Abstract

The purpose of this study is to explore how Training Development Officers (TDOs) solve novel problems. Unlike other organizations, the military grows its talent. After enrolment in the Canadian Armed Forces (CAF), individuals are promoted to fill more senior positions. Senior positions are not filled by individuals outside of the CAF. Central to the education and training within the military is facilitating the development of expertise. Investigating qualitatively how officers solve novel problem can provide valuable insight into the development of expertise generally and also specifically within individual occupations within the military. The position of TDO was selected because TDOs serve as change agents and educational consultants for individual and collective operational performance. A hallmark of the TDO occupation is systematic thinking when providing advice, guidance, or facilitation. The purpose of this study was to explore: (a) how do TDOs characterize and identify novel problems within their occupation? and (b) how do TDOs respond to novel problems (i.e. transfer from automatic to effortful decision making)? Using Transfer and Adaptive Expertise paradigms, this study sought to understand how individuals are able to solve novel problems. This study identified that individuals are able to determine a problem is novel once forced to create a new approach to solve the solution. This goes beyond adapting or exporting a solution. Individuals become effortful in order to plan their actions. Participants develop a plan that is flexible and involves an ongoing integrated and iterative process allowing a plan to be reexamined and reoriented as required.
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I would also like to dedicate this work to retired LCol W.H.T. (Peter) Wilson (deceased). A Signal Officer he was asked to complete a mission during WW2 that was outside of his area of expertise. In 19 August - 3 September 1941, during with 35 men under his command, Captain W.H.T. Wilson, all of K Section, 1 Divisional Signals arrived at Hvalfjord, Iceland enroute to as part of "111 Force". On 25 August four signalmen under Lieutenant M.H.F. Webber, made the first landing (from the destroyer HMS Icarus) at the wireless station at Kap Linne, Spitsbergen. Meeting only friendly Norwegians they organized deceptive weather reports indicating fog over Spitsbergen, effectively cancelling routine German reconnaissance flights for the raid's duration. On 3 September the Kap Linne station was destroyed. The rest of K Section landed at Barentsburg where, in addition to signals duties, they helped destroy several German radio stations and strategic supplies including 540,000 tons of coal and 275,000 gallons of petrol, oil and lubricants. Russians stationed on the island were evacuated to Archangel in the intervening eight days. When the Empress of Canada returned from Archangel the force then withdrew.
taking the Norwegian civilians from the island. As a staff member of Canadian Forces School of Communications and Electronics Regiment, I was privileged to know Peter. He humbly offered his time to come in and talk to the Signal Officer students. He used his experience of OPERATION GAUNTLET to remind Signal Officers that there will come a time that they will be asked to do something for which they had no specific training. Their duty as officers was to find a way to get the mission done. I will forever treasure our conversations at the Officers Mess. To retired Sgt. Chris Burns (deceased), unfortunately you did not see me achieve this milestone. It was thanks to our numerous collaborations that involved debates, arguments and contemplations regarding training and education within the CAF that I decided that I should leave the Signals Officer occupation to follow my passion and become a Training Development Officer. Thank you for believing in me and for always having my back. Your friendship has made a mark that I will always take with me.
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Chapter 1: Introduction

Every sector of society requires individuals who possess specialized expertise. Experts are highly regarded due to their ability to consistently make accurate and reliable judgments and for this reason are typically requested by others to deal with the tough and uncommon problems (Chi, 2006; Dane, 2010). Experts possess the ability to: (a) effectively access a large breadth and depth of knowledge, (b) recognize patterns in situations, (c) respond in highly sensitive ways to what they know and do not know, (d) consistently generate accurate solutions, (e) intuitively monitor and predict results, (f) adopt numerous problem solving strategies, and (g) think critically and use minimal effort (Chi, 2006; Dane, 2010). Experts stand out because they effectively, efficiently and consistently solve problems within their domain because of their commitment to scholarship and prolonged experience (Bereiter & Scardamalia, 1993; Dane, 2010). They are often entrusted to complete functions on behalf of others and provide valuable knowledge and facts that enable others to make decisions.

Because experts are seen as the elite, the attainment of expertise has been greatly studied. Within the educational field, studies have focused on teaching and learning processes to facilitate the development of expertise. Grenier and Kehrhahn (2008) point out that research regarding expertise development depicts development as progressing linearly through stages. This linear progression suggesting that competence is also not a “once-and-never-again proposition” (O’Neil, Anderson, & Freeman, 1986, p. 971). In today’s workforce, remaining within one domain or area of expertise will be unlikely amenity (Carbonell, Stalmeijer, Könings, Segers, & van Merriënboer, 2014; Grenier & Kehrhahn, 2008). Experts must be prepared for continuous learning (Chi, 2006; Moulton, Regehr, Mylopulos, & MacRae, 2007). Within the workforce, individuals are often “forced back into development modes to adapt their competencies”
(Grenier & Kehrhahn, 2008, p. 199) in order to react to high pace of change and evolving knowledge. If not, knowledge and competencies will become inert and impossible to mobilize for solving novel problems (Grabinger & Dunlap, 1995).

Studies regarding why experts underperform when faced with novel problems have highlighted that there are expert-to-expert differences (Chi, 2006; Hatano & Inagaki, 1986; Moulton et al., 2006; Dane, 2010). These differences are mainly with regard to the decision making process among experts (Bereiter & Scardamalia, 1993; Hatano & Inagaki, 1986; Kitchener, 1983; Schön, 1983; Moulton, et al, 2007; Dane, 2010). Solving novel problems is central to the current research of within expert comparisons (Carbonell et al, 2014; Moulton et al, 2007). This is not surprising given the expert role in our society and the expectation that they will solve novel problems. The challenge for the education sector will be how to support the attainment of novel problem solving skills and for the workforce how to integrate this ability into human resource development and organizational perspectives. This challenge is exacerbated because there is not a consensus within regards to what makes a problem novel (Carbonell et al., 2014).

**Purpose**

The purpose of this study is to explore how individuals solve novel problems. Officers within the CAF are expected to make decisions on behalf of the organization and contribute to overall leadership of the organization. Learning how best to make effective decisions is a cornerstone of all leadership development (Bentley, 2008). Within the CAF there is an expectation that officers are trained to handle any situation; this is reflected in a common phrase, ‘one must adapt and overcome.’ This philosophy supports the expectation that the military must be prepared to operate in situations with uncertainty, instability, and risk (Command of Land
Front after the World War 1 commented (as cited in Command of Land Forces Operations, 2007)

The most important object of our training must be to produce commanders with the
character and ability to turn unfamiliar conditions to their own advantage, and who
will neither be crushed by the unexpected, nor afraid of the unknown.

Unlike other organizations, the military grows its talent. The military does not hire
individuals into positions; rather, individuals are selected and promoted to higher positions
throughout their careers. Central to the education and training within the military is facilitating
the development of expertise. Investigating how officers solve novel problem can provide
valuable insight into the development of expertise and also specifically within individual
occupations within the military.

Unfortunately, the officer core is too vast to cover within one study. The literature also
suggests that one’s ability solve problems is affected by context (Lewanandowsky, Little, &
Kalish, 2007), experience (Barnett & Koslowski, 2002), goal-states (Lewanandowsky, Little, &
Kalish, 2007), nature of expertise (Marathe & Hmelo-Silver, 2007), and type of problem
(Schraw, Dunkle, & Bendixen, 1995). As each occupation has its own professional obligations
that can be unique, a single occupation was selected: the TDO.

The primary function of TDOs is to serve as change agents and educational consultants
for individual and collective operational performance. A hallmark of the occupation is systematic
thinking when providing advice, guidance, or facilitation. Typically, they analyze operational job
performance requirements, identify needs, suggest solutions to performance problems and
implement their solutions. TDOs are also entrusted with the duty to ensure the optimum
effectiveness and efficiency of training and other performance. Other common responsibilities
include the analysis of requirements, human performance improvement, instruction, research and
educational management functions (Job Based Occupational Specification, 2009). This occupation was also selected because the competency required of their occupation at the Captain and above rank requires them to be able to “synthesis and integrate theory, facts and practical lessons learned to support the identification of solutions to non-routine problems” (Job Based Occupational Specification for TDO, 2009, chapter 3, p 2). There is therefore an expectation that officers from this occupational are expected to solve novel problems.

**Research Questions**

(1) How do TDOs characterize and identify novel problems within their occupation?

(2) How do TDOs respond to novel problems (i.e., transfer from automatic to effortful decision making)?

**Theoretical Background**

Studies comparing the performance of experts faced with novel problems have resulted in the contrasting concept of adaptive and routine expertise (Bereiter & Scardamalia, 1993; Hatano & Inagaki, 1986; Bransford, Brown, & Cocking, 2000; Varpio, Schryer, & Lingard, 2009). Both expert groups are differentiated by their ability to solve novel problems that are unique, ill-defined and potentially beyond their current domain of expertise (Bereiter & Scardamalia, 1993; Hatano & Inagaki, 1986; Schön, 1983). A routine expert is able to effectively solve familiar problems but not novel problems. In contrast, an adaptive expert is able to solve novel problems. To solve a novel problem, the adaptive expert must recognize and determine how to adapt their decision making (Moulton et al, 2007; Kitchener, 1983), typically by constructing new knowledge (Bereiter & Scardamalia, 1996; Chi, 2011; Hatano & Inagaki, 1986; Schön, 1983). They are also capable of more effectively transitioning from automatic to effortful decision making processes (Moulton et al, 2007). Automatic decision making processes are fast,
effortless, autonomous and unconscious. Effortful decision making processes are slow, deliberate and conscious. The two decision making processes are on a continuum and are not dichotomous ideas. It has been suggested that an individual relies on these processes concurrently. Their automatic decision making processes free their cognitive capacity to enable effortful decision making process to occur (Logan, 1997; Moulton, et al 2007; Carbonell et al, 2014).

Using scenario based problems (Barnett & Koslowski, 2002; Gregan-Paxton & John, 1997; Walker, Cordray, King, & Brophy, 2006) and by observing the implementation of new equipment (Varpio et al., 2009), research has identified what is happening. However, it has not explained exactly how this phenomenon occurs. There is a requirement when one considers expertise to examine that expertise in the context where it naturally occurs which will incorporate the complexity and dynamic nature of that context (Chi, 2006; Clancey, 2006) emphasized that dealing To develop a deeper understanding it is necessary to explore how adaptive experts are able to transfer from the automatic to effortful decision making processes (Moulton et al., 2007) and develop new knowledge once they recognize that the problem they are faced with is novel (Bereiter & Scardamalia, 1996; Hatano & Inagaki, 1986; Schön, 1983). It is this transfer of decision making efforts that this study hopes to explore through the experiences of TDOs who are faced with novel problems.
Definition of Novel Problems

Novel problems are those problems that are considered non-routine (Schraagen, 1993). To be solved, this type of problem requires decision-maker(s) to adapt or create new procedures or processes. These types of problems may also require the attainment of new information or a different perspective to successfully solve the problem. To solve this type of problem a decision-maker may also be required to weigh the information presented in the problem situation, identify the end-state or spend additional effort analyzing the problem because it is ill-defined.

Rationale

As suggested by Cojocar (2011) adaptive leadership is integrated into current military doctrine but the essence of transferring from automatic to effortful decisions is not within the military decision making model. To understand what is occurring there is a requirement for contextualization and interpretation of the situation in order to develop a comprehensive account of the phenomenon (McMillan & Schumacher, 2010; Szyjka, 2012; Stake, 2010). Black (1994) suggested when there are too many variables to define and control, then qualitative design should be chosen. Qualitative research also seems the best method to study novel problems which are ambiguous and complex and hence have various variables. Quantitative research design would also not be the preferred approach because it would risk losing the complexities essential to understanding how novel problems are solved (McMillan & Schumacher, 2010; Patton, 2002; Stake, 2010). It is also necessary to go beyond the organizational view and obtain the deep and personal view of individuals making the decisions to gather the required depth of understanding. The data needs to be “thick in description” (Sebastian, 2012, p. 112) and explore the phenomenon through the lens of those involved as it naturally occurs (Glesne, 2006; McMillan
& Schumacher, 2010; Sebastian, 2012; Stake, 2010) which is greatly affected by the situational details (Cojocar, 2011).

Understanding the ability of experts to solve novel problems, may help cultivate the development of adaptive expertise within the TDO occupation. Understanding the development of adaptive expertise can provide insight into specific learning strategies and learning environments for expert-like endeavors within their occupational training. The hope is that understanding the development of adaptive expertise can eventually be applied to other occupations within the military.
Chapter 2: Literature Review

The intent of this chapter is to introduce the concepts that formulate the study’s purpose and enable insight that contributes to the current understanding of how people solve novel problems. The concepts introduced include novel problems, how novel problems are integrated into the concept of expertise, transfer and military decision-making model. The chapter will close with an overview of current research.

Novel Problems

From the research investigating how individuals solve novel problems, there is not one standard definition, though many similar ones. Often descriptors do not provide enough context to truly explain what a novel problem is or consider degrees of novelty (Carbonell et al., 2014). The literature describes them as being nonroutine or ill-defined (Schraagen, 1993; Schraw et al., 1995).

Nonroutine Problems

Novel problems for the most part are those problems that cannot be solved using routine strategies (Brandford, Brown & Cooking, 2000; Bereiter & Scardamalia, 1993; Carbonell et al., 2014; Catrambone, 1998; Hatano & Inagaki, 1986). Literature suggests that novel problems are those outside an individual’s domain of expertise or at the edge of their current competency within a domain. Schraagen (1993) in the study of how experts solve novel problems in experimental design, defined novel problems as “nonroutine but not necessarily difficult ones” (p. 286). Within this Schraagen’s (1993) study, participants were given a novel problems where they were asked to design a sensory psychology experiment. The primary participants were labelled design experts and considered experts in designing experiments in psychology, but not sensory psychology. Their solutions were then compared against individuals who were labelled
domain experts and considered experts in designing experiments in sensory psychology. This suggests that novel problems are those typically outside of their domain of expertise.

Similarly Cortright, Collins, and DiCarlo (2005) in their investigation of how peer instruction affected the ability of novel problems defined novel problem as one that differs from a previous problem in that it is in a new context. In their study they compared how well students solved novel problems before and after being given opportunities to for peer instruction. After peer instruction, the students performed better on novel problems. Finally, Schubert, Denmark, Crandall, Grome, and Pappas (2013) define a novel problem as a “cognitively challenging situation rather than performing less challenging routine tasks” (p. 98). In their study they examined the difference between how novice and expert emergency physicians solve problems, most of which would be considered novel. This indicates that novel problems include a component that cannot be solved using existing knowledge and procedures that enable a routine task to be solved. This is consistent with Barnett and Koslowski (2002) who studied the effects of experience on the development of adaptive expertise. In their study, they gave participants a problem that intersected the specific domain of the two groups of participants, each group possessed expertise in a different domain. The solutions generated by the two different groups of participants, was then compared to the solutions of experts, refer to as super experts, who possessed expertise in both domains of the two different groups of participants. These studies suggest that adaptive experts solve novel problems that are at the edge of their competency.

Ill-defined Problems

The literature also describes them as being unusual, uncertain and ill-defined (Funari, Gentzier, & Wyssling, 2011; Moulton et al., 2007). Schraw et al. (1995) studied problem solving of well-defined and ill-defined problems based on Kitchener’s model of hierarchal cognitive
processing (Kitchener, 1983). Schraw et al. (1995) cite Kitchener’s definition of ill-defined problems to be “those for which there are conflicting assumptions, evidence and opinions which may lead to different solution[s]” (as cited by Schraw et al., 1995, p. 523). Schraw et al. (1995) elaborated Kitchener’s definition, identifying that there is not one specific solution nor is there a specific procedure to be used. Their study showed that different cognitive processes were required in order to solve well-defined problems compared to ill-defined problems. They also recognize that research shows ill-defined problems demonstrate between domain transfer, where individuals are able to transfer knowledge from one domain to another. Their study supports the Kitchener’s work, that epistemic belief affects problem solving of ill-defined problems and that ill-defined problems are solved using general-domain knowledge versus specific domain knowledge. Due to the epistemic belief effect, one’s perception with regard to solving novel problems is important. Moulton et al. (2007) support this concept and identifies that individuals must transfer from their automatic processes to their effortful processes in order to solve ill-defined problems. This again supports the notion that novel problems do not rely on routine procedures and that an altered process must be used for novel problems. The research discussing ill-defined problems uses descriptions that are similar to non-routine problems.

