Université d'Ottawa • University of Ottawa

Self-efficacy Beliefs and Creative Performance in Adults:

A Phenomenological Investigation

By

Judy Laws

Thesis submitted to the School of Graduate Studies

Of the University of Ottawa

In Partial Fulfillment of the Requirements for the degree of

Doctor of Philosophy in Education

Ottawa, Canada, 2002

TABLE OF CONTENTS

LISTS OF FIGURES

LISTS OF TABLES

ABSTRACT

This study was a phenomenological investigation of Research and Development scientists' experience of creative self-efficacy. Creative self-efficacy is defined as an individual's belief in his or her ability to be creative in a given situation. A phenomenological research model (Moustakas, 1994) guided the investigation. Data collection methods included in-depth interviews with the 12 participants, a review of documents collected from participants, and researcher's reflective journal. Core findings that emerged were that creative self-efficacy seems to operate below the surface of awareness for the R & D scientist; it is not something he or she would have thought about until asked, and positively influences creative performance. Creative self-efficacy can be traced back to age four to twelve through the act of building things and making things work. It is influenced by freedom and thought space to be creative, along with positive feedback. Finally, creative self-efficacy contributes to the creative process providing confidence in the R & D scientist to use novel and new approaches to solve technical problems. Future research implications in the area of educational practice, the professional development of R & D scientists, organizational development, and society, are also discussed.

ACKNOWLEDGEMENTS

As I sit here writing this page of my dissertation I feel a sense of gratitude that overwhelms me. I can feel tears well up in my eyes; not tears of sadness, but of joy and satisfaction. I would not be here if it were not for the support and encouragement I have received from my family, friends, and colleagues. For this, I feel truly blessed.

The first person that I would like to acknowledge is my husband. He has been beside me relentlessly through this whole process, both in offering me encouragement and providing me the space and time to do a Ph.D. I can remember a point when I was ready to quit, but instead of agreeing with me, he encouraged me to 'give it one more chance'. I know that he has made personal sacrifices for me to do my Ph.D. and I am truly grateful. I would also like to acknowledge my children, Caroline and Richard, who have experienced their mother 'always being in school'. Thank you for your patience, encouragement, and support.

My deepest gratitude is held out to Dr. Janice Leroux. Thank you for always being in my corner, reminding me of my true gifts and talents. You have been and will continue to be my role model and inspiration. My sincere thanks to my committee members, Dr. Mary Foster, Dr. Penny Gurney, and Dr. Maurice Taylor; each of you provided me the support and direction that I needed throughout this study. I would also like to thank Professor Genevieve Rail for taking the time to review my dissertation and offering me feedback on the phenomenological approach used in this study. Thanks also goes to my professors at McGill University, Marcie Delcourt, Bruce Shore, and Gill Rejskind, for getting me started on my Ph.D. journey.

To the participants of my study, I offer my deepest appreciation. I feel truly honored to have had the opportunity to meet with each of you and have you share your experiences of creative self-efficacy with me. In addition, special thanks to Helen Cooper and Omer Aziz for helping me conduct this study. Without Helen's sponsorship this study would not have happened.

Lastly, my acknowledgement wouldn't be complete without thanking certain family members and friends – Mom, Dad, Linda, Rebecca, Roberta, Louise, Helene, Michelle. Thank you for all your encouragement and support.

CHAPTER ONE

Introduction and Statement of Topic and Outline

"I believe I can solve any problem that is thrown at me...
I have no doubts about my ability to be creative."
(Richard, personal interview, May 1, 2001)

Introduction

I am not sure if I have always believed in my ability to be creative, perhaps I just have not stopped to think about it, but like Richard, there are very few problems that I believe that I cannot solve creatively. My conviction or confidence in my creative ability is what allows me to do this. My curiosity about this phenomenon, one that I will call creative self-efficacy, began during my Master's research where I was taken aback by several of my participants declaring themselves as not creative. How could this be? These were individuals whose jobs were to solve technical problems creatively. More specifically, these were individuals working in a high technology organization, where innovation is deemed critical to organizational survival in the new economy. Why was it that many participants had no trouble describing times where they felt most creative at work, while others could not? Was it the perception or belief that they had about their creative abilities that made the difference? Hence, my journey to understand this phenomenon began.

