M. Guglielmino. In return, I will receive authorization from Dr. Guglielmino to use the DLRA online at a cost of $2.00 per administration and will send the results to Guglielmino & Associates for scoring (cost: $75.00) and to be added to the database.

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Appendix D

The FMAQ 2.0 International Version

Flight Management Attitudes Questionnaire 2.0 (International)

The success of the survey depends on your contribution, so it is important that you answer questions as honestly as you can. There are no right or wrong answers, and often the first answer that comes to mind is best. Individual responses are absolutely confidential.

Part I - XX Pilot Views: This portion of the questionnaire is designed for you to express your view of your company. Please answer by writing beside each item a letter from the corresponding scale.

A=1	B=2	C=3	D=4	E=5
Very Low	Low	Adequate	High	Very High

A. Please evaluate your level of ***satisfaction*** with these different aspects of flight operations.

____1. Ground School
____2. Simulator-based training
____3. Line relevance of training material
____4. Quality of new-hire training
____5. Instructor skills
____6. Flight Training Overall
____7. Fairness of checking
____8. Flight Manager/Chief Pilot availability
____9. Flight Ops Management
____10.Disciplinary policy and enforcement
____11.Pilot utilization and productivity
____12.Operations Manuals
____13.Checklists

B. Please describe your personal perception of the ***quality of teamwork & cooperation*** you have experienced with:

____14.Other cockpit crewmembers
____15.Gate Agents
____16.Ramp Personnel
____17.Flight Attendants
____18.Dispatch
____19.Maintenance
____20.Crew Scheduling

C. Please answer the following by writing your response beside each item using the following scale.

A=1	B=2	C=3	D=4	E=5
Disagree Strongly	Disagree Slightly	Neutral	Agree Slightly	Agree Strongly

____21. The managers in Flight Operations listen to us and care about our concerns.
____22. I know the proper channels to direct questions regarding safety practices.
____23. Check Airmen are respected role models in our airline.
____24. I feel comfortable going to the Chief Pilot's office to discuss problems or operational issues.
____25. Our training has prepared pilots and flight attendants to work as a well-coordinated team.
____26. My last line check was a positive learning experience. NEW ITEM

____27. I am encouraged by my supervisors and coworkers to report any unsafe conditions I may observe.

____28. Working here is like being part of a large family.

____29. Flight Management staff constructively deal with problem pilots.

____30. I am proud to work for this organization.

____31. Management will never compromise safety concerns for profitability.

____32. My last simulator instructor effectively debriefed the flight's human factors issues.

____33. My suggestions about safety would be acted upon if I expressed them to management.

____34. Check Airmen across all fleets hold pilots to the same standard.

____35. Our Instructors have a good understanding of line operations.

____36. Senior management at XX is doing a good job.

____37. Cabin personnel should be included in the crew briefing at the start of a duty day.

____38. Crew members that I fly with comply with XX SOP's.

____39. Pilot morale is high.

____40. Flight Operations Management fully supports my daily efforts on the line.

____41. I like my job.

____42. Pilots trust senior management at XX.

____43. This airline has a positive safety culture.

____44. XX practices the highest maintenance standards.

D. Please name your top three recommendations to improve XX flight operations and training.

_____

_____

Part II - Flight Management Attitudes.

Please answer the following items by writing your response beside each item using the following scale

A Disagree Strongly	B Disagree Slightly	C Neutral	D Agree Slightly	E Agree Strongly

____1. The captain should take physical control and fly the aircraft in emergency and non-standard situations.

____2. Captains should encourage crewmember questions during normal flight operations and in emergencies.

____3. Even when fatigued, I perform effectively during critical times in a flight.

____4. The airline's rules should not be broken - even when the employee thinks it is in the airline's best interests.

____5. I expect to be consulted on matters that affect the performance of my duties.

____6. Senior staff deserve extra benefits and privileges.

____7. I let other crewmembers know when my workload is becoming (or about to become) excessive.

____8. Captains who encourage suggestions from crewmembers are weak leaders.

____9. My decision making ability is as good in emergencies as in routine flying conditions.

____10. Junior crewmembers should not question the captain's or senior crewmembers' decisions.

____11. It is better to agree with other crewmembers than to voice a different opinion.

____12. The captain's responsibilities include coordination between the cockpit and cabin crew.

____13. I am more likely to make judgment errors in an emergency.

____14. Successful flight deck management is primarily a function of the captain's flying proficiency.

____15. If I perceive a problem with the flight, I will speak up, regardless of who might be affected.

____16. I am ashamed when I make a mistake in front of my other crewmembers.

____17. In abnormal situations, I rely on my superiors to tell me what to do.

____18. Crewmembers should not question actions of the captain except when they threaten the safety of the flight.

____19. I am less effective when stressed or fatigued.

____20. My performance is not adversely affected by working with an inexperienced or less capable crewmember.

____21. To resolve conflicts, crewmembers should openly discuss their differences with each other.

____22. Crewmembers should monitor each other for signs of stress or fatigue.

____23. Personal problems can adversely affect my performance.

____24. A truly professional crewmember can leave personal problems behind when flying.

____25. Except for total incapacitation of the captain, the first officer should never assume command of the aircraft.

____26. Written procedures are necessary for all in-flight situations.

____27. Crewmembers should mention their stress or physical problems to other crew before or during a flight.

____28. Good communication and crew coordination are as important as technical proficiency for flight safety.

____29. Effective crew coordination requires crewmembers to consider the personal work styles of other crewmembers.

____30. During periods of low work activity, I would rather relax than keep busy with small tasks.

____31. A true professional does not make mistakes.

____32. An essential captain duty is training first officers.

____33. How frequently, in your work environment, are subordinates afraid to express disagreement with their superiors?

A. Very frequently B. Frequently C. Sometimes D. Seldom E. Very seldom

____34. How often do you feel nervous or tense at work?

A. Always B. Usually C. Sometimes D. Seldom E. Never

Part III. Leadership Styles

Please read the following descriptions of four different leadership styles, and answer the questions that follow.

Style A Leader usually makes decisions promptly and communicates them to subordinates clearly and firmly. Expects them to carry out the decisions loyally and without raising difficulties.

Style B Leader usually makes decisions promptly, but, before going ahead, tries to explain them fully to subordinates. Gives them the reasons for the decisions and answers whatever questions they may have.

Style C Leader usually consults with subordinates before reaching decisions. Listens to their advice, considers it, and then announces decision. Expects all to work loyally to implement it whether or not it is in accordance with the advice they gave.

Style D Leader usually calls a meeting of subordinates when there is an important decision to be made. Puts the problem before the group and invites discussion. Accepts the majority viewpoint as the decision.

First and Second officers, please think of Captains when answering the next two questions; Captains, please think of Flight Ops. Management.

___ 1. Which one of the above styles of leadership would you *most prefer* to work under?

___2. In your organization, which style do you find yourself most often working under?

Part IV - Work values and goals

Please answer the items below by writing beside each item a letter from the scale below.

A	B	C	D	E
Of very little or no importance	Of little importance	Of moderate importance	Very Important	Of Utmost Importance

Please think of your *ideal* job - disregarding your present job. In choosing an *ideal* job, how important would it be to you to:

_____1. Maintain good interpersonal relationships with fellow workers or crewmembers?

_____2. Have an opportunity for advancement to higher level jobs?

_____3. Have security of employment?

_____4. Live in an area desirable to you and your family?

_____5. Have a changing work routine with new, unfamiliar tasks?

_____6. Have a warm relationship with your direct superior?

_____7. Have an opportunity for high earnings?

_____8. Have challenging tasks to do, from which you get a personal sense of accomplishment?

_____9. Know everything about the job, to have no surprises?

_____10. Have sufficient time left for your personal or family life?

_____11. Work with people who cooperate well with one another?

_____12. Find the truth, the correct answer, the one solution?

_____13. Observe strict time limits for work projects?

Part V Cockpit Automation

The following items deal with attitudes regarding flightdeck automation. For purposes of this survey, automated aircraft are defined as those with a programmable Flight Management Computer (FMC). If you are currently flying an automated aircraft, base you responses on experience in this airplane. *If you have not flown such an airplane, base your answers on your expectations regarding such aircraft.* Please answer by writing beside each item a letter from the scale below.

A	B	C	D	E
Disagree Strongly	Disagree Slightly	Neutral	Agree Slightly	Agree Strongly

____1. I prefer flying automated aircraft.
____2. Under abnormal conditions, I can rapidly access the information I need in the FMC.
____3. The effective crewmember always uses the automation tools provided.
____4. I am concerned that the use of automation will cause me to lose flying skills.
____5. It's easy to forget how to do FMC operations that are not performed often.
____6. I look forward to more automation - the more the better.
____7. Pilots should avoid disengaging automated systems.
____8. There are modes and features of the FMC that I do not fully understand.
____9. Automated cockpits require more verbal communication between crewmembers.
____10.I regularly maintain flying proficiency by disengaging automation.
____11.Automated cockpits require more cross-checking of crewmember actions.
____12.My company expects me to always use automation.
____13.I feel free to select the level of automation at any given time.
____14.Automated systems should be used at the crews' discretion.
____15.Flying highly automated aircraft alters the way crewmembers transfer information.
____16.I try to use automation as much as possible during flight operations.
____17.It is difficult to know what FMC operations the other crewmember is performing.

MULTINATIONAL CREWS (if applicable)

A. What is/are the best thing(s) about flying with multi-national crews?

_____

_____

B. What is/are the most frustrating thing(s) about flying with multi-national crews?

_____

_____

Part VI -Background Information.

SEX__ (M or F) __BASE _____Years at XX _____Years in Aviation____

Fleet (A/C type & series) __ How much experience do you have in this aircraft ? (years)

BACKGRND Nature of flying background (check one) __Military __Civilian __Both

POS Crew Position: _____Captain _____ First Officer _____ Second Officer

STATUS Status: ____Line Pilot _____Instructor _____Check Airman

_____ Management ____OTHER

What is your nationality? _____

What was your nationality at birth (if different from your present nationality?)

_____

Thank you for taking the time to complete the questionnaire. Your participation is appreciated

Appendix E

Research Instrument – English Version

Distance Learning for Crew Resource Management Training in Military Aviation

Instructions: This is a questionnaire designed to gather data on your attitude to Crew Resource Management (CRM) training. There is no right or wrong answer. After reading each item, please indicate the degree to which you feel that each statement is true of you. Please read each choice carefully and fill in the number of the response which best expresses your feelings.

There is no time limit for this questionnaire. Try not to spend too much time on any one item. Your first reaction to the question will usually be the most accurate.

Part I:

This portion of the questionnaire is designed to express **your personal view** of the flight operations in the German Air Force. Please answer each item and fill in the number of the response which best expresses your feelings.

1	2	3	4	5
Very Low	Low	Adequate	High	Very High

Please evaluate your level of satisfaction with these different aspects of **your work** in the air wing's flight operations.

1. ☐ Ground school and practical training in flight operations. (TngChe 1)
2. ☐ Line relevance of training material in flight operations. (TngChe 2)
3. ☐ Quality of new-hire training in flight operations. (TngChe 3)
4. ☐ Instructor skills in flight operations. (TngChe 4)
5. ☐ Availability of superiors in flight operations. (PercMng 1)
6. ☐ Management of daily flight operations. (PercMng 2)
7. ☐ Instructions and manuals in flight operations. (TngChe 5)
8. ☐ Cooperation and teamwork in flight operations. (TeamWo 1)

Please answer the following by writing your response beside each item using the following scale.

1	2	3	4	5
Disagree Strongly	Disagree Slightly	Neutral	Agree Slightly	Agree Strongly

9. ☐ Superiors in flight operations listen to us and care about our concerns. (SafeCul 1)
10. ☐ I know the proper channels to direct questions regarding safety practices. (SafeCul 2)
11. ☐ I feel always comfortable going to superiors to discuss problems of operational issues. (PercMng 3)
12. ☐ Our training has prepared us to work as a well-coordinated team. (TeamWo 2)
13. ☐ I am encouraged by my superiors and coworkers to report any unsafe conditions I may observe. (SafeCul 3)
14. ☐ I feel good in my working environment. (OrgCli 1)
15. ☐ Superiors constructively deal with problem coworkers. (PercMng 4)
16. ☐ I am proud to work for this German Air Force wing. (OrgCli 2)
17. ☐ Superiors will never compromise safety concerns for operational necessities. (PercMng 5)
18. ☐ My suggestions about safety would be acted upon if I expressed them to superiors. (SafeCul 4)
19. ☐ My training was praxis-orientated. (TngChe 6)
20. ☐ My coworkers comply with instructions. (SafeCul 5)
21. ☐ There is a positive work attitude in my German Air Force wing. (OrgCli 3)
22. ☐ My superiors fully support my daily work efforts. (PercMng 6)
23. ☐ I like my job. (OrgCli 4)
24. ☐ Our German Air Force wing has a positive safety culture. (SafeCul 6)

Part II: Attitude to work management

Please answer each item and fill in the number of the response which best expresses your feelings.

1	2	3	4	5
Disagree Strongly	Disagree Slightly	Neutral	Agree Slightly	Agree Strongly

25. ☐ Work processes should be scrutinized in daily operations. (ComAtt 1)

26. ☐ Even when fatigued, I perform effectively. (StressFat 1 reversed)
27. ☐ Rules should not be broken even when the employee thinks it is in the German Air Force's best interests. (RulRol 1)
28. ☐ I expect to be consulted on matters that affect the performance of my duties. (ComAtt 2)
29. ☐ Senior staff deserves extra benefits and privileges. (ComAtt 3)
30. ☐ I let coworkers know when my workload is becoming (or about to become) excessive. (StressFat 2)
31. ☐ Superiors who encourage suggestions from employees are weak leaders. (ComAtt 4 reversed)
32. ☐ My decision making ability is not affected by my personal stress level. (StressFat 3 reversed)
33. ☐ Junior employees should not question the decisions made by senior employees or superiors. (ComAtt 5 reversed)
34. ☐ It is better to agree with other coworkers than to voice a different opinion. (ComAtt 6 reversed)
35. ☐ I am more likely to make judgment errors under stress. (StressFat 4)
36. ☐ If I perceive a problem in my work environment, I will speak up, regardless of who might be affected. (ThrErrMng 1)
37. ☐ I am ashamed when I make a mistake in front of my other coworkers. (ThrErrMng 2 reversed)
38. ☐ In abnormal situations, I rely on my superiors to tell me what to do. (ThrErrMng 3 reversed)
39. ☐ I am less effective when stressed or fatigued. (StressFat 5)
40. ☐ My performance is not adversely affected by working with an inexperienced or less capable coworker. (StressFat 6 reversed)
41. ☐ To resolve conflicts, coworkers should openly discuss their differences with each other. (ThrErrMng 4)
42. ☐ Coworkers should monitor each other for signs of stress or fatigue. (StressFat 7)
43. ☐ Personal problems can adversely affect my performance. (StressFat 8)
44. ☐ Professionalism means leaving personal problems behind. (StressFat 9 reversed)
45. ☐ Written procedures are necessary for all work situations. (RulRol 2)
46. ☐ Employees should mention their stress or physical problems to other coworkers. (StressFat 10)
47. ☐ Good communication and crew coordination are as important as technical proficiency for work safety. (ThrErrMng 5)

48. ☐ Effective crew coordination requires crewmembers to consider the personal work styles of other crewmembers. (ThrErrMng 6)
49. ☐ During periods of low work activity, I would rather relax than keep busy with small tasks. (StressFat 11)
50. ☐ A true professional does not make mistakes. (ThrErrMng 7 reversed)
51. ☐ How frequently, in your work environment, are subordinates afraid to express disagreement with their superiors? (LeadSty 1)
1. Very frequently **2.** Frequently **3.** Sometimes **4**. Seldom **5**. Very seldom
52. ☐ How often do you feel nervous or tense at work? (StressFat 12)
1. Always **2**. Usually **3**. Sometimes **4**. Seldom **5**. Never

Part III: Work values and goals

Please answer each item and fill in the number of the response which best expresses your feelings.

1	2	3	4	5
Of very little or no importance	Of little importance	Of moderate importance	Very important	Of Utmost importance

Please think of your *ideal* job – disregarding your present job. In choosing an *ideal* job, how important would it be to you to:

53. ☐ Maintain good interpersonal relationships with fellow workers? (WorkVal 1)
54. ☐ Have a changing work routine with new, unfamiliar tasks? (WorkVal 2)
55. ☐ Have a warm relationship with your direct superior? (WorkVal 3)
56. ☐ Have challenging tasks to do, from which you get a personal sense of accomplishment? (WorkVal 4)
57. ☐ Know everything about the job, to have no surprises? (WorkVal 5)
58. ☐ Have sufficient time left for your personal or family life? (WorkVal 6)
59. ☐ Work with people who cooperate well with one another? (WorkVal 7)
60. ☐ Ultimate perfection at the workplace? (WorkVal 8)
61. ☐ Observe strict time limits for work projects? (WorkVal 9)

Teil IV: Leadership Styles

Please read the following descriptions of four different leadership styles, and answer the two questions that follow.

Style 1 Leader usually makes decisions promptly and communicates them to subordinates clearly and firmly. Expects them to carry out the decisions loyally and without raising difficulties.

Style 2 Leader usually makes decisions promptly, but, before going ahead, tries to explain them fully to subordinates. Gives them the reasons for the decisions and answers whatever questions they may have.

Style 3 Leader usually consults with subordinates before reaching decisions. Listens to their advice, considers it, and then announces decision. Expects all to work loyally to implement it whether or not it is in accordance with the advice they gave.

Style 4 Leader usually calls a meeting of subordinates when there is an important decision to be made. Puts the problem before the group and invites discussion. Accepts the majority viewpoint as the decision.

62. **Style** ☐ Which one of the above styles of leadership would you *most prefer* to work under? (LeadSty 2)

63. **Style** ☐ In your organization, which style do you find yourself most often working under? (LeadSty 3)

Instructions: This is a questionnaire designed to gather data on distance learning preferences and attitudes towards learning. There are no right or wrong answers. After reading each item, please indicate the degree to which you feel that each statement is true of you. Please read each choice carefully and circle the number of the response which best expresses your feelings.

There is no time limit for this questionnaire. Try not to spend too much time on any one item, however. Your first reaction to the question will usually be the most accurate.

Use this key in answering the questions below:

1. **I never feel like this.**
2. **I feel like this less than half the time.**
3. **Half the time I feel this way**
4. **I usually feel this way.**
5. **I feel like this all the time.**

Items:

64. ☐ I am confident of my ability to use e-mail. (TXR 1)
65. ☐ I like to learn new ways of communicating over the internet. (TXR 2)
66. ☐ I am comfortable writing at the computer. (TXR 3)
67. ☐ I have difficulty opening and attaching e-mail files. (TXR 4 reversed)
68. ☐ I like using the computer. (TXR 5)
69. ☐ I can quickly find information I need on the internet. (TXR 6)
70. ☐ I have excellent reading skills. (SDLR 1)
71. ☐ I can express my ideas well in writing. (SDLR 2)
72. ☐ I am confident of my ability to use correct grammar and punctuation.(SDLR3)
73. ☐ I have easy access to the equipment I need for distance learning. (TXR 7)
74. ☐ When I need technical support, I can get it. (TXR 8)
75. ☐ I need a lot of face-to-face interaction when learning. (SDLR 4 reversed)
76. ☐ I am willing to ask for help when I need it. (SDLR 5)
77. ☐ I am highly motivated to learn through distance learning. (SDLR 6)
78. ☐ I am good at organizing my time for learning. (SDLR 7)
79. ☐ If there is something I want to learn I can find a way to learn it. (SDLR 8)
80. ☐ I am good at learning things by myself. (SDLR 9)
81. ☐ I enjoy learning new things. (SDLR 10)

82. ☐ If there is something I have decided to learn I can find time for it, no matter how busy I am. (SDLR 11)
83. ☐ Understanding what I read is a problem for me. (SDLR 12 reversed)
84. ☐ I know when I need to learn more about something. (SDLR 13)
85. ☐ I learn well from written materials. (SDLR 14)
86. ☐ I can think of many different ways to learn about something new. (SDLR 15)
87. ☐ I try to think about how the things I am learning will fit in with the plans I have for myself. (SDLR 16)
88. ☐ I enjoy looking for the answer to a hard question. (SDLR 17)
89. ☐ When I decide to find out something, I do it. (SDLR 18)
90. ☐ I can make myself do what I think I should. (SDLR 19)
91. ☐ I am really good at solving problems. (SDLR 20)
92. ☐ I become a leader in learning groups. (SDLR 21)
93. ☐ My learning is my responsibility--no one else can do it for me. (SDLR 22)
94. ☐ I know where to go to get information when I need it. (SDLR 23)
95. ☐ I like to try new things, even if I am not sure how they will turn out.(SDLR24)

Part V: Background Information

96. Gender (1)☐ Male (2)☐ Female (2)

97. Age
(1)☐ under 21
(2)☐ 22 – 30 years
(3)☐ 31 – 41 years
(4)☐ 42 – 50 years
(5)☐ over 50 years

98. Rank
(1)☐ Civilian
(2)☐ Airman
(3)☐ Junior NCO
(4)☐ Senior NCO
(5)☐ Officer

99. Years in Service
(1)☐ less than 2 years
(2)☐ 2 – 4 years
(3)☐ 5 – 10 years
(4)☐ 11 – 15 years
(5)☐ more than 15 years

100. Experience in Present Position
(1)☐ less than 1 year
(2)☐ 1 – 2 year(s)
(3)☐ 3 – 4 years
(4)☐ 5 – 7 years
(5)☐ more than 7 years

101. Operational Function
(1)☐ Leadership Personnel (starting at operations officer)
(2)☐ Air Crew
(3)☐ Aircraft Technical Personnel
(4)☐ Support Personnel / Other

102. Level of Education
(1)☐ Hauptschulabschluss [High School Degree – standard level]
(2)☐ Realschulabschluss [High School Degree – advanced level]
(3)☐ Abitur / Fachabitur [High School Degree – university qualification]
(4)☐ University / College Degree
(5)☐ No Degree

[The German school system is not directly transferable to the U.S. school system]

103. Level of Computer Competency
(1)☐ Beginner
(2)☐ Intermediate
(3)☐ Expert

104. Level of Experience with Distance Learning
(1)☐ Beginner
(1)☐ Intermediate
(2)☐ Expert

Appendix F

Research Instrument – German Version

Fernausbildung für Crew Resource Management Training in der militärischen Luftfahrt

Anleitung: Dieser Teil des Fragebogens wurde entwickelt, um Erkenntnisse über das Crew Resource Management (CRM) Training zu erlangen. Es gibt keine richtigen oder falschen Antworten. Nach dem Lesen der einzelnen Positionen, geben Sie bitte Ihre persönliche Meinung dazu ab. Bitte lesen Sie die Antwortmöglichkeiten aufmerksam durch. Dann schreiben Sie für jede Position die Zahl der Antwortmöglichkeit in das Kästchen, die Ihrem Gefühl am ehesten entspricht.

Für das Ausfüllen des Fragebogens gibt es keine Zeitbegrenzung. Versuchen Sie dennoch, sich nicht zu lange mit einer einzelnen Position zu beschäftigen. Ihre erste Reaktion auf die einzelne Position wird gewöhnlich am ehesten zutreffen.

Teil I:

Dieser Teil des Fragebogens ermittelt **Ihre persönliche Meinung** über den Bereich Flugbetrieb in der Luftwaffe. Bitte bewerten Sie jede Aussage, indem Sie eine Zahl der nachfolgenden Skala neben jede Aussage schreiben.

1	2	3	4	5
sehr gering	gering	angemessen	hoch	sehr hoch

Persönliche **Zufriedenheit** über Ihre Arbeit im Bereich Flugbetrieb des Geschwaders:

1. ☐ theoretische und praktische Ausbildung im Bereich Flugbetrieb.
2. ☐ Praxisnähe der Ausbildungsinhalte im Bereich Flugbetrieb.
3. ☐ Qualität der Grundlagenausbildung im Bereich Flugbetrieb.
4. ☐ Kompetenz der Ausbilder im Bereich Flugbetrieb.
5. ☐ Präsenz und Ansprechbarkeit der Vorgesetzten.
6. ☐ Führung / Gestaltung des täglichen Dienstbetriebs im Bereich Flugbetrieb.
7. ☐ Zufriedenheit mit den Vorschriften im Bereich Flugbetrieb.
8. ☐ Zusammenarbeit / Teamwork im Bereich Flugbetrieb.

Bitte geben Sie zu jeder Aussage eine Bewertung ab und schreiben eine Zahl der nachfolgenden Skala neben jede Aussage.