By examining novel problems as non-routine and ill-defined we can conclude that novel problems require us to use different cognitive processes. Novel problems require us to deviate from normal processes and require us to become more mindful. We need to attain or create new knowledge, consider the legitimacy of information and rely on general or abstract knowledge principles. Novel problems tend to exist outside the domain of one’s expertise or at the edge of their competency within a domain. As suggested by Carbonell et al., (2014) in order to measure adaptive expertise characteristics of this expertise need to be clearly defined. From their study
they determined that research does not identify the “degree of adaptability one might expect from [an] adaptive expert” (p. 27). Carbonell et al. (2014) therefore suggest that research needs to examine the degree of difference needed between old and new tasks for adaptive expertise develop. To begin that examination I will first discuss how novel problems are integrated into the concept of expertise and specifically adaptive expertise.

How Novel Problems are Integrated into the Concept of Expertise

Expertise.

Before beginning to discuss how experts make decisions, one must first explain what it means to be an expert. As defined by Ericsson and Charness, experts demonstrate “consistently superior performance on a specified set of representative tasks for the domain that can be administered to any subject” (Ericsson & Charness, 1999, p. 731). Expertise at a minimum requires five years but more likely about ten years to develop (Cornford & Athanasou, 1995). The literature consensus (Bransford et al, 2000; Chi, Glaser & Farr, 1988; Ericsson & Charness, 1999; Hatano & Inagaki, 1986; Klein, 1993; Tozer, Fazey & Fazey, 2007) is that the development of expertise is the result of one’s ability to:

- rely on their expansive repertoire of knowledge schema;
- rely on their extensive pattern recognition;
- effortlessly retrieve relevant information;
- develop meaningful deductions;
- adapt to situations; and
- routinize performance.

Expertise in the above description represents the attainment of the final stage of development outlined by Dreyfus and Dreyfus (1986). Within their model there are five stages of
development: novice, advanced beginner, competent, proficient and expertise. These stages are similar to the proficiency scale from novice to mastery proposed by Hoffman (1998). The literature describes experts as individuals whose judgment has become automatic or unconscious. As described by Moulton et al. (2007) toddlers must problem solve when attempting to complete a simple task and adults just do it.

Dreyfus and Dreyfus (1986) do acknowledge that novel problems exist and they seem to agree with Johnson’s (1988) idea that the adaptive nature of experts reflects their ability to adapt their behaviors to changes in a situation based on their repertoire of possible solutions they have grown to efficiently and effectively use. The problem with Dreyfus and Dreyfus’s (1986) model of skill acquisition is that it does not address or truly acknowledge how experts solve novel problems, but concentrates on routine problems.

The literature is starting to look more closely at expert-to-expert comparisons. This has highlighted that the development of expertise is not simply a “once-and-never-again proposition” (O’Neil, Anderson, & Freeman, 1986, p. 971), but that there is a requirement to maintain one’s proficiency. Examinations of experts has identified that maintenance may prevent experts from falling into the pitfalls of expertise where they overlook important aspects of the problem, are biased by their domain specific views, incorrectly accept the best-fit solution or fail to adjust their normal workflow (Barnett & Koslowski, 2002; Chi, 1978; Varpio et al., 2009; Wiley, 1998).

These situations have researchers re-examining expertise and specifically with regards to how experts solve novel problems. Normally experts are able to solve problems more effectively because they deconstruct it into smaller categories or segments (Schraagen, 1993). With novel problems experts may “tend to instead adapt the problem to familiar solutions rather than
adapting the solution to the problem” (Moulton et al, 2007, p. S109) or improperly reduce the problem (Bereiter & Scardamalia, 1993). When experts deconstruct a problem into smaller segments there is a risk that the complexity may be removed enabling it to be solved by routine processes, but compromising the integrity of the problem, so that the original problem is never actually solved; only certain aspects of it are. With this study, hopefully compromising the integrity of a problem can be avoided. Research suggests that pitfalls of expertise are often the contributing factor to why someone cannot solve a novel problem (Dane, 2012; Moulton et al, 2007).

**Integration into Concepts of Expertise.**

Four models of experts’ decision-making processes may present a more complete context of what may be occurring when experts face a novel problem:

1. *Adaptive and Routine Experts* of Hatano and Inagaki;
2. *Experts And Experienced Non-Experts* of Bereiter and Scardamalia;
3. *Knowing-In-Action, Reflection-In-Action And Reflection-On-Action* of Schön; and
4. *Kitchener’s model of cognitive processing*.

**Adaptive and Routine Experts.**

The idea of adaptive and routine expertise was developed by Hatano and Inagaki (1986) who identified that among expert sushi chefs there were differences. In an examination of expert sushi chefs, they identified 2 groups of experts. One group of sushi chefs could not produce the same high quality of food when the ingredients were not available because they were incapable of deviating from their recipes. A second group of sushi chefs were able to produce high quality food when key ingredients were not available by adapting their normal recipes. Hatano and Inagaki (1986) identified the first group as routine experts and the second group as adaptive
experts. Follow on research modified the context of these experts. Eventually, both expert groups became differentiated by their ability to solve novel problems that are unique, ill-defined and potentially beyond their current domain of expertise (Holyoak, 1991).

Routine experts use procedural knowledge and “learn to perform a skill faster and more accurately without constructing or enriching their conceptual knowledge, even after some room in their attentional resources have been produced through automatization of the procedure” (Hatano & Inagaki, 1986, p. 5). Routine experts qualitatively analyze problems to effectively and efficiently solving problems, but they are limited to the domain of their expertise. When a routine expert is given a novel problem they may focus on working quickly to employ the best known strategy and often over use a known strategy even when it does not apply (Hatano & Inagaki, 1986; Chi, 2006; Crawford et al., 2005; Hatano & Oura, 2003; Moulton et al, 2007). They may be overconfident and therefore overlook important details that define a problem or be fixated with domain specific views of new information (Chi, 1978; Wiley, 1998) and as a result removes the complexity of the problem (Moulton et al., 2007). In Varpio et al’s (2009) study on the use of electronic patient records (EPR) by medical professionals, routine experts were those participants who failed to truly adopt the new communication system and therefore tried to force the EPR to accommodate their typical workflow. Barnett and Koslowski (2002) in their study of expertise identified that restaurant managers could only modestly deal with novel restaurant problems, compared to business consultants with no restaurant experience who could. Routine experts are often overly concerned with increasing their efficiency in their domain of expertise thus limiting their adaptability to solve novel problems (Schwartz et al., 2005; Bernett & Koslowski, 2002; Varpio et al, 2009) and making them more susceptible to the pitfalls of expertise.
Adaptive experts on the other hand “not only perform procedural skills efficiently but also understand the meaning of the skills and nature of their expertise” (Hatano & Ingaki, 1986, p. 5). These experts are defined as being those who can also solve problems beyond their domain of expertise, i.e., they are able to solve novel problems. Adaptive experts are capable of realizing when normal rules and principles do not apply to the current situation and work to provide context to the problem they are trying to solve (Holyoak, 1991). As a result, adaptive experts build a new framework that enables them to invent or adapt new problem-solving procedures and processes (Hatano & Inagaki, 1986). Their thinking is more theoretical, enabling them to appreciate that their current knowledge may not be sufficient to address the problem presented to them.

Adaptive experts seek to continually expand their repertoire of strategies by building their capacity to theory-build or practice explanation testing. Adaptive experts therefore have a drive to figure-out the new context and create what schemas are lacking to fully understand the problem before solving it (Carbonell et al, 2012). Adaptive experts do not simply strive to improve so they are more efficient and effective; they strive to be better (Bransford et al., 2000). Adaptive experts do not simply differ in how they approach novel problems; to them, novel problems are opportunities to learn and develop their problem-solving abilities (Carbonell et al, 2012; Hatano & Oura, 2003).

Adaptive experts balance flexibility and innovation with efficiency. Adaptive experts not only react differently to situations but are able to change the situation for their benefit (Lin, Schwartz, & Bransford, 2007). The main contribution of Hanato and Inagaki (1986) is that not all experts are created equal. Routine and adaptive experts are the most prevalent way of
comparing expert to expert differences; therefore all other models will be compared to this concept.

**Experts and Experienced Non-Experts.**

Bereiter and Scardamali (1993) describe routine experts as experienced nonexperts and adaptive experts as simply experts. In their view adaptive experts are the true expert. They focus more on the expert’s ability to transition between automatic and effortful thinking in an effort to deal with novel problems. For them experts and experienced non-experts are discriminated by their ability to effectively enact this transition. In their explanation, true experts are able to effectively identify the complexities of situations and respond by becoming more effortful in their decision making processes (Bereiter & Scardamalia, 1993). They describe true experts as possessing a deeper understanding of how systems work and therefore are able to continually re-examine the problem until it is well understood. When this occurs experts are able to create a new solution; this explains the nature of how individuals are able to adapt to the problem to find new solutions stated previously. Bereiter and Scardamalia’s (1993) model was intended to adjust our view of expertise from a benchmark to a process. They identify experts as being those individuals who continually strive to advance their understanding compared to experienced nonexperts who conform to routines. Normally, reducing a problem is a process by which experts begin to solve problems more efficiently. Bereiter and Scardamalia (1993) identify that experienced nonexperts reduce a problem in a way that nullifies the original problem. They participate in problem reduction where they reduce the number and severity of problems. Bereiter and Scardamalia’s (1993) explanation also includes the idea that experts can become experienced non-experts because they become complacent about their competence (Fazey & Schultz, 2009; Ericsson & Charness, 1999). For instance, studies have shown that financial
experts do not yield investment returns that far outweigh their novice counterparts or even random selections of stocks (Bereiter & Scardamalia, 1993). It is because of this underperformance that Bereiter and Scardamalia (1993) identified that experts did not reliably perform superior to non-experts on many critical tasks. Unfortunately, because they fail to continually strive to increase their decision making abilities in complex and undefined contexts, experienced non-experts fall evolve their expertise. Bereiter and Scardamalia (1996) advocated that continual development of competence is realized only when experts participate in progressive problem solving where they extend their extensive pattern and procedural skills to enable them to deal with the complexities of the novel problem. They explain that experts continually expand their mental resources by reinvesting in learning, seeking more difficult problem and tackling more complex representations of recurrent problems. Their message is that expertise is not attained but a philosophy for living that resides in one’s edge of competency enabling one to transfer from automatic to effortful processes to solve novel problems. Bereiter and Scardamalia (1996) contribute to the routine and adaptive paradigm by identifying how important reactions to novel problems affects whether a person will successfully be able to deal with them.

**Knowing-In-Action, Reflection-In-Action and Reflection-On-Action.**

Through his extensive observation of workplace practices, Schön furthers the idea of transition from automatic to effortful process of decision making by suggesting three other mechanism are at play: knowing-in-action, reflection-in-action and reflection-on-action.

Knowing-in action corresponds with routine experts in that individuals simply react to situations automatically using their expertise to solve routine tasks. An individual’s actions are therefore spontaneous and often the individual completes tasks without thinking (Schön, 1983).
Reflection-in-action refers to an expert’s ability to think on their feet and improvise as the situation dictates. In these situations a person must use effortful processing to address the problem (Schön, 1983) and improvise to the unexpected and therefore corresponds with adaptive expertise. Reflection-on-practice describes the metacognitive function where after the situation is over one re-examines the unexpected situation to further understand its uniqueness and uncertainty. This is actually done some time after the events so there is no impact or ability to change results, but what this practice does is enable individuals to re-evaluate and learn from their actions (Schön, 1983). Since the process can enhance understanding this process may contribute to development of adaptive experts.

Schön (1983) places a heavy emphasis on the fact the problems in practice are rarely neat packages or a list of givens. Instead problems are messy and difficult to solve with standard theories or techniques. He therefore suggests that individuals properly “name the things to which (they) attend and frame the context in which (they) will attend to them” (Schön, 1983, p 9). Schön also recognizes that problems evolve; they may start typical and eventually become atypical. Unlike the previous models of expertise he does not explicitly see expertise as being adaptive or routine. Instead expertise involves continual transition from automatic to effortful processes (Schön, 1983). This makes sense when you consider that if a surgeon is dealing with an atypical situation with their patient, they must continue to use automatic processes to continue to work on that patient while also using effortful processes to find a solution. In a way the automatic process allows for the effortful to occur, for in this situation no action is unacceptable, particularly when actions take time and there is a finite time by which those actions can be completed.
Schön (1983) recognizes that an individual is not one type of expert or another but simply changes in his or her degree of effectiveness. His contribution to the routine and adaptive paradigm is that an adaptive expert also needs to be a routine expert to enable cognitive opportunities to deal with novel problems. Schön’s (1983) idea of framing and naming is very simplistic and though he emphasizes that problems are messy, he doesn’t account for the fact that routine experts may incorrectly name and frame problems but as presented by Kruger and Dunning (1999), they just don’t know what they don’t know.

**Model of Cognitive Processing.**

Kitchener (1993) proposed a model of cognitive processing that corresponds with problem solving skills for well-defined and ill-defined problems. Well-defined problems “absolutely (possess) correct and knowable solutions” and ill-defined problems possess “conflicting assumptions, evidence, and opinion which may lead to different solutions” (Kitchener, 1993, p. 223). Level 1 involves well-defined problems that are solved using specific inferential rules and strategies. Level 2 involves well-defined problems that are solved using metacognition to select and monitor Level 1 skills. Level 3 involves ill-defined problems that use episodic monitoring processes. Episodic knowledge refers to the legitimacy of solutions instead the processes by which a solution is achieved. Kitchener’s theory is important because “well-defined and ill-defined problems require separate cognitive processes and epistemic beliefs play an important role in ill-defined problems” (Schraw et al, 1995, p.534). Using separate cognitive processes and epistemic beliefs corresponds with the routine and adaptive paradigm because it suggests adaptive experts recognize the need to adapt and the routine expert does not.

What is consistent across all views of expert processes is that not all experts are created equal and most of the differentiating qualities surround the idea of being able to transition from
automatic to effortful processes to manage the complexity of the novel problem. Experts who are capable of this transition seek to continually expand their repertoire of strategies by building their capacity to theory-build or practice explanation testing. They deliberately focus on being innovative (Varpio et al., 2009) and therefore have a drive to figure-out the new context and create what schemas are lacking to fully understand the problem before solving it. This differs compared to routine experts who strive to improve so they are more efficient and effective. Experts who are capable of transitioning between automatic and effortful processes strive to be better (Bransford et al., 2000) and welcome opportunities to learn and further develop their problem solving abilities (Hatano & Oura, 2003). Many identify this individual as the ‘true’ expert (Bereiter & Scardamalia, Hatano, & Oura, 2003). Others have suggested that an individual may have to be a routine expert before becoming an adaptive expert (Carbonell et al, 2012; Varpio et al., 2009).

**Product of Transfer**

Transfer is the process by which individuals are able to utilize the skills and knowledge to perform one task towards the execution of a second task (Kimball & Holyoak, 2000). When the similarity of one task assists the achievement of another the transfer is considered positive. When the similarity of one task inhibits the achievement of another the transfer is considered negative. Kimball and Holyoak (2000) argue that it is “theoretically indistinguishable from learning” (p. 109). Kimball and Holyoak relate transfer to expertise in that “experts must use transfer to acquire their expertise”, “expertise affects the degree and quality of transfer” and “there are types of expertise that do not involve transfer of learning to novel tasks” (p. 109). Transfer is therefore a key concept in the discussion of how individuals solve novel problems for it is within this situation that they are able to use their existing knowledge to potentially guide their efforts toward a solution. Transfer
involves three categories and only one involves novel problems. The three tasks being compared are
categorized as being identical, highly similar or very different. Identical tasks are very rare and
mainly only seen in the learning environment where repetition is sought. Tasks that are highly
similar result in near transfer. Tasks that are very different result in far transfer (Kimball &
Holyoak, 2000; Barnett & Koslowski, 2002). The degree by which tasks are similar is characterized
by the context they are completed. Routine problems are therefore associated with near transfer and
novel problems are associated with far transfer (Larsen-Freeman, 2013). Kimball and Holyoak
(2000) identify that adaptive experts are able to address novel problems because they use deep
reasoning to formulate their recommendations, consider multiple complimentary solutions, and they
are able to utilize both forward and backward searching strategies to develop solutions.