The 21st century presents a variety of external pressures for many organizations, creating the need for them to find ways to tap into the creative potential of all employees (Drucker, 1993; Kanter, 1995; Ohmae, 1995; Tapscot & Caston, 1993). Companies are being forced to shift to a "creativity orientation" in an effort to endure the dynamic, ever-changing global marketplace (Arad, Hanson, & Scheider, 1997; Mumford & Simonton,

1997; Tesluk, Farr, & Klein, 1997; Youngblood, 1997). For high technology companies, in particular, it is not good enough to rest on their laurels given that "the best companies are innovating and surpassing themselves constantly" (Kiernan, 1995, p. 14). To meet this challenge, high technology organizations need to find ways to unleash the creativity present in their employees who may be failing to live up to their creative potential. To do this, it may be useful to learn from creative employees who are utilizing their creative abilities to solve problems creatively.

Statement of Topic

Although many creativity researchers have investigated external factors that either stimulate or inhibit creativity within an organization (Amabile, 1988; Burnside, Amabile, & Gryskiewicz, 1988; Ekvall, 1997), few have studied factors internal to the individual working within an organization such as creative self-efficacy. Specifically, how an individual's belief in his or her ability to be creative in a given situation (creative self-efficacy) influences how creative he or she is within that situation (Locke, Frederick, Lee, & Bobko, 1984; Schack, 1989, Starko, 1988). Although the constructs of creativity (see Amabile 1983a; 1988; 1996) and self-efficacy (see Bandura, 1977a, 1977b, 1986, 1997) have been posited, very little is known about the essential experience of creative self-efficacy. Extensive research on self-efficacy does provide evidence that there is a strong relationship between self-efficacy and performance of a specific task (e.g., Bandura, 1977a, 1977b, 1986, 1997; Lent, Brown, & Larkin, 1987; Taylor, Locke, Lee, & Gist, 1984). Minimal research on self-efficacy and creative performance in children has provided some evidence of an interaction between self-efficacy and creative performance (Locke et al, 1984; Schack, 1989; Starko, 1988). Yet, one significant unexplored

knowledge gap remains: what is the essence and meaning of the experience of creative self-efficacy from the perspective of an adult working within a high technology organization? No quantitative or qualitative research studies specifically investigating an adult's experience of creative self-efficacy have been conducted to date.

Several problems are evident in the area of creativity research. First, that there is no widely accepted structural framework or synthesis of models and definitions for creativity. Second, not one instrument will precisely measure creative performance. For those researching the area of self-efficacy and creative performance, this can be problematic when trying to develop a self-efficacy scale that must rely on a good conceptual analysis of the relevant domain of functioning (Bandura, 1997). There is a need to investigate creative self-efficacy holistically, to get a conceptual understanding of the essential experience of it, which can guide those wishing to study creative self-efficacy more empirically.

Finally, qualitative studies on creative performance in adults have focused on exceptional artists and scientists, not adults in a work setting. The demands of the new economy on high technology organizations make it ever so important for every employee to have a "creativity orientation." Consequently, this study seeks to provide a better understanding the role self-efficacy plays with creative adults, specifically Research and Development (R & D) scientists working in a high technology company. The investigation is centered on the broad research question:

How do adults, working in an R & D environment, perceive and describe their experience of creative self-efficacy?

Research and Development (R & D) scientists, who were working in a high technology organization, volunteered for this study based on criteria stated in an email sent to them. Data were gathered during several interviews I had with them in which we explored their experience of creative self-efficacy. I also explored their personal accounts of their experience of creative self-efficacy in terms of:

- The source of their self-efficacy beliefs about creative performance
- The level, strength, and generality of the beliefs as they relate to creative performance
- The influence of self-efficacy on the creative process as it relates to creative performance
- The environmental conditions that have an effect on creative self-efficacy.

I was then able to interweave my insights and their descriptions with what is known and not known, in the literature about creative self-efficacy. Consistent with the phenomenological approach suggested by Moustakas (1994), the rich, detailed data captured in narratives and texts, describes the nature of creative self-efficacy, as experienced by R & D scientists.