1	2	3	4	5
stimme **absolut nicht** zu	stimme **teilweise nicht** zu	enthalte mich	stimme **teilweise** zu	stimme **voll und ganz** zu

9. ☐ Vorgesetzte im Flugbetrieb haben immer ein offenes Ohr und kümmern sich um unsere Belange.
10. ☐ Ich kenne meine Ansprechpartner hinsichtlich aller Arbeits-/Flugsicherheitsfragen.
11. ☐ Ich kann mit Vorgesetzten immer über Probleme in meinem Aufgabenbereich sprechen.
12. ☐ Unsere Ausbildung hat uns gut vorbereitet, als Team zu arbeiten.
13. ☐ Ich werde durch Vorgesetzte und Kameraden ermutigt, sicherheitsrelevante Missstände anzusprechen.
14. ☐ Ich fühle mich in meinem Arbeitsumfeld wohl.
15. ☐ Vorgesetzte reagieren angemessen auf problematische bzw. schwierige Mitarbeiter.
16. ☐ Ich bin stolz, in meinem Luftwaffengeschwader zu arbeiten.
17. ☐ Meine Führung stellt dienstliche Notwendigkeiten nie vor Arbeitsplatz- / Flugsicherheit.
18. ☐ Meine Vorschläge zur Arbeitsplatz- / Flugsicherheit werden von meinen Vorgesetzten berücksichtigt.
19. ☐ Meine Ausbildung war an der Praxis orientiert.
20. ☐ Meine Arbeitskollegen / Kameraden halten sich an die Vorschriften.
21. ☐ In meinem Luftwaffengeschwader herrscht eine positive Einstellung.
22. ☐ Meine Führung unterstützt mich bei meiner täglichen Arbeit.
23. ☐ Ich mag meine Arbeit.
24. ☐ Unser Luftwaffengeschwader hat eine positive Sicherheitskultur.

Teil II: Einstellung zur Betriebsführung

Bitte geben Sie zu jeder Aussage eine Bewertung ab und schreiben eine Zahl der nachfolgenden Skala neben jede Aussage.

1	2	3	4	5
stimme **absolut nicht** zu	stimme **nicht** zu	enthalte mich	stimme **teilweise** zu	stimme **voll und ganz** zu

25. ☐ Im täglichen Dienstbetrieb sollten Arbeitsprozesse hinterfragt werden.
26. ☐ Müdigkeit hat keinen Einfluss auf meine Leistungsfähigkeit.
27. ☐ Vorschriften sollten immer eingehalten werden, auch wenn der Mitarbeiter glaubt, dass ein Verstoß im Sinne des Dienstherrn wäre.
28. ☐ Ich erwarte, an Entscheidungen, die meinen Arbeitsbereich betreffen, beteiligt zu werden.
29. ☐ Ältere Kameraden / Mitarbeiter verdienen besondere Rechte oder Privilegien.
30. ☐ Ich teile anderen Kameraden / Mitarbeitern mit, wenn ich an meine Leistungsgrenze stoße.
31. ☐ Es ist ein Zeichen von Schwäche, wenn Vorgesetzte Vorschläge von Mitarbeitern annehmen.
32. ☐ Meine Urteilsfähigkeit ist unabhängig von meinem persönlichen Stresspegel.
33. ☐ Junge Kameraden / Mitarbeiter sollten die Entscheidung erfahrener Kameraden / Mitarbeiter oder die der Vorgesetzten nicht in Frage stellen.
34. ☐ Es ist besser, die Meinung anderer Kameraden / Mitarbeiter anzunehmen, als seine eigene Meinung zu vertreten.
35. ☐ Unter Stress mache ich mehr Fehler.
36. ☐ Wenn ich ein Problem am Arbeitsplatz entdecke, spreche ich es an, egal wen es betrifft.
37. ☐ Ich schäme mich, wenn ich Fehler vor anderen mache.
38. ☐ In ungewöhnlichen Situationen verlasse ich mich auf die Entscheidung meiner Vorgesetzten.
39. ☐ Bei Müdigkeit und unter Stress arbeite ich weniger effektiv.
40. ☐ Die Zusammenarbeit mit weniger erfahrenen oder weniger fähigen Mitarbeitern / Kameraden beeinflusst meine Leistungsfähigkeit nicht.
41. ☐ Zur Konfliktlösung sollten Mitarbeitern / Kameraden offen diskutieren.
42. ☐ Mitarbeiter / Kameraden sollten sich gegenseitig auf Anzeichen von Stress und Müdigkeit überwachen.
43. ☐ Persönliche Probleme können einen negativen Einfluss auf meine Leistung haben.

44. ☐ Professionalität bedeutet, sich nicht von persönlichen Problemen beeinflussen zu lassen.
45. ☐ Alle Arbeitsabläufe sollten schriftlich festgelegt werden.
46. ☐ Mitarbeiter / Kameraden sollten ihre Probleme mit der Stressbelastung oder mit der Gesundheit am Arbeitsplatz offen ansprechen.
47. ☐ Für die Sicherheit sind gute Kommunikation und Zusammenarbeit am Arbeitsplatz genau so wichtig wie fachliche Fähigkeiten.
48. ☐ Gute Zusammenarbeit bedeutet, dass man sich auf andere Mitarbeiter / Kameraden einstellen kann.
49. ☐ Wenn am Arbeitsplatz weniger zu tun ist, entspanne ich mich lieber als mich mit kleinen Aufgaben zu beschäftigen.
50. ☐ Ein wahrer Profi macht keine Fehler.
51. ☐ Wie häufig kommt es in ihrem Arbeitsumfeld vor, dass Mitarbeiter / Kameraden Angst davor haben, Uneinigkeit mit Vorgesetzten offen anzusprechen?
    1. sehr häufig **2**. häufig **3**. manchmal **4**. selten **5**. sehr selten
52. ☐ Wie oft fühlen Sie sich nervös und angespannt bei der Arbeit?
    1. immer **2**. häufig **3**. manchmal **4**. selten **5**. nie

<u>Teil III: Werte und Ziele im Arbeitsumfeld</u>

Bitte geben Sie zu jeder Aussage eine Bewertung ab und schreiben eine Zahl der nachfolgenden Skala neben jede Aussage.

1	2	3	4	5
gar nicht wichtig	weniger wichtig	nicht entscheidend	wichtig	sehr wichtig

Denken Sie bei den Aussagen an den für Sie *idealen Arbeitsplatz* und denken Sie weniger über Ihren derzeitigen Arbeitsplatz nach. In Bezug auf Ihren *idealen Arbeitsplatz*, wie wichtig ist für Sie:

53. ☐ eine gute persönliche Beziehung zu Mitarbeitern / Kameraden pflegen
54. ☐ abwechslungsreiche und neue Aufgaben
55. ☐ ein gutes Verhältnis zu meinen direkten Vorgesetzten
56. ☐ Berufszufriedenheit durch fordernde Aufgaben
57. ☐ die Aufgaben im Beruf genau kennen, um keine Überraschungen zu erleben
58. ☐ genügend Freizeit und Zeit für das Privatleben haben
59. ☐ gute Zusammenarbeit mit Mitarbeitern / Kameraden
60. ☐ höchste Perfektion am Arbeitsplatz

61. ☐ fristgerechtes Arbeiten

Teil IV: Führungsstile

Bitte lesen Sie die nachfolgenden vier Aussagen zu den jeweiligen Führungsstilen und beantworten die nachfolgenden 2 Fragen.

Stil 1 Entscheidungen werden von Vorgesetzten üblicherweise prompt getroffen und den Untergebenen klar und deutlich mitgeteilt. Vorgesetzte erwarten, dass die Entscheidungen loyal und ohne Probleme umgesetzt werden.

Stil 2 Entscheidungen werden von Vorgesetzten üblicherweise prompt getroffen. Vor der Umsetzung werden den Untergebenen die Entscheidungen in vollem Umfang erklärt. Dabei werden Gründe für die Entscheidungen dargestellt und Fragen diesbezüglich beantwortet.

Stil 3 Bevor Entscheidungen getroffen werden, werden sie von Vorgesetzten üblicherweise mit den Mitarbeitern beraten und besprochen. Vorgesetzte erwarten dann, dass die Entscheidungen von allen Mitarbeitern loyal und konsequent umgesetzt werden, egal ob der Rat der Mitarbeiter angenommen wurde oder auch nicht.

Stil 4 Vorgesetzte treffen sich mit ihren Mitarbeitern zu einer Besprechung, um Probleme und anstehende wichtige Entscheidungen offen mit der Gruppe zu diskutieren. Vorgesetzte akzeptieren dann die von der Gruppe mehrheitlich getroffene Entscheidung zur Vorgehensweise.

62. **Stil** ☐ Unter welchem Führungsstil würden Sie *am liebsten* arbeiten?

63. **Stil** ☐ Mit welchem Führungsstil werden Sie in Ihrem Arbeitsumfeld am häufigsten konfrontiert?

Anleitung: Dieser Teil des Fragebogens wurde entwickelt, um Erkenntnisse über die Vorlieben in der Fernausbildung und die Einstellung zum Lernen allgemein zu erlangen. Es gibt keine richtigen oder falschen Antworten. Nach dem Lesen der einzelnen Positionen, geben Sie bitte Ihre persönliche Meinung dazu ab. Bitte lesen Sie die Antwortmöglichkeiten aufmerksam durch. Dann schreiben Sie für jede Position die Zahl der Antwortmöglichkeit in das Kästchen, die Ihrem Gefühl am ehesten entspricht.

Für das Ausfüllen des Fragebogens gibt es keine Zeitbegrenzung. Versuchen Sie dennoch, sich nicht zu lange mit einer einzelnen Position zu beschäftigen. Ihre erste Reaktion auf die einzelne Position wird gewöhnlich am ehesten zutreffen.

Bitte nutzen Sie diesen Antwortschlüssel für die unten aufgeführten Positionen:

1. **Trifft für mich überhaupt nicht zu**
2. **Trifft für mich weniger zu**
3. **Trifft für mich halbwegs zu**
4. **Trifft für mich überwiegend zu**
5. **Trifft für mich voll und ganz zu**

Positionen:

64. ☐ Ich kann mit E-Mails umgehen.
65. ☐ Ich lerne gerne neue Kommunikationswege über das Internet kennen.
66. ☐ Es fällt mir leicht, am Computer zu schreiben.
67. ☐ Bei E-Mails habe ich Schwierigkeiten mit dem Öffnen oder Anhängen von Dateien.
68. ☐ Ich mag den Umgang mit Computern.
69. ☐ Ich kann gesuchte Informationen im Internet schnell finden.
70. ☐ Ich kann sehr gut lesen.
71. ☐ Ich kann meine Ideen schriftlich gut ausdrücken.
72. ☐ Ich bin sicher im Umgang mit Grammatik und Satzzeichen.
73. ☐ Ich habe leichten Zugang zu der benötigten Ausrüstung für Fernausbildung (Computer, Internetzugang).
74. ☐ Wenn ich technische Unterstützung benötige, dann kann ich sie bekommen.
75. ☐ Zum Lernen benötige ich viel direkten persönlichen Kontakt mit meiner Lerngruppe im Klassenraum.
76. ☐ Wenn ich Hilfe benötige, frage ich danach.
77. ☐ Ich bin motiviert, durch Fernausbildung zu lernen.

78. ☐ Ich kann meine Zeit zum Lernen gut organisieren.
79. ☐ Wenn ich etwas lernen möchte, dann finde ich einen Weg dafür.
80. ☐ Ich kann sehr gut allein lernen.
81. ☐ Ich habe Spaß, neue Dinge zu lernen.
82. ☐ Wenn ich mich entschieden habe etwas zu lernen, finde ich auch die Zeit dafür, unabhängig davon, wie beschäftigt ich bin.
83. ☐ Ich finde es schwierig, den Inhalt von Texten, die ich gerade lese, auch zu verstehen.
84. ☐ Ich erkenne, wann ich zu einem Thema mehr lernen muss.
85. ☐ Ich kann gut mit schriftlichen Unterlagen lernen.
86. ☐ Ich kann mir viele Wege vorstellen, etwas Neues zu lernen.
87. ☐ Ich denke darüber nach, wie die Dinge, die ich lerne, in meine persönliche Planung passen werden.
88. ☐ Ich suche gern die Antwort auf schwierige Fragen.
89. ☐ Wenn ich mich dazu entschlossen habe, etwas herauszufinden, dann tue ich das auch.
90. ☐ Ich kann mich selber motivieren, für mich wichtige Dinge zu erledigen.
91. ☐ Ich kann sehr gut Probleme lösen.
92. ☐ In Lerngruppen werde ich der Anführer.
93. ☐ Mein Lernfortschritt ist meine eigene Verantwortung – niemand anderes kann dies für mich tun.
94. ☐ Ich weiß, wo ich die Informationen bekomme, die ich gerade benötige.
95. ☐ Ich probiere gern neue Dinge aus, auch wenn ich nicht sicher bin, wie sie sich am Ende entwickeln.

Hintergrundinformationen

96. Geschlecht ☐ männlich ☐ weiblich

96. Alter

☐ unter 21
☐ 22 – 30 Jahre
☐ 31 – 41 Jahre
☐ 42 – 50 Jahre
☐ über 50 Jahre

97. Dienstgrad

☐ Angestellter
☐ Mannschaft
☐ Unteroffizier
☐ Portopeeunteroffizier
☐ Offizier

99. Dienstzeit

☐ weniger als 2 Jahre
☐ 2 – 4 Jahre
☐ 5 – 10 Jahre
☐ 11 – 15 Jahre
☐ mehr als 15 Jahre

100. Erfahrung in derzeitiger Position / Verwendung

☐ weniger als 1 Jahr
☐ 1 – 2 Jahre
☐ 3 – 4 Jahre
☐ 5 – 7 Jahre
☐ mehr als 7 Jahre

101. Position / Funktion

☐ Führungspersonal (ab Einsatzoffizier)
☐ Luftfahrzeugbesatzung
☐ Luftfahrzeugtechnisches Personal
☐ Unterstützungspersonal / sonstiges Personal

102. Schulausbildung

☐ Hauptschulabschluss
☐ Realschulabschluss
☐ Abitur / Fachabitur
☐ Hochschul-/Fachhochschulabschluss
☐ kein Schulabschluss

103. Fähigkeiten im Umgang mit Computern

☐ Anfänger
☐ Grundkenntnisse
☐ Fortgeschrittener

104. Erfahrung mit Fernausbildung

☐ Anfänger
☐ Grundkenntnisse
☐ Fortgeschrittener

Appendix G

Letter of Approval

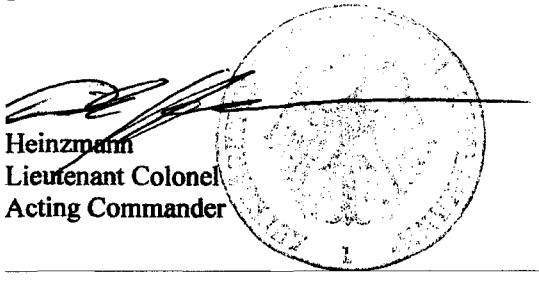
Aufklärungsgeschwader 51 "Immelmann"
Geschwaderstab
-Kommodore-

24848 Kropp, 09.08.2007
Kai-Uwe-von-Hassel Kaserne
Bennebeker Chaussee
Bundesrepublik Deutschland
Tel.: +49- 4684- 30- 1000
Fax: +49- 4684- 30- 1009

LETTER OF APPROVAL

Lieutenant Colonel Andreas C. Bruemmer intends to conduct a study within German Air Force in partial fulfillment of the requirements for the degree of Doctor of Philosophy with Northcentral University.
The study is to explore distance learning for Crew Resource Management training in military aviation and the research results are in the viable interest of the German Air Force.

For this the Tactical Reconnaissance Wing 51 "Immelmann" supports Lieutenant Colonel Bruemmer in the ambitious goal. I give approval to conduct the study according to the proposed procedure and the selection of participants. Data collected are released for scientific analysis as long as anonymity of participants and confidentiality of data is guaranteed and no national or international laws and regulations are violated.



Heinzmann
Lieutenant Colonel
Acting Commander

Appendix H

Cumulative Scores for the Acceptance of Distance Learning Items

Cumulative Scores for the Acceptance of Distance Learning Items

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
90	2	1.5	1.5
91	1	0.7	2.2
97	1	0.7	2.9
11	1	0.7	3.6
104	4	2.9	6.6
105	2	1.5	8.0
107	1	.7	8.8
108	3	2.2	10.9
109	2	1.5	12.4
110	2	1.5	13.9
111	4	2.9	16.8
112	3	2.2	19.0
113	1	0.7	19.7
114	1	0.7	20.4
115	3	2.2	22.6
116	2	1.5	24.1
117	1	0.7	24.8
118	1	0.7	25.5
119	11	8.0	33.6
120	3	2.2	35.8

Cumulative Scores of the Acceptance of Distance Learning Items (continued)

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
121	4	2.9	38.7
122	6	4.4	43.1
123	6	4.4	47.4
124	4	2.9	50.4
125	3	2.2	52.6
126	2	1.5	54.0
127	5	3.6	57.7
128	5	3.6	61.3
129	6	4.4	65.7
130	6	4.4	70.1
131	4	2.9	73.0
132	2	1.5	74.5
133	5	3.6	78.1
134	1	0.7	78.8
135	3	2.2	81.0
136	6	4.4	85.4
138	5	3.6	89.1
140	1	0.7	89.8
141	3	2.2	92.0
142	1	0.7	92.7

Cumulative Scores of the Acceptance of Distance Learning Items (continued)

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
144	2	1.5	94.2
145	2	1.5	95.6
146	1	0.7	96.4
147	1	0.7	97.1
148	3	2.2	99.3
152	1	0.7	100.0
Total	137	100.0	100.0

Appendix I

Cumulative Scores for the Attitude to CRM Training Items

Cumulative Scores for the Attitude to CRM Training Items

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
186	1	0.7	0.7
204	1	0.7	1.5
209	2	1.5	2.9
210	1	0.7	3.6
212	1	0.7	4.4
213	4	2.9	7.3
214	4	2.9	10.2
215	1	0.7	10.9
216	1	0.7	11.7
217	3	2.2	13.9
218	1	0.7	14.6
219	1	0.7	15.3
220	5	3.6	19.0
222	2	1.5	20.4
223	4	2.9	23.4
225	4	2.9	26.3
226	1	0.7	27.0
227	1	0.7	27.7
228	2	1.5	29.2
229	5	3.6	32.8

Cumulative Scores of the Attitude to CRM Training Items (continued)

Cumulative Scores	Frequency	Percentage	Cumulative Percentage
230	3	2.2	35.0
231	3	2.2	37.2
232	3	2.2	39.4
233	2	1.5	40.9
234	1	0.7	41.6
235	4	2.9	44.5
236	7	5.1	49.6
237	5	3.6	53.3
238	3	2.2	55.5
239	4	2.9	58.4
240	10	7.3	65.7
241	5	3.6	69.3
242	5	3.6	73.0
243	4	2.9	75.9
244	1	0.7	76.6
245	2	1.5	78.1
246	3	2.2	80.3
247	3	2.2	82.5
248	3	2.2	84.7
249	2	1.5	86.1

Cumulative Scores of the Attitude to CRM Training Items (continued)

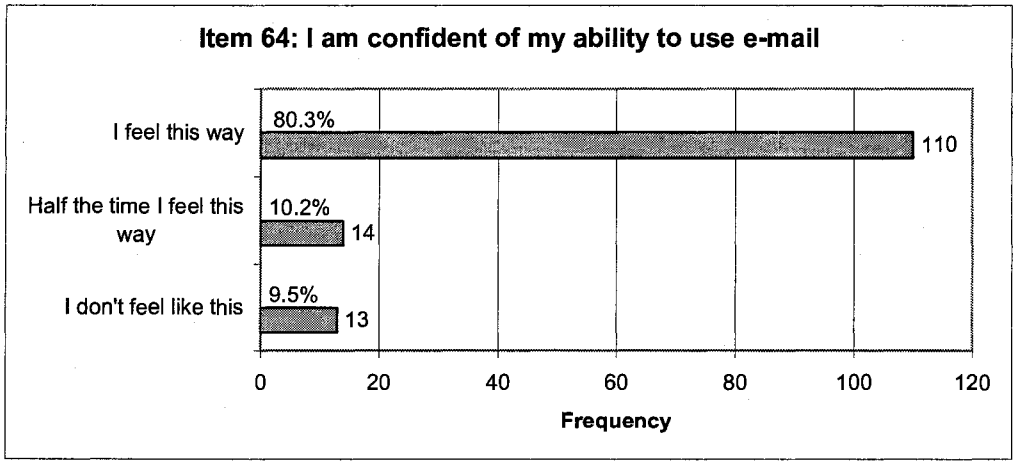
Cumulative Scores	Frequency	Percentage	Cumulative Percentage
250	1	0.7	86.9
251	2	1.5	88.3
252	2	1.5	89.8
253	1	0.7	90.5
254	3	2.2	92.6
255	1	0.7	93.4
256	3	2.2	95.6
260	1	0.7	96.3
262	2	1.5	97.8
263	1	0.7	98.5
264	1	0.7	99.3
271	1	0.7	100.0
Total	137	100.0	100.0

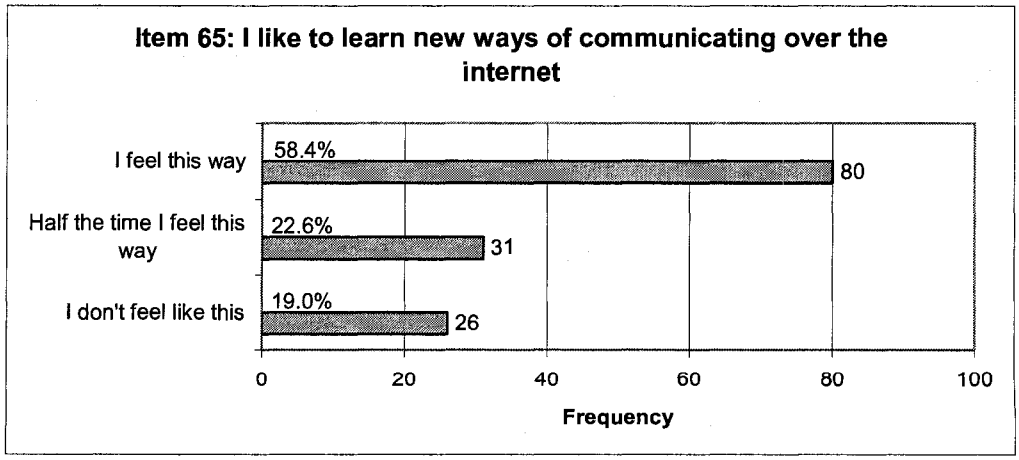
Appendix J

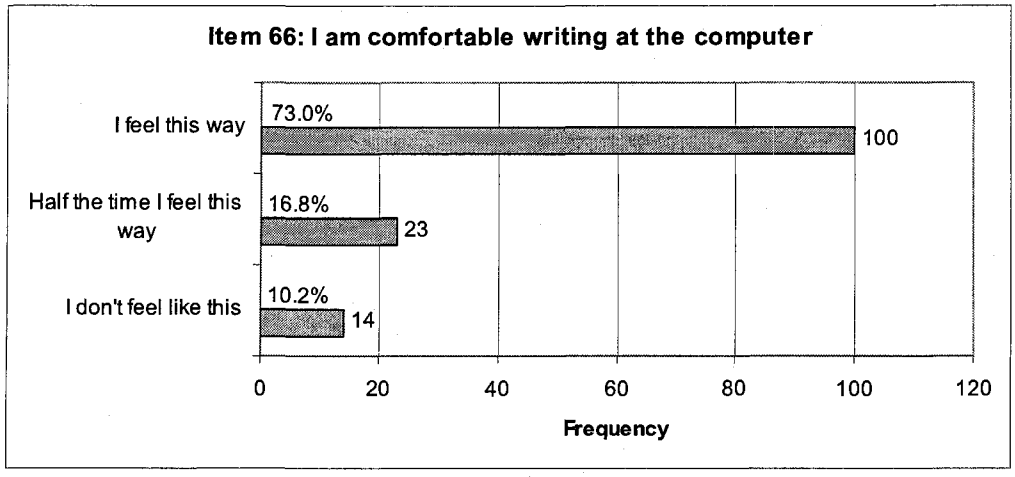
Frequency Summary for the Acceptance of Distance Learning Items

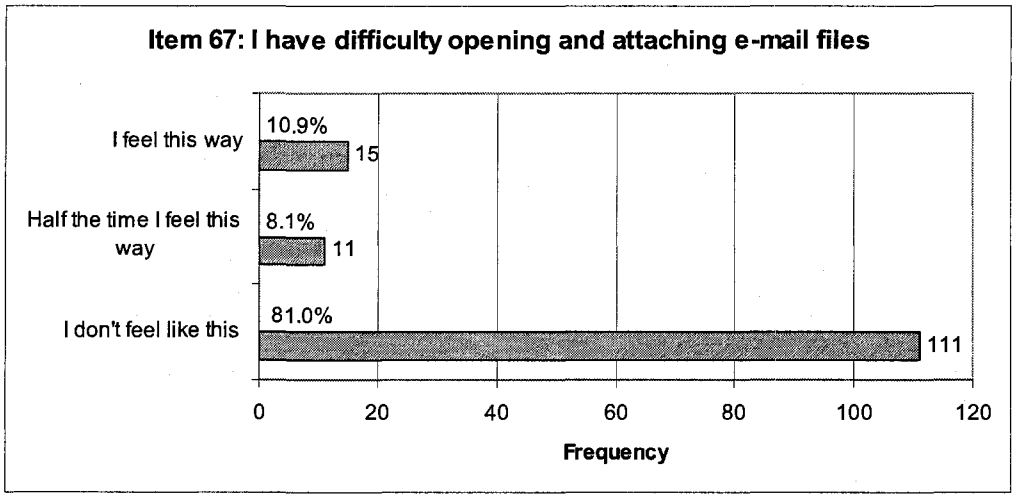
This Appendix provides a frequency summary of all items of the variable acceptance of distance learning. Items on the survey are answered such that one indicates disagreement using a 5-point scale, the midpoint (three) is neutral, and five indicates agreement. The ranking categories were collapsed to a 3-point ranking using the following code keys: (1) I don't feel like this, (2) Half the time I feel this way, (3) I feel this way. Items were organized according to the identified domains technical readiness and readiness for self-directed learning.