Research on transfer explains those capabilities through two principles: the magnitude of
transfer and the direction of transfer. The magnitude of transfer refers to an individual’s
perception of how similar two tasks are. The more similar an individual perceives the similarity,
the more likely the transfer (Larsen-Freeman, 2013; Lewandowsky, Little, & Kalish, 2006;
Nokes, 2009; Perkins & Salomon, 2012). The direction of transfer refers to whether transfer will
be positive or negative and is based on two tasks sharing causal features with respect to the goal
or final response (Kimball & Holyoak, 2000). Because this research is focusing on how TDOs
solve novel problems, I will focus on the magnitude of transfer and how individuals perceive
similarity.

A critical component of transfer is one’s perception of how similar two tasks are. If the
tasks are too dissimilar, an individual will not use knowledge gained from solving one task to
assist in the solving of another task. There are four factors that affect similarity:
• Deep versus Surface Similarity: This similarity factor differentiates the situation or objects regarding the two tasks. For instance two stories may have similar characters (surface similarity) but greatly differ in the moral of the story (deep similarity) (Lewendowsky et al., 2007). Medical research has identified instances where doctors have failed to make accurate diagnoses because they only saw the surface similarity between a patient’s presentation of symptoms and did not recognize the deep similarity (Chi, 2006; Chi & VanLehn, 2012; Moulton et al., 2007). Tasks must share deep similarity for far transfer to occur.

• Context of judgment: This similarity factor refers to the similarity of the goal-state of two tasks. It is more likely for transfer to occur if two tasks have the same goal-state than if they have different goal-states (Lewendowsky et al., 2006).

• Conceptual versus Structural similarity: This similarity factor deal with procedures. Conceptual similarity refers to an individual’s ability to understand the underlying reason of why a procedure is effective. Structural similarity refers to an individual’s understanding of the order of step contained within a procedure. Far transfer is more successful if two tasks are conceptually similar. (Lewendowsky et al., 2006; Kimball & Holyoak, 2000)

• Context specificity: This similarity factor refers to the order in which various tasks are introduced. In one study two groups of students were given physics problems and algebra problems. The students who received the algebra problems first were able to transfer concepts to physics problems. The students who were given the physics problems were not able to transfer the concepts to algebra problems. This is because physics problems are more context specific than the algebra problems (Lewendowsky et al,
2007). This is also referred to as fixation and significantly affects experts when their prior knowledge inhibits them from successfully solving a new problem (Chi, 2006; Lewendowsky et al, 2007; Wiley, 1998).

Research shows that for far transfer to occur, individuals must have deep structural and conceptual or abstract understanding of the two tasks (Chi & VanLehn, 2012; Larsen-Freeman, 2013; Kimball & Holyoak, 2000). An interesting observation is that far transfer may be more successful when an individual can identify the deep similarity and conceptual similarity (Wiley, 1998). Research also identifies the importance of the degree to which encoding conditions facilitate retrieval of general rules that are common to both tasks (Chi & VanLehn 2012; Larsen-Freeman, 2013; Kimball & Holyoak, 2000). This highlights the importance of mechanisms to facilitate the perception of similarity.

Nokes (2009) researched on multiple mechanisms focusing on analogue transfer, knowledge compilation and constraint violation. In analogy transfer an individual must perceive that two tasks share the same deep structure. As described by Nokes (2009), individuals must “retrieve prior exemplar, create a mapping between it and current problem or situation and then using mapping to draw inference relevant to application context” (p.3). Knowledge compilation refers to an analysis of declarative knowledge to generate new procedure for a specific task. Constraint violation involves multiple iterations of a generate-evaluate-revise cycle to mobilize prior knowledge and transfer knowledge from one task to another (Nokes, 2009). Perkins and Salomon (2012) propose three mental steps for students to improve transfer in an academic context. These steps are referred to as detect, elect and connect. In this model students are encouraged to detect similarities; they then must elect to examine that similarity further and eventually connect a relevant relationship between the two tasks. An important point made by
Perkins and Salomon (2012) is that connection is not only about finding similarities but also identifying contrasts to develop the relationship between two tasks and that “transfer emerges from the gradual accumulation of smaller elements of knowledge, rooted in particular contexts, and gradually extending a great range of situation” (p. 252). These mechanisms of transfer are summarized by Goldstone and Day (2012) who describe transfer as “adapting new perspectives – developing new ways of seeing familiar situations” (p. 151). Volet (2013) describe these mechanisms of transfer as expansive framing where an individual identifies meaningful connections between “what has been learnt in a particular setting to a range of other settings” (p. 92).

Research has identified important factors that facilitate transfer. The first was individual traits. For instance motivation affects transfer because it activates the need to use knowledge (Dane, 2010; Goldstone & Day, 2012; Larsen-Freeman, 2013). Research has also identified open-minded thinking and being open to new experiences as important traits (Berieter & Scardamalia, 1993; Dane, 2010; Kimball & Holyoak, 2000). The second was the individual’s perspective of a situation and how they perceive the similarity between one task and their prior experiences (Billet, 2013; Chi and Lan Lehn, 2013; Labato, 2012; Goldstone and Day, 2012). The third is that others facilitate transfer by help individuals develop new perspectives. Cortright, Collins, and Dicarlo (2005) found that peer instruction enhanced student ability to solve novel problems. This may be due to a reminding or prompting effect (Bjork, 2011; Reed 2012). Billet (2013) also explored how societal and cultural contributions help individuals learn. Specifically, research has explored that individuals need to receive positive feedback (Volet, 2013). Due to these factors, it has been recommended that recommends that research concentrates more on what students do versus what they do not do (Labato, 2012; Larson-Freeman, 2013). Larson-
Freeman (2013) proposed to evolve the construct of transfer for “is not a matter of exporting an intact bit of knowledge from within the classroom to without or even students reusing what they have been taught, but rather of students transforming what they have learned” (p.108). This also supports the idea of developing new perspectives.

As mentioned the participants of this study are members of the military. Military leadership education and training involves preparing members with the task of deciding what to do in any given situation. As this is applicable to solving novel problems, I will now examine military decision making model.

**Military Decision Making Model**

Within the military the decision-making model is a crucial component of all functions. It enables a commander to effectively lead his/her forces. It is used at the tactical, operational, and strategic levels of command and across the entire spectrum of conflict. Within the Canadian Armed Forces, doctrine refers to the decision making model as the planning process which “applies to all Canadian Forces operations” or levels of operations: tactical, operational and strategic (Canadian Forces Operational Planning Process, 2008, p.45). The planning process involves five stages. These stages are slightly amended to satisfy each specific level of operation. The fives general stages are as follow::

1. **Initiation** begins with the *Receipt of Orders*. This essentially outlines the objective to be achieved. It involves the gathering of relevant information, including details about the current situation and particularly guidance documents. At this stage potential obstacles may be determined.

2. **Orientation** is primarily completed by what is referred to as *Mission Analysis*. The intent of this stage is to determine the decisive objective by analyzing the nature of
the problem and results to be achieved. Leaders therefore must consider their higher authorities’ direction and their strengths and weakness, tasks, constraints and restraints. This also includes possible enemy actions. Basically orientation determines “what needs to be accomplished, where, by whom, by when and why” (Canadian Forces Operational Planning Process, 2008, p.54).

(3) Course of Action Development focuses on Course of Action. Factors such as time, capabilities, constraints/restraints and risk are considered to develop complimentary courses of action or COAs. Each COA is wargamed to consider possible results and then compared to other COAs using developed criteria of comparison. Eventually a COA is selected by requisite authority.

(4) Plan Development involves outlining the specifics of the Plan, seeking approval by requisite authority and communicating the plan. Developing the specifics is important as it addresses issues, potential shortfalls or obstacles in the execution of the plan.

(5) Plan Review ensures that plan is continuously reviewed. There is an assumption that plans have a “limited period of validity” (Canadian Forces Operational Planning Process, 2008, p. 73), therefore the plan undergoes Review. Progress reviews and periodic reviews ensure the objective or mission is attained. If the situation changes there may be a need to reallocate resources, change the concept of the operation without changing the mission or change the mission. Progress reviews are ongoing to enable changes to the plan to be continually integrated. Periodic reviews are conducted at predetermined timings typically set by doctrine or other by requisite authorities.
This description of the planning process is simplified for the purpose of this thesis. For that reason it is important to clarify that routine problems are usually dealt with using set routines, Standard Operating Procedures (SOPs) and Tactics, Techniques and Procedures (TTPs) (Bentley, 2008). The planning process or other decision-making tools are used by “military leaders at all levels faced with complex, dynamic and novel problem situations where solutions of doctrine will not suffice” (Bentley, 2008, p. 216). Doctrine therefore encapsulates solutions to routine problems. Doctrine is important to not only enable quick reactions to be made, but also for unity of effort between teams of individuals at all levels of operations. Doctrine is so fundamental to all levels of operations that leaders are taught they must expressly chose when not follow doctrine and why there is a reliance on decision making tools.

The planning process is the primary decision making tool and is based on the rational decision making model. Its guiding principle is to determine a standard for an acceptable solution and rejects all solutions until one is formulated that exceeds that standard (Bentley, 2008). Bentley (2008) points out that leaders are not limited to the planning process or rational decision making model. Leaders also rely on Naturalistic Decision Making which enable a leader to take a more holistic review courses of action, incorporate experiences in generating possible options, and integrate satisfying criteria to develop solutions. Leaders also use Narrative-Based Models that examine the cause of a situation to predict solutions. Finally, leaders use System Theory or Systems Thinking to generate “systematically desirable and culturally feasible” solutions by focusing on getting the “Big Picture” and determining what is “relevant and significant to an organization” (Bentley, 2008, p. 224).

Decision making is important within the Canadian Armed Forces, which professes the concept of Mission Command, where individuals are told what to do but not how. Decision
making, particularly within the officer core, is a part of every developmental period within each occupation structure including both formal and informal learning. It is also incorporated in student assessment of every officer course. Being able to deal with novel problems is expected of all leaders.

**Current Research**

Currently research regarding adaptive expertise involves scenarios as a means of identifying that one group is more adaptive than another (Barnett & Koslowaki, 2002; Walker, Corday, King, & Brophy, 2005). Barnett & Koslowski (2002) identified how experience plays a large part of adaptive expertise. In their study using a hypothetical scenario involving a restaurant, participant solutions were compared to the solutions of super experts and measured based on theoretical concepts. When participant demographics were compared experiences were deemed to be the only significant factor that explained the adaptive expert performance of the business experts compared to the routine expert performance of restaurateurs and non-business university students. Walker et al. (2007) in a study involving engineering students demonstrated that scenarios were an effective method in assessing adaptive expertise. This assessment method using criteria including theory-based reasoning, innovation, causational relationships, and substantiation of one’s conclusions, may only determine who is more adaptive. These scenarios do not identify a clear point at which someone is an adaptive expert versus a routine expert. The scenario for assessment may not capture the entire picture. Marathe and Hmelo-Silver (2007) compared the qualitative differences between aquarium hobbyists and scientists. Both groups of participants were given a picture of an aquarium and asked a series of questions during an interview. Focus statements indicated that hobbyist where statistically more focused on the components of the aquarium, while scientists were more focused on the abstract ecosystem of the
aquarium. When both groups were prompted through specific questions hobbyists could discuss aquarium ecosystems and scientists could discuss components of the aquarium. A comparison of elaborative, causal, functional and hierarchical reasoning between hobbyists and scientists showed no significant difference. This study showed that experts differ due to how their knowledge is applied. It also suggests that experts can expand outside in their domain with prompting.

Other studied examined workplace activities. Bauer, Chambers, Neidenthal, and Chatard-Pannetier (2004) identified that there are potentially advisory experts and performance experts. In their study they also suggest that how individuals use their knowledge will affect how they store that information. In their study, they find that advisory experts tend to provide rather moderate evaluations and provide alternative choices and implications of each. A performance expert on the other hand makes extreme evaluations and provides clear and concise answers that are unambiguous. The performance expert may not be deemed an adaptive expert because their response does not include elaborative, causal, functional and hierarchical reasoning. This may not mean that their reasoning did not include it just that they normally do not offer it because they are the one making the decision, compared to an advisor who does not.

Another study by Varpio et al, (2009) involved the observation of the collaborative communications used by nurses and doctors after the implementation of an electronic patient record (EPR). Problematic interactions were then examined to determine if the participants when given the opportunity to incorporate the EPR into their normal workflow would abandon the EPR, force the EPR or adopt it. From the study Vaprio et al (2009) determined that those who abandoned the EPR were routine experts, while those who forced the EPR or adopted it were adaptive experts. Bereiter and Scardamalia’s (1993) would have been considered those
who forced the EPR to be experienced nonexperts because they reduced the problem to a routine by forcing the EPR to accommodate their workflow.

These studies have been identifying that routine and adaptive experts are dichotomous. Limi and Regehr (2007) also advocate that “adaptive expertise is not a developmental stage beyond routine expertise” (p. 1164), but that routine component of expertise allow for the automatic while adaptive component of expertise is afforded time to deal with the novel situation (Hatano & Inagaki, 1986; Kalyungn, Renkl, Paas, 2010; Kimball & Holyoak, 2000). Carbonell et al (2014) suggest that adaptive expertise develops from routine expertise and specifically the varied experiences afford to developing experts as they expand their competencies. Though connections have been made that an individual needs to be both a routine and adaptive expert, missing is a deeper understanding of the how one transitions from automatic decision making processes of the routine expert to effortful decision making processes of the adaptive expert.

Additional research has suggested that there is other theoretical information to consider. Shoss, Witt, and Vera (2012) examined when adaptive behavior can lead to higher task performance, by considering the impact of organizational politics and consciousness. Their results showed that the relationship between adaptive performance and task performance was positive when both conscientiousness and organizational politics are high and when both are low. The relationship was not significant when consciousness was high and organizations politics were low or vice versa. Jennings, Hanson, Skovholt, and Grier (2005) examined the breadth of knowledge needed to facilitate the development of expertise in counseling professionals. Jennings et al (2005) determined that expertise in the cognitive domain may assist in well-defined problems, but additional skills were required by counseling professionals when dealing with ill-defined problems. Due to expertise in relational and emotional domains, counselors had
the requisite automaticity that enabled them to function with a relaxed posture in their therapy
sessions thereby allowing them to notice the complex issues of their patients that are often subtle
and camouflaged. This coincides with Moulton et al. (2007) who examined attention, effort and
situational awareness.

Moulton et al. (2007) deduced that in order to deal with uncertain and challenging
situations and multiple stimuli simultaneously, a person must be capable of focusing attention
and effort, which translates into the idea that automatic processing resources are used for routine
components of a situation and free one’s attention and focus towards the components of the
situation requiring effortful resources. Moulton et al. (2007) emphasized how one’s reaction to
situation and ability to remain calm impacts one’s ability to control one’s attention and effort. In
an examination of situational awareness, errors often occur because a person makes a decision
based on the parameters he or she felt were important at the time and unfortunately miss
important parameters. Essentially, situational awareness is one’s ability to stay in tuned to the
evolving situation, and Moulton et al (2007) identified it as the cross-road factors where other
expert judgment concepts intersect. It is proposed that “expert judgment be considered as an
expert’s ability to respond effectively in the moment to the limits of his or her automatic
resources and transition appropriately to a greater reliance on effortful processes when needed”
(Moulton et al., 2007, p. 114). To do this, experts must recognize when to slow down to enable
automatic processes to continue to work while simultaneously using effortful ones to address the
muddy problems that are not routine. These studies indicate that there may be other
considerations such as the workplace dynamics, how one employs his or her expertise, what
other expertise he or she possess and the type of situations he or she faces.
In a review of the literature from late 1990s to present, Carbonell et al (2014) identifies the following individual factors regarding adaptive experts:

- They differ in knowledge representation in specifically how they organize and abstract their knowledge;
- They possess different cognitive abilities and analogical problem solving processes;
- They differ in the breadth of experiences they’ve had; and
- They possess achievement motivation.