Presuppositions and Assumptions

When embarking on a phenomenological study it is important that the researcher state her presuppositions and assumptions regarding the phenomenon under investigation and then bracket or suspend these preconceptions in order to fully understand the experience of her participants (Moustakas, 1994). For many years, I have been interested in creative performance and how an individual's belief in his or her ability to be creative could possibly have an influence on it. My investigation of the literature on self-efficacy

and creative performance and my curiosity about the phenomenon has influenced me to pursue the present work. As a result, I recognize that I cannot be a neutral observer, but that I am an integral part of the generation of knowledge (Patton, 1990). Everything that I bring into this – my experiences, perceptions, and interpretations – has an influence on the research process. This has affected my choice of topic (creative self-efficacy), my choice of method (phenomenology), and how I interpret the data.

My choice of topic evolved from my Master's study. I discovered that adults working within a high technology organization, who declared themselves as not creative, produced low scores on the Torrance Test of Creative Thinking (TTCT) (Torrance, 1974), and had difficulty describing times when they felt most creative in the workplace (Laws, 1995). Upon reflection, I was curious as to why those individuals declared themselves as not creative and whether this had an influence on their ability to come up with descriptions of being creative in the workplace. My experience as it relates to my creative ability and performance is that confidence in or a belief in my ability to be creative plays a big role in how creative I am in a given situation. I was curious about how others experienced this, and what influences a person's belief in his or her ability to be creative in a given situation. From the beginning, my research focus has been directed at gaining a better understanding of the phenomenon of creative self-efficacy. Within this study, my quest is to understand how adults, working in an R & D environment, perceive and describe their experience of creative self-efficacy; in particular to write about it in a way that captures the essence of the R & D scientist' experience of creative self-efficacy.

There is a scarcity of literature on the experience of creative self-efficacy for adults in a work setting, and of the phenomenon of creative self-efficacy. While there has

been empirical research relating to self-efficacy and creative performance, the focus has been on children or young adults measuring self-efficacy as a predictor of creative production in an educational environment. Clearly, this work is important, yet I desire to delve deeper to explore what creative self-efficacy looks and feels like from the experience of an adult working in an organization. As a researcher, it was important to me to have direct contact with R & D scientists who had experienced creative self-efficacy. Although complete objectivity is impossible, my passion for understanding creative self-efficacy through the lens of my participants, will guide me through the process. I will use my personal experiences and insights as part of the inquiry process in understanding the phenomenon of creative self-efficacy, while taking a neutral non-judgmental stance towards whatever content emerges (Patton, 1990).

There is a trend, in the literature, to move towards an interactionist model to better understand the multifaceted nature of creativity (Isaksen, Puccio, & Treffinger, 1993; Woodman & Schoenfeldt, 1990). As opposed to investigating individual dimensions of creative self-efficacy, I want to understand how the dimensions of the person, process, product, and environment interact with self-efficacy in real situations to influence creative performance. For this reason a qualitative investigation, incorporating a phenomenological approach, is deemed as one way to better understand the interaction of the different dimensions of creativity as it relates to creative self-efficacy. My desire to represent the perspective of R & D scientists' experience of creative self-efficacy through a phenomenological lens represents another bias.

Finally, this qualitative study of creative self-efficacy is based on a number of assumptions. These assumptions are based on the researcher's experience and research in

the field of creativity and personal conversations with several creativity researchers (e.g.; Teresa Amabile, Gary Davis, Howard Gruber, and Maurice Stein), and Albert Bandura, whose seminal work in social learning theory provided the theoretical basis for most of the self-efficacy research to date. First, it is assumed that individuals can articulate their experiences, perceptions, and process of creative self-efficacy. The aim of a phenomenological approach is to determine what the experience means for the persons who have had the experience and are able to provide a comprehensive description of it (Moustakas, 1994). Many phenomenological studies have been conducted that have described phenomenon related to creativity (e.g., Bindeman, 1998; Conrad, 1990; Melrose, 1987, 1989). Second, creative self-efficacy can be identified and investigated, based on the research of others (e.g.; Locke et al, 1984; Schack, 1989; Starko, 1988). Third, it is assumed that people who believe in their ability to be creative in a specific situation influence their creative performance in positive ways. Their belief in their creative abilities has an effect on whether they openly pursue solving a problem in a creative way. Finally, from the researcher's experience base, it is assumed that many people limit creativity to science and the arts, for example, music, dance, creative writing, and art, or inventions and scientific breakthroughs, and do not link it to other everyday creativity and the work that they do.

Definitions of Concepts

The following definitions of key concepts serve to anchor the study within the body of conceptual literature that frames the research. They will be used throughout the subsequent chapters of the study.