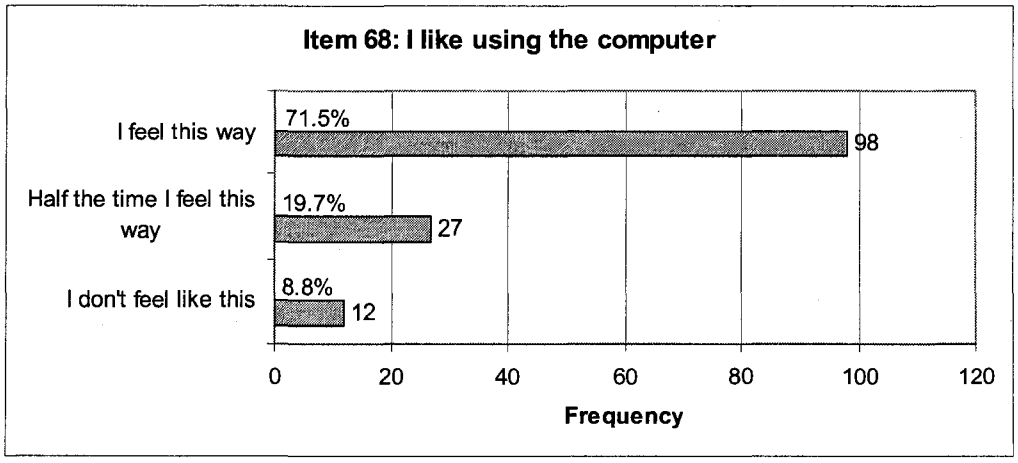
Items for Technical Readiness

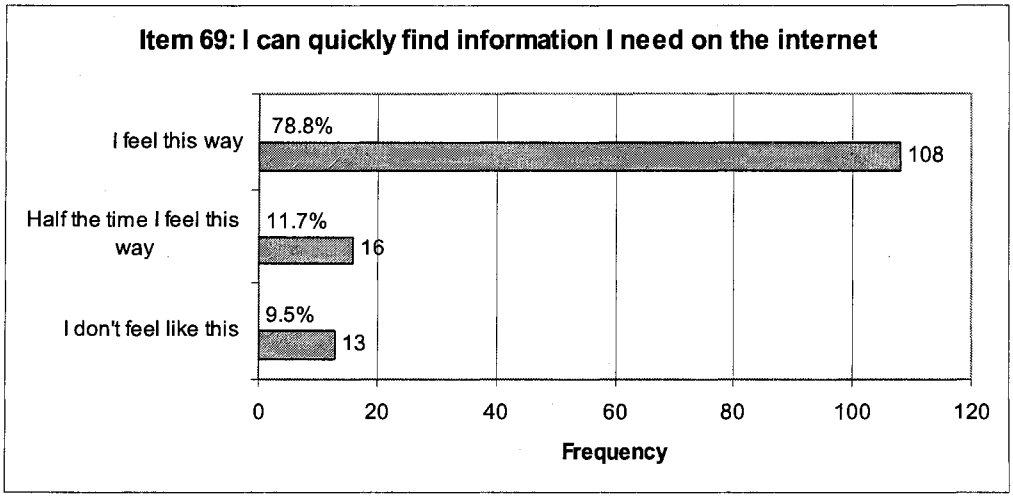


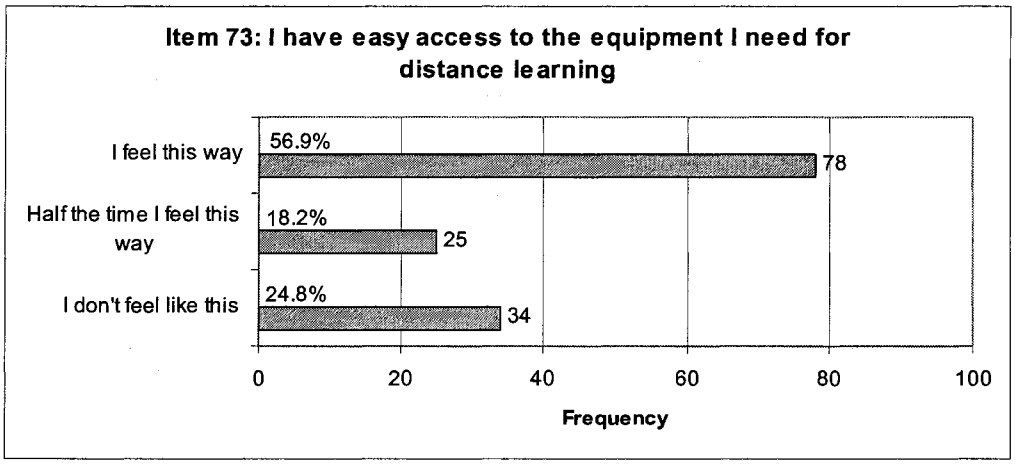


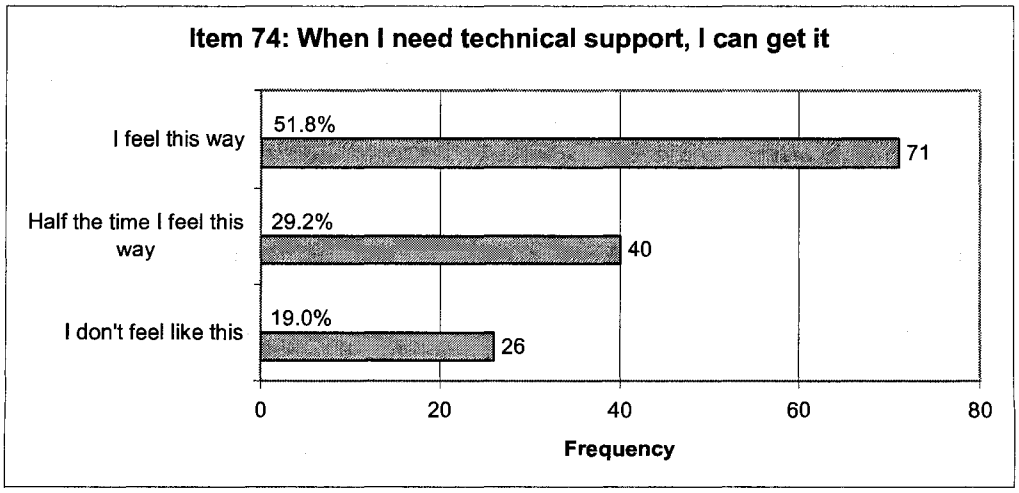

Item 66: I am comfortable writing at the computer
I feel this way
Half the time I feel this way
I don't feel like this
73.0%
100
16.8%
23
10.2%
14
0
20
40
60
80
100
120
Frequency


Item 67: I have difficulty opening and attaching e-mail files
I feel this way
Half the time I feel this way
I don't feel like this
10.9%
15
8.1%
11
81.0%
111
0
20
40
60
80
100
120
Frequency

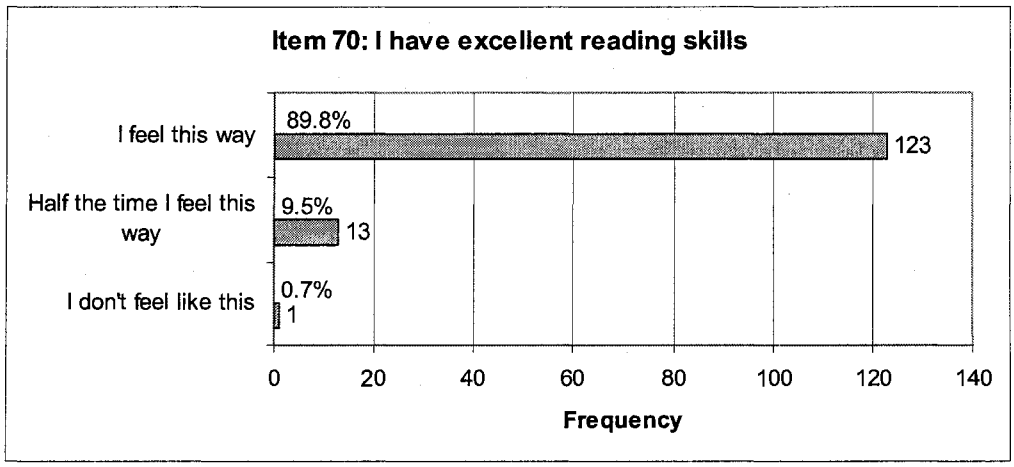

Item 68: I like using the computer
I feel this way
Half the time I feel this way
I don't feel like this
71.5%
98
19.7%
27
8.8%
12
0
20
40
60
80
100
120
Frequency

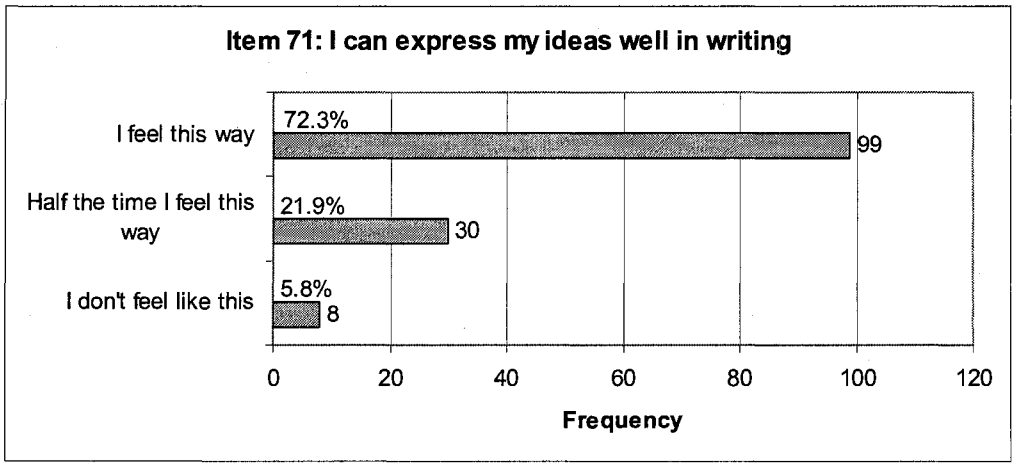

Item 69: I can quickly find information I need on the internet
I feel this way
Half the time I feel this way
I don't feel like this
78.8%
108
11.7%
16
9.5%
13
0
20
40
60
80
100
120
Frequency

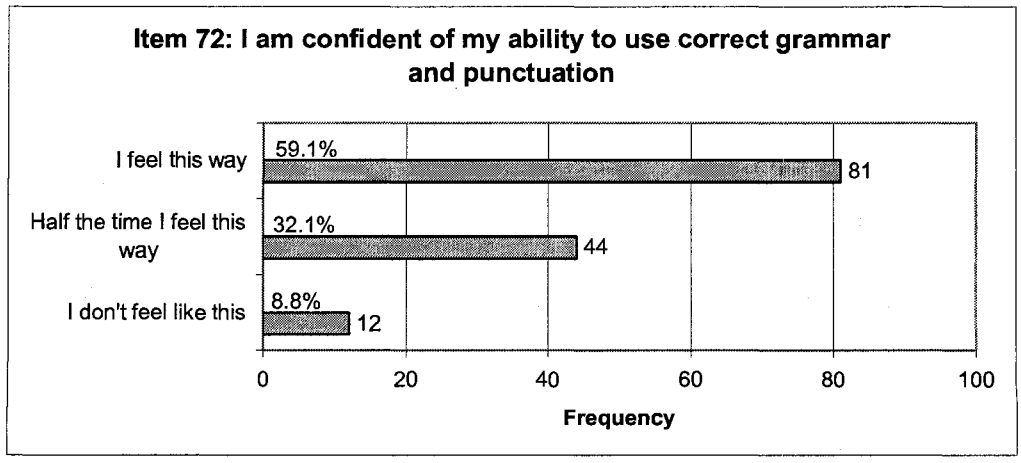

Item 73: I have easy access to the equipment I need for distance learning
I feel this way
Half the time I feel this way
I don't feel like this
56.9%
78
18.2%
25
24.8%
34
0
20
40
60
80
100
Frequency

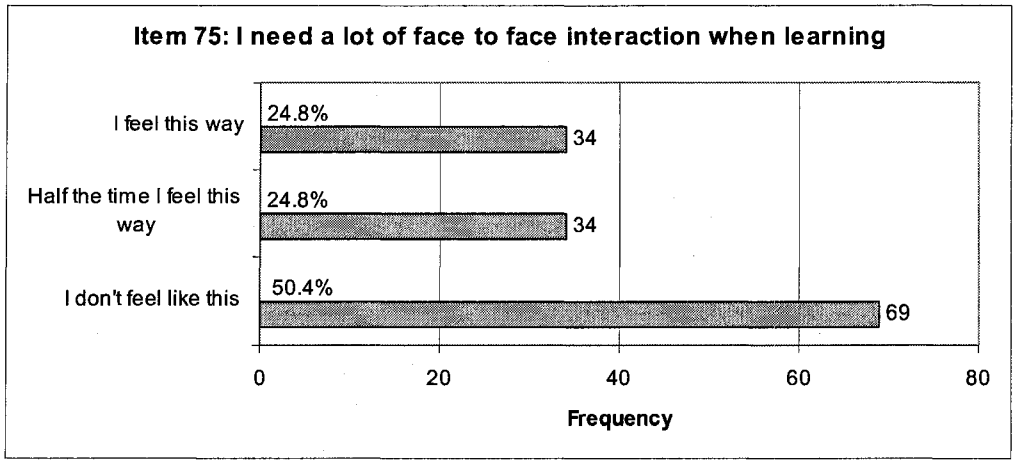

Item 74: When I need technical support, I can get it
I feel this way
Half the time I feel this way
I don't feel like this
51.8%
71
29.2%
40
19.0%
26
0
20
40
60
80
Frequency

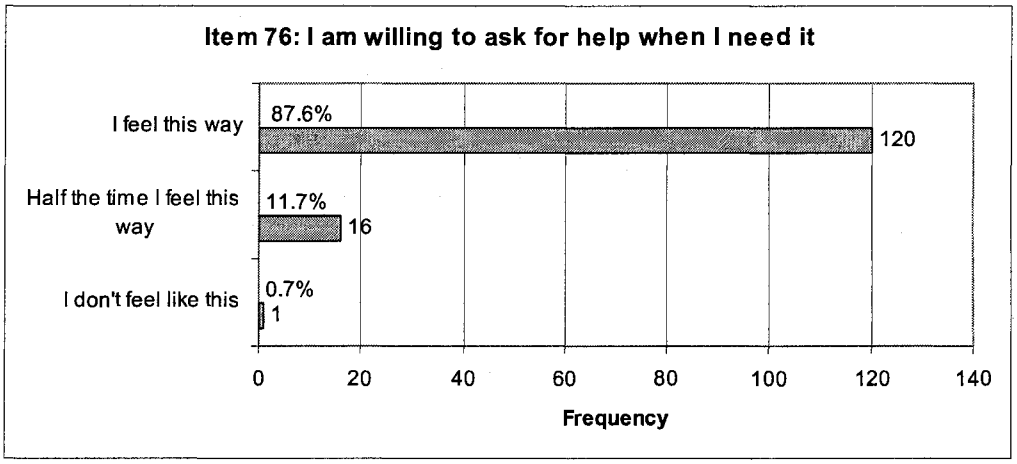
Items for Self-Directed Learning Readiness

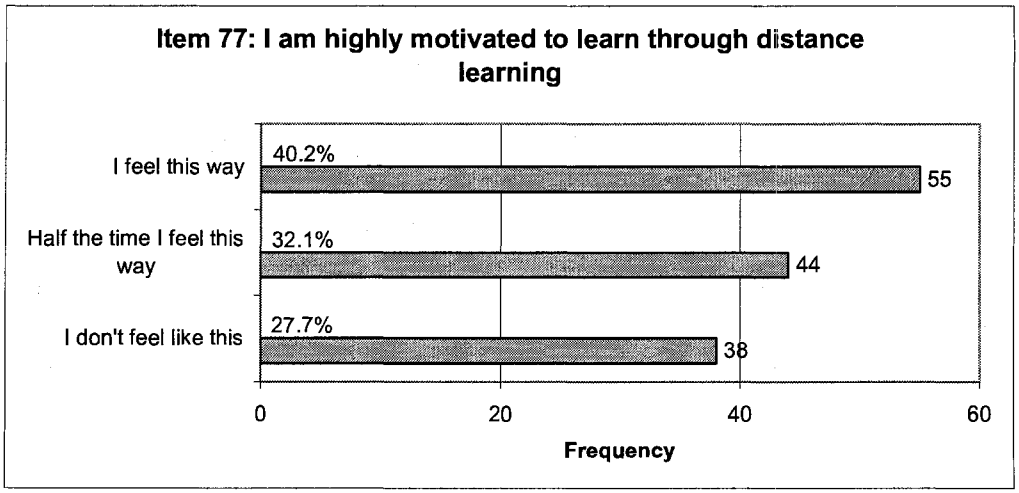


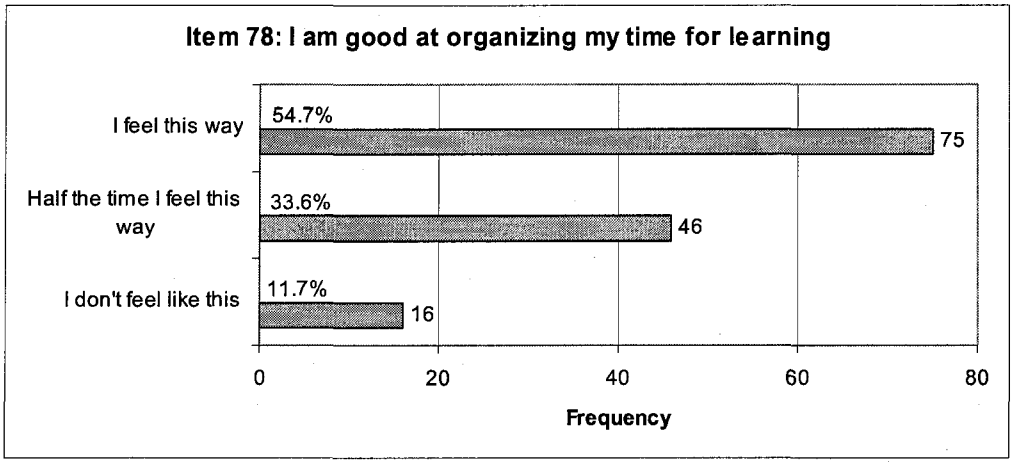


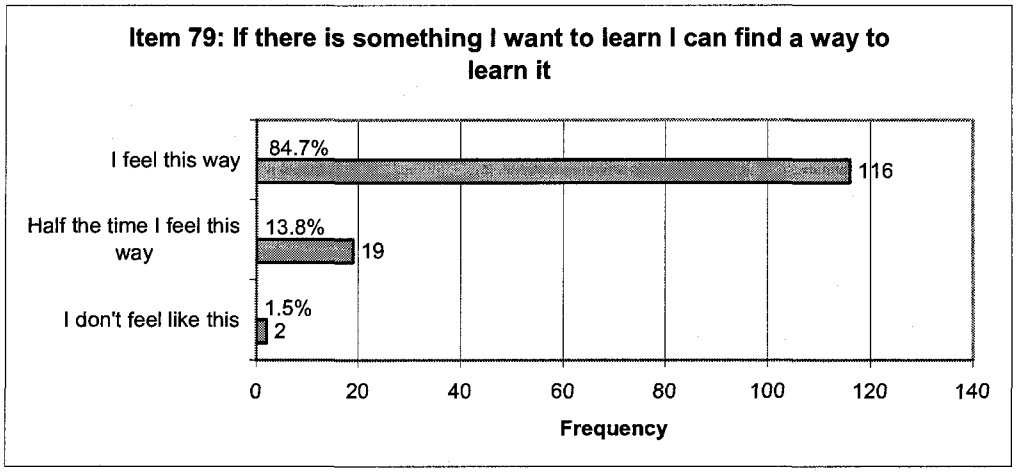


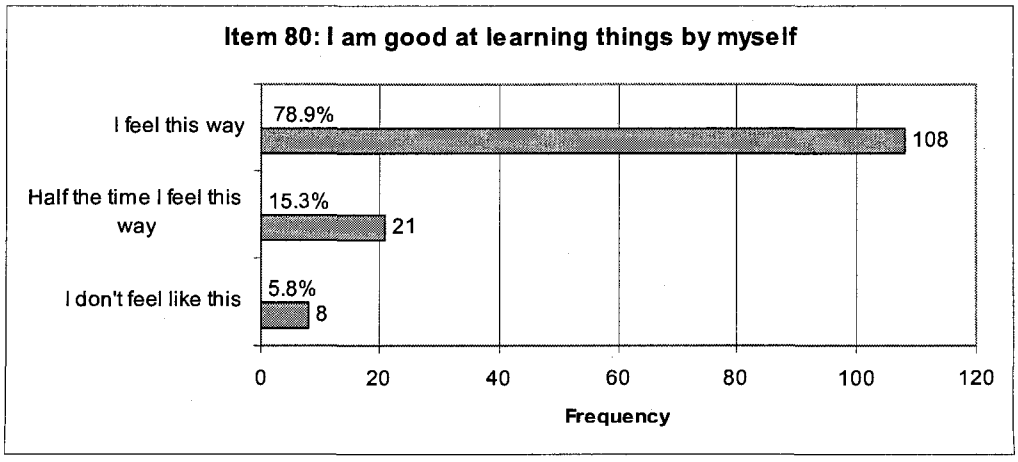

Item 75: I need a lot of face to face interaction when learning
I feel this way
Half the time I feel this way
I don't feel like this
24.8%
34
24.8%
34
50.4%
69
0
20
40
60
80
Frequency

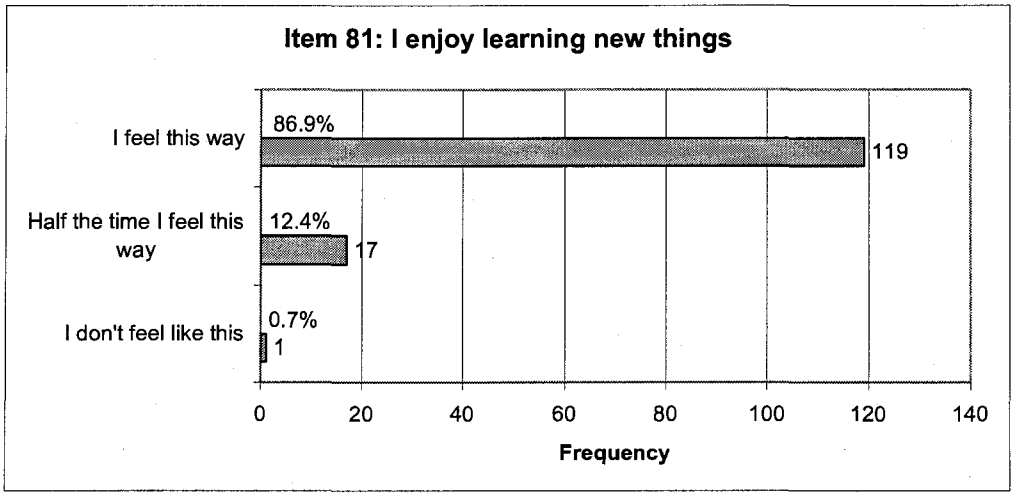

Item 76: I am willing to ask for help when I need it
I feel this way
Half the time I feel this way
I don't feel like this
87.6%
120
11.7%
16
0.7%
1
0
20
40
60
80
100
120
140
Frequency

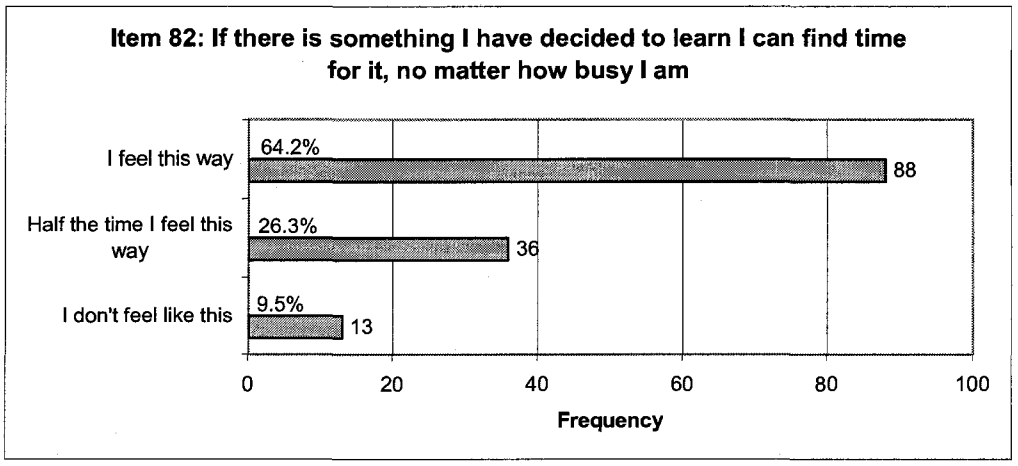

Item 77: I am highly motivated to learn through distance learning
I feel this way
Half the time I feel this way
I don't feel like this
40.2%
55
32.1%
44
27.7%
38
0
20
40
60
Frequency