Carbonell et al. (2014) also suggested that a supportive learning environment and opportunity to participate in deliberate learning activities are also important. Review of literature did not find that experience with other people influenced adaptive expertise, but the specific support of a supervisor did. Carbonell et al. (2014) highlighted a study by Carbonnier-Voirin, Akermi & Vandenberghhe (2010) who found that there is a positive relationship between transformational leadership and adaptive expertise and a study by Griffin & Hesketh (2003) who found a positive relationship between management support and adaptive expertise.

Carbonell et al.’s review also coincides with the resurgence of studies regarding the transfer of learning. Perkins & Salomon (2012) emphasize the role of motivation on the part of students. They identified that students, regardless of their cognitive abilities, need to be motivated to see the connection between experiences in order for transfer to occur. This is similar to achievement motivation. Chi and VanLehn (2012) in their examination of the failure-to-transfer phenomenon hypothesize that one must teach “students to explicitly focus on the interactions among the relevant literal surface features as a way to “see” and understand the deep structure of a problem ..” (Chi & VanLehn, 2012, p. 183). This coincides with how individuals represent their knowledge. It is for this reason that Lin, Schwartz & Bransford (2007) have
suggested that the acquisition of adaptive expertise would involve learning environments where learners are required to notice situational differences between problems to enhance awareness of situational variability, develop new approaches to enhance procedural variability and embrace opportunities to develop new understandings.

Theoretical information has explained *what* may be happening and how to facilitate it, but it has not explained exactly *how* this phenomenon occurs or the context where it naturally occurs. To develop a deeper understanding it is necessary to explore how adaptive experts are able to transfer from the automatic to effortful decision making processes (Moulton et al., 2007) and develop new knowledge once they recognize that the problem they are faced with is novel (Bereiter & Scardamalia, 1996; Crawford et al., 2005; Hatano & Inagaki, 1986; Schön, 1983). To achieve this, it has been suggested that decision making should be studied using real examples and within natural settings where factors are not controlled (Grenier & Kehrha, 2008; Nokes, 2009; Schubert et al., 2013). Genrier and Kehrha (2008) emphasize that we need to stop looking at expertise as an endpoint and begin acknowledging that expertise needs to continually adapt. Nokes (2009) also recommends incorporating multiple theoretical perspectives to further understand mechanisms or processes used in transfer of knowledge. Carbonell et al. (2014) suggests that adaptive expertise be migrated from traditional expert performance research to professional performance research because typically tasks are to standardized and not realistic, participants are typically only experts and therefore offer limited insight into development of adaptive experts and performance measures are too specific such as speed and accuracy and do not allow for qualitative measures. Larsen-Freeman (2013) recommends changing the term from transfer to transform, so research is not focused on how individuals export their knowledge but incorporate it and hence transform it. As proposed by Labato’s (2012) using an action-oriented
approach will identify the connections individuals make in the process of transfer. If we understand how individuals adjust from automatic to effortful processes and how they incorporate new knowledge, we will be further towards facilitating the development of adaptive expertise.

Summary

This literature review provides context that will be used to examine the research questions. Novel problems are problems where existing knowledge and procedures alone are insufficient to solve the problem. As a result individuals must be more effortful and use different cognitive processes. Expert-Expert differences, specifically in decision-making, have identified that not all experts are created equal. The literature suggests that adaptive experts compared to routine experts are able to deal with novel problems. This ability to deal with novel problems is explained through transfer and the factors that facilitate transfer. TDOs are specifically trained in a linear decision-making process, but can rely on other decision-making models. By examining first how TDOs characterize and identify novel problems and second how they respond to novel problems, changes in decision-making processes can be better understood. Recommendations on how to educate TDOs to deal with novel problems can then be made.
Chapter 3: Method

Research Design

Through a short survey and semi-structured interviews (Patton, 2002; Rossman & Rollis, 1998) this study captured participants’ perspectives. The intent of this methodology was to reveal their experiences of facing novel problems (Stake, 2011) within their occupation in the Canadian Armed Forces (CAF). A qualitative analysis provided a meaningful context (McMillan & Schumacher, 2010; Sebastian, 2012; Stake, 2010) that could be related to current theory enabling new insight and deepening our understanding of how this phenomenon occurs (McMillan & Schumacher, 2010).

Recruitment and Sampling

The participants of this study are officers of the CAF within the TDO occupation. Currently within the CAF there are approximately 160 TDOs. These individuals are employed throughout Canada and within select foreign militaries. These positions are in Training Establishments, various levels of unit, formation or command headquarters. Participation in this study was solicited through the assistance of the TDO Branch within the CAF who have sponsored my pursuit of a Masters in Education and through personal contacts. Recruitment documents for participation are included in Appendix A and B.

For this study, a purposeful sample of only the TDOs within the Canadian Defense Academy was used. There were 41 TDOs within the Canadian Defense Academy at the rank of Captain or above. These individuals were employed in CFB Borden, CFB Kingston, and CFB St. Jean. This group of TDOs was specifically selected because their role is to advise the chain-of-command on all issues regarding training and education within and across the entire CAF, including the Army, Navy, or Air Force. The TDO occupation was also selected because
according to the occupational specification for this occupation, after a specific rank they are required to be proficient in identifying solutions to non-routine problems (Job Based Occupational Specification for TDO, 2009). Developmentally, this competency is to occur within the occupation at the rank of Captain/Lieutenant (N) or above. The denotation of (N) indicates a Navy rank.

Recruitment of participants was achieved through workplace email. The Training Development Branch provided the email of all CDA TDOs who had attained the rank of Captain or above. An email was then sent to each possible participant requesting their participation in the survey. This email included the Letter of Information and a link to the survey. The Consent form was also imbedded in the survey.

Data Collection

Data collection was achieved using a survey and interviews. Since this study was examining how TDOs solve novel problems, it was important to select individuals who were considered to be adaptive experts. A general measure to determine if someone is an adaptive expert does not exist, though measures predicting adaptive performance do exist (Pulakos, Schmitt, Dorsey, Arad, Borman, & Hedge, 2009). For this reason a short survey was used primarily as an intake tool to select interview participants, but also to provide some initial data regarding the specific research questions. The survey is available in Appendix C.

To limit the bias of the researcher, those individuals that the researcher had directly collaborated with in a professional problem solving situations were not selected. This eliminated 2 of the possible 41 candidates. The survey was then given to 39 TDOs, 20 individuals responded. The participants who responded to the surveyed ranged in rank from Captain to Colonel as follows: Captain/Lieutenant (N) =9, Major/Lieutenant-Commander (N)=7,
Lieutenant-Colonel/Commander =3, Colonel/Captain (N) =1. Candidates were sent an email inviting them to participate in an on-line survey, provided through the tool Fluidsurvey.

The participants were first asked to provide some demographics such as their rank, time in the military, and time in the military as a TDO. They were then provided a definition of a novel problem and then asked if they believed they solved novel problems as part of their occupation. Those that answered no were thanked for their participation. Those that answered ‘yes’ were then asked further questions. Specifically, they were asked to describe a novel problem they faced and also to indicate how frequently they performed certain actions. Their responses were compared to current research regarding novel problems. The last question of the survey requested their further participation in an interview.

Willing participants were then selected for the interview based on their descriptions of their novel problems. Ten descriptions were selected to ensure a breath of novel problems and possibility of a rich description. The interviews were semi-structured to both collect the required data to answer the research questions but also to enable the participant flexibility to share his or her unique experience in facing novel problems. Though participants were asked to provide an example of a novel problem they faced, they were free to discuss that problem or another. The interviews were expected to last for approximately 30-45 minutes but actually ranged between 32 -90 minutes. In total, ten interviews were completed. 9 of the interviews were conduct face-to-face at Queen’s University or the Canadian Defense Academy and one was conducted over the phone. All the interviews were recorded. Unfortunately, one of the intended recordings was unsuccessful, so field notes were used for that interview. The interview guide is provided in Appendix D.
Data Analysis

The quantitative survey data were analyzed in SPSS for descriptive statistics. These statistics provided demographic information on the participant group. Qualitative responses were reviewed to determine if the participant may provide insight into how people solve novel problems. Survey data were also reviewed to ensure novel problems were consistent with the literature.

All the recorded interviews were transcribed by the researcher. This had a secondary effect of enabling the researcher to become very familiar with the participants’ experience. These data were then imported into ATLAS-Ti for analysis. Data analysis involved a systematic code-category-theme process (McWilliam, Young, & Harville, 1996). The codes were created as the data were reviewed and additional codes were added as needed. Multiple approaches to code the data were conducted until final codes were chosen. This process involved continually rereading the data and comparing it to other participants and collapsing multiple versions of codes into one representative code. Codes were later categorized into groups and eventually larger themes. The overarching analytical approach for the grounded theory was the systematic approach advocated by Strauss and Corbin (1990) versus the constructivist model of Charmaz (2006). This approach was viewed to be more relevant given the researcher’s familiarity with the TDO experience and the participants involved. Due to the researcher’s familiarity, a truly interpretive approach would depend too much on the researcher’s view, and be perceived as being biased.

Ethical Consideration

The ethical risks of this research were perceived to be low. It was approved by the General Research and Ethics Board at Queen’s University, see Appendix B. Each participant was provided a letter of information both before beginning both the survey and interview, see
Appendix A. The participants also signed consent for both the survey and interview as well, see Appendix B. Requisite steps were made to protect the identity of the participants and care was used to properly secure their personal information and data.

**Trustworthiness**

To ensure accuracy of the interviews, transcriptions were verbatim and by the primary researcher to ensure no third-party error in interpretation. All of the interviews included acronyms and jargon, which could have made it difficult for a third-party to accurately transcribe. After initial coding, the researcher shared the codes with an experienced researcher to ensure that coding process was in alignment with qualitative methodology. A second experienced researcher was then given an interview to code to ensure inter-rater reliability, 79.3%. After the researcher and second experienced researcher discussed the codes and decisions surround the selection of each code, some codes where amended. This process identified more thoroughly what an individual code captured and delineated one code from another. The researcher then continued using this approach when creating any additional codes and particularly when collapsing codes.

This approach also enabled the research to evaluate her own deductions from the data. As mentioned the researcher was familiar with the participants and the subject. Therefore the researcher needed to constantly be reflective of her own experiences in order to be reflexive regarding the data. Through note taking and re-examination of data, the researcher continually reviewed the data and themes developed from it. This continued even into the drafting of the results, after which the researcher again, re-examined each participant response to ensure it accurately reflected the data, both in terms of actual words and context.
Care was also taken to ensure that the data shared truly represented the voice of the participants. Re-examining the participant responses also ensured that the researcher was expressing their voice accurately as well.
Chapter 4: Results

This chapter will report on the aggregation of participant responses to the survey and interview questions. The responses present the key themes that emerged from the data collected. As stated earlier, the purpose of this study is to explore how TDOs (TDOs) solve novel problems. How these themes provide insight into that purpose will be discussed in the next chapter. The intent of this chapter is to have a less contextualized review of the emerging data.

Survey Results

The survey provided some preliminary insight into how TDOs solve novel problems. In total 20 of 39 individuals completed the survey, 53% response rate. From the survey the following participants by rank responded: Captain/Lieutenant (N) =9, Major/Lieutenant-Commander (N) =7, Lieutenant-Colonel/Commander =3, Colonel/Captain (N) =1. Of those participants, 17 of the participants were in another occupation before becoming a TDO and 3 of the participants enrolled into the CAF as a TDO. The participants had between 6 and 30 years of experience within the CAF. For their highest level of education, 1 participant had a Graduate Diploma, 5 participants had Undergraduate Degrees, and 14 participants had Masters Degrees.

Of those who answered the survey, only 1 participant stated that they do not solve novel problems. Therefore 19 individuals or 95% of TDOs agreed that they solve novel problems. These 19 participants were asked how often they used particular actions in an effort to solve novel problems. The list of actions was created based on current research (Moulton et al, 2007; Schraagen, 1993; Vapiro et al, 2009; Tozer et al, 2007). The responses for those actions are as follows:
Table 1

<table>
<thead>
<tr>
<th>Action</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapt new procedures or processes</td>
<td>0%</td>
<td>0%</td>
<td>36.8%</td>
<td>42.1%</td>
<td>21.0%</td>
</tr>
<tr>
<td>Spend additional time analyzing the problem</td>
<td>0%</td>
<td>0%</td>
<td>10.5%</td>
<td>47.4%</td>
<td>42.1%</td>
</tr>
<tr>
<td>Seek additional information to understand the situation surrounding the problem</td>
<td>0%</td>
<td>0%</td>
<td>10.5%</td>
<td>26.3%</td>
<td>63.2%</td>
</tr>
<tr>
<td>Consult with a colleague or other individual on how to approach the problem</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>68.4%</td>
<td>31.6%</td>
</tr>
<tr>
<td>Educate yourself on knowledge that would help you solve the problem</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>47.4%</td>
<td>52.6%</td>
</tr>
<tr>
<td>Deconstruct the problem into smaller components that included potentially both routine and non-routine solutions</td>
<td>0%</td>
<td>0%</td>
<td>47.4%</td>
<td>10.5%</td>
<td>42.1%</td>
</tr>
<tr>
<td>Considered the legitimacy of the solution</td>
<td>0%</td>
<td>0%</td>
<td>5.3%</td>
<td>31.5%</td>
<td>63.2%</td>
</tr>
<tr>
<td>Consider the legitimacy of the information surrounding the situation</td>
<td>0%</td>
<td>0%</td>
<td>10.5%</td>
<td>26.3%</td>
<td>52.6%</td>
</tr>
</tbody>
</table>

Participants were also asked to identify why they believed their problem was novel. Based on the descriptions of the participants: 7 participants described it as being new, 4 participants claimed there was no known solution or precedence, 2 participants said it involved organizational change, 1 participant described it as challenging and 5 participant identified that multiple types of information had to be considered. Most of the problems involved an aspect of change management. One participant specifically commented that there was “no clear policy or direction”. Another participant commented that the problem “required significant change management and support from a variety of key stakeholders.” Participants were also asked how often they solved novel problems:
Table 2

Frequency by which Participant deal with Novel Problems

<table>
<thead>
<tr>
<th>Frequency</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than once a month</td>
<td>6</td>
</tr>
<tr>
<td>Once a month</td>
<td>5</td>
</tr>
<tr>
<td>2 to 3 times a month</td>
<td>4</td>
</tr>
<tr>
<td>Every day</td>
<td>4</td>
</tr>
</tbody>
</table>

From the participants who reported solving novel problems, 15 volunteered to be interviewed. Two volunteers were disregarded because their description included statements such as “typical and expected”. Unfortunately there was no clear discriminant feature among the remaining participants, essentially all could have been interviewed. Interviewing them all was not possible. Problems were therefore reviewed and ranked. If the problems could be addressed potentially by someone at the rank Lieutenant, they were ranked lower because those with the rank of Lieutenant were not required to deal with non-routine problems. The results of this ranking still allowed for there to be at least one participant of each rank. Individuals with higher rankings were contacted first.

**Interviews**

In total, 10 individuals were selected to be interviewed based on the ranking given. These interviews ranged from 32 to 90 minutes in length. During the interview each participant was asked to share an experience of a novel problem. As a result their responses were not limited to a specific time or rank. Some of the older novel problems occurred between 10 and 20 years ago. The newer novel problems occurred less than a year ago. When asked to define a novel problem, one participant discussed philosophically how he approached novel problems in general, without providing a specific problem. As a result, his participation will be as an
informant regarding novel problems. Below is a summary of the nine novel problems described by participants during the interviews and an explanation for using the informant’s information.