Creative Performance – The production of novel and appropriate solutions to open-ended problems in any domain of human activity (Amabile 1983a, 1988, 1996).

Self-efficacy - An individual's belief in his or her ability to perform a behavior in a given situation (Bandura, 1977a, 1977b).

Creative Self-efficacy - an individual's belief in his or her ability to be creative in a given situation.

Research and Development Scientist - A research & development (R & D) scientist is defined as an employee in a high technology company, with either a computer science, physics, or engineering background, who works in a design capacity either on hardware or software design of telecommunications products and services for the organization.

Significance of the Study

First, this exploratory study will fill in the gaps in the current knowledge base on self-efficacy and creative performance. Specifically, it will provide the essence and meaning of the experience of creative self-efficacy for an R & D scientist working in a high technology organization. It will provide insights on creative self-efficacy, as experienced by an adult, which will lead to valuable information for future inquiry. The study will act as a starting point for developing a better understanding of creative self-efficacy, and will lead to further questions for research.

This study uses a unique methodology for studying creativity, a phenomenological research approach. It will contribute to the literature on qualitative research methods used to study creativity. In addition, this study may serve as a foundation for building a quantitative instrument for measuring an adult's creative self-efficacy.

From an educational perspective, the knowledge gained from this study could be used to assist in the development of R & D scientists, both in their workplace and in their academic programs. For example, the information from this study could be used in the development of a course on creativity for engineering students or MBA students studying entrepreneurial management. As discussed earlier, developing a creativity orientation is critical to employees working in the new economy. Educational programs to further develop this creativity orientation in R & D scientists would be of most benefit.

From an organizational standpoint, this study will contribute to the knowledge base on organizational practices and structures that lead to creative performance. An understanding of creative self-efficacy will contribute to the knowledge about how to develop creative self-efficacy in employees through education, interventions, and on-line learning tools and programs. For high technology organizations, a key sector in the new economy, the knowledge gained from this study can contribute to the development of creative self-efficacy within employees who may be inhibiting their creative potential. Equally important is the organization's ability to attract, select, and retain creative talent. Knowledge gained from this study can contribute to the development of a performance dimension for creative performance that includes the element of creative self-efficacy.

Outline

This research report begins with a review of the relevant literature relating to creative self-efficacy and is followed by the conceptual framework of the model for this study. Chapter three provides a description of the qualitative investigation, grounded in phenomenology, used to investigate the overarching research question:

> *How do adults, working in an R & D environment, perceive and describe their experience of creative self-efficacy?*

Chapter four describes the collection of data and its analysis and synthesis leading to a thick description of R & D scientists' experience of creative self-efficacy. This is followed by a summary of the findings. Chapter five provides a discussion of the findings, particularly addressing how the findings compare and differ from findings presented in the literature. Finally, chapter six provides a summary of the study in brief, contribution to the scholarly knowledge and implications of the study.

CHAPTER TWO

Review of the Relevant Literature

Introduction

When it comes to creative efficacy, neither the extent of our knowledge nor the potency of talent is as vital as our driving power (Alex Osborn, 1888 – 1966, founder of The Creative Education Foundation, Inc.)

This chapter traces the development of a conceptual model of framework through the examination of relevant findings in the literature regarding the construct of creative self-efficacy in R & D scientists. Thus, the chapter will begin with a focused review of the literature on the elements incorporated within this construct, creative performance, and self-efficacy. This will be followed by a discussion of those studies that look at creative performance and self-efficacy synergistically. Next, this chapter will include a discussion on the phenomenological approach and creativity, to not only shed light on the concept under investigation, but to add credibility and legitimacy to the decision to use the phenomenological approach to study creative self-efficacy. Finally, a portrayal of a creative research and development scientist will be provided. From these domains, a conceptual framework weaves together Bandura's self-efficacy theory (1977a, 1977b, 1982, 1997), and Amabile's (1983 a, 1983b, 1996) comprehensive theoretical framework on creative performance, and applies them to this present inquiry into the perceptions of creative self-efficacy of R & D scientists working within a high technology organization.