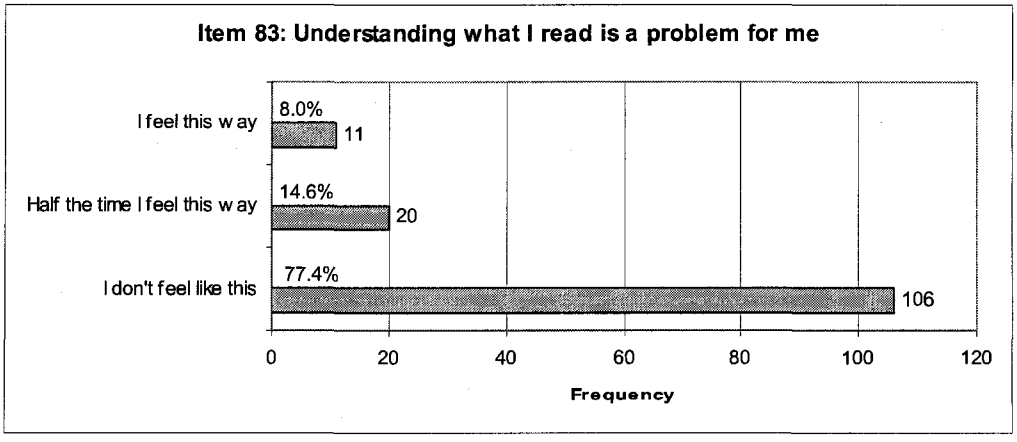

Item 78: I am good at organizing my time for learning
I feel this way
Half the time I feel this way
I don't feel like this
54.7%
75
33.6%
46
11.7%
16
0
20
40
60
80
Frequency

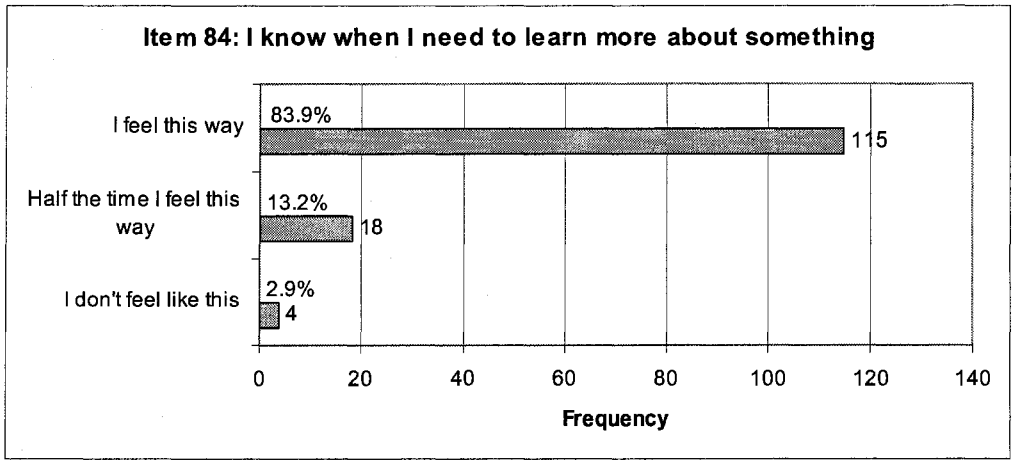

Item 79: If there is something I want to learn I can find a way to learn it
I feel this way
Half the time I feel this way
I don't feel like this
84.7%
116
13.8%
19
1.5%
2
0
20
40
60
80
100
120
140
Frequency

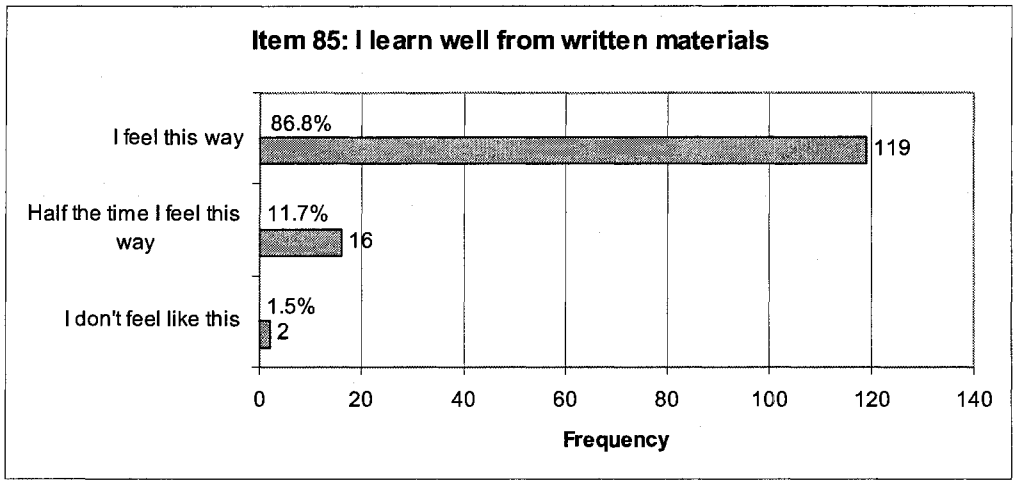

Item 80: I am good at learning things by myself
I feel this way
Half the time I feel this way
I don't feel like this
78.9%
108
15.3%
21
5.8%
8
0
20
40
60
80
100
120
Frequency

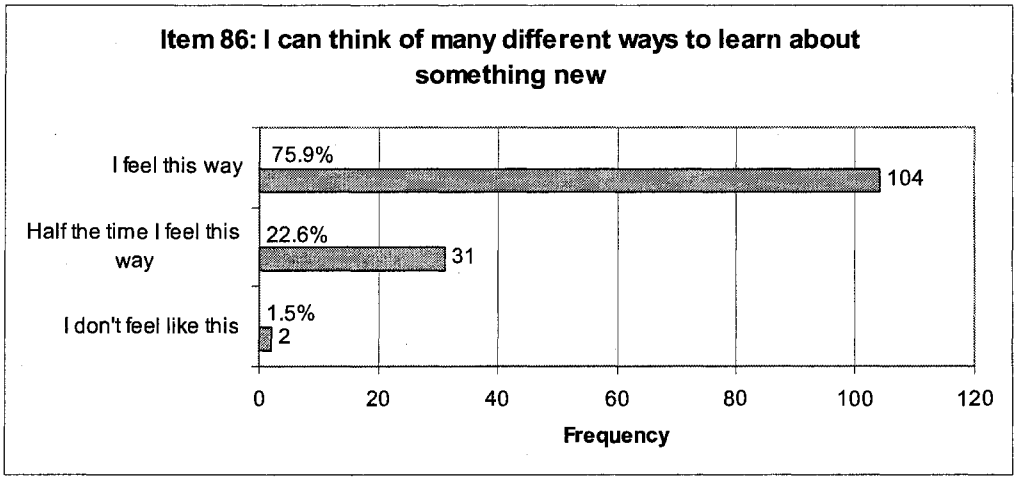

Item 81: I enjoy learning new things
I feel this way
Half the time I feel this way
I don't feel like this
86.9%
119
12.4%
17
0.7%
1
0
20
40
60
80
100
120
140
Frequency

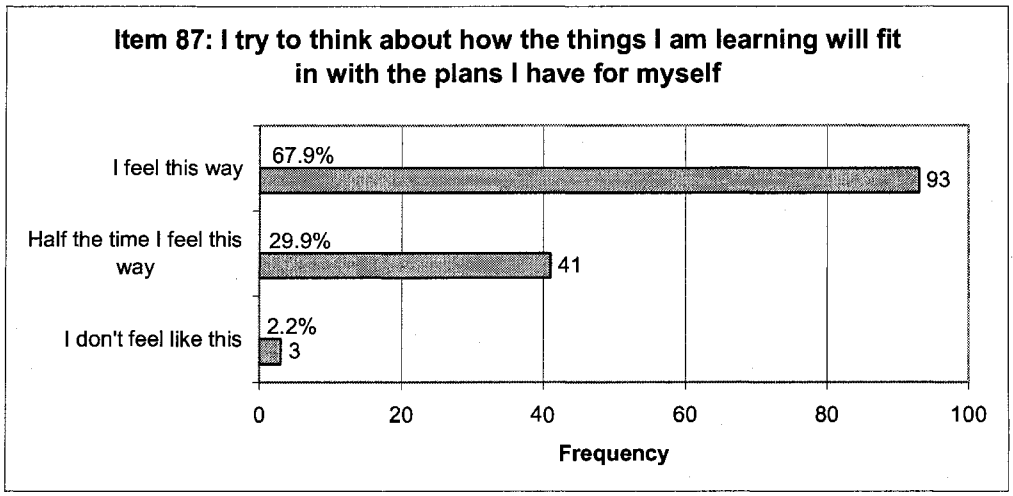

Item 82: If there is something I have decided to learn I can find time for it, no matter how busy I am
I feel this way
Half the time I feel this way
I don't feel like this
64.2%
88
26.3%
36
9.5%
13
0
20
40
60
80
100
Frequency

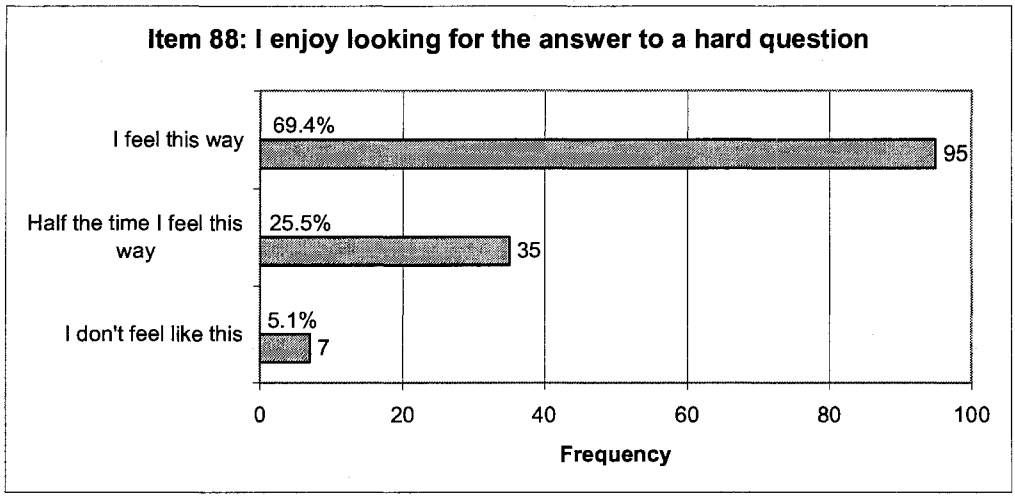

Item 83: Understanding what I read is a problem for me
I feel this way
Half the time I feel this way
I don't feel like this
8.0%
11
14.6%
20
77.4%
106
0
20
40
60
80
100
120
Frequency

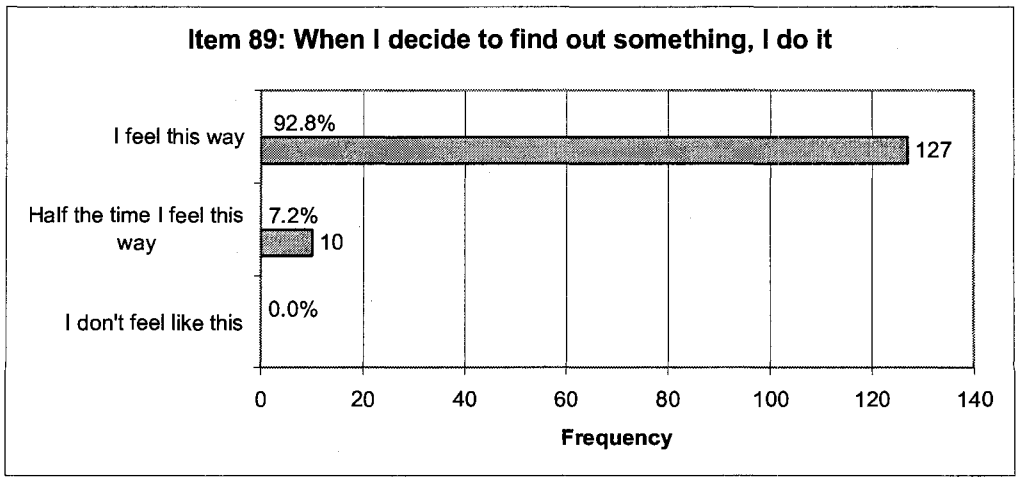

Item 84: I know when I need to learn more about something
I feel this way
Half the time I feel this way
I don't feel like this
83.9%
115
13.2%
18
2.9%
4
0
20
40
60
80
100
120
140
Frequency

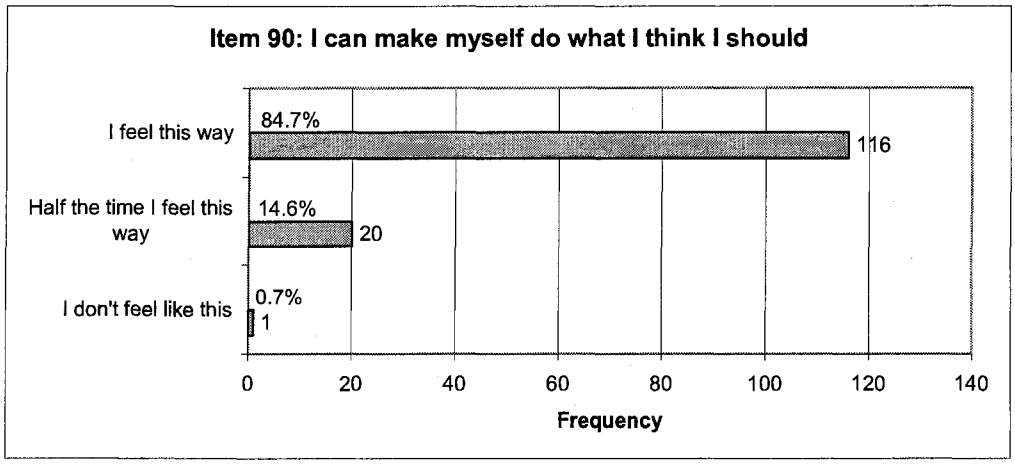

Item 85: I learn well from written materials
I feel this way
Half the time I feel this way
I don't feel like this
86.8%
119
11.7%
16
1.5%
2
0
20
40
60
80
100
120
140
Frequency

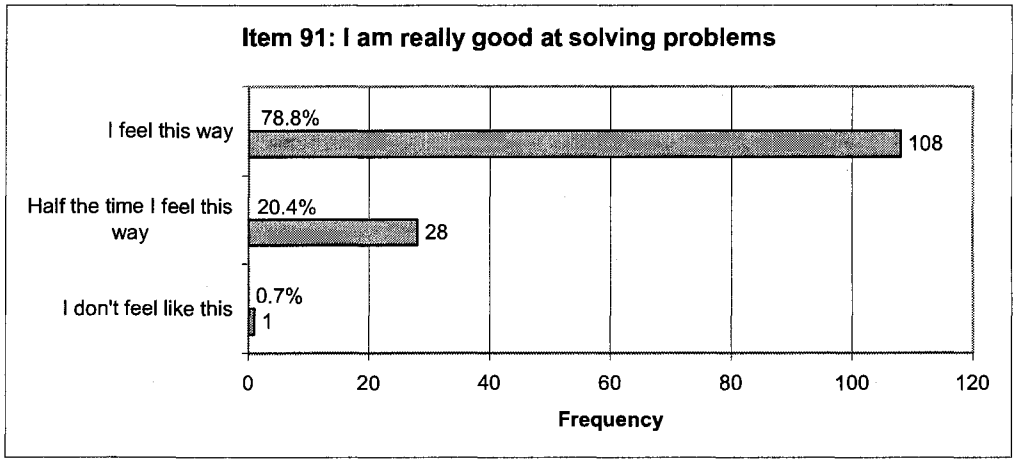

Item 86: I can think of many different ways to learn about something new
I feel this way
Half the time I feel this way
I don't feel like this
75.9%
104
22.6%
31
1.5%
2
0
20
40
60
80
100
120
Frequency

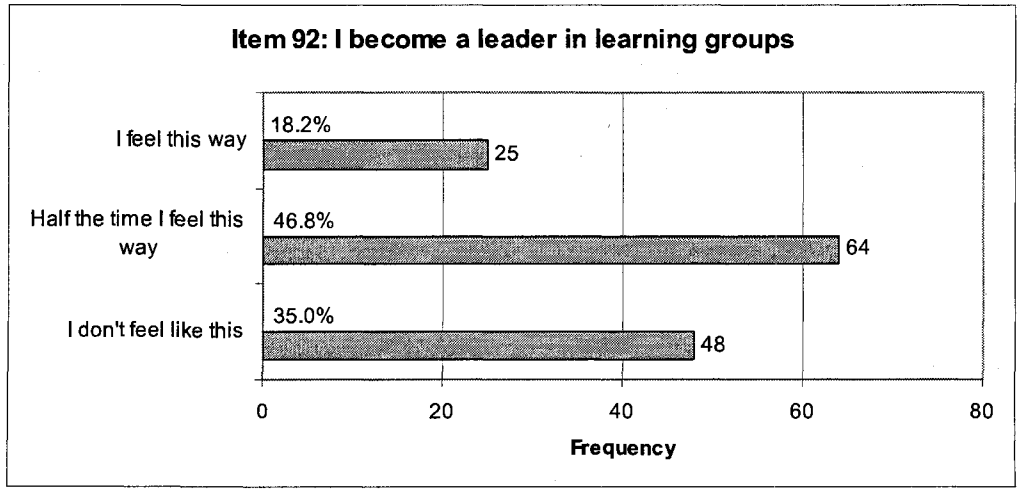

Item 87: I try to think about how the things I am learning will fit in with the plans I have for myself
I feel this way
Half the time I feel this way
I don't feel like this
67.9%
93
29.9%
41
2.2%
3
0
20
40
60
80
100
Frequency

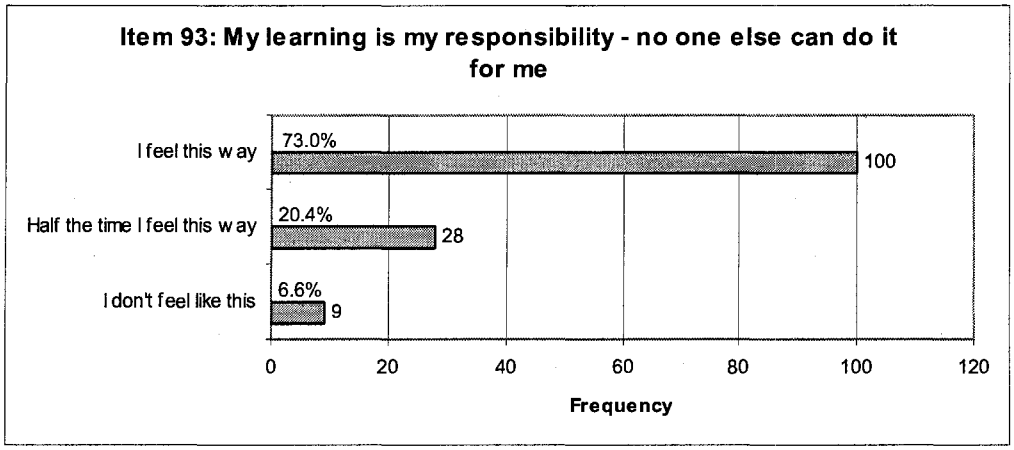

Item 88: I enjoy looking for the answer to a hard question
I feel this way
Half the time I feel this way
I don't feel like this
69.4%
95
25.5%
35
5.1%
7
0
20
40
60
80
100
Frequency

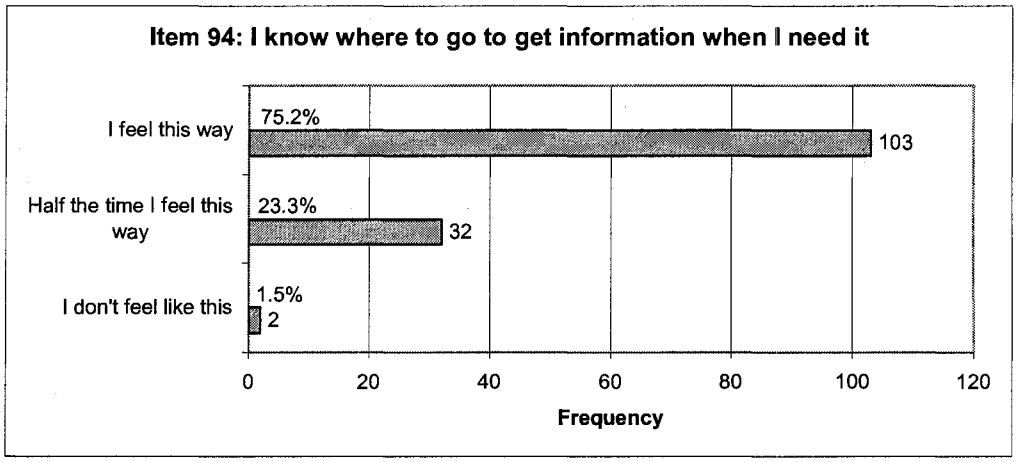

Item 89: When I decide to find out something, I do it
I feel this way
Half the time I feel this way
I don't feel like this
92.8%
127
7.2%
10
0.0%
0
20
40
60
80
100
120
140
Frequency

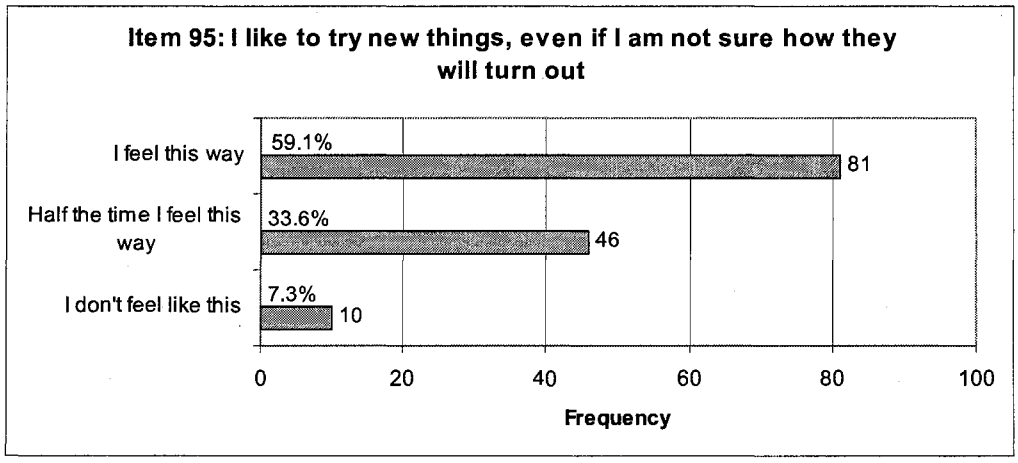

Item 90: I can make myself do what I think I should
I feel this way
Half the time I feel this way
I don't feel like this
84.7%
116
14.6%
20
0.7%
1
0
20
40
60
80
100
120
140
Frequency


Item 91: I am really good at solving problems
I feel this way
Half the time I feel this way
I don't feel like this
78.8%
108
20.4%
28
0.7%
1
0
20
40
60
80
100
120
Frequency


Item 92: I become a leader in learning groups
I feel this way
Half the time I feel this way
I don't feel like this
18.2%
25
46.8%
64
35.0%
48
0
20
40
60
80
Frequency


Item 93: My learning is my responsibility - no one else can do it for me
I feel this way
Half the time I feel this way
I don't feel like this
73.0%
100
20.4%
28
6.6%
9
0
20
40
60
80
100
120
Frequency


Item 94: I know where to go to get information when I need it
I feel this way
Half the time I feel this way
I don't feel like this
75.2%
103
23.3%
32
1.5%
2
0
20
40
60
80
100
120
Frequency


Item 95: I like to try new things, even if I am not sure how they will turn out
I feel this way
Half the time I feel this way
I don't feel like this
59.1%
81
33.6%
46
7.3%
10
0
20
40
60
80
100
Frequency