**Summary of Novel Problems**

The individual experiences of each participant are labeled 1-10 respectively. The intent of the summaries is to provide some context to discuss the data aggregated.

*Participant 1, Male*

This senior officer had to deal with a personnel problem. In this situation a unit member’s specific life situation had become increasingly complicated. There was a possibility that the member may be forced to leave the CAF because it would be impossible to fulfill both their private commitments and professional commitments. This participant described this problem as being novel because he needed to find a compromise to enable the member to remain within the CAF.

*Participant 2, Male*

This individual did not provide a specific novel problem, but provided a general information regarding novel problems that provided valuable insight into the development of the themes as this information echoed the ideas expressed by the others. This individual will therefore be considered an informant regarding novel problems.

*Participant 3, Male*

In this novel problem the school TDO was involved with developing a new training methodology when the existing methodology was no longer available. Up to this point all MARs Officers were given the opportunity to train and be assessed on board an operational ship. With the replacement ship this training methodology was no longer possible because there was no additional space to accommodate trainee personnel and supporting staff. As a result the
opportunity to train MARs Officers at sea and an approximately 200 year old training model was lost and a crisis was left in its wake. The training solution chosen, involved simulation which only pilots were using at the time. The participant described this problem as being novel because (a) “everyone believed it was a significant crisis”, (b) “this was actually new to everybody, no one in the Canadian Navy, save a few folks, who had been on exchanges with the Americans, had ever been exposed to Naval Simulation on a large scale”, (c) “aside from the Air Force, simulation was not a big thing for the Canadian Forces”. The participant acknowledged that there was a huge organizational cultural education and change involved with this problem and that organizational cultural biases needed to be overcome.

Participant 4, Female

While working with a foreign military, this Senior Staff Officer was a part of a team that was to introduce eLearning as a new training model within a foreign military school. The school personnel were not trained in how to utilize the new Learning Management System (LMS) nor was there guiding policy on how to implement eLearning into the existing training system. Not only was the Senior Staff Officer faced with the implementation of new technology, but also had to deal with organizational obstacles. The main obstacle was the personnel within the organization. Those involved did not appreciate the scope of the novel problem they faced and essentially expected the tool, Moodle, to take over all teaching responsibilities. The participant identified this problems as being novel because it meant dealing with a problem in a non-standard way. Normally if someone was going to introduce eLearning, within the CAF there was a doctrinal process to follow. In this situation the foreign military did not have a process and the CAF member had the challenge of trying to get them to adopt a process when they did not see the need. The problem was novel due to the organizational culture. The Staff Officer, who normal
had a model to deal with this issue, was specifically told not to utilize a proven method to address the implementation of eLearning. As a result the Staff Officer had no authority and only the power of influence.

*Participant 5, Female*

In this novel problem a new small ship was joining the Naval Fleet. Originally it was planned as a training vehicle. After the acquisition contract was in place, it was decided that it would be an operational asset. The school TDO involved was first consulted regarding the competency of an occupation being considered for positions on the new small ship. As the novel problem came to light, not only was training for those tasked to ship in question, but the actual manning and tasks assigned to individuals on the ship needed to be determined; as a result it also affected the career paths and hence management of occupations involved. At the time of the TDO’s initial involvement the only real decision was that the ship would be part of the security element at the upcoming Olympics. The participant described this problem as being novel because of the numerous occupations, the different individuals and the new naval ship involved. The participant also highlighted that as she broke the problem into components, each was novel. It was also because of the overall scope and complexity. The participant realized it was novel fairly quickly, because it was unprecedented, but the magnitude increased in breadth as it continued to unfold.

*Participant 6, Male*

For this novel problem, the school TDO was involved in integration of capital projects, essentially new equipment, into the Individual Training and Education of the Navy. At the time there were no processes or policy governing this endeavor. This individual was a Staff Officer within the Naval Headquarters, but within a completely different part of the organization than
those involved in capital projects. The participant commented that though others had dealt with situations where they had to integrate the organizational functions of two entities, he had not experienced it before and therefore it was novel to him. Again this problem had organizational change issues that evolved over time.

**Participant 7, Male**

As a Senior Staff Officer at a Formation Headquarters, this individual was charged with the task of creating mobile learning technologies for the entire Canadian Forces in the form of Apps. This was something that our NATO partners were also exploring but no one had a proven solution and at every turn there were obstacles. This problem was novel because there was no plan, no developmental models that one could leverage and very little policy to offer guidance.

**Participant 8, Female**

In this situation eLearning was being implemented within a military Base (Headquarters for approximately 8 military schools). The individual was tasked with incorporating eLearning within the school with really no specific direction on how it was to be accomplished or with the requisite resources to support it. The individual was a Staff Officer within the Headquarters did not work directly with the school personnel and therefore had limited influence over the Commandants who were responsible for conducting the training within their school. IT services, who were responsible for all computer services were also part of a different organization within the formation. The eLearning capability did not fit within the current policies governing computer security, employment, funding or training and therefore was novel.

**Participant 9, Male**
With this novel problem, the Senior Staff Officer was deployed as part of training mission to institutionalize an Academy of Medical Science within the host foreign military. This Academy would provide training to all military medical personnel. Due to the conflict within the host country, the medical services within this military were also the primary medical service for the country, because they were physically able to maneuver through the country with some level of safety, though at great risk. Efforts to modernize the host nation’s medical capabilities were to be achieved by the institutionalization of the Academy. Due to the intended impact of the Academy and the nature of this problem, the organizations involved in the evolving medical services included NATO, the foreign military, other government establishments (OGEs) both nationally and regionally, and non-government organizations (NGOs). The scope and complexity of this problem made it novel.

Participant 10, Male

The Staff Officer who faced this problem felt it was novel because it was completely new to him. Up until this point in his career they were responsible for developing curriculum within training establishments and overseeing the standards provided by this curriculum. The individual was then asked to provide advise on how to structure a the senior position within the Standards Cell of the Brigade. This involved not only recommending the rank of the individual, but also determining possible occupations to select individuals for the position, their tasks, their training requirements and all various reporting lines they need to have.

Research Themes

Five themes emerged from the interview data. These themes included (a) realizing the problem was novel, (b) creating an accurate picture of the novel problem, (c) creating an approach to solve the novel problem, (d) creating a flexible plan and (e) building partnerships.
As the participants described how they approached their novel problem a process was unfolded. As a result the themes are not disconnected themes and represents a direction that appears to be linear.

**Theme 1: Realizing the Problem Was Novel.**

For the first theme, all the participants discussed how they were in a situation where they realized their problem was novel. Some of the participants realized immediately that their problem was novel. For others that realization came over time. All the participants agreed that the complexity or intricacy of the problem was appreciated gradually. There was no one reason for categorizing a problem as novel. Instead there were multiple facets to each problem that were expressed through the codes within the theme. These facets included no plan or solution, the problem no longer working, a new way of doing business and time.

**No plan or solution.**

For at least half of the participants there was no current solution that they could adopt to resolve the situation. As Participant 3 commented,

I think when you encounter a novel situation, the first thing you need to do is stop…say, right…why is this novel? What is the problem situation issue? Because there has got to be something. If there wasn’t you would know how to solve it, that’s a logical assumption. So that is the first thing you need to do.

After engaging with a particular group from within the organization unsuccessfully during a number of initiatives and trialng a number of solutions, Participant 6, realized there was no process in existence to enabling two independent systems to be compatible. The participant highlighted the criticality of “making sure they (groups within the organization) engaged in the right kind of analysis and at the right decision points” to ensure that capital projects could be implemented in the Navy with as little disruption to the training system. For if training was disrupted, it affected military operations. For Participant 7, after discussing with others within
the military and then OGEs, it became evident that no one had a plan on how to utilize or develop Apps for learning purposes. This novel problem became more evident as they consulted with additional NATO partners and found the NATO partners were creating strategies as well. Participant 9, had a similar experience when working to develop the Academy of Medical Science during a NATO mission. Training was being provided through another NATO country, but that there was no plan to enable it to be institutionalized. There was no training system in place to support, develop, implement and evolve the training. Essentially the host nation was completely dependent on NATO and unable to deliver it independently. For Participant 1, there was a member of the unit that had a unique situation where military commitments and life commitments were not compatible and given the current policies in existence there was no avenue to readably resolve it. As a result a resolution had to be created.

**Old Solution Was No Longer Working.**

For other participants, current solutions were either no longer available or stopped working. Participant 3 described how this was considered a crisis for those involved with this training model.

Up until this particular time, this would have been the early 90s, the way you trained a MARs (Maritime Officer, group of occupations) is you took a destroyer, the Makenzie Class, and you set a bunch of trainees to sea and they sailed around the ocean for 6-8 months as part of the normal ship’s crew and they stood watches on the bridge, training in the mess deck. And they sort of sailed the ship and learned how to sail at the same time. The RCN (Royal Canadian Navy) had been doing it from the way the RN (Royal Navy) had been doing it and the way they did it and everything else. It was hundreds of years of unimpeded progress. Well, when the steamers were paid off and we went to the CPF (Canadian Patrol Frigate). The engineers decided the ships compliment is 350 people, they only needed (bed space) for 350 people. Small flaw in there is that there is no way to train anybody. So now the RCN is faced with a huge problem in that their whole training system has now just collapsed. What do you do?

Participant 4 described how normally training design occurs through a period of steps. In the given situation, the decision was to just put the current PowerPoint presentations into the
LMS, Moodle. This would become the eLearning. Though a process existed, the colleagues did not know the process nor did they want to consider it. Normally, for a TDO, it is by taking others through the design process that you educate and get the buy-in to create a good training product. In this case that process was not available. Participant 8 had a similar situation. Participant 8 was also implementing eLearning into various schools, but in this case it was not that the design process was not being utilized but that allocation of tasks to individuals within the organizations such as schools and IT services had to change. This involved reallocating funding, amending support agreements, changing terms of work, etc.

For Participant 9, who was trying to institutionalize the Academy, the curriculum the host nation was given by another NATO country was not meeting their needs. To begin with it was based on a university level curriculum, and the host military utilized an apprentice type of training model. As mentioned it was currently working because NATO was heavily involved in the delivery of the training and soon that responsibility was going to shift to be solely the responsibility of the host military. The current curriculum did not consider the audience or capabilities of those delivering the training. The participant discussed how the mission essentially abandoned the old curriculum and redeveloped it to meet the intended outcomes but by incorporating the host military’s specific circumstance. Participant 10 also described how the status quo was no longer working. In this situation, he was asked to develop a position and particularly the duties and reporting lines of that position, because there was a lack of oversight of standards functions within an organization within the Army.

Participant 4 described the fact that the situation involved a “non-standard way” of doing things. Participant 7 echoed that idea by calling the situation a “not just run of the mill.” For all these participants, solutions that were previously used were no longer viable.
New Way of Doing Business.

There was also a consistent theme among the participants that there was a need for change and hence a new way of doing business. The need for change is typically because the old way of doing things is no longer working, but sometimes it is because there is simply something new. This is best explained with technology. For instance, a university has three Learning Management Systems: Moodle, Desire2Learn, SAABA. The university decides to only support Moodle. For the Education Faculty who was using Desire2Learn, they must now start using Moodle. From the Education Faculty perspective, the change is occurring because of new technology, not because Desire2Learn was no longer providing the service they needed. The need for change may be in response to changes with technology, processes, organizations, and/or roles. Participant 3 discussed how a new fleet of ship caused the collapse of the existing training model. As a result, they pursued simulators for the first time in the Navy. Up until that point, the only occupation using simulation were Pilots. There was a lot of skepticism regarding simulations ability to deliver the training experience offered by an actual ship. Participant 3 commented:

there just wasn’t the organizational culture …..the discussion I always heard was the simulation of fighter pilots. That was it, it was no value to anyone else. You’ve got to go to sea or you’ve got to go to the field. It was really a cultural issue, a cultural bias if you will, that you had to overcome.

Participant 4’s experience involved the introduction of eLearning. This plan for this initiative involved placing current PowerPoint slides on Moodle and somehow the LMS was going to facilitate learning. In this situation, it was not skepticism regarding the technology, but a lack of understanding that contributed to the complexity of the problem.
Participant 5’s experience involved determining the manning of an entirely new small ship. At the onset it was unclear who would actually command the ship. Even to discuss what occupations would be on the ship, entire task structures and where there interacted and overlapped had to be considered. This was complicated further when determining what rank individuals within the occupations had to be. Many of the occupations could not agree and all had vested interest in the outcome. The role of the small ship in operations was evolving, which only complicated matters worse. Participant 6 while working for the Navy in strategic level Training and Education realised the need for an evolution of processes to enable the integration of capital projects and force generation of trained personnel to ensure we have the right individuals at the right time to function effectively. This is best expressed in participant 6’s comment “I was amazed to find out how many times pieces of equipment were showing up and no one had done any analysis on training.”

Participant 7, was entrusted with implementing learning Apps. After consulting with other NATO militaries he learned they too were trying to formulate a solution. Participant 7 described it as starting from scratch; “we don’t have doctrine, we don’t have any process, we don’t have any supporting mechanisms.” This situation became more complicated when the participant tried to pursue App development and licensing, he was being asked to accept the terms and conditions on behalf of the Canadian Government which the participant could not do. The issue of licensing was such that it almost halted the whole initiative. Eventually a partnership developed that resolved the issue. Until then the fact that an organizational infrastructure did not exist was something that made this experience a standout.

This was a similar experience for Participant 8 who was also implementing eLearning using a LMS. The supporting culture did not exist. Individuals had to be hired or reassigned and
the current public service category of employment did not include an eLearning competencies that were required. Other organizational changes also resulted due to the implementation of new technology.

Participant 10 was being asked to propose the terms of reference for a senior officer position. In this case this kind of a problem was new to him. This highlights the issue that novel can be new to an individual or new to an organization. Proposing a solution to this novel problem forced him to examine new processes in terms of strategic planning, strategic organization structures, etc.

In an effort to institutionalize the Academy of Medical Science, Participant 9 described that there was no existing training and education governance policy or guidance. This governing policy would guide the operations within the school both administratively and in terms of the actual learning. Without it, it would be difficult for things to evolve and improve. As the participant said:

There was no standards, no standards cell. No training for any of the instructors. No organization in place to evaluate the training or help these guys out. No validation, none of that. There was no Individual Training and Education governance policy or guidance. So though they had the HQ laid out there was nothing coming down from on high. In terms of this is how you do Individual Training and Education. The faculty was generally untrained. And the leadership was abysmal. So most of these guys were in their positions based on their tribal connections.

Again an organizational culture had to be built from scratch. In this situation the culture was very different from our western culture. The participant discussed how tribal connections and appointments were made, so often people appointed had no experience. He also had to consider the role of the other government establishments and non-government organizations because until the country’s infrastructure developed further they would be part of the creating the provision of
medical services. It became clear the solution could not simply involve rebranding western solutions and imposing them within their culture. He had to build it from the ground up.

Participant 9 also discussed how the role of training and education in a military missions was evolving “as NATO plans for the future they all see training and education as very much being a part of how they are going to spread the ideas globally (to) decrease global tension (and) increase peace”. In the background there was also an evolving increase in the TDO’s involvement in the mission objectives. The participant was not just dealing with activities within a physical school, but more so working with the host nation on a national level. The intent being that through training and education one will build a nation up and create infrastructures that would empower them. The participant talked about using the “train-the-trainer” model to assist with that empowerment objective. This was important because the host military was considered leading edge for the health care system within the country due to the conflict. Because of that, building the school that helped build the national health care system, which then helped build the nation, was a part of the evolving training and education role and hence increased the TDO’s involvement in a military mission. The participant further discussed how due to his ability to see things strategically, he accompanied his superior to strategic meetings and was tasked with coordinating follow on activities.