Creative Performance

Creativity has been viewed as possible in any field of human activity (Gruber, 1988; Gruber & Wallace, 1989; Koestler, 1964). Creativity has been studied and defined from the perspective of the creative product (Amabile, 1983a, 1983b, 1996; Barron,

1968; Mackinnon, 1965, 1978), the creative person (Guilford, 1986; Sternberg, 1988; Tardif & Sternberg, 1988; Torrance, 1979, 1988) the creative process (Koestler, 1964; Osborn, 1963; Perkins, 1988; Torrance, 1965, 1988; Wallas, 1926), and the creative press (Csikszentmihalyi, 1988; Rhodes, 1987; Rogers, 1962). Creative performance has been described as the result of the interactions among several important components or dimensions of creativity, specifically, the creative person, process, product, and press to produce novel and appropriate solutions to open-ended problems in any domain of human activity (Amabile, 1996; Rhodes, 1987). Many investigators have concluded that creativity is a multi-faceted phenomenon that results in production of new (or novel) and useful (or appropriate) ideas (Isaksen et al, 1993). For the purpose of this study, creative performance will be defined as the production of novel and appropriate solutions to open-ended problems in any domain of human activity (Amabile 1983a, 1988, 1996).

Literature relating to creative performance as it relates to the self has focused on the areas of self-concept, locus of control, divergent thinking, intrinsic/extrinsic motivation, openness to inner experiences, complex thinking, autonomy/independence, and self-determination in personality, in relation to creativity. Dowd's (1989) review of the literature on creativity and the self found that (a) creativity is only weakly related, at best, to such person variables as self-concept and self-actualization; (b) creativity may be somewhat correlated with internal locus of control, suggesting that creative individuals tend to believe that they are in control of their own destiny and fate; and (c) there is a moderate relationship between creativity and intrinsic motivation, openness to inner experiences, preference for complex thinking, relative autonomy, and the capacity for divergent thinking. Sheldon (1995) concluded that a general disposition to be self-

determining may help attune creative people to deeper cognitive resources and capacities within themselves.

Personality variables such as persistence, self-esteem, and temperament have also been found to have an effect on creative performance. Coopersmith's (1967) seminal work on the antecedents of self-esteem found a strong relationship between high self-esteem and high creativity. His study involved 1748 pre-adolescents aged 10-12, using measures of self-esteem (50-item Self-Esteem Inventory) and performance on three of the sub-tests of Torrance Tests of Creativity (Unusual Uses, Circles, and Draw a Person Test). He found that persons with high self-esteem are likely to be more creative, assertive, and independent than persons with low self-esteem ($p<.01$). Coopersmith's (1967) review of intensive studies of the creative personality (e.g., Barron, 1955; Kubie, 1958; Kris, 1952) concluded that "to be creative an individual must trust his own perceptions of truth and reality and believe in his capacity to order and deal with uncertainty" (p. 60). Although this finding addresses the element of belief in capacity, how creative self-efficacy plays out in the face of uncertainty needs further investigation. Specifically, how do adults experience creative self-efficacy when faced with uncertainty, and does a strong belief in creative ability assist the person in dealing with uncertainty when solving problems creatively? The current literature does not provide answers to these questions.

Dowd (1989) assessment of the literature on creativity and the self confirmed:

> The research in the area of creativity and the self has been limited due to problems with the definitions of concepts; with the measurement of creativity; and the literature on creativity being characterized by a collection of one-shot

studies that do not seem to be informed by any significant higher-order theoretical constructs or programmatic thrust. (p. 238).

The qualitative approach used in this research, discussed in more detail in Chapter three, addresses the limitations described by Dowd.

Investigators have often dealt with the multi-faceted nature of creativity by attempting to separate creativity into manageable areas of investigation or to reduce one dimension of creativity to the most fundamental or basic variables that would best predict creativity in a broader or more general conception (Isaksen, 1987; Treffinger, Sortore, & Cross, 1993). Many of the earliest definitions of creativity, for example, focused on process, while the majority of creativity research has been dominated by a trait approach, attempting to precisely identify the personality differences between creative and not creative individuals (Amabile, 1983a, 1996). Although prior research has clarified our understanding of many important variables within each dimension by separating the four themes or dimensions – the creative person, product, process, and environment - for purposes of systematic investigation, it has not demonstrated how these variables interact in real situations to influence creative performance. For example, how do adults describe their experience of creative self-efficacy as they attempt to solve problems creatively within their work environment? How does this influence how creative they are in that situation? This study will attempt to provide an understanding of this phenomenon.