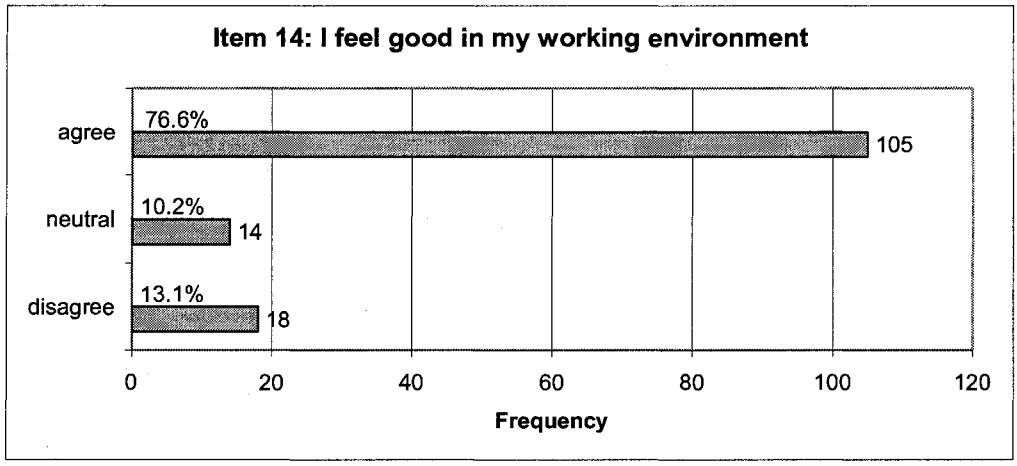
Appendix K

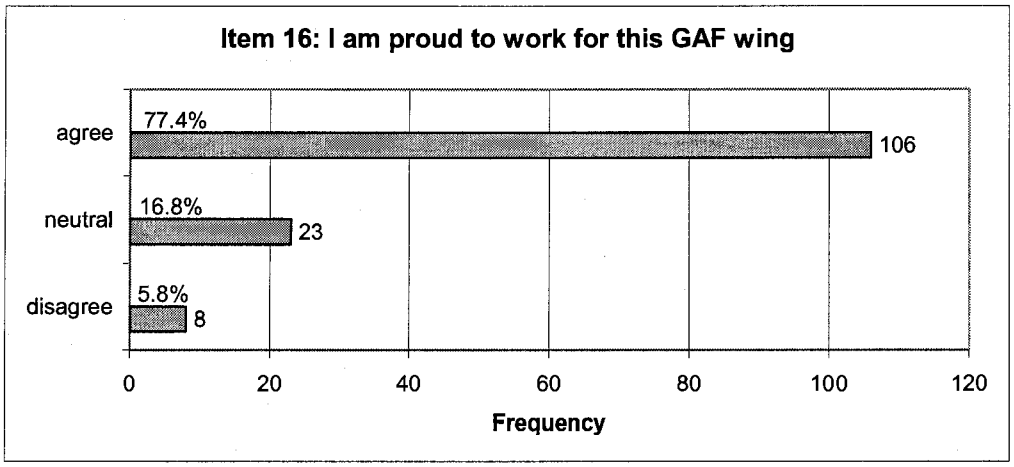
Frequency Summary for the Variable Attitude to CRM Training Items

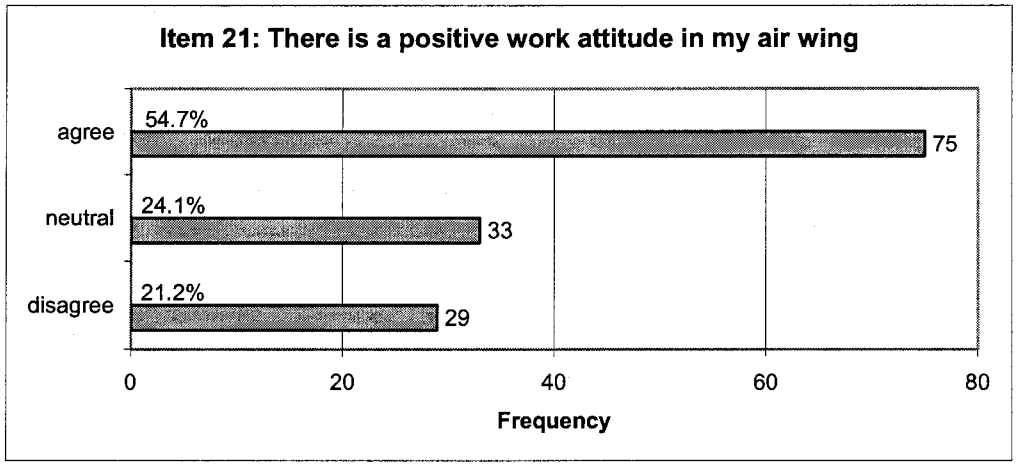
This Appendix provides a frequency summary of all items of the variable attitude to CRM training. Items on the survey are answered such that one indicates disagreement using a 5-point scale, the midpoint (three) is neutral, and five indicates agreement. The ranking categories were collapsed to a 3-point ranking using the following code key for item one through item 8: (1) low, (2) adequate, and (3) high. The following code key was used for item nine through item 52: (1) disagree, (2) neutral, and (3) agree. The following code key was used for item 53 through item 61: (1) of little importance, (2) of moderate importance, and (3) very important. The following code key was used for item 62 and for item 63: (1) Style 1, (2) Style 2, (3) Style 3, and (4) Style 4. Items were organized according to the identified main domains and sub-domains representing the variable's attitudinal domain.

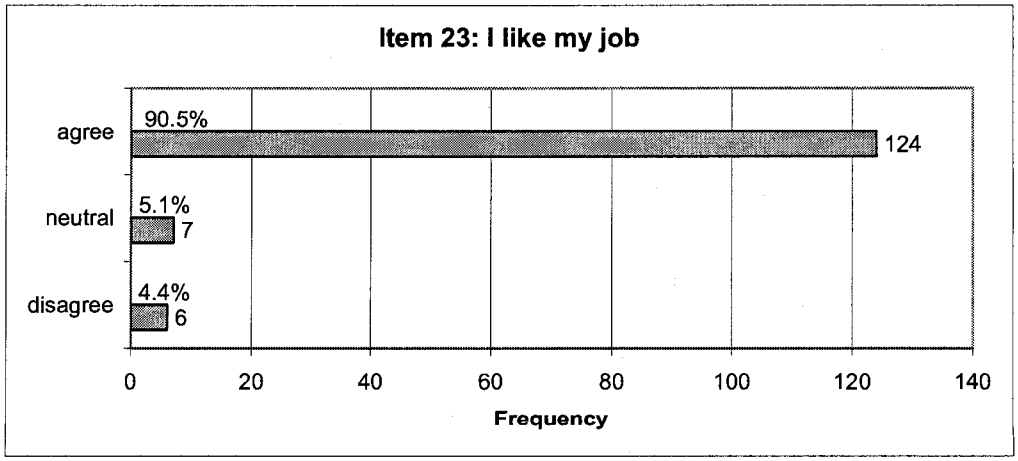
Items for the main domain institutional issues

Items for the sub-domain organizational climate

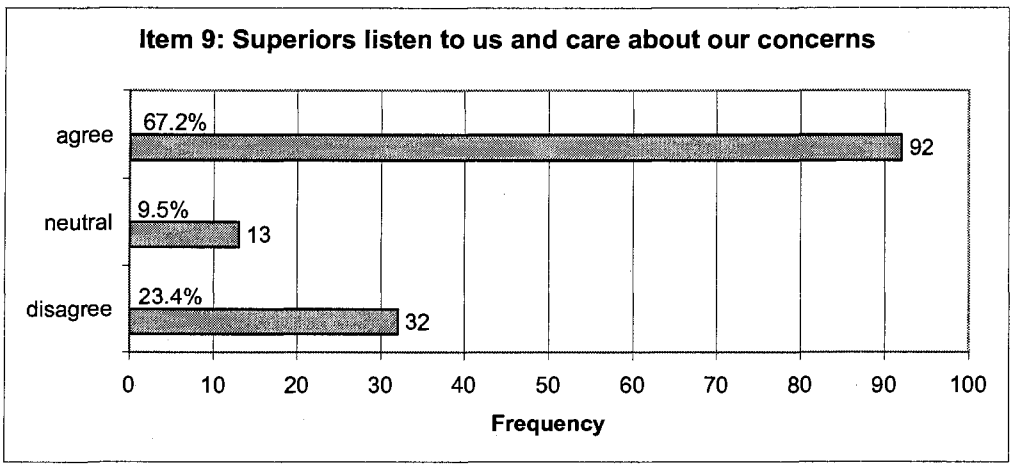


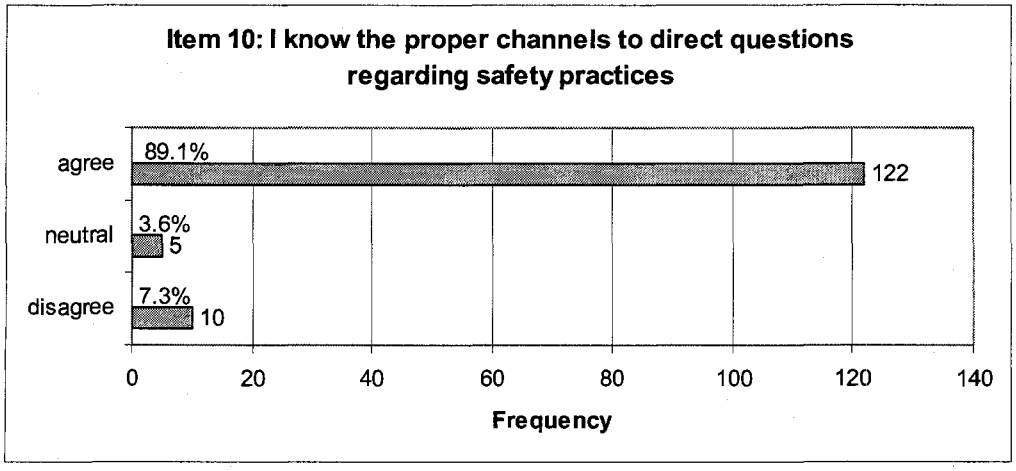

Item 16: I am proud to work for this GAF wing
agree
neutral
disagree
77.4%
106
16.8%
23
5.8%
8
0
20
40
60
80
100
120
Frequency

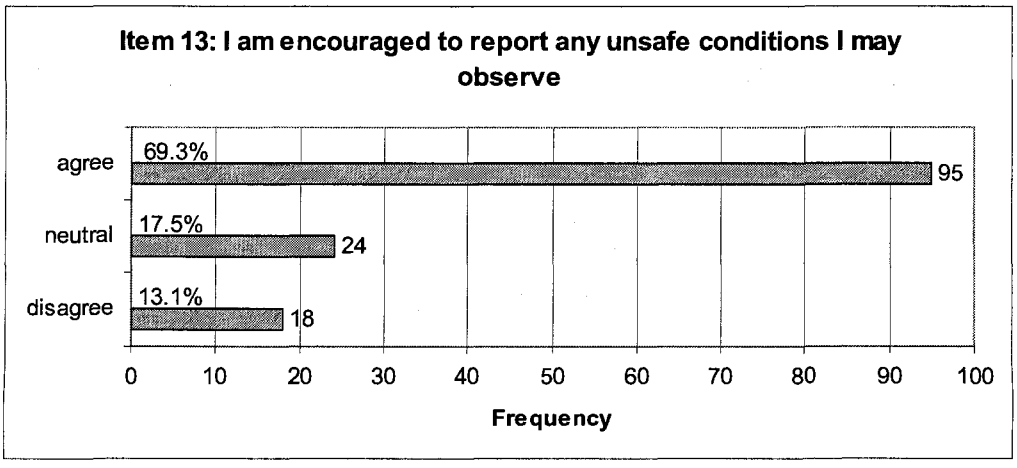

Item 21: There is a positive work attitude in my air wing
agree
neutral
disagree
54.7%
75
24.1%
33
21.2%
29
0
20
40
60
80
Frequency

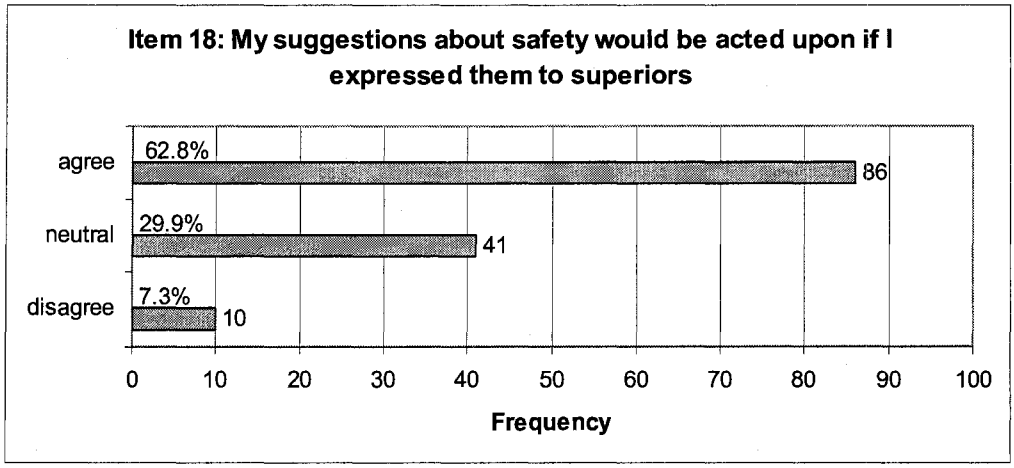

Item 23: I like my job
agree
neutral
disagree
90.5%
124
5.1%
7
4.4%
6
0
20
40
60
80
100
120
140
Frequency

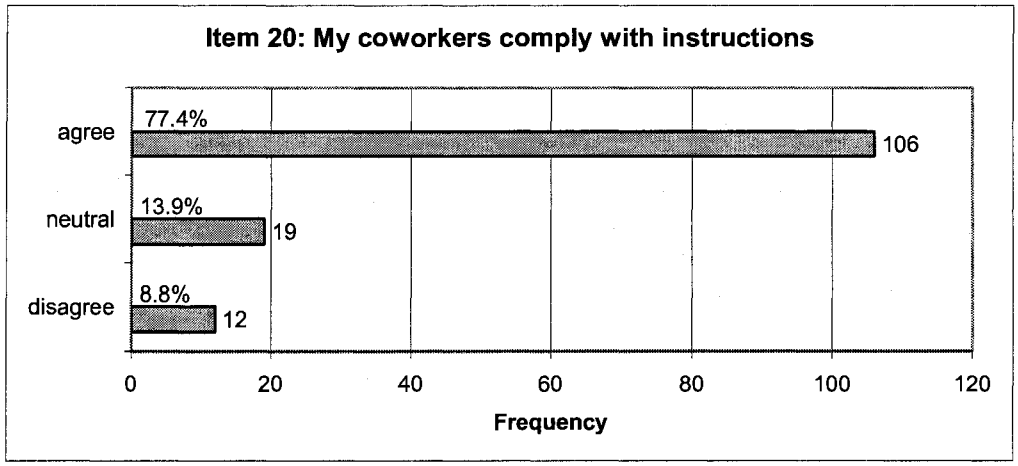
Items for the sub-domain safety culture

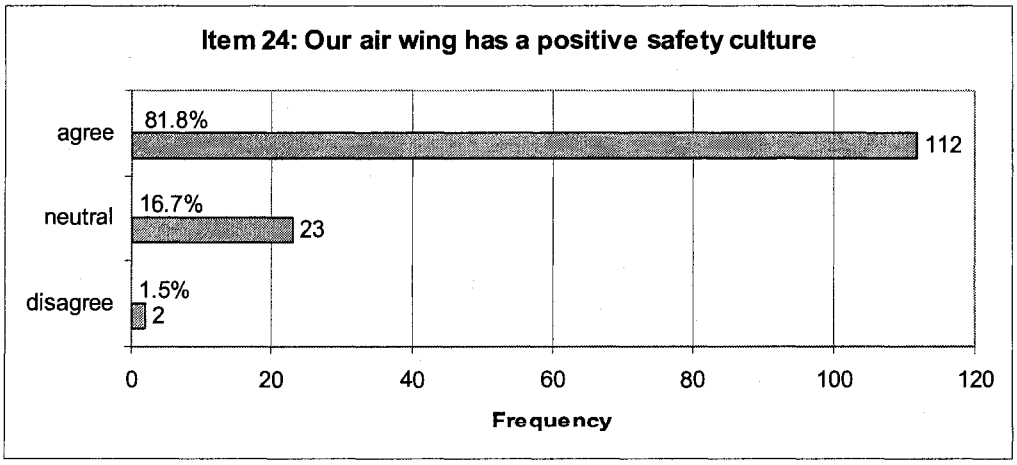




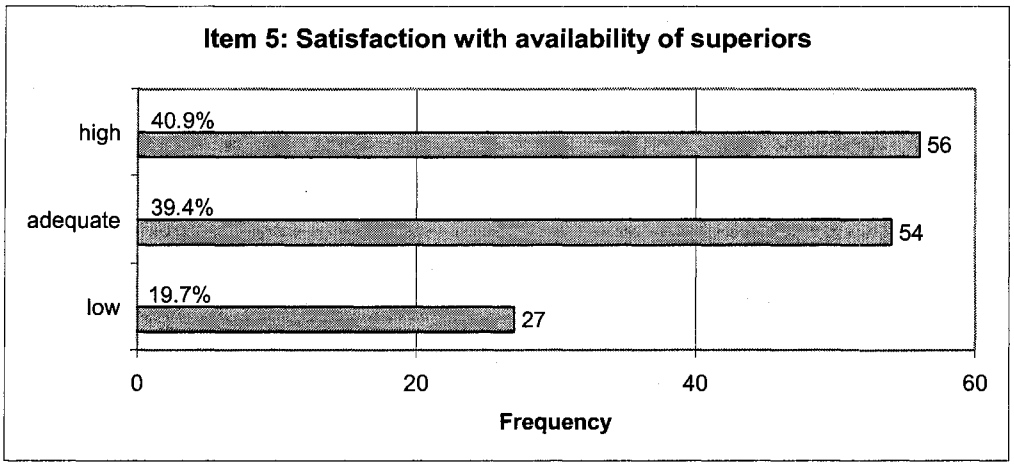


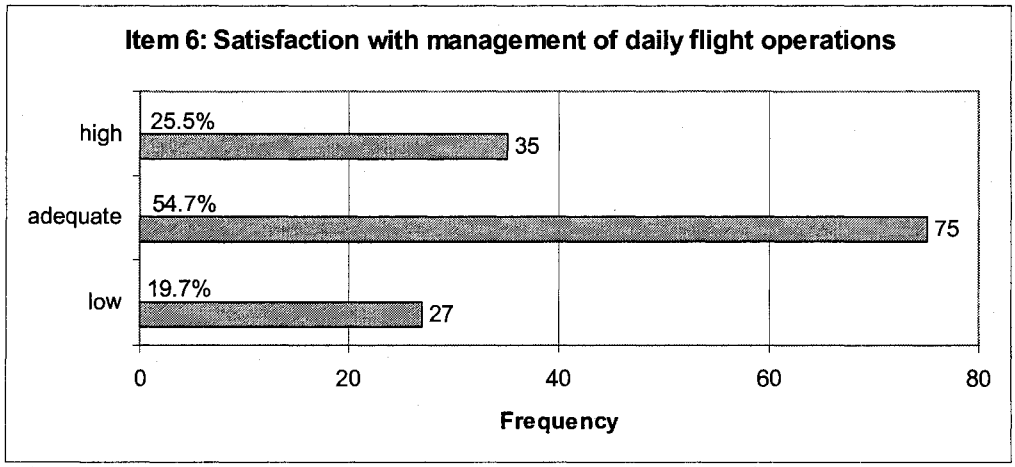

Item 18: My suggestions about safety would be acted upon if I expressed them to superiors
agree
neutral
disagree
62.8%
29.9%
7.3%
86
41
10
0
10
20
30
40
50
60
70
80
90
100
Frequency

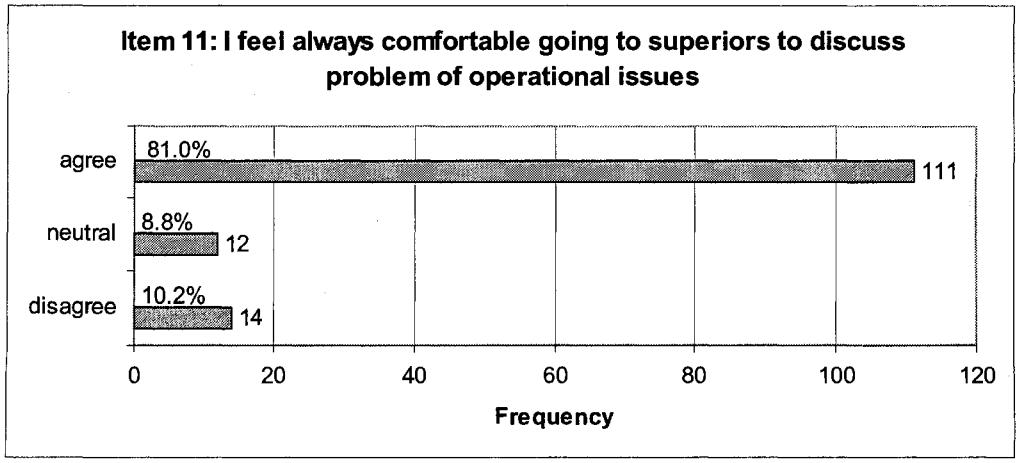

Item 20: My coworkers comply with instructions
agree
neutral
disagree
77.4%
13.9%
8.8%
106
19
12
0
20
40
60
80
100
120
Frequency

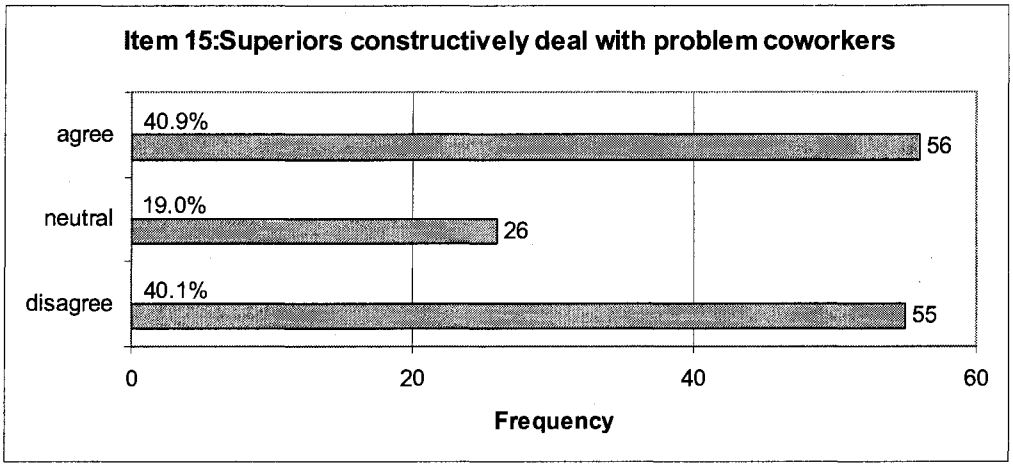

Item 24: Our air wing has a positive safety culture
agree
neutral
disagree
81.8%
16.7%
1.5%
112
23
2
0
20
40
60
80
100
120
Frequency

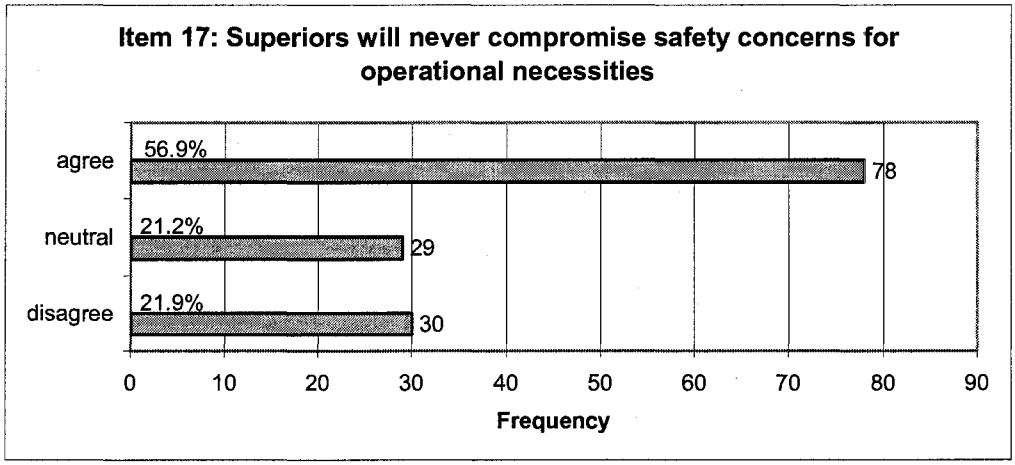
Items for the sub-domain perception of management