Time also played a role to play in the realization that there is a need for a solution. The problems faced by Participants 3 and 5 were identified approximately 8-10 years before they became involved. But they were labeled a lower priority and something to be resolved later, because the organization was dealing with more immediate issues. Participant 3 also discussed the need for theatre activation training for a military operation and how it hadn’t been done since Korea and what normally was completed in three weeks had to be accomplished in four days.
Time itself can therefore affects the context and may indicate a problem is novel. The training associated with this military operation was normally three weeks, but when the time available for training is only four days becomes a novel problem. Likewise, participant 5 also identified that the fine water spray fire suppression system that was in existence but no one knew how it worked or how to train it. This highlights that people become comfortable with the status quo. The more time passes, the less likely people are to accept change. The cultural aspect may be the part that makes it novel of which time set that particular condition. Participant 4 also discussed time, but in a different way. In Participant 4’s experience a plan forward was determined, but as deadlines were being missed it became evident that the plan was not working. Time in this situation may be an indicator of a problem. Time placed pressure on achieving a solution. Participant 5 discussed how supporting the upcoming Olympics was putting pressure on finding a solution for the new small ship because it was going to be part of the security force capability. Participant 9 arrived to the NATO mission and saw how previous attempts to institutionalize the medical academy had failed; again, that was a reoccurring problem. He was deployed for nine months and therefore had a limited time to affect change.

For Participant 6, as he interacted with other organizational groups on separate occasions with no success and hence had a negative reoccurring experience, he felt he had a novel problem to solve. This is also similar to Participant 4’s experience in the continual difficulties and failures the team she worked with in developing the eLearning. In this case it is the frequency or times an event occurs that helped indicate a problem was novel.

To realize that a problem was novel, was multifaceted. Realising that the there was no solution, that a solution was no longer working or that there was a new way of doing business
occurred only after an individual analyzed the problem. Time also played a role in this
determination.

**Theme 2: Building the Picture of the Novel Problem.**

All the participants discussed the theme of building a picture of the problem. This
involved deconstructing the problem and educating themselves. Both of these activities enabled
the participants to have a better understanding of the problem. Participant 3’s experience best
introduced this next large theme:

And so what I needed to do was take some time and talk to all the people who had been
involved in this and go, “so tell me again why you couldn’t deal with this?” And you sort
of repeat that. That was one of the biggest hurdles in solving the problem is trying to build
that picture.

The remainder of this section will discuss how the participants went about building that picture
by describing 2 of codes within this theme: (a) deconstructing the novel problem, (b) education
about components of the problem.

**Deconstruct the Novel Problem.**

A code that all the participants shared was the need to deconstruct the novel problem to
fully understanding it. Specifically, this meant that individuals would take apart the problem and
examine each piece more closely and how it relates to the other pieces in an effort to develop an
understanding. Participant 3 discussed how over his career when engaged in a novel problem he
took a conscious pause to “take a moment and clarify the issue” for often no one seemed to know
what the solution, the intended outcome or the real issue was. Participant 5 described the
whiteboard in her office and how it was broken down into many little issues. She also described
how once she started to deconstruct and identify smaller questions that it resulted in more
questions, “smaller questions had to be broken out to solve that one larger one.” Participant 6
also identified how the novel problem had to be deconstructed to identify the missing pieces. He
mentioned how initial proposed solutions may have addressed some of the issues, but how they failed to address the training requirement because the problem was not fully fleshed out. Participant 6 also discussed how that deconstruction of a novel problem helped sequence activity and qualify what was to be achieved. He specifically talked about developing governance in the form of orders and what those orders needed to include to have success in solving the issue.

Participant 7 discussed how in pursuing the CAF App development, he really had to determine “what does that mean and how does that work.” Participant 8 furthers the concept of deconstructing the novel problem. She shared how identifying all the pieces that they did not control, essentially identified all the partnerships they would have to build in order to solve the novel problem. She commented “we had to work all those avenues to get where we wanted to go.” Deconstruction helped identify those avenues. Participant 9 throughout the interview gave the sense that interconnectedness of people, situations, priorities were critical in understanding the situation. Specifically he comments, “take that step backwards and don’t let yourself become overwhelmed and that will allow you to see the problem. And how to solve it.”

Participant 10 outlined how he deconstructed the problem by reviewing past situations and where the difficulties arose. He talked about how important the Standards role is in military training for assuring quality control of training and education. He specifically discussed after deconstructing the problem the issue surrounding training waivers was not about whether they were being received or not, but when. Participant 2 discussed the importance of helping articulate the novel problem. He highlighted how TDOs are often the ones helping others articulate the problem. Often others consult TDOs looking for a training to fix a performance problem. He identified that often they failed to see how there are reasons for the performance issue that will negate the need for training such as materials or equipment, information
awareness, information transfer, improper selection of person for the task, not communicating the expectation of the performance or an issue with the work environment. After articulating the problem, a training fix is no longer the solution needed.

Participant 1 highlighted the importance of taking more time during the awareness stage of problem solving. People often fail to truly examine the issue and break it apart. If they broke it apart, they would see how there are already solutions to the smaller problems.

*Education about components of the Problem.*

Participant 3 discussed “quantifying the knowns and unknowns” when articulating his approach to developing an understanding. This involved identifying what is known about a situation and then identifying what pieces of information are missing. Once one knows what information is missing one then work towards obtaining that information. The participants identified how deconstructing the problem helped them identify what they did not know.

Participant 3 discussed how he talked to everyone inside and outside the military he knew who worked with simulators. He outlined how he found “stuff that would lead him down one path and that would either provide answers or raise more questions that sent him down another path.” Participant 6 echoed that experience outlining how “basically if information was missing from anyone of those areas, then I’d have to flesh-out that information.”

Participant 9 emphasized the importance of completing a literature review to guide his quest for missing information. Participant 3 made an interesting point that one of the key unknowns may be the end state or final outcome. Often with a problem there is an intention but the outcome is not measureable. An end state or outcome qualifies the success of solving the
novel problem; hence, there was expressed need to identify and ideally measure the outcome from novel problems. He described it as being very difficult to achieve anything without identify the outcome. He reflects that,

I think that in all those cases, I didn’t know where the end state was going to be. I really think for me that is what defines a novel problem….you really don’t know how it is going to end, but you rely on the process to get it to some sort of logical conclusion.

All of the participants discussed how they needed to research missing information.

Participants 10 and 5, discussed getting into documents until one knows something inside and out. Participant 3, 6 and 8 talked about looking at what other training schools were doing. Participant 9 described how he was calling back to Canada to consult with colleges to see how they approached training with a more hands-on or apprentice model. Participant 3 also conducted original research to determine if simulation would provide a viable training model for the Navy MARs Officers. He even conducted follow on research to determine if motion was necessary or if the training value was achieved through visual and audio cues. He also identified the importance of being methodical in one’s search in order to careful prepare oneself to refute the arguments from skeptics and stop it from devolving down to a debate. As stated by Participant 8 “research it, research it.” The participants also discussed that once they collect more information they need to analyze it to compare and contrast the information. Participant 1 cautioned that often people think they have a novel problem but they really do not because someone has a proven solution that they could have used in the form of a standard operating procedure or other guiding principle.

Participant 3 and Participant 2 discussed how being aware of the organizational culture around an individual is also very important as it provided context to the problem. Participant 3 identified that he needed to know how the so-called “back room” functions. This will help an
individual when one needs to fight against a cultural obstacle. Participant 3 also emphasized that you need to be both dogmatic and pragmatic. A person needs to be able to say, “yes I understand this is what the process says, and this is what we are supposed to do, in 98% of the cases, but this isn’t one of those cases.” He actually described the TDO as being the person paid to deviate.

Participant 2 discussed recognizing differences in terms of feasibility. He discussed three different feasibilities: instructional feasibility, resource feasibility and organizational feasibility. Understanding the feasibility of these areas helps one build the picture to understand the problem. It helps one get a better sense of the environment where the situation is occurring. He talked about being a systems thinker and how most of the novel problems are between interaction(s) of systems. One needs to see how they are different to understand the nature of their interaction.

Participant 7 also discussed how the strategies of others may have worked for them but not for his situation. He highlights that one needs to consult with others to get ideas, but one needs to know one’s own environment and when taking an exact strategy will not work. An individual can though use his or her experience and build on it to resolve one’s specific situation. For instance he discovered that the American military had Apps on a public store, but the CAF wanted them, however, to be on the CAF store, to control access and collect data to enable them to evolve. The Americans did have policy that was adopted into the CAF model. He discovered that the British military was also developing an App capability. Both were actually using the same vendor. The British military hired the vendor to develop all their Apps and therefore lost some ownership of the technology. The CAF instead kept the development internal and not only has ownership but now has an App development capability. Another interesting difference was that the British military also paid about 10 times more money to hire the vendor to develop the
Apps. The CAF would probably not have been able to afford to do that. Participant 6 and 10 discussed looking at differences in terms of “what ifs?” Participant 6 was considering how the needs assessment would fit within certain systems and Participant 10 was considering how the terms of reference of the Chief Standards Officer position would fit within the organization.

Participant 10 also mentioned how important it was to think it through. Participant 5 also described it as “literally (I) had to walk away and think and research.” Participant 6 talked about taking an opportunity to organize the information and make connections between the discovered information so it makes sense. Most of the participants agreed that all of the themes outlined as part of educating oneself was to prepare oneself to address the problem. Participant 9 suggested that one “take the time to set yourself up.” Participant 7 suggested that educating oneself enables one to realize what one can possibly do. Participant 3 encapsulates the requirement to educate oneself and focus on preparing oneself in the following, “You are never going to solve the novel problem if you don’t believe your solution will work.” His message was that one has to start by convincing oneself, which is achieved through education.

**Theme 3: Creating an Approach to the Novel Problem.**

The next large theme that participants shared was that they all needed to create an approach to the novel problem. To achieve that they found similarities from their experience or the experience of others to guide them, developed goals, ensured it fit into the overall strategy and obtain feedback.

*Founded Similarities from Their Experience or Others That Guided Them.*

Almost all of the participants discussed how they relied on similarities from their experience or others to guide them. Participant 3 relied on his master’s degree to guide him in conducting his own original research to help him deal with the simulators. Participants 3 and 7
also commented on the impact of formal education on their approach. Participant 7 had an opportunity to be a part of the implementation of the first LMS in the CAF and therefore was able to draw on that experience when dealing with Apps. Participant 5 developed a new perspective after seeing her classmates be removed from training due to injuries and witnessing their frustration because they were not given meaningful work during recovery. An appreciation for a person’s sense of pride was something she considered when dealing with the manning of the new small ship.

Participant 8 also discussed how she had to deal with an issue regarding military police training and convincing people to accept a solution. She relied on that experience to guide how she dealt with the various key players involved in implementing eLearning. That experience also enabled her to appreciate the impact of change within a school, for during that time she was an instructor. Participant 9 discussed his experiences dealing with Training and Education issues at various organizational levels and also dealing with different cultures during a previous deployment. From those experiences, he had a better appreciation not only of individuals and how to deal with different personalities, but also how to make systems within various levels of an organization work effectively. Each experience provided new knowledge that could be mobilized towards dealing with current situations.

Participant 3 emphasized the need to talk to people to learn from their mistakes, which is why he consult with everyone he knew who dealt with simulation, so he could prevent making the same mistakes and also use their successes to drive his own. Participant 4 had a negative experience where she was trying to share her experience to prevent another military from making similar mistakes but no one wanted to develop an implementation plan for eLearning and hence it fell on deaf ears. Participant 5, consulted with Naval personnel she trusted to help her
understand the complexity of the situation she was facing in trying to man the small ship, and to help her maneuver the organizational climate. Participant 6 described the capital projects database and how it outlined all the projects and personnel involved. He used that database to find people who were dealing with similar issues and gathered their perspective, particularly the factors others considered when making certain decisions. Participant 7 discussed how he talked to individuals already involved in App development, such as the American military and how he reviewed their governance protocols because they were further along than those of the CAF. He also consulted with industry to see what experience they had and he could learn from. Based on this, he developed an agile plan that incorporated best practices that others learned and enabled him to potentially avoid the obstacles and mistakes others made.

Participant 8 talked about how some eLearning initiatives worked in Borden and Esquimalt but not in Gagetown. She would connect the IT personnel so that one could learn from the other. When others told her it could not be done, she was often able to show how others had overcome a similar obstacle and that enabled her to get the buy-in she needed to move forward. Participant 9 shared how in preparation for his deployment he consulted other TDOs who were involved in training and education missions in an effort to learn from their experiences. Participant 10 explained how he talked to other Standards personnel to get their viewpoint and experiences to incorporate into his own solution. Participant 2 accentuated how experiential learning and sharing lessons learned was a big part of the military culture. Participant 10 discussed that this is why so much of military training involved scenarios and simulation. During training individuals had exposure to realistic problems, so when they are on the job they are better able to handle the situation.
Using one’s own experience or that of others was very important in developing a plan to solve the novel problem. Participant 1 highlighted that more than likely, someone has experienced a similar problem that one can at least spring board off from. Participant 2 identified that experience and working with others is how one develops the skill sets to deal with novel problems. Hence, through education and through consultation with others, participants articulated that they were able to devise a plan to address the novel problem.

**Developing Goals.**

Some of the participants discussed the importance of developing goals, both at the micro and macro levels. Participants 3 and 5 discussed goals in terms of how once a novel problem is deconstructed one needed to formulate what problems to resolve first. Understanding the goal of each smaller problem, made this process easier. Participant 7 discussed how he examined why the CAF needed a mobile site and from that derived the five overall goals. These goals, such as ownership and compliance with personal devices, where then used to develop the strategy to resolve the problem. In a way they provided a frame of reference for a situation where there was no clear end state. Participant 8 also discussed the importance of goals and helping formulate “where they wanted to be”.

**Ensuring it Fit into Overall Strategy.**

Considering the overall strategy was another important aspect in developing an approach as expresses by 6 participants. Participant 5 described how she would look at the board and consider decision A versus decision B and their domino effect resulting in secondary and tertiary effects. One specific secondary effect was that MARs officers posted to the particular supporting
unit have another opportunity to command a ship, because not all of them would ever get to command a ship and certainly never as part of a support unit. She emphasized to do this one needed “to integrate your way of thinking.” Participant 6 proposed that one litmus test to determine if a solution incorporated the overall strategy was if it was sustained after one left a position. If not one knows it was personality driven. He discussed the importance of having a view of all the systems involved, and specifically how they interact, to ensure a strategy involving all of them was in place. Similarly, Participant 7, in dealing with the App development, was conscious of the overall strategy and how one initiative support and evolved another. Participant 8 emphasized how one can not just arbitrarily make changes without knowing their implications.

Participant 9 mentioned how because he had a more strategic vision he often accompanied his boss to strategic meetings. For if one has a holistic view, one becomes more relevant, that is how important the overall strategy is. He also highlighted that governance documents are important in ensuring compliance to the overall strategic plan. Participant 2 also reiterated the need to have a holistic and systems view of the environment one is working in. As he described it there are “systems on systems”. One needs to understand the constraints organizations face in order to determine the feasibility of initiatives. That is done by knowing one’s environment and the overall strategic vision. Accordingly, ensuring a solution fit an overarching strategic vision was viewed a useful strategy to ensure navigation through the novel problem.

*Obtaining Feedback Regarding Your Approach.*

A few of the participants identified the importance of consulting with others for feedback regarding one’s approach. Participant 3 identified it as the communication plan. One needs to let
people know what one is doing and have the opportunity to provide feedback. That feedback may then be a critical piece of the solution one had not considered. He also discussed how consulting with others helps one realize when the path one is on is not going to take one where one wants to go and hence the requirement for valuable feedback. He also recommended that the feedback needed to be credible.

Participant 4 outlined how eventually the team who did not think there was an issue with the implementation plan for eLearning, came to realize there was. This realization materialized after consulting and comparing their approach to others. Participant 7 also talked about consulting with experts in the area of the problem and sharing the plan with them. In this way, not only did one get feedback but additional ideas to incorporate into the solution.