Amabile (1983a, 1983b, 1996), along with Woodman and Schoenfeldt (1990), is one of the few researchers in creativity to offer an interactionist model to encourage creativity researchers to incorporate a multi-dimensional methodology. Amabile's (1983a, 1983b, 1996) theoretical framework, inclusive of the varying perspectives of

creativity, attempts to account for several well established influences on creative performance: the importance of talents, education, cognitive skills, innate interests, personality dispositions, and the social environment, all functioning interactively to influence creative performance. Amabile's componential conceptualization of creativity, outlined in Table 1, involves three components (domain-relevant skills, creativity-relevant processes, and task motivation) necessary and sufficient for creative performance in any domain.

Table 1

Components of creative performance

Domain-Relevant Skills	Creativity-Relevant Processes	Task Motivation
Includes: - Knowledge about the domain - Technical skills required - Special domain-relevant "Talent"	*Includes:* - Appropriate cognitive style - Implicit or explicit knowledge of heuristics for generating novel ideas - Conducive work style	*Includes:* - Attitudes toward the task - Perceptions of own motivation for under-taking the task
Depends on: - Innate cognitive abilities - Innate perceptual and motor skills - Formal and informal education	*Depends on:* - Training - Experience in idea generation - Personality characteristics	*Depends on:* - Initial level of intrinsic motivation toward the task - Presence or absence of salient extrinsic constraints in the social environment - Individual ability to cognitively minimize extrinsic constraints

Source: Amabile (1983b, 1996).

Amabile suggested that the higher the levels of domain-relevant skills, creativity-relevant processes, and intrinsic task motivation, the higher the final level of creativity in a given product.

Amabile's theoretical framework serves well for researchers wanting to investigate creativity from an interactionist approach, specifically, to examine the role self-efficacy plays in creative performance in adults in a work setting. While Amabile's (1983a, 1983b) framework is comprehensive, further evaluation is necessary in order to determine if it would be appropriate to include the element of creative self-efficacy. How might an R & D scientists' belief about his or her ability to be creative fit within her framework? This will be explored further in the discussion of the conceptual model.

Bandura's Self-efficacy Theory

The construct of self-efficacy proposed by Albert Bandura (1977a, 1977b) is part of his larger concept of social learning theory. He defined the construct of self-efficacy as an individual's belief in his or her ability to perform a behavior in a given situation (Bandura, 1977a, 1977b). Bandura's view is that "psychological functioning involves a continuous reciprocal interaction between behavioral, cognitive, and environmental influences" (Bandura, 1988, p. 344). He proposed that people's judgments about what they can accomplish are influential arbitrators in human agency, and, as such, are powerful determinants of their behavior (Bandura, 1986, 1997). Consequently, these self-efficacy beliefs are said to act as mediators between other acknowledged influences on behavior - such as skill, ability, or previous accomplishments - and subsequent performance. Attributes of efficacious behavior include coping behaviors, interest

motivation, stress reactions, reactions to failure experiences, achievement motivation, goal setting, and career choices (Bandura, 1982).

In comparison to other constructs of the self, such as self-concept and locus of control, self-efficacy beliefs are specific to a particular activity or situation. Self-concept and locus of control are global beliefs. Studies on the predictive power of self-efficacy beliefs and self-concept on behavior have shown that self-efficacy beliefs are highly predictive of behavior, whereas the effect of self-concept is weaker and equivocal (Pajares & Kranzler, 1995; Pajares & Miller, 1994). Self-concept is a composite view of oneself that is presumed to be formed through direct experience and evaluations adopted from significant others (Bandura, 1997). For example, the person may see herself as a good athlete based on experience and feedback from others, but may not feel efficacious talking about her athletic ability in front of a group.

Self-efficacy is different from locus of control in that it is task specific, examining the individual's conviction that he or she can perform a task at a specific level of expertise. Locus of control is described as being either internal or external with internal locus of control being defined as a perception that rewards are contingent on individual behavior. External control is the notion that rewards are controlled by outside factors, such as chance, luck, fate or powers beyond their personal control (Rotter, 1966, 1982; Rotter, Chance, & Phares, 1972; Strickland, 1989). Internal locus of control, on the other hand, is a generalized construct covering a variety of situations, and is the specific belief that actions will affect outcomes. Baron, Cowan, Ganz, and MacDonald (1974) found that individuals who possess a strong belief in internal control excel in tasks involving

self-disclosed feedback, while individuals who perceive reinforcement as being externally control excelled in tasks reinforced through verbal feedback.