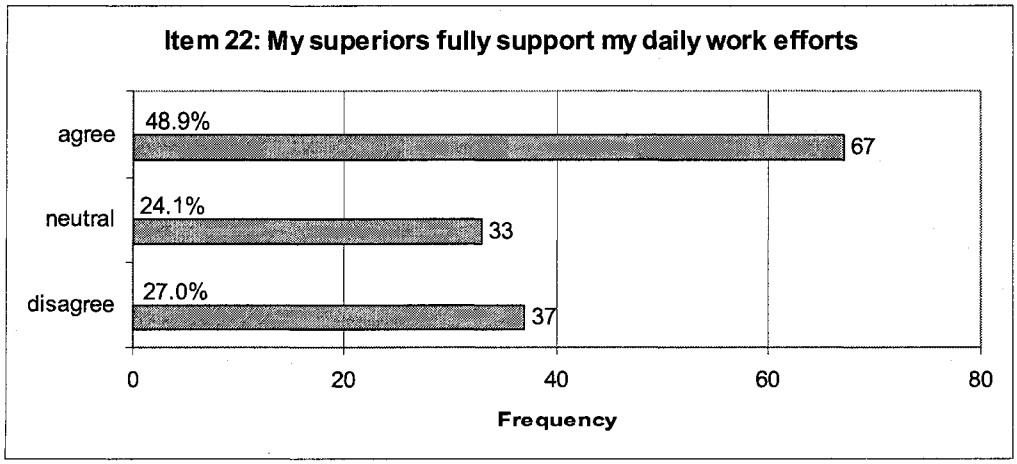




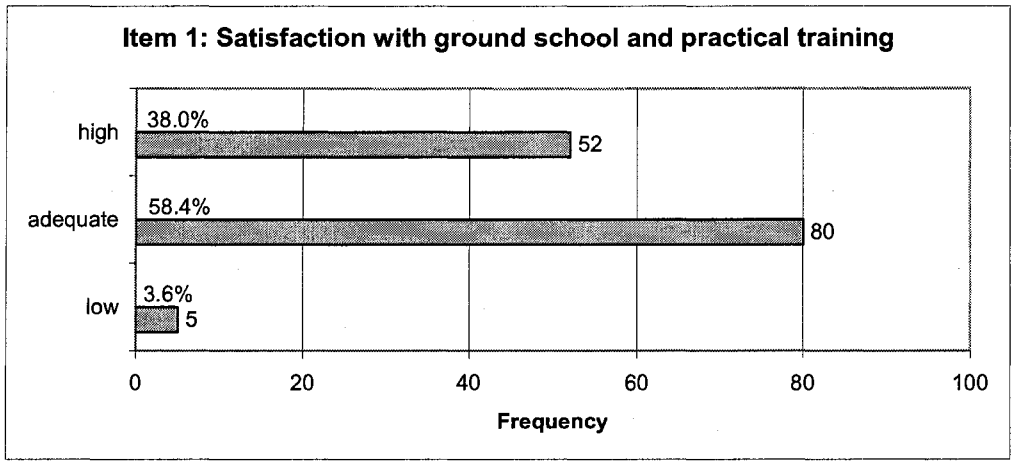


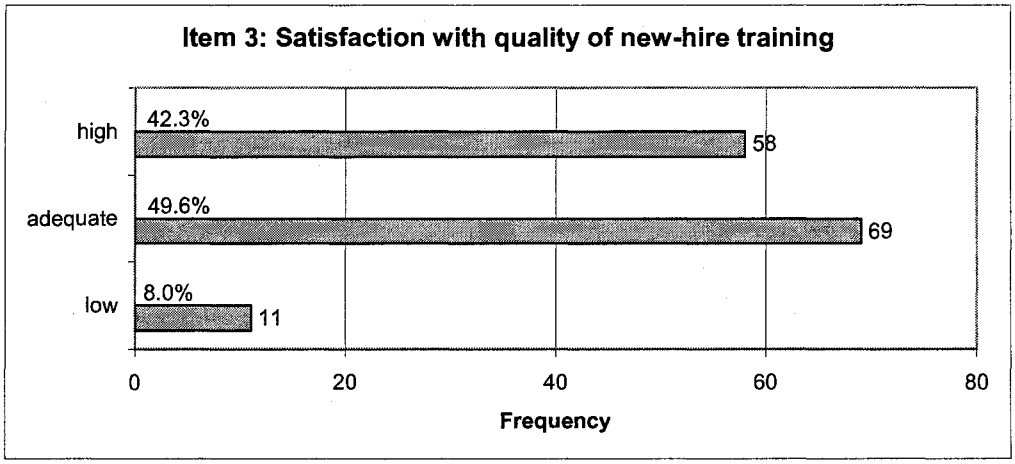

Item 15:Superiors constructively deal with problem coworkers
agree
neutral
disagree
40.9%
19.0%
40.1%
56
26
55
0
20
40
60
Frequency

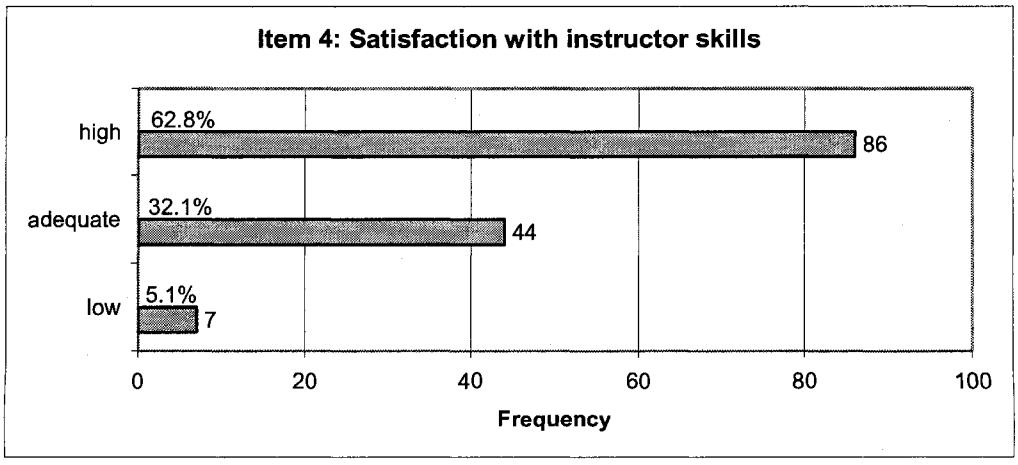

Item 17: Superiors will never compromise safety concerns for operational necessities
agree
neutral
disagree
56.9%
21.2%
21.9%
78
29
30
0
10
20
30
40
50
60
70
80
90
Frequency

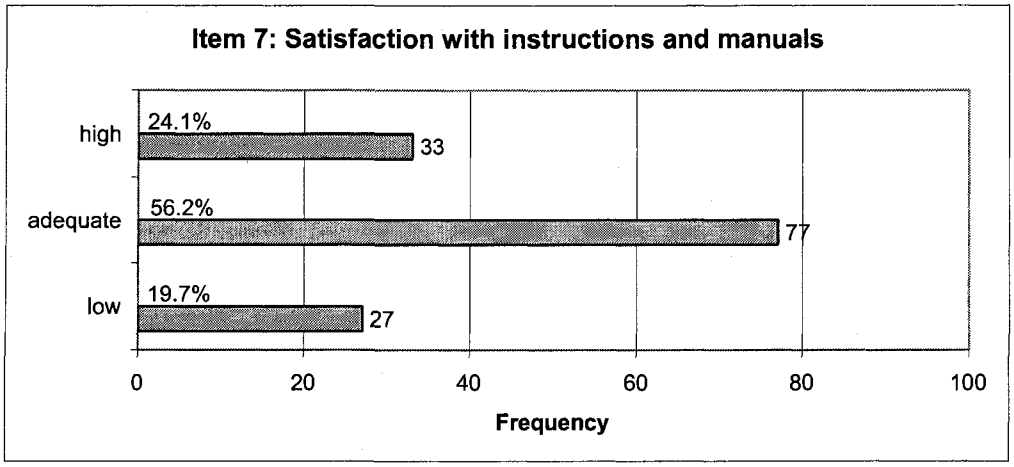

Item 22: My superiors fully support my daily work efforts
agree
neutral
disagree
48.9%
24.1%
27.0%
67
33
37
0
20
40
60
80
Frequency

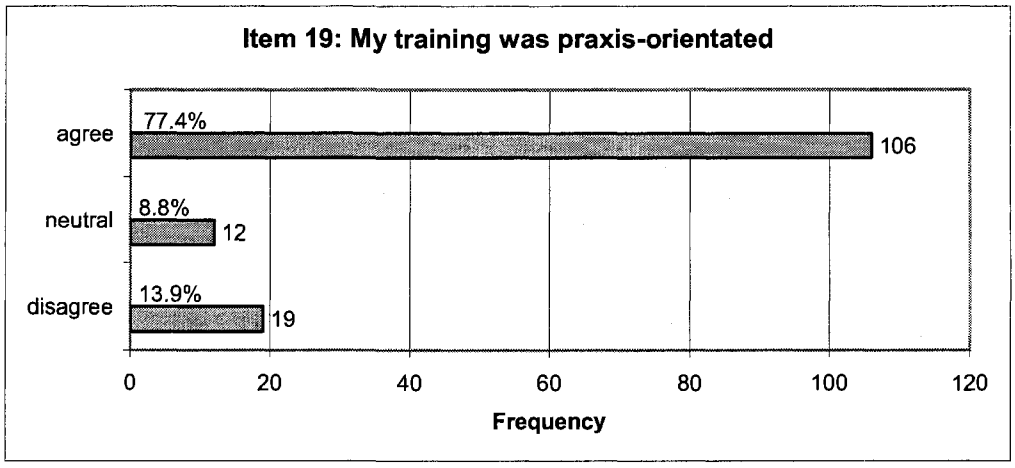
Items for the sub-domain training and checking



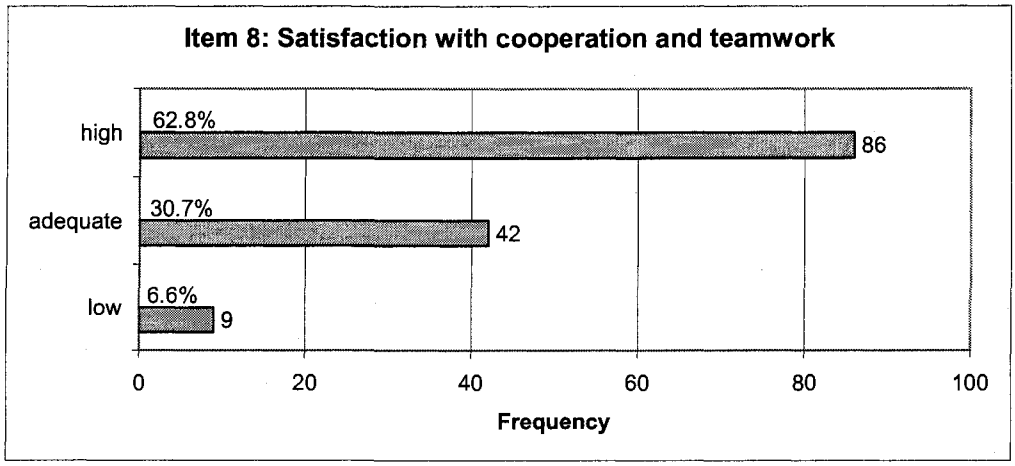


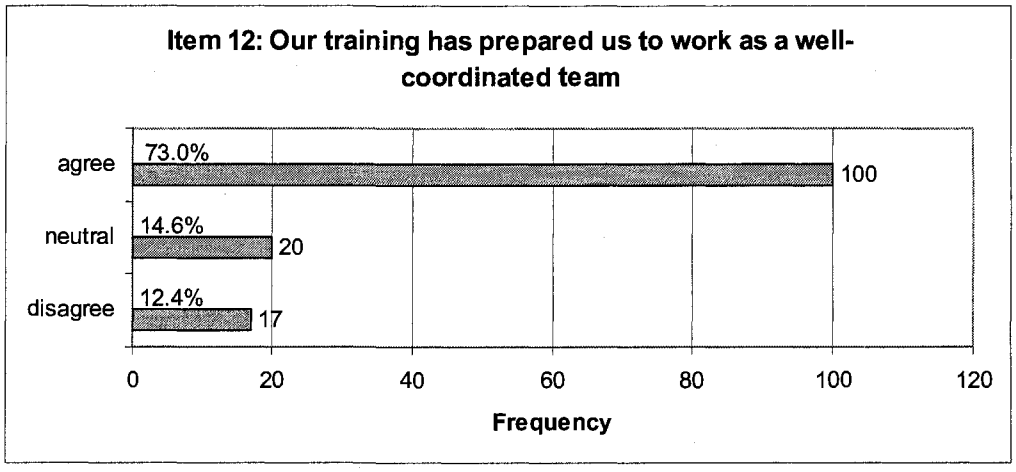



Item 7: Satisfaction with instructions and manuals
high
adequate
low
24.1%
33
56.2%
77
19.7%
27
0
20
40
60
80
100
Frequency


Item 19: My training was praxis-orientated
agree
neutral
disagree
77.4%
106
8.8%
12
13.9%
19
0
20
40
60
80
100
120
Frequency

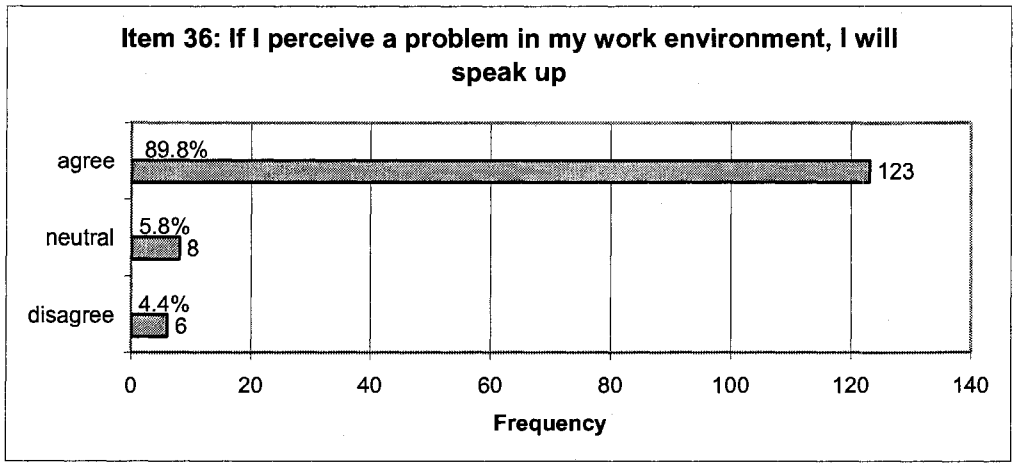
Items for the sub-domain teamwork

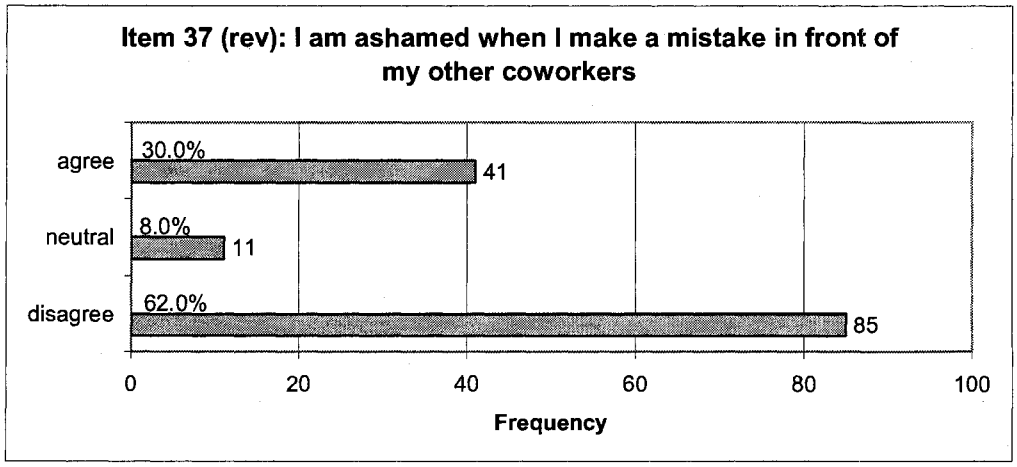


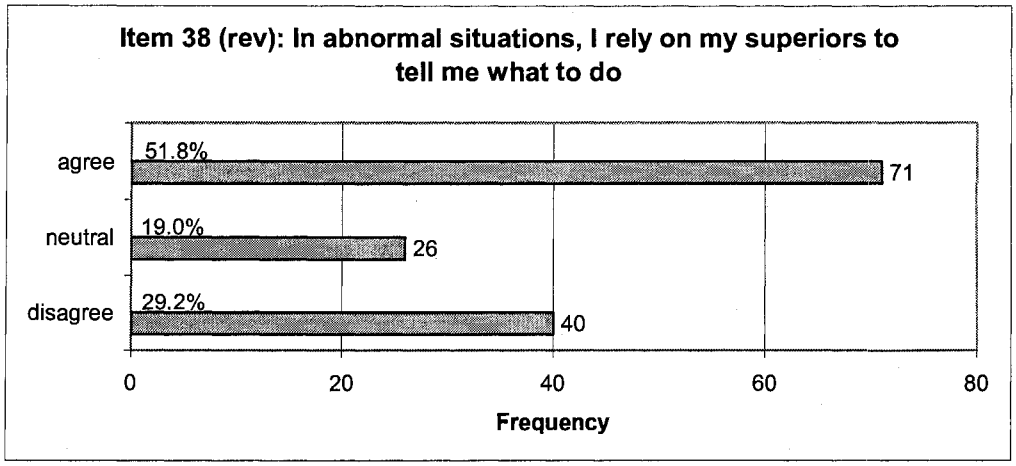


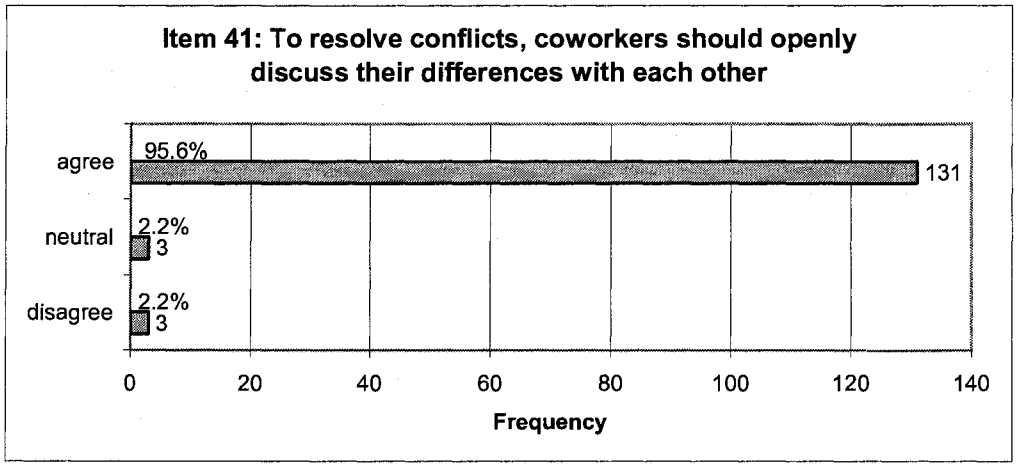
Items for the main domain work management attitude

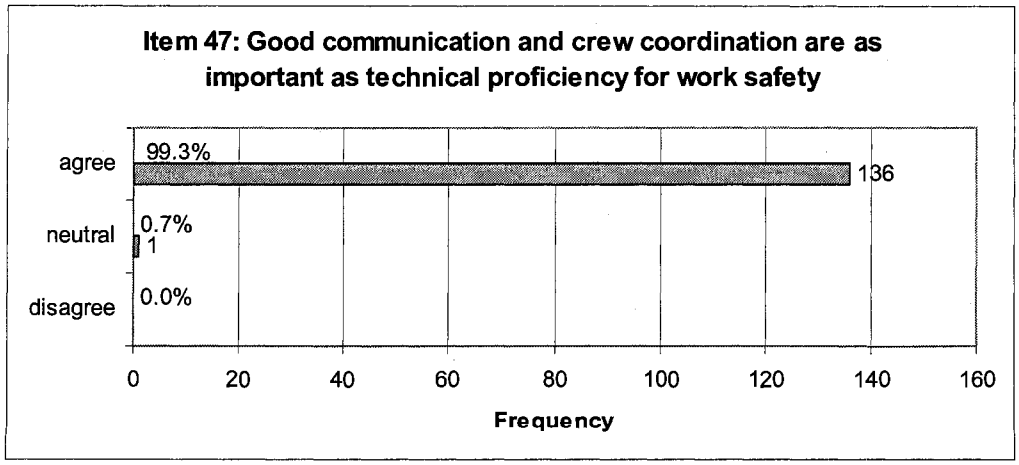
Items for the sub-domain threat and error management

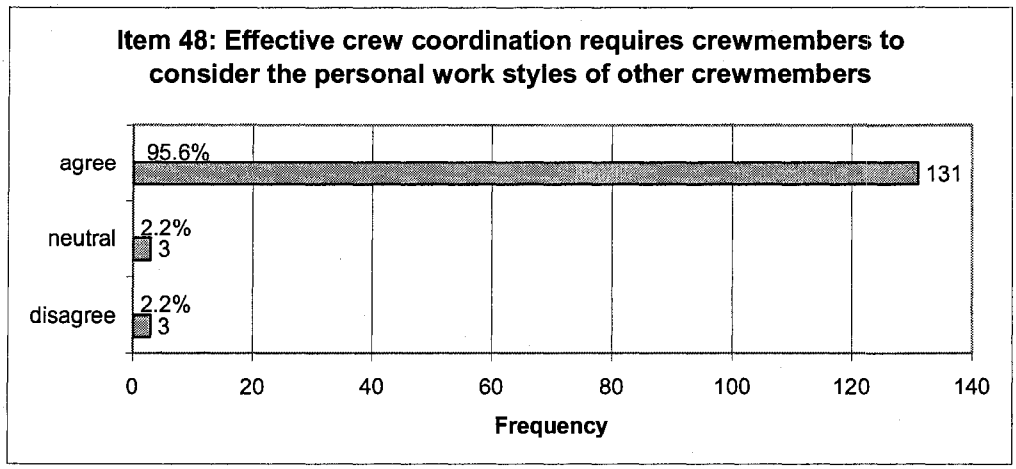


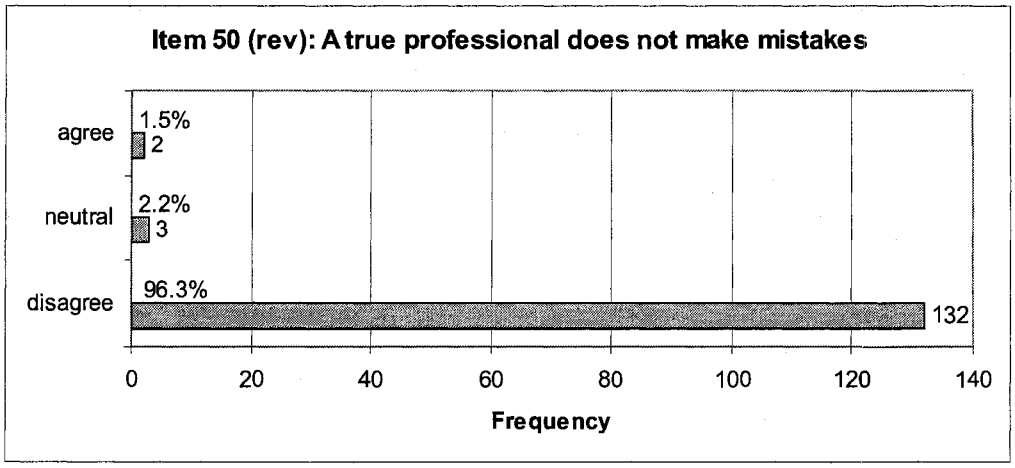



Item 38 (rev): In abnormal situations, I rely on my superiors to tell me what to do
agree
neutral
disagree
51.8%
71
19.0%
26
29.2%
40
0
20
40
60
80
Frequency

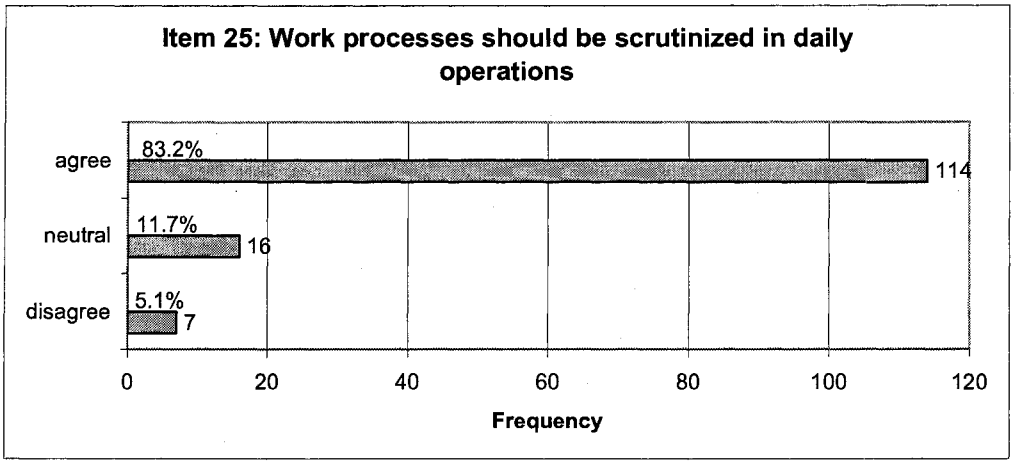

Item 41: To resolve conflicts, coworkers should openly discuss their differences with each other
agree
neutral
disagree
95.6%
131
2.2%
3
2.2%
3
0
20
40
60
80
100
120
140
Frequency

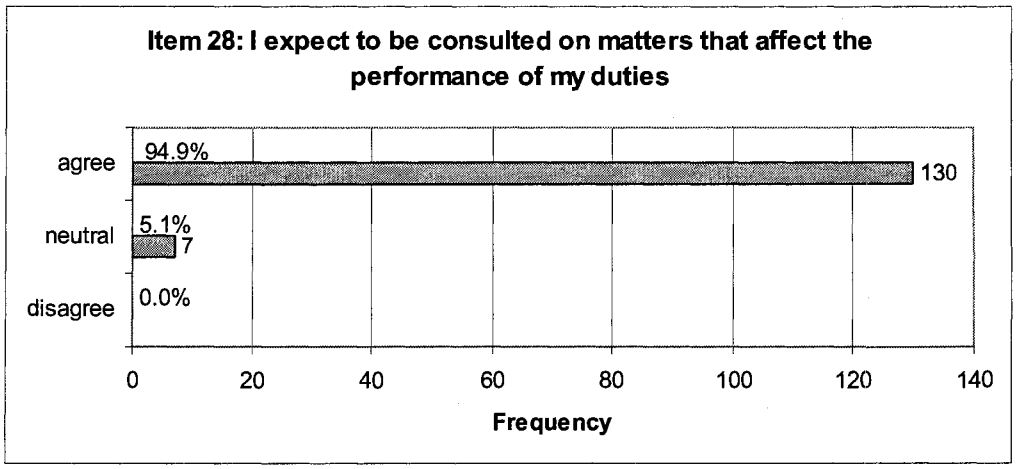

Item 47: Good communication and crew coordination are as important as technical proficiency for work safety
agree
neutral
disagree
99.3%
136
0.7%
1
0.0%
0
20
40
60
80
100
120
140
160
Frequency