**Theme 4: Creating a Flexible Plan.**

Another theme that emerged from participants’ data was that one had to create a flexible plan. The participants described that plan as continually evolving. It therefore need to enable them to react to changing situations and as a result they continually reexamined and reoriented the approach being taken. Two codes were represented in this theme: (a) integrate new information and (b) reexamine and reorient.

**Integrate New Information.**

Participant 3 discussed how the team working on the problem would share their ideas in an open form and how as new information came forward they would adjust the plan. Participant 5 specifically gave reference to her whiteboard and how the team shared their progress and new information. Each day she would have to reevaluate the information and integrate it. She talked about the multiple sources of information and how you would “look at one issue and it unravels into 10 issues.” Hence this is what she referred to as having an integrated way of looking at
things. Participant 6 also mentioned how he did not have all the steps worked out but that he just kept moving the initiative forward as more information was gathered. Participant 7 also discussed how one was forced to find a balanced solution. For example, what looked like a good idea at first would have ended up discriminating 50% of cell phone users if they used a specific App design. The potential of a solution was something that emerged over time therefore one has to continually integrate new information into the plan. As a result his progressive mobile strategy map was continually evolving.

Reexamine and Reorient.
Because the participants were often integrating new information, they also had to reexamine and reorient their plan or approach. Participant 5 discussed going back to the drawing board when obstacles came up or could not be overcome. Participant 3 discussed how over time the individuals involved just developed a sense that something was not going to work, because they had adjusted so many times. Participant 6 and 7 also discussed how constant adjustment was normal. It seemed as the novel problem unfolded so did the available information and options open to solve it. As stated by Participant 7,

You definitely have to reorient yourself. At one point you are chasing a solution that we thought was a really good fit. Then we’d step back and look at the competitors in the field and we found one that, not only did what we were initially asking for, but more.

This indicates that it was not simply about assessing how new information affected the implementation of the plan but more a question of identifying the right path, hence there was a need to reexamine and reorient. Both Participant 7 and 9 referred to the plan as being a strategic road map. Participant 7 actually denoted his as a “progressive mobile strategy map”. Participant
9 described it as a plan that was concrete enough that the initiative would move forward. This was important, since often executing the plan depended on the involvement of many people, often from multiple organizations. However, the plan was not so concrete that it was constraining. Similarly, Participant 5 described how the plan needed to be agile enough that it could react to new information or obstacles that were constantly developing, and that it could evolve as needed. As she described, one door opened that opened numerous others. Participant 8 also described how she examined what road block could potentially come up and had to look at how things were connected so she could deal with them. Developing a flexible plan enabled one to participate in an ongoing and iterative process where new information is integrated and the approach, not simply the plan, is reexamined or reoriented.

**Theme 5: Building Partnerships.**

The one theme that was integrated with all the others was the idea that one needed to build partnerships. There are two main issues, you don’t control the key players involved with the solution and there are organizational or cultural obstacles. It’s important to note that building partnerships starts from day one.

**Key Players.**

Participant 3 identified that TDOs are often advising or recommending the chain-of-command to make decisions, and therefore TDOs need to get the buy-in of key players. Participant 4 identified how when individuals do not work together, initiatives will fail. Participant 5 discussed how when key players did buy-in, it was clear they were on the right path. It was also important to know when to solicit support, which she did when dealing with the manning of the ship and the career progress of individuals affected. Participant 6 mentioned how one had to demonstrate why someone should give one his or her time to assist with one’s issue.
To resolve this he took a face-to-face approach and meet with the key players. He took opportunities to collaborate and be social. He also considered what was feasible from their perspective, so he was not advocating something that was not possible. He also discussed how he would use his expertise and contribute to the overall group’s project. For example, when a simulator was being implemented he identified and added the requirement for the requisite T&E which contributed to the team’s effectiveness.

Participant 7 also discussed how they started working with OGEs to build their Apps and how there was a network he would tap into to discuss strategies. Participant 8 also discussed how she would take the time to talk to individuals in different settings, so she could get them away from their immediate priorities. She also talked about demonstrating reasons why something was beneficial, essentially selling the idea. The more she talked the more they became interested. The building of partnerships was vital because she was not in a position where she controlled everything therefore she needed partners to achieve results with eLearning initiatives.

Participant 9 talked about reaching back to Canada to adopt a college’s curriculum, which was discussed earlier. He also discussed being able to adapt to one’s audience and deal with the partnerships. One also needed to identify the key stakeholder and gatekeepers to build relationships. When dealing with the appointed government official he was cautious to give suggestions and not simply solutions; for the cultural landscape was different. Eventually the official would connect him with his counterpart so they could achieve objectives together. If he did not take this approach the official would ignore him and he would not have achieved his mandate.

Participant 1 and 2 also identified how partners help one build understanding and develop solutions. One needs to seek out those with the right competencies, because one is not an expert
in all domains and needs others. Participant 2 talked about how you need to participate in the
culture of other organizations and become part of their team.

**Organizational or Cultural Obstacles.**

Some of the participants identified that some of the obstacles in building partnerships are
organizational or cultural barriers. It is therefore important to take a change management
approach as suggested by Participant 8. She faced daily obstacles with finance and IT personnel.
She anticipated problems and then developed solutions to resolve the obstacles. Participant 9 also
discussed the constant tension between various military entities and the host nation. He had to
use a humble and reserved approach when dealing with the host nation in order to gain their trust
and build a partnership. When dealing with some NATO personnel he had to use a more
assertive and aggressive approach. Participants 5 and 10 both felt that it often boiled down to
personalities. Participant 3 agreed that one had to overcome the cultural bias. Participant 5
explained it further as helping someone realize what could be done instead of seeing what has
always been done. The message that all the participants shared was that to build partnerships one
needs to address the organizational or cultural obstacles.

**Results Summary**

From the participants’ experience in dealing with novel problems, there is a recognition
that novel problems are different from routine problems. Combined, data point toward a common
approach to resolving novel problems. Once participants realized that the problem was novel,
they had to (a) create an accurate picture of the problem, (b) create an approach to the novel
problem, (c) create a flexible plan and (d) build partnership throughout to enable ideas to become
realities. The participants’ responses to a novel problems demonstrated how they did not simply
rely on the primary linear decision-making model used within the military, but that they
incorporated different ways of thinking about the novel problem. This enabled the participants to respond to the specific challenges of the novel problem and enabled them to adjust accordingly as new information was integrated into their understanding of the problem. The participants had to develop an approach to the novel problem that would result in a strategic plan. As a result their plan was not so concrete as to inhibit flexibility, but agile and responsive to changing situations and new information. In solving a novel problem, the participants also did not simply reexamine their plan and make adjustments to it but reexamined the approach by which they developed the plan and if required changed their approach. The participants also made a conscious effort to integrate different systems within the CAF that were affected by the novel problems they faced. In the next chapter we will discuss these experiences in the context of the research questions.
Chapter 5: Discussion and Recommendations

In this chapter I reexamine the data in relation to the research questions. I discuss how TDOs characterize and identify novel problems and how they react to novel problems. By answering these questions, I am able to provide implications for the TDO occupation and decision-making processes currently dominating military leadership. Future avenues for research are also discussed.

Research Question 1: How do TDOs characterize and identify novel problems within their occupation?

TDOs solve a range of problems dealing with training and education within the CAF. For the most part, participants felt the problems they faced were novel because there were no readily available solutions or approaches to follow to solve them. As one participant mentioned, “when this occurs it’s a logical assumption that the problem must be novel”. There were a number of indicators that not only help an individual determine if a problem is novel but serve to help categorize the novel problem.

First, participants’ commented that they had to stop and think. This was a comment expressed by both those who immediately recognized that the problem was novel and by those who gradually came to that conclusion. In one instance, a participant was asked to consult on a decision that a group was making regarding an occupation’s competence to complete a certain task; that initial consultation, was like opening Pandora’s Box where the problem just kept growing into a crisis that the organization had to face. This finding supports Schon’s (1983) foundational work that problems evolve. Participants commented that they needed to be effortful and purposeful about their thinking regarding the problem. As one participant commented
“you’d have to integrate a lot of your way of thinking.” Many participants described thinking systematically and thinking differently. This finding coincides with research that suggests that individuals need to adapt their thinking in order to find new ways of viewing the situation (Goldstone & Day, 2012; Schraw et al, 1995). This finding also supports the notion that it is in an effort to seek understanding that enabled the participants to create new frameworks to create solutions (Carbonell et al., 2014; Hanto & Ingaki, 1986). This did not stop even after participants determined the problem was novel. The study also supports Larson-Freeman’s (2013) suggestion that individuals do not simply export or reapply their knowledge but transform their knowledge.

The second indicator in determining that a problem was novel was that the participants had to exert effort to clearly define the problem. They had to ask themselves, “what exactly is my problem?” or “what am I trying to solve?” That scoping exercise forced the participants to examine different perspectives to ensure that they were properly and completely defining the problem. As suggested by Perkins and Salomon (2012), they were motivated to find connections. Participants had to research, analyze and consult with others. Even though the problem was deconstructed the participant did not reduce the problem’s complexity (Bereiter & Scardamia, 1993, Dane, 2010; Moulton et al, 2007). There was a definite shift of what other researchers have called transitioning from automatic to effortful decision making processes (Moulton et al, 2007). During that research, analyzing and consulting, individuals found similar problems but no readily available approaches to the problem or model of thinking that they could adopt and therefore they would have to become more effortful to develop one. This supports Perkins & Salomon’s (2012) suggestion that individuals do not only identify similarities but differences. This presented itself in this study, for the participants clearly focused on why potential strategies or approaches would not work for their situation. They had to adjust the strategy to suit their
needs and often in such a way that combined multiple models or approaches to ultimately created new ones. This involved using different cognitive processes to resolve conflicting assumptions, evidence and opinions (Kitchen, 1983; Schraw et al, 1995, Dane, 2010). Participants described how they were methodical in their effort to compare and contrast information. Context was therefore very important. Context was often influenced by time, work environment, people or other factors. Context though helped define the problem because it enabled participants to see interconnectedness of the elements within a specific context. Defining the problem therefore helped the participants determine that the problem was novel.

The third indicator that the problem was novel was that there was no clear objective. This supports Schraw et al (1995) who identified that problems do not have specific objectives. In most cases the criteria for developing success were up to the individuals solving the problem and hence were incorporated in the development of their solution. The problem was often ill-defined such as “we want to start using apps in learning”, “we need to decide how to train individuals to man the ship (and) we haven’t decide what occupations that will be or even who will command it”. Most of the problems identified additional questions that resulted in further questions. This often increased the complexity of the problem. Participants also reflected that they often did not know how the novel problem would actually end. One participant commented that “you just trust the process”. The lack of a clear objective therefore helped determine that the problem was novel.

The fourth indicator was that the novel problems involved the implementation of change. This coincides with the occupation’s role to be a change agent. Interestingly, most of the problems were strategic in nature and this may further define the work of TDOs within the CAF. They were often working to integrate existing systems in an effort to support change within the
organizations of CAF. As a result the complexity of the novel problem was due to organizational issues such as multiple and potentially conflicting priorities, multiple stakeholders, different agendas and personalities of individuals. Bauer et al (2005) discussed that individuals are either advisory experts or performance experts. For the TDO, though they an advisory occupation and must use their influence to effect change. Therefore, they are also performance experts. They must enact the change they are advising to occur. Typically TDOs are performance experts without the actual authority, but are given authority by the decision maker within the organization. Due to the complexity that occurs within strategic change, strategic problems are typically deemed novel.

Only after these indicators were examined was there a determination that a problem is novel. The data shows us that novel problems were typically due to two situations:

(1) The old solution stopped working or was no longer appropriate; or

(2) There was a need for change either in the way organizations had to operate or due to new technology being implemented into the organization.

These situations activate individuals to search for a solution. Once no solution is identified through research, analysis and consulting, a problem is deemed novel. As Carbonell et al. (2014) suggested, domain knowledge, skills, regulation processes and past experiences of an individual are important. Having expertise in multiple domains (Jennings et al, 2005) and how knowledge is represented are also important (Chi & VanLehn, 2012; Larsen-Freeman, 2013). There comes a point when an individual must make a determination that a problem is novel. Often that judgment rests with the realization that even though one may have seen something similar or discovered something through one’s research, one is forced to create a new approach to solve the solution. It goes beyond adapting or exporting a solution. That “create factor” is what makes
a problem novel. This triggers a change in how one must react to the novel problem and the actions themselves results in a transformation of knowledge.

**Research Question 2: How do TDOs respond to novel problems (i.e., transfer from automatic to effortful decision making)?**

The themes presented in Chapter 4 described an iterative process that should not be seen as lockstep but integrated to satisfy the needs of the situation: (a) recognizing the problem was novel, (b) building a picture of the novel problem, (c) creating an approach to the novel problem, (d) creating a flexible plan, (e) building partnerships. Reactions to the problems were continuous. For example, deconstructing the problem was continually done in an effort to integrate and understand new information as a solution unfolded. To simplify the explanation of the reaction to a novel problem, they will be described in sequence.

Once a participant realized the problem was novel, one was effortful in developing an understanding of the problem. This effort was accomplished by first deconstructing the problem which helped one identify gaps in one’s knowledge and help identify who to consult with to find required information. The participants then focused their efforts on educating themselves about these gaps to increase their understanding of their novel problem. This effortful and mindful process supports the literature identifying that motivation drives people to make connections from their experiences and current knowledge to the problem they currently face (Dane, 2010; Goldstone & Day, 2012; Larsen-Freemans, 2013; Perkins & Salomon, 2012). The data also supports Nokes’ (2009) recommendation that individuals use multiple mechanisms to mobilize knowledge depending on the given situation. As mentioned earlier, participants had to continually think the problem through. As they uncovered new knowledge the participants had to incorporate it their current knowledge schemas. This provided a foundation for their new
knowledge. This was achieved by identifying the unknowns and mapped them out against current understanding as suggested by Nokes (2009). The participants compared not simply how the information was similar, but as Perkins and Salomon (2012) suggest how it is different. This also supports Larson-Freemans’s (2013) notion that knowledge is not simply transferred but is transformed. Deconstructing the problem was therefore not about making the problem more manageable but to creating an understanding. Participants discussed how they had to be methodical. They considered feasibility and interaction of systems. Appreciating context was therefore very important in uncovering the interconnectedness of people, priorities, organization relationships and other factors. Context was often understood by virtue of one’s experience. Being able to ask the “what ifs” regarding information enabled one to know when possible solutions were not viable. Once the participants developed an understanding it enabled them to create an approach to solve the novel problem.

Because the novel problem is ill-defined and complex, participants relied on their experience and that of others to guide them in developing an approach their problem. The literature suggests that past experiences impact on how one perceives the similarity between two tasks and facilitates transfer (Billet, 2013; Chi & LanLehn, 2013; Labato, 2012). This was true for the participants of this study. Experience not only provided guidance but also seemed to develop confidence. Participants also discussed how they consulted with others while dealing with the novel problem and how this helped them gain different perspectives. This was especially important as participants tried to maneuver around organizational obstacles. As Corthright and colleagues (2005) suggested, others help individuals develop different perspectives. Carbonell (2014) identified that one’s supervisor largely influences one’s ability to be an adaptive expert. An overall supportive learning environment also improves one’s ability to
deal with novel problems (Giffin & Hesketh, 2003). Participants shared how they used multiple approaches because they continually adjusted. This could only be done with a supportive learning environment (Lin et al, 2007).

The participants also developed their own goals and measures of success. Therefore secondary and tertiary effects were considered as participants wanted to ensure that their solution fit within the overall strategy of the organization and mobilized change. This also indicates systems thinking as described by Bentley (2008). One way of ensuring this was to seek out feedback from others. Carbonell and colleagues (2014) reviewed the literature and identified that experiences with others did not support the development of adaptive experts. This study suggests that experiences with others did help participants deal with novel problems. Feedback provided by others, not only assisted with understanding but also developing feasible solutions. One participant emphasized that if individuals do not work together initiatives will fail. Feasibility can only be considered if one understands the perspectives of others; their priorities and their constraints. Others may also provide expertise that one may be lacking. By working with that individual, one can leverage their expertise to compensate for one’s limitations. Others also provide feedback, prompt connections and help formulate ideas (Bjork, 2011; Cortright et al, 2005; Reid, 2012) Through consulting with other key players, the participants were also able to determine the problem was novel, create a picture of the novel problem and develop a flexible plan.