Self-efficacy beliefs should not be confused with response-outcome expectations. Response-outcome expectancy is the belief that a particular behavior will lead to certain outcomes. An efficacy expectation, on the other hand, is the belief in one's capability to execute the required behavior successfully (Bandura, 1977a, 1977b, 1982, 1997). For example, the belief that one could successfully high jump six feet is an efficacy judgment (Bandura, 1986, p. 391), while believing, that successfully high jumping six feet will lead to first place is response-outcome expectancy. In the area of creativity, individuals could believe they are capable of producing creative solutions to problems within their domain (efficacy judgment), and that this will lead to recognition and rewards within their domain (response-outcome expectancy).

The extensive research on self-efficacy provides evidence that it is an effective predictor of engagement in subsequent behavior (Bandura, 1977a, 1977b; Barling & Abel, 1983; Davis & Yates, 1982; DiClemente, Prochaska, & Gibertini, 1985; Hackett, 1985; Lee, 1984; Mitchell & Stuart, 1984). Self-efficacy has also been associated with work performance (Barling & Beattie, 1983; Campbell & Hackett, 1986; Hill, Smith, & Mann, 1987; Lent et al, 1987; Stumpf, Brief, & Hartman, 1987; Taylor et al, 1984; Wood & Locke, 1987). For example, Stajkovic and Luthans (1998) conducted a meta-analysis (114 studies, $k = 157$, N = 21,616) examining the relationship between self-efficacy and work-related performance. Results of the primary meta-analysis indicated a "significant weighted average correlation" (see p. 245 of this article for a description of how this is calculated) between self-efficacy and work-related performance of .38 (adjusted for

sample size outliers and extreme values). They also found a significant within-group heterogeneity of individual correlations indicating that the higher the perception of self-efficacy the better the actual work performance. Since most of the studies Stajkovic and Luthans analyzed used a correlational design, and the meta-analytic procedures applied were respectively concordant, the results of their meta-analysis need to be interpreted as representing the magnitude of the relationship between self-efficacy and work-related performance. Their findings did, however, point to self-efficacy as positively and strongly related to work-related performance, and that the relationship between self-efficacy and work-related performance was moderated by task complexity and locus of performance.

Research has also been conducted showing a significant statistical relationship between self-efficacy and cognitive skills, such as writing performance (Meier, McCarthy, & Schmeck, 1984; Zimmerman & Bandura, 1994), math achievement (Schunk, 1981; 1982; 1983; 1984), and the effect of interventions (Barling & Snipelisky, 1983). As these studies provided significant evidence that self-efficacy plays a role in performance, it would be expected that self-efficacy could influence creative performance in adults.

The strength of self-efficacy determines whether a behavior will be initiated, the amount of effort devoted to pursuing a goal, and the degree of goal persistence in the face of difficulty (Bandura, 1977b). Feedback is vital under these circumstances. Evaluative feedback can be conveyed in ways that could undermine a sense of efficacy or boost it (Bandura, 1997). Bandura and Wood (1989) proposed that individuals who believe themselves to be inefficacious effect little change, even in social systems that provide

many opportunities. On the other hand, individuals with firm belief in their efficacy, through ingenuity and perseverance, find ways to exercise some measure of control over social systems containing limited opportunities and many constraints. When presented with a social environment with surmountable barriers, people who have a high sense of self-efficacy will be able to exercise more control over it and will view it as more changeable than self-doubters who give up quickly in the face of difficulties.

In summary, the extensive research on self-efficacy provides evidence that self-efficacy beliefs act as mediators to perform a behavior in a given situation. The strength of a person's self-efficacy can sustain him or her through difficulties and barriers to performance. The gap in the literature on self-efficacy lies in the area of creative self-efficacy, specifically, what is the meaning and essence of the experience of creative self-efficacy for R & D scientists working in a high technology organization? What influence does self-efficacy have on R & D scientist's creative performance?

Studies Relating to Creative Self-efficacy

Direct research related to creative self-efficacy has been minimal and mostly directed at children. Schack (1989) investigated the effect of participation in a treatment designed to increase self-efficacy on both efficacy and involvement in independent investigations. In this study, Schack (1989) defined self-efficacy as "an individual's level of confidence doing a particular behavior" (p. 19) and measured self-efficacy using a scale developed by Starko (1986). Participants consisted of 294 students in Grade 4 through 8 who were enrolled in gifted programs based on the Enrichment Triad Model in eight schools. Path analysis was used to test the influence of grade, sex, years in the gifted program, previous independent projects, and self-efficacy for creative production

before and after a research methodology mini-course, and studied before the initiation of an independent project on final efficacy scores as a creative producer. A second analysis examined the role of the first six variables and participation in the research methodology mini-course on subsequent initiation of independent project.

Results of Schack's study showed that final efficacy was positively and significantly related to initial self-efficacy as a creative producer, post-treatment self-efficacy as a creative producer, and participation in a Type III (independent investigations), indicating stability of the construct and increases in efficacy as a result of participation in the target behavior ($p < .001$). Variables in the causal model accounted for 57% of the variance in final self-efficacy as a creative producer, with the equation yielding a multiple R of .7542. However, the intervention did not increase efficacy and the target behavior.

Although participants consisted of children only, the results of this study support Bandura's theory that performance accomplishments have a direct effect on self-efficacy. Thus, it could be expected that self-efficacy would have a role in the creative performance of R & D scientists. One could envisage that R & D scientists who believe themselves to be creative producers will initiate and sustain creative production with other tasks or problems that occur within or outside their domain.

Starko (1988) examined the effects of the Revolving Door Identification Model (RDIM), a model for education of the gifted, on student creative productivity and self-efficacy for creative productivity. She compared 22 seventh grade and 22 eight grade students who had participated in RDIM programs for at least four years with comparable students in a nearby district who had been identified for a gifted program but had not

received services. In this quasi-experimental study, Starko used questionnaires and self-efficacy scales designed by her, and used hierarchical multiple regression for analysis.

The results of Starko's study indicated that participation in an RDIM program and independent or major creative products (creative productivity in school) were significant predictors of creative productivity outside of schools ($p < .001$). Interview data supported a relationship between independent products (creative products produced within RDIM program) and self-efficacy with regard to creative productivity. Again, this study points to the influence of performance accomplishments on creative self-efficacy.

Locke and his colleagues (1984) investigated the role of perceived cognitive efficacy in creative thinking when individuals were taught cognitive strategies for thinking creatively. Two hundred and nine undergraduates from an introductory management course went through seven 1-minute trials, following an initial practice trial. For each trial, participants were asked to come up with uses for common objects such as use of a hanger (a different object was used on each trial). After the practice trial, each participant completed a self-efficacy scale that was developed based on Bandura's conceptualization of the dimensions of self-efficacy. The same scale was used after each subsequent trial. Trials 1-3 were treated as training trials, while Trial 4 was a post training trial, and Trial 5-7 were experimental trials. Training trials were manipulated as follows: High strategy (n=46) -participants were trained to use three methods of getting a large number of uses; Low Strategy (n=45) - participants were told to give only good or high quality ideas and not uses that are "crazy and far out"; and Control (n=55) – participants were given no training. Multiple regression analyses were used to analyze performance, goal choice, and goal commitment for each trial. A path analysis was used

to integrate the findings from trials 5 and 6 into a coherent framework; only path coefficients that were significantly different than zero ($p < .05$) were reported.

Locke and his colleagues (1984) results showed that ability, self-efficacy, goals and task strategies were all related to task performance, and that self-efficacy was more strongly related to past performance than to future performance. However, self-efficacy was still a strong predictor of future performance even when past performance was controlled. Self-efficacy ratings for moderate to difficult levels of performance were the best predictors of future performance. Although this study was not directed at adults in a work setting, it serves as reference point in formulating an understanding of creative self-efficacy in adults, particularly the role of past and future performance has on creative self-efficacy.

Additional literature on the interaction between self-efficacy and creative performance among adults is limited in quantity and relevance. Most of it does not address self-efficacy beliefs specifically, and does not provide evidence of the interaction between self-efficacy beliefs and creative performance among adults (G. A. Davis, personal communication, September 4, 1998; Halpin, Halpin, & Torrance, 1974; Khatena, 1972, 1977; Michalko, 1992; Stein, 1974). Stein's (1974) review of the literature of personality characteristics that were associated with creative individuals listed "sees himself as