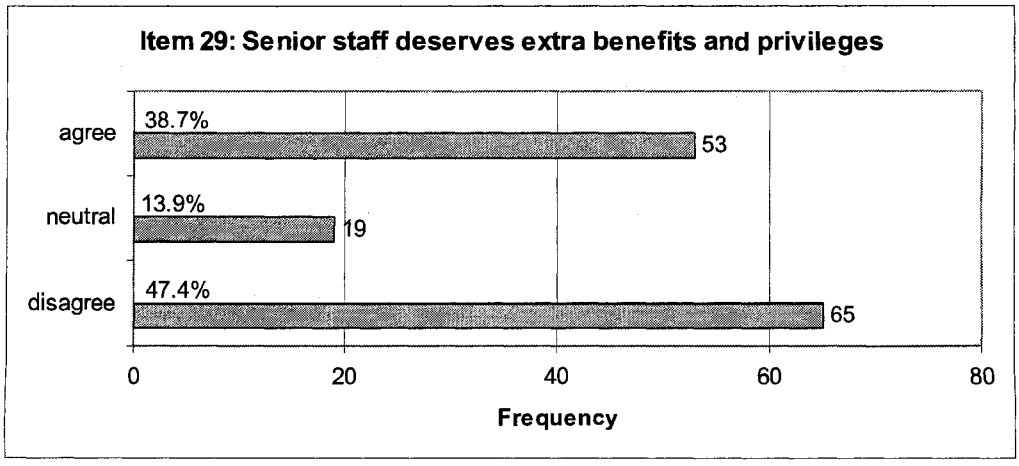

Item 48: Effective crew coordination requires crewmembers to consider the personal work styles of other crewmembers
agree
neutral
disagree
95.6%
131
2.2%
3
2.2%
3
0
20
40
60
80
100
120
140
Frequency

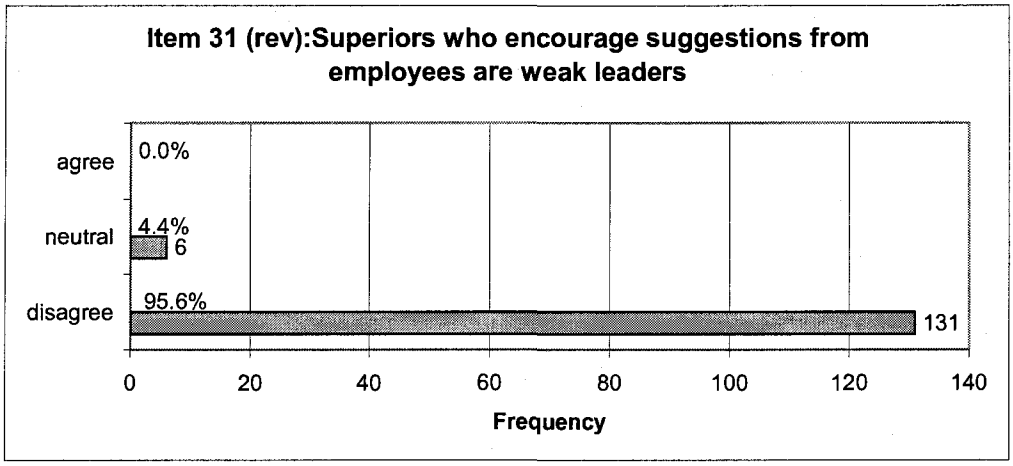

Item 50 (rev): A true professional does not make mistakes
agree
neutral
disagree
1.5%
2
2.2%
3
96.3%
132
0
20
40
60
80
100
120
140
Frequency

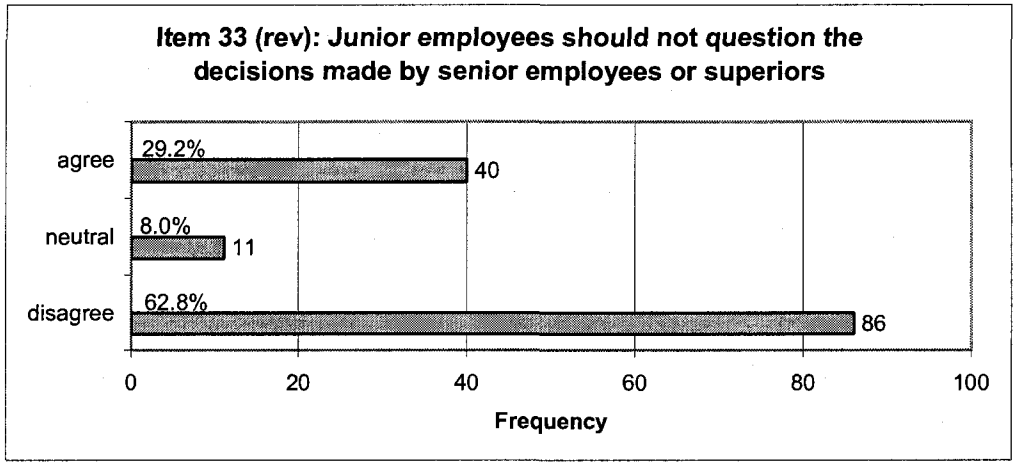
Items for the sub-domain command attitudes

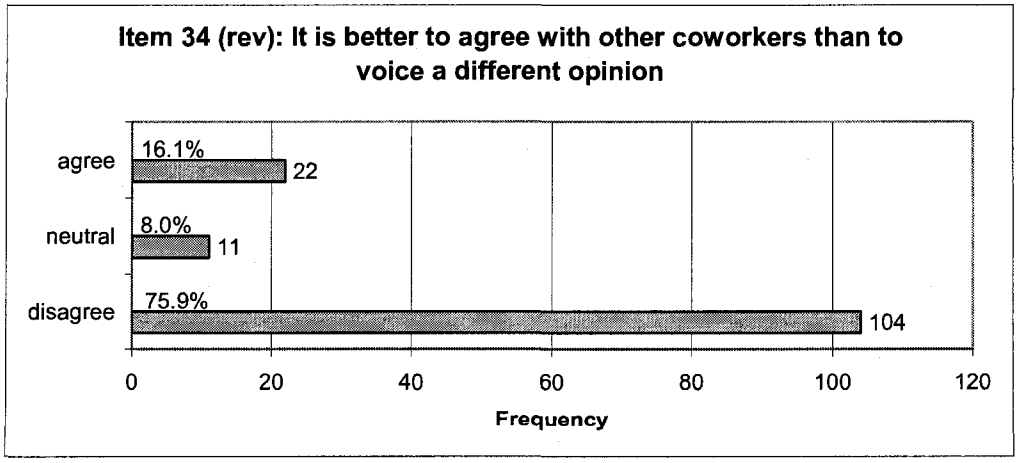




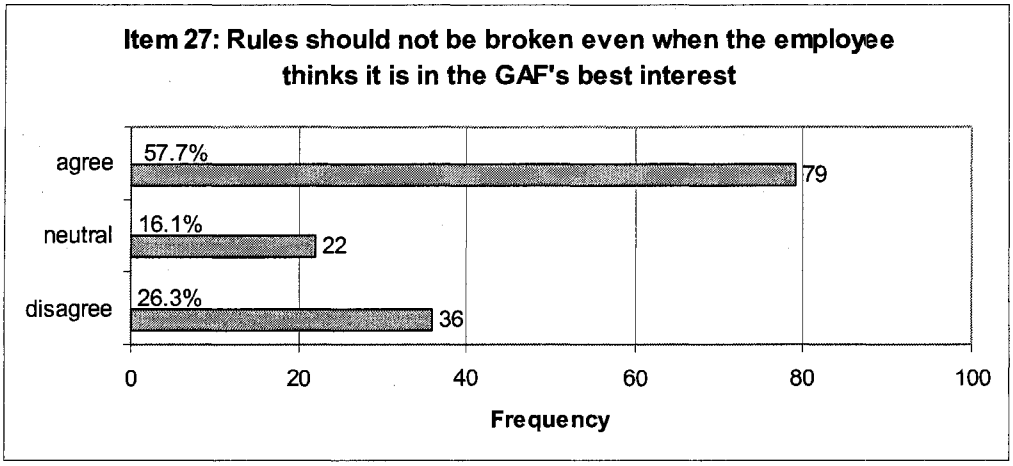


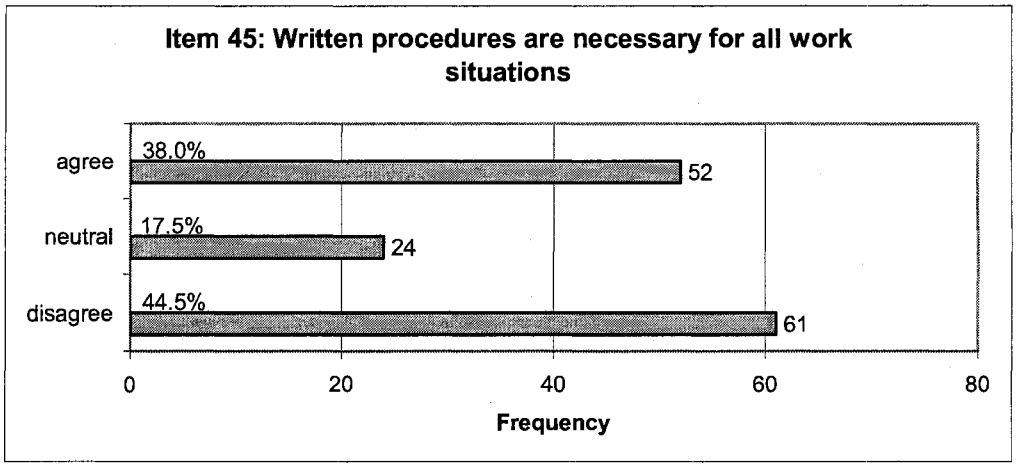

Item 31 (rev):Superiors who encourage suggestions from employees are weak leaders
agree
neutral
disagree
0.0%
4.4%
6
95.6%
131
0
20
40
60
80
100
120
140
Frequency


Item 33 (rev): Junior employees should not question the decisions made by senior employees or superiors
agree
neutral
disagree
29.2%
40
8.0%
11
62.8%
86
0
20
40
60
80
100
Frequency

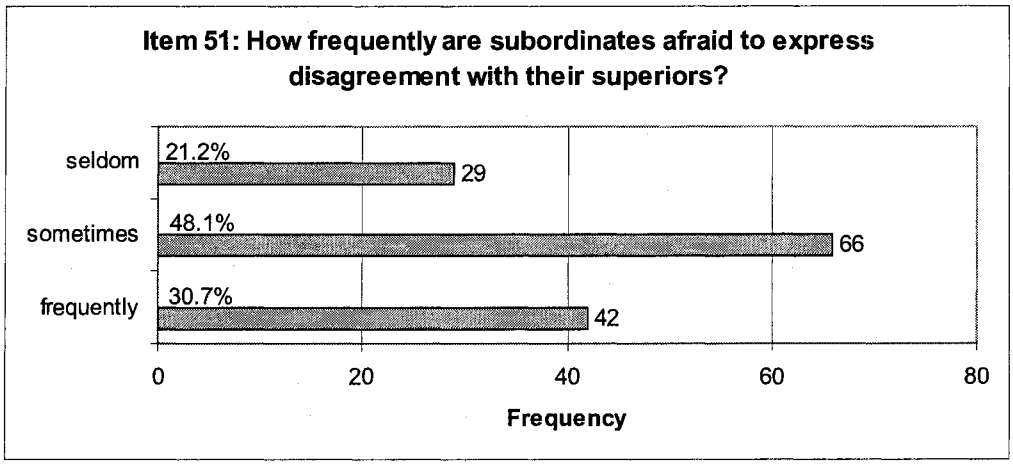

Item 34 (rev): It is better to agree with other coworkers than to voice a different opinion
agree
neutral
disagree
16.1%
22
8.0%
11
75.9%
104
0
20
40
60
80
100
120
Frequency

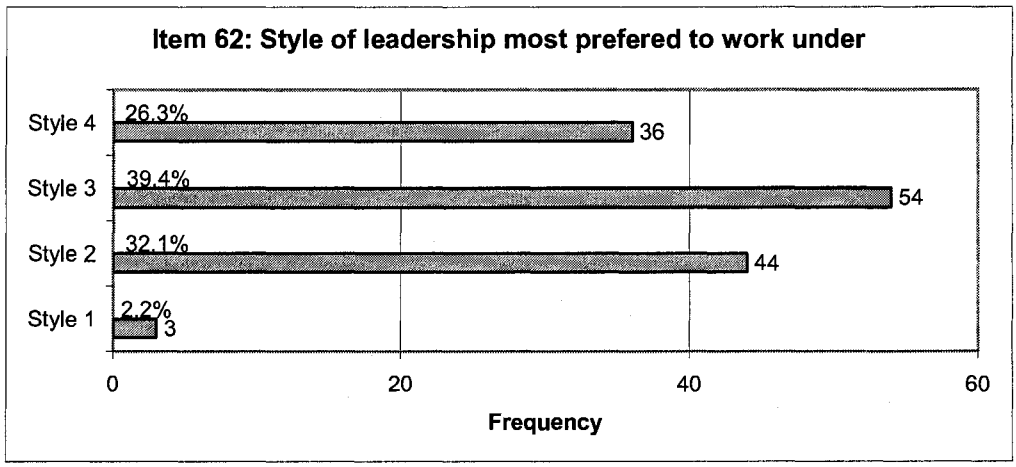
Items for the sub-domain rules and roles

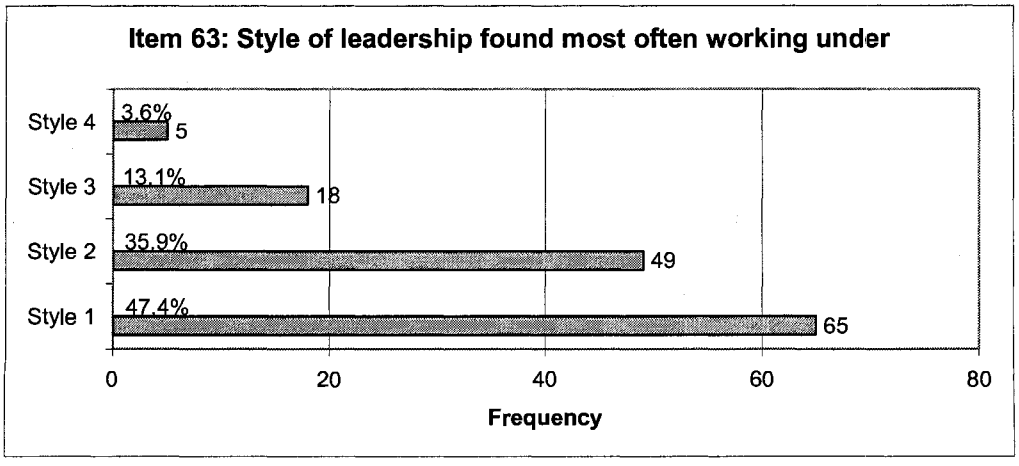




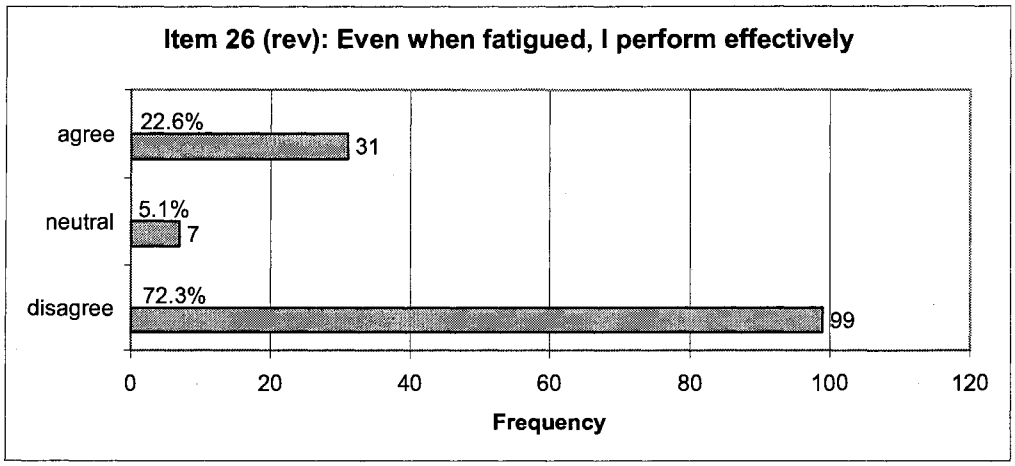
Items for the sub-domain leadership styles

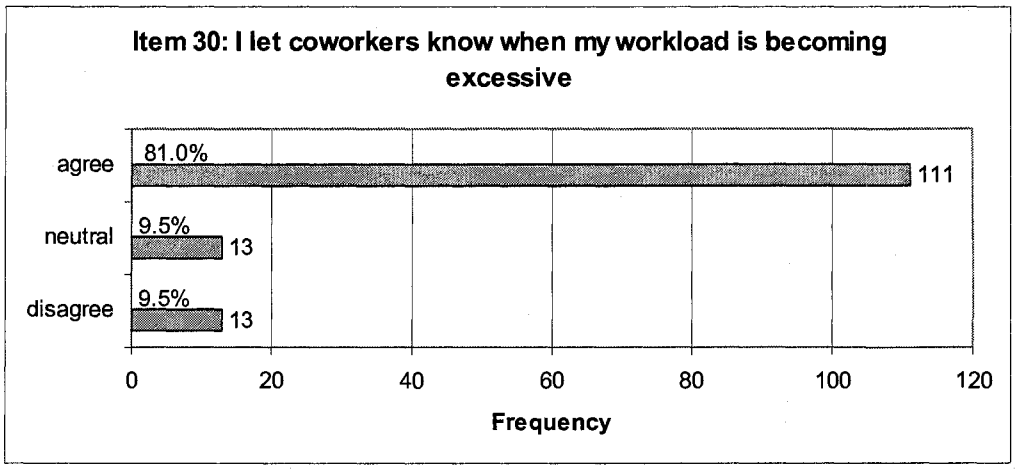


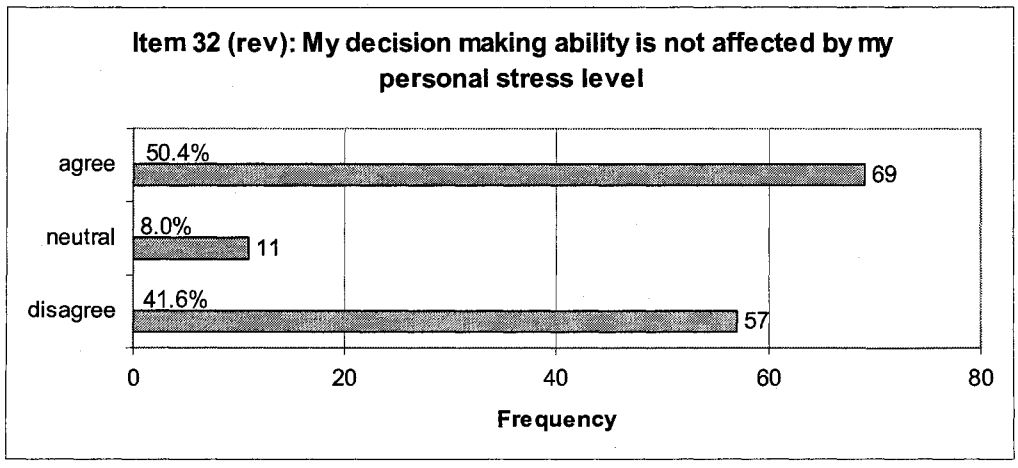


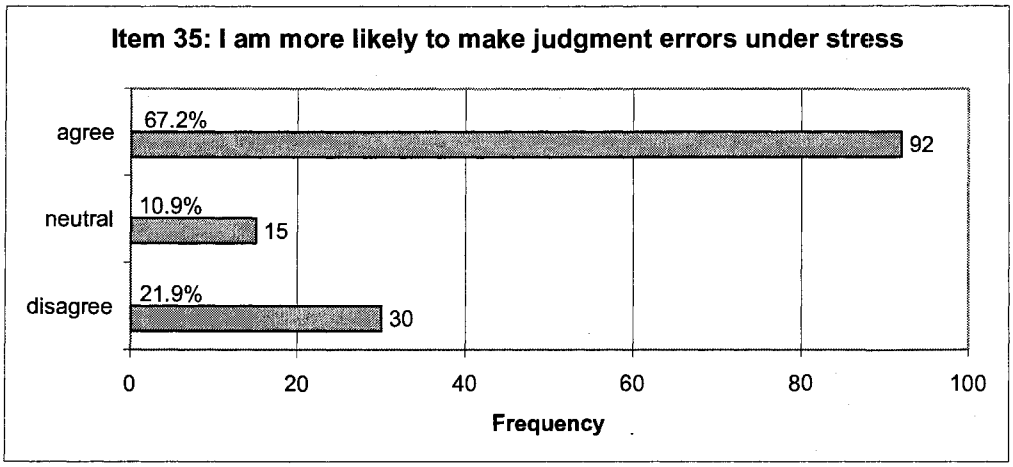


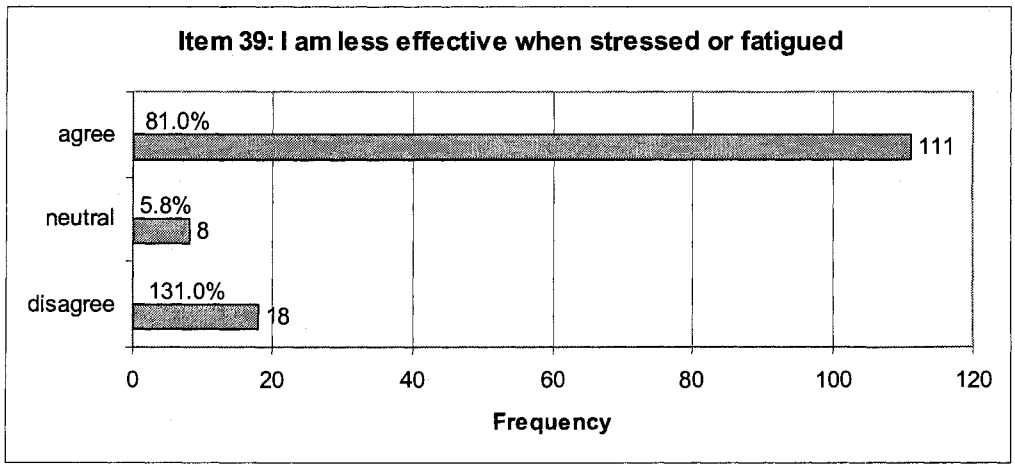
Items for the sub-domain attitude to stress and fatigue

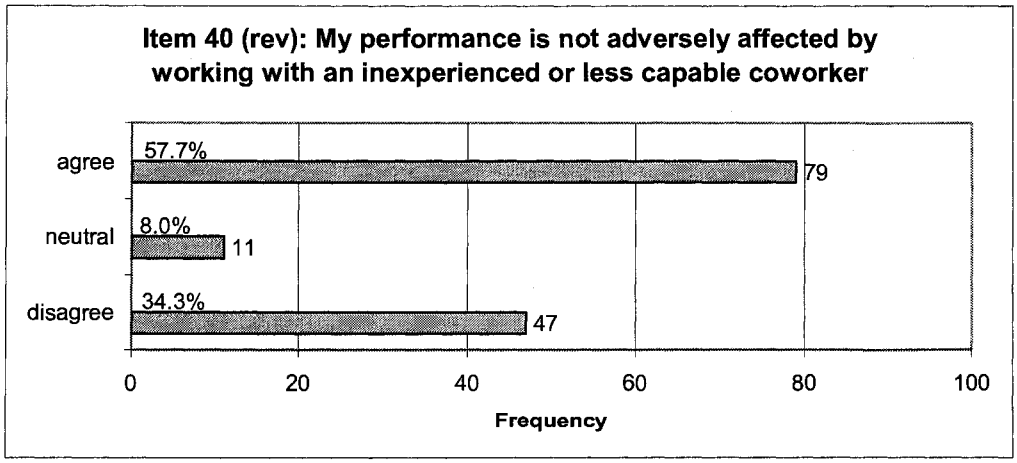


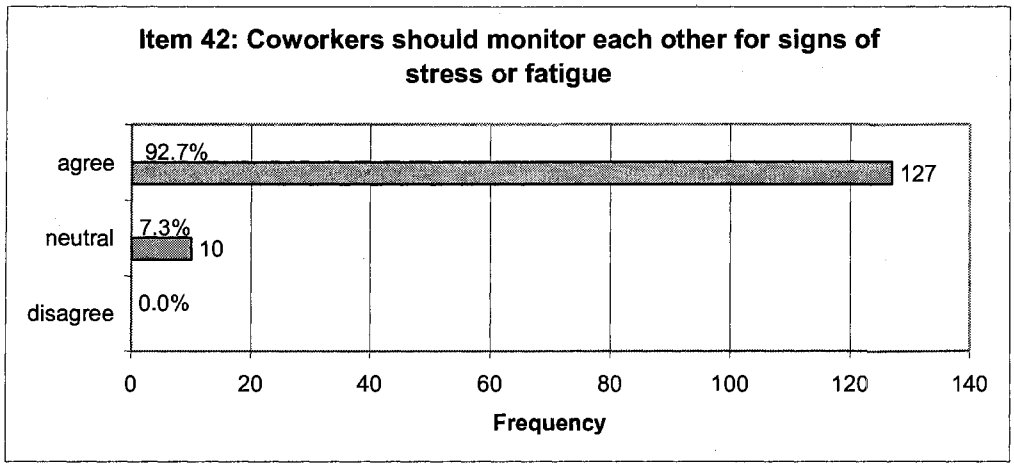


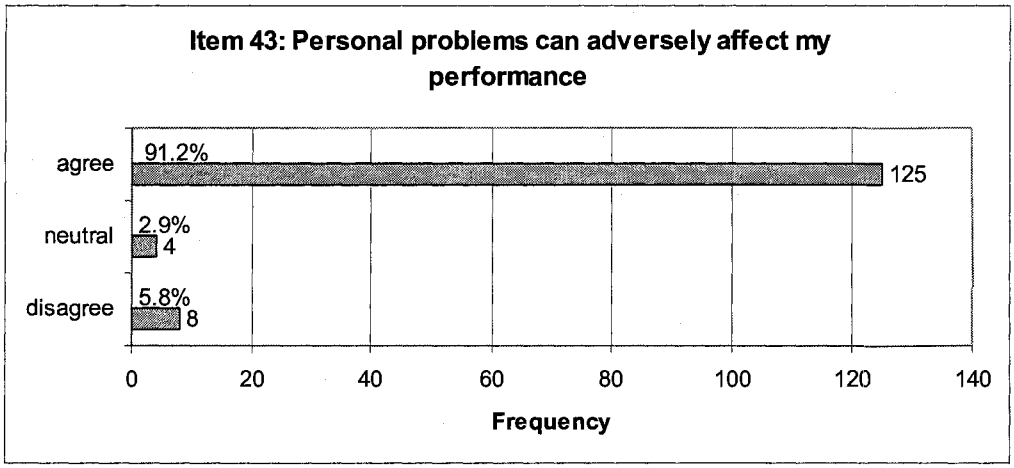


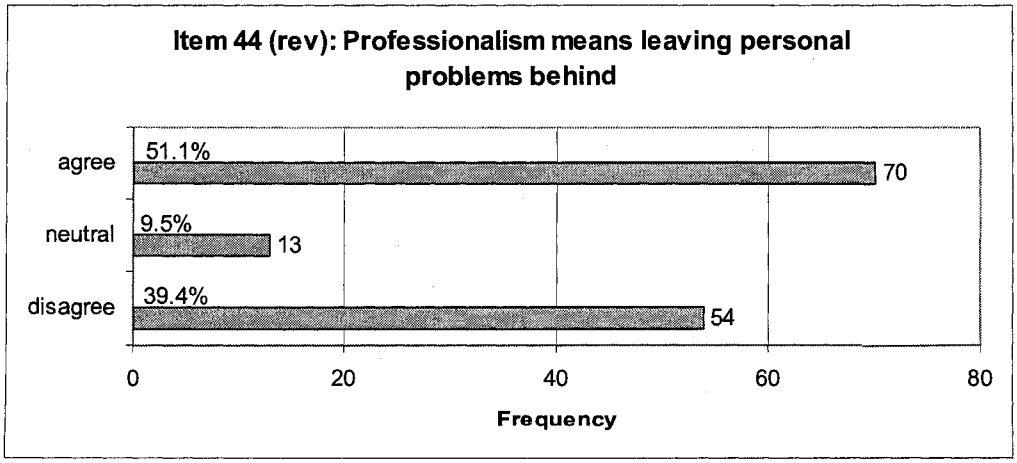

Item 35: I am more likely to make judgment errors under stress
agree
neutral
disagree
67.2%
92
10.9%
15
21.9%
30
0
20
40
60
80
100
Frequency

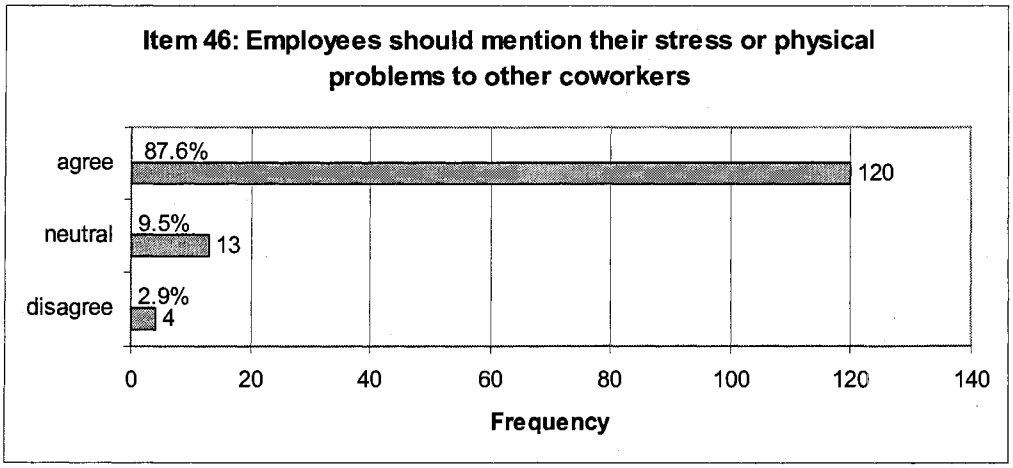

Item 39: I am less effective when stressed or fatigued
agree
neutral
disagree
81.0%
111
5.8%
8
131.0%
18
0
20
40
60
80
100
120
Frequency

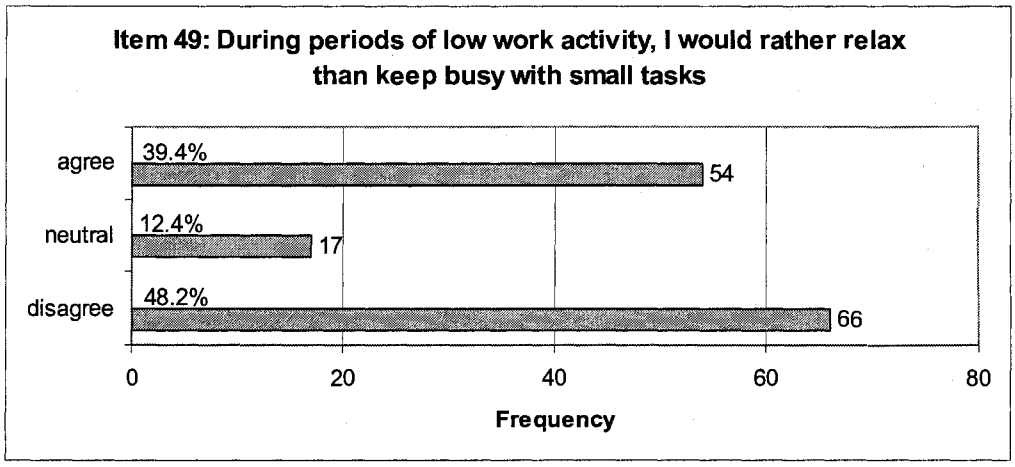

Item 40 (rev): My performance is not adversely affected by working with an inexperienced or less capable coworker
agree
neutral
disagree
57.7%
79
8.0%
11
34.3%
47
0
20
40
60
80
100
Frequency

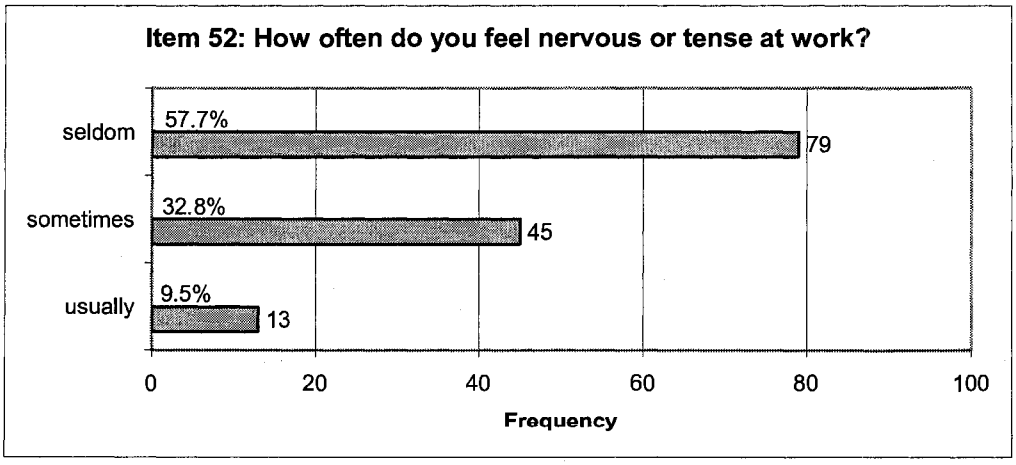

Item 42: Coworkers should monitor each other for signs of stress or fatigue
agree
neutral
disagree
92.7%
127
7.3%
10
0.0%
0
20
40
60
80
100
120
140
Frequency


Item 43: Personal problems can adversely affect my performance
agree
neutral
disagree
91.2%
125
2.9%
4
5.8%
8
0
20
40
60
80
100
120
140
Frequency

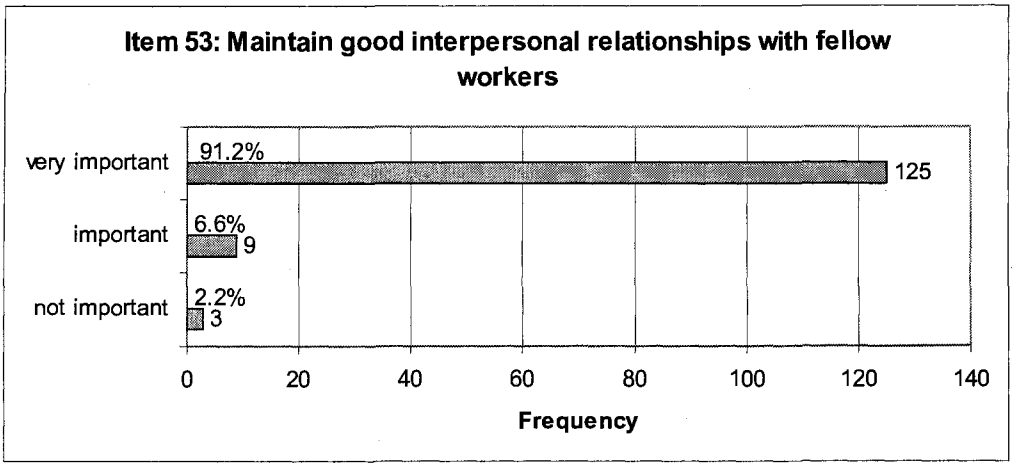

Item 44 (rev): Professionalism means leaving personal problems behind
agree
neutral
disagree
51.1%
70
9.5%
13
39.4%
54
0
20
40
60
80
Frequency

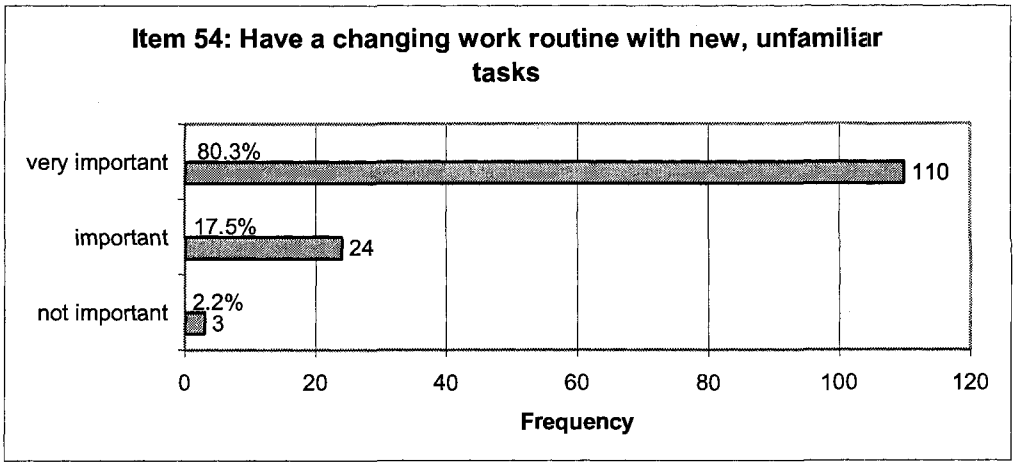

Item 46: Employees should mention their stress or physical problems to other coworkers
agree
neutral
disagree
87.6%
120
9.5%
13
2.9%
4
0
20
40
60
80
100
120
140
Frequency

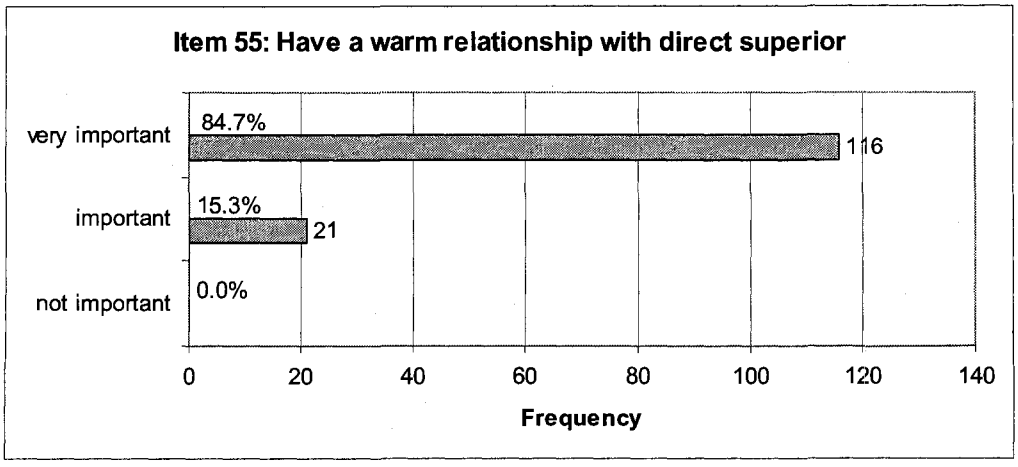

Item 49: During periods of low work activity, I would rather relax than keep busy with small tasks
agree
neutral
disagree
39.4%
54
12.4%
17
48.2%
66
0
20
40
60
80
Frequency

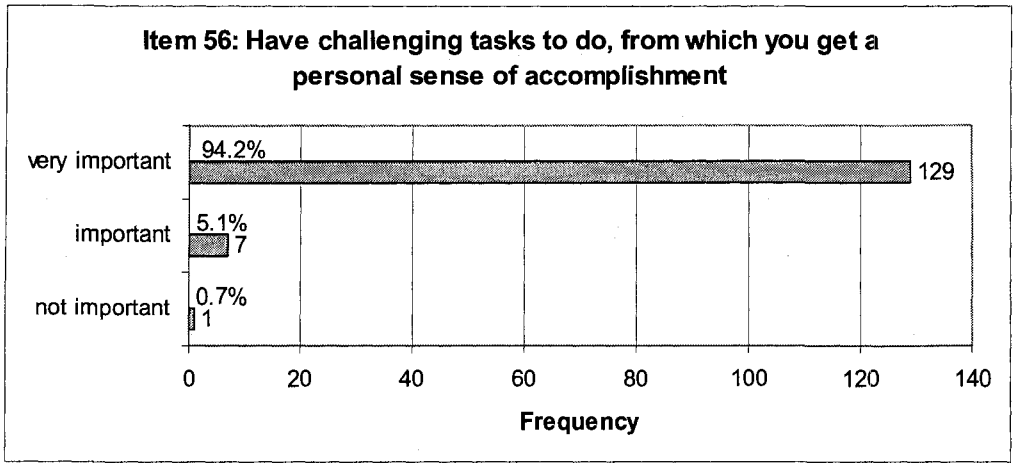

Item 52: How often do you feel nervous or tense at work?
seldom
sometimes
usually
57.7%
79
32.8%
45
9.5%
13
0
20
40
60
80
100
Frequency

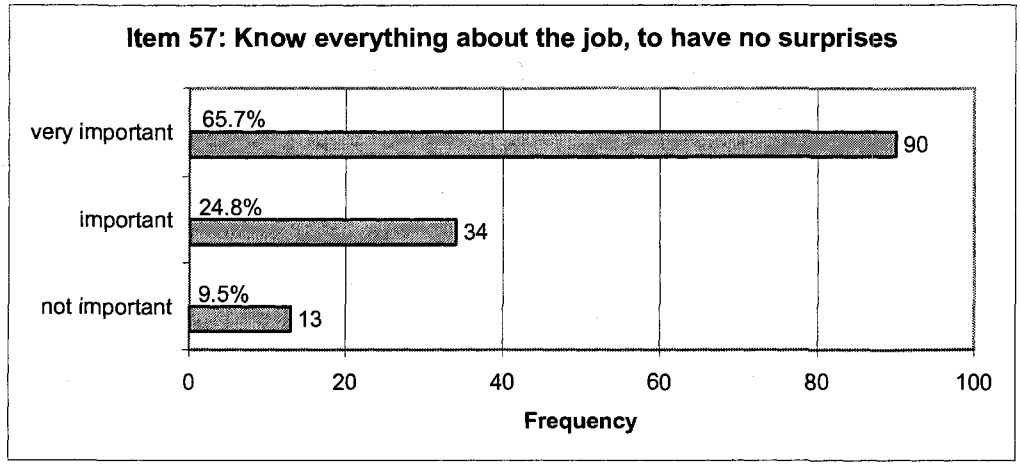
Items for the main domain work values

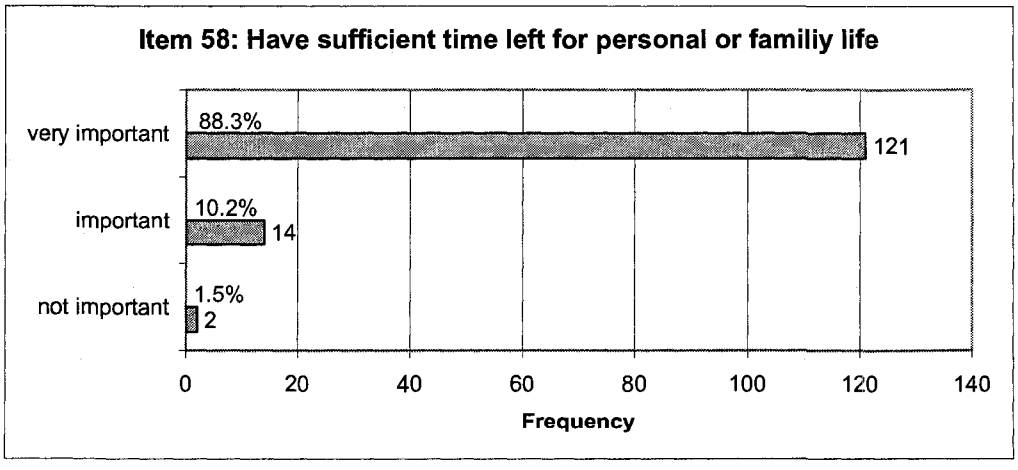


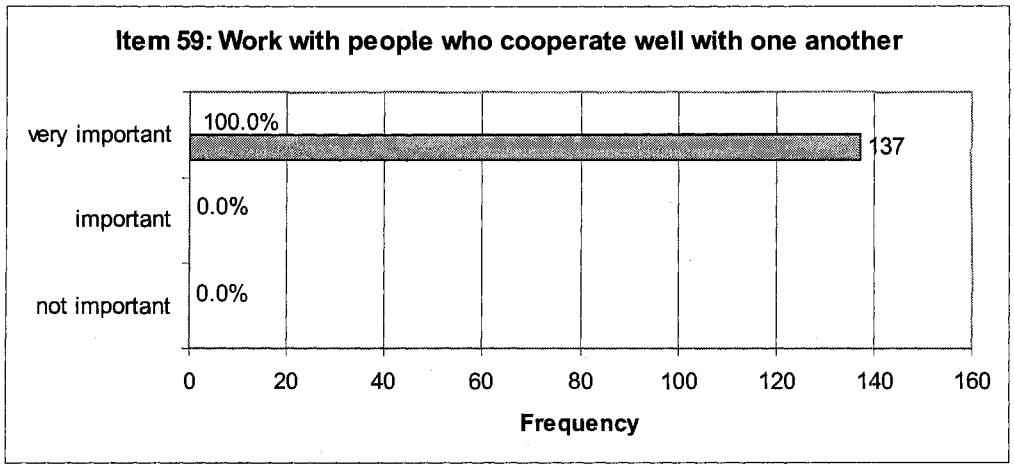


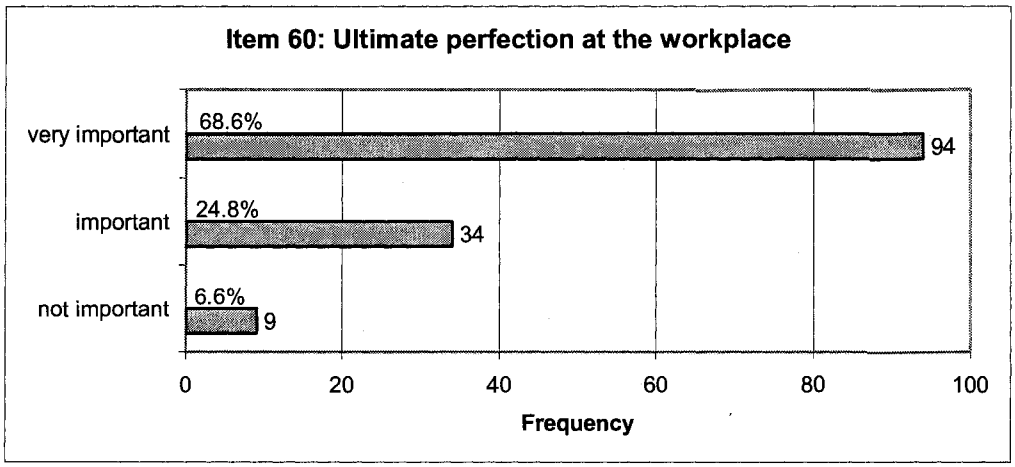


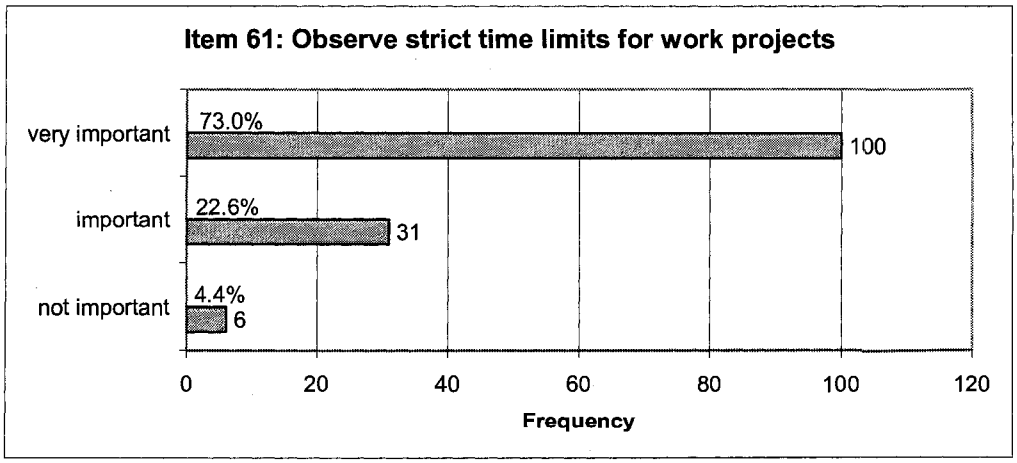

Item 56: Have challenging tasks to do, from which you get a personal sense of accomplishment
very important
important
not important
94.2%
129
5.1%
7
0.7%
1
0
20
40
60
80
100
120
140
Frequency


Item 57: Know everything about the job, to have no surprises
very important
important
not important
65.7%
90
24.8%
34
9.5%
13
0
20
40
60
80
100
Frequency


Item 58: Have sufficient time left for personal or familiy life
very important
important
not important
88.3%
121
10.2%
14
1.5%
2
0
20
40
60
80
100
120
140
Frequency


Item 59: Work with people who cooperate well with one another
very important
important
not important
100.0%
0.0%
0.0%
137
0
20
40
60
80
100
120
140
160
Frequency


Item 60: Ultimate perfection at the workplace
very important
important
not important
68.6%
24.8%
6.6%
94
34
9
0
20
40
60
80
100
Frequency


Item 61: Observe strict time limits for work projects
very important
important
not important
73.0%
22.6%
4.4%
100
31
6
0
20
40
60
80
100
120
Frequency