By creating an approach with these components, participants were able to develop a flexible and agile plan. This is important because a flexible plan enabled them to integrate new information as it was presented. Compared to a more concrete situation typical of tactical military operations, when new information was discovered participants did not simply review it
to determine how they should adapt their plan. Instead, participants reevaluated their approach. In fact, developing a flexible plan enable them to participate in an ongoing integrated and iterative process by which new information is continually reexamined and their approach is reoriented as required. This indicates that participants were relying on other decision-making models besides the rational decision making model as suggested by Bentley (2008).

Working with others is about building partnerships. This significantly impacted the participants’ ability to solve novel problems. Primarily, this was because most problems involved an aspect of organizational change and therefore dealt with people within that organization. Participants were also continually consulting with others. Therefore having interpersonal skills was very important. This also supports the suggestion that multiple domains of knowledge are required (Jennings et al, 2005), not simply the cognitive domain. Others do not simply help an individual figure out how to react to a novel problem but are integral in the effort to solve the novel problem.

In summary, participants reacted differently when faced with a novel problem compared to if they faced a routine problem. Most notably they transitioned from automatic to effortful processes. The most significant aspect of reacting to novel problems is that efforts as discussed enable one to mobilize knowledge to solve problems that are either outside their domain or on the edge of their competency.

**Implications for the TDO Occupation**

From this study there a number of implications for the occupation. First of all is the importance of having a variety of experiences to develop adaptive expertise. For it is through
experiences that one is able to continually develop and deal with new problems that will improve their ability to deal with novel problems. Secondly, there is significant data that interpersonal or soft skills need to be a competency of TDOs. As change agents within an organization it is imperative that TDOs can effectively work with others. This is particularly important when they possess limited, to no authority. Every participant within this study had to work with others in order to solve his or her novel problem. The ability to research and analyze information was critical. Though this is a skill for all leaders, TDOs need to be specific expertises within their field of education and training. A needs assessment and training needs analysis should be considered to explore this further. Consideration should be given to higher education beyond the Bachelor’s Degree since 15 of 20 survey respondents had a Graduate Diploma or Master’s Degree.

**Implications for Future Research**

For further research, it was clear from this study that individuals within this occupation do solve novel problems. Other occupations should also be examined to see how they approach novel problems and how they define those novel problems. An examination of General Officers should also be considered, in particular senior officers who possess leadership positions outside their occupational field. This may assist in achieving a consensus on what a novel problem is.

Throughout this study participants continually commented that complexity was a factor. This study did not incorporate the complexity paradigm in the analysis of how individuals solve novel problems. Given that complex problems differ from complicated problems this should be considered along with the decision-making models to address them. Carbonell et al. (2014) also suggested that examining differences between problems will also provide insight into how adaptive expertise is manifested. Further research should therefore work to characterize novel
problems, by utilizing different frameworks such as complexity theory or as Carbonell et al. (2014) suggest, professional expertise.

This study did not examine the impact of individual characteristics. Though research has been done to identify behavioral indicators (Pulakos et al., 2009), the complete collection of an individual’s competencies have not been examined. For each individual has competencies that they can leverage to solve novel problems. For instance an individual may use their strength of interpersonal skills to enable him or her to connect with others in an effort to develop understanding of a situation. For as Jenning et al. (2005) suggest, expertise may require multiple domains of knowledge as part of one’s professional expertise.

Having a better understanding of individual characteristics will provide a more informed approach for establishing training and education opportunities to facilitate the development of adaptive expertise. Experiences have shown to contribute to adaptive expertise, but this needs to be explored to capitalize on opportunities. This will allow learning experiences to be incorporated into the development of one's professional expertise and facilitate adaptive expertise, not simply routine expertise.

The study did develop a preliminary framework of how individuals solve novel problems and therefore are adaptive experts. The participants in this study sequenced their decision making, which is expected given that the dominant decision making model is linear in nature. The participants did not truly follow a linear model, but incorporated other decision making models. This framework therefore needs to be explored further to provide a more complete picture of how individuals are able to be adaptive experts. Together, these suggestions for future research can contribute to the discourse of adaptive and routine expertise and how together these expertise contribute to one’s professional development.
Limitations

For this study there were a few limitations. First, there were only 10 interviews conducted. It is therefore unlikely that saturation of ideas was reached (Creswell, 2007; McMillan & Schumacher, 2010). Normally saturation of information is achieved by having approximately 20 interviews and therefore the conclusions made will only be suggestive, but this is not uncharacteristic (Charmaz, 2005). What is important is that these data provide understanding and meaning.

The researcher also provided a definition of a novel problem to the participants to assist them in making their determination was novel or not. This definition was developed from current research, but as Carbonell et al. (2014) highlight there is a lack of consensus within the literature on exactly what characterizes a novel problem. The characteristics of the novel problem discussed in this study are the perspective of the participants within this study.

The researcher is also a TDO within the CAF. Though the researcher’s experience within the CAF has initiated her interest in solving novel problems, it can also lead to bias. For this reason actions were taken to minimize this bias, but the fact that the researcher was also a TDO needs to be appreciated. Finally, the TDO occupation within the CAF is very small with only approximately 160 officers. It is also a specialist occupation dealing primarily with training and educational issues. As such, large generalizations to other occupation within and outside the CAF may be difficult to assert.

Conclusion

From this study, novel problems can be defined as those problems outside and individual’s domain or at the edge of their competency requiring them to create new solutions by
transforming their knowledge. Reacting to novel problems, individuals must remain flexible in their thinking and approach to enable them to use multiple decision-making processes that are iterative and integrated. Given that the workplace is forever evolving, research in expertise may need to adopt a professional expertise paradigm in order to address the complex and intricate elements of the work environment that concurrently and holistically impact on an individual’s ongoing professional development. Continual research is needed to understand routine and adaptive experts in order to prepare members of society to transition from automatic to effortful actions when faced with novel problems.
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Appendix A: Letter of Information

Letter of Information
How Training Development Officers Solve Novel Problems

This research is being conducted by Vicki Woodside-Duggins under the supervision of Dr. Denise Stockley, in the Faculty of Education at Queen’s University in Kingston, Ontario. Vicki Woodside-Duggins is a Training Development Officer who is being sponsored by the Canadian Defence Academy through the Post-Graduate Program. This research is a requirement of the Post-Graduate Program and Thesis requirement for Queens.

What is this study about? The purpose of this research is to determine how Training Development Officers transfer from automatic to effortful decision making processes and how they develop new knowledge in order to solve novel problems. The study will require a 30 minute on-line survey and if you agree potentially a follow-on 60 minute interview. For your convenience interviews will be conducted either at the Centre for Teaching of Learning of Queen’s University or at the Canadian Defence Academy of personnel in Kingston. If this is not agreeable other arrangement will be made. For those personnel outside of Kingston, special arrangements will be made. Vicki Woodside-Duggins will be conducting the interview. There are no known physical, psychological, economic, or social risks associated with this study.

Is my participation voluntary? Yes. Although it be would be greatly appreciated if you would answer all material as frankly as possible, you should not feel obliged to answer any material that you find objectionable or that makes you feel uncomfortable. You may also withdraw at any time. If you do choose to do so, you may request removal of all or part of your data.

What will happen to my responses? We will keep your responses confidential. An on-line survey tool will be used and therefore a digital record of results will be made. The researcher will also use an audio recorder and notes to record participant responses during interviews. Only the researcher and supervisor will have access to this information. The data may also be published in professional journals or presented at scientific conferences, but any such presentations will be of general findings and will never breach individual confidentiality. Any reported or published responses will be aggregated and will not be associated with your identity (for example, one participant stated ….). Even with this precaution there is a possibility that you will be indirectly identified due to the unique cases and contexts you describe. Should you be interested, you are entitled to a copy of the findings. In accordance with the Faculty of Education’s policy, data will be retained for a minimum of five years after which time it will be destroyed.

Will I be compensated for my participation? No. But your participation will provide insight into specific learning strategies and learning environments for expert-like endeavors of the Training Development Officer occupation.

What if I have concerns? Any questions about study participation may be directed to the researcher Vicki Woodside-Duggins or her supervisor Dr. Denise Stockley. Vicki Woodside-
Duggins can be contacted at 12ywd@queensu.ca or 613-985-2695. Dr. Denise Stockley can be contacted at stockley@queensu.ca or 613-533-6428. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at chair.GREB@queensu.ca or 613-533-6081.

Again, thank you. Your interest in participating in this research study is greatly appreciated.

_This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen's policies._
Appendix B: Consent Form

Consent Form

How Training Development Officers Solve Novel Problems

Name (please print clearly): ________________________________________

1. I have read the Letter of Information and have had any questions answered to my satisfaction.

2. I understand that I will be participating in the study about how Training Development Officers solve novel problems. I understand that this means that I will be asked to participate in a survey and possibly an interview. The survey will involve an on-line tool and therefore a digital recording of my results will be made. The researcher will also use an audio recorder and notes to record my responses. I understand that my participation in the survey will be for 15 minutes and my participation in the interview will be approximately 60 minutes.

3. I understand that my participation in this study is voluntary and I may withdraw at any time and request the removal of partial or all of my data. I understand that every effort will be made to maintain the confidentiality of the data now and in the future. Because specific problems will be discussed, there is a potential possibility that you will be indirectly identified. The data may also be published in professional journals or presented at scientific conferences, but any such presentations will be of general findings and will never breach individual confidentiality. Any reported or published responses will be aggregated and will not be associated with my identity (for example, one participant stated ….). Even with this precaution there is a possibility that I will be indirectly identified due to the unique cases and contexts I describe. Should you be interested, I am entitled to a copy of the findings. In accordance with the Faculty of Education’s policy, data will be retained for a minimum of five years after which time it will be destroyed.

4. I am aware that if I have any questions, concerns, or complaints, I may contact Vicki Woodside-Duggins at 12vwd@queensu.ca or 613-985-2695 or the faculty supervisor, Dr. Denise Stockley at stockley@queensu.ca or 613-533-6428. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at chair.GREB@queensu.ca or 613-533-6081.

I have read the above statements and freely consent to participate in this research:

Signature: _____________________________________   Date: _____________________

Please sign one copy of this Consent Form and Return to Vicki Woodside-Duggins.
Retain the second copy for your records.
Appendix C: Survey Questions

1. What is your current rank?
2. What is your environment (Army, Air Force or Navy)?
3. Have you had any other occupation(s) within the Canadian Forces?
4. How many years were you in each of those occupations?
5. How many years have you been in the Canadian Forces?
6. How many years have you been a qualified Training Development Officer?
7. Which of the following levels of education have you completed?:
   a. Undergraduate Degree;
   b. Graduate Diploma;
   c. Master’s Degree;
   d. Doctorate Degree;
   e. Other (leave a blank)
8. Where you in a different occupation(s) before becoming a Training Development Officer?
9. List other occupations
10. Identify the occupations that you became qualified in.
11. What types have jobs have you had as a Training Development Officer, select all that apply:
    a. Training and Education Development Advisor;
    b. Training and Education Manager (School or Headquarters);
    c. Training and Education Staff Officer (Headquarters);
    d. Senior Training and Education Staff Officer (Headquarters or Commanding Officer);
    e. Instructional Technologist;
    f. Human Performance Technologist;
    g. Test Measurement and Evaluation;
    h. Computer Aided Learning;
    i. Instructional Systems Design;
    j. Project Officer;
    k. Performance Analyst;
    l. Validation Analyst
12. Novel problems are those problems that are considered non-routine. To be solved, this type of problem requires decision-maker(s) to adapt or create new procedures or processes. These types of problems may also require the attainment of new information or a different perspective to successfully solve the problem. To solve this type of problem a decision-maker may also be required to weigh the information presented in the problem situation, identify the end-state or spend additional effort to analyzing the problem because it is ill-defined. As part of your occupational responsibilities have you ever solved a novel problem?
13. Please provide an example of a novel problem you solved.
14. Why was this problem novel for you?
15. In response to this novel problem did you do any of the following (select those that apply):
a. Adapt new procedures or processes;
b. Spend additional time analyzing the problem;
c. Seek additional information to understand the situation surrounding the problem;
d. Consult with a colleague or other individual on how to approach the problem;
e. Educate yourself on knowledge that would help you solve the problem;
f. Deconstruct the problem into smaller components that included potentially both routine and non-routine solutions;
g. Considered the legitimacy of the solution; and/or
h. Other actions.
In the survey you identified a novel problem. Please describe it further.

In your view, what aspects of the problem made it a novel problem? Why did you think these details were important or affect the result of problem? Had you previously encountered a similar problem? In what way was it similar?

Can you explain further the clues or indicators you provided in the survey that suggest it was novel and required a non-routine approach to solve? Did you become aware of these clues or indicators immediately or over-time. Describe how the clues and indicators unfolded or presented themselves. Was there any additional information that lead to the deduction that the problem was novel?

Once you realized the problem was novel what did you do to solve it?

When solving the novel problem, did you feel you needed to provide more of your attention to solve this problem and why? As you solved the novel problem what mechanisms did you use to maintain their situational awareness until the resolution of the problem. Did you have to adjust you initial action plan for this problem or did the resolution unfold without additional adjustments.

What did you learn from this experience? How has it shaped your view of your professional abilities?

In the survey you identified some actions you used in response to a novel problem. Why did you identify these actions as useful? What drives your choice of action?

Do you have anything else you would like to contribute?
Appendix E: Letter of Ethics Clearance

November 01, 2013

Ms. Vicki Woodside-Deggins
Master’s Student
Faculty of Education
Donohue McArthur Hall
Queen’s University
511 Union Street
Kingston, ON, K7M 3E7

GREB Ref #: GEDUC-768-10, Kesaro #: 8011148
Title: “GEDUC-768-13 How Training Development Officers Solve Novel Problems”

Dear Ms. Woodside-Deggins,

The General Research Ethics Board (GREB), by means of a delegated board review, has cleared your proposal entitled “GEDUC-768-13 How Training Development Officers Solve Novel Problems” for ethical compliance with the Tri-Council Guidelines (TCGS) and Queen’s ethics policies. In accordance with the Tri-Council Guidelines (article D.1.5) and Senate Terms of Reference (article G), your project has been cleared for one year. At the end of each year, the GREB will ask if your project has been completed and if not, what changes have occurred or will occur in the next year.

You are reminded of your obligation to advise the GREB, with a copy to your unit REB, of any adverse event(s) that occur during this one year period (access this form at https://research.queensu.ca/researcher and click Events - GREB Adverse Event Report). An adverse event includes, but is not limited to, a complaint, a change or unexpected event that alters the level of risk for the researcher or participants or situation that requires a substantial change in approach to a participant(s). You are also advised that all adverse events must be reported to the GREB within 48 hours.

You are also reminded that all changes that might affect human participants must be cleared by the GREB. For example, you must report changes to the level of risk, participant characteristics, and implementation of new procedures. To make an amendment, access the application at https://research.queensu.ca/researcher and click Events - GREB Amendment to Approved Study Form. These changes will automatically be sent to the Ethics Coordinator, Gail Irving, at the Office of Research Services or greb@queensu.ca for further review and clearance by the GREB or GREB Chair.

On behalf of the General Research Ethics Board, I wish you continued success in your research.

Yours sincerely,

Jean Stevenson, Ph.D.
Chair
General Research Ethics Board

c. Dr. Denise Storkey, Faculty Supervisor
Dr. Don Klinger, Chair, Unit REB
Erin Wicklund, Chair Graduate Studies and Bureau of Research
Appendix F: Ethics Certificate

Certificate of Completion

This document certifies that

Vicki Woodside-Duggins

has completed the Tri-Council Policy Statement:
Ethical Conduct for Research Involving Humans
Course on Research Ethics (TCPS 2: CORE)

Date of Issue: 9 September, 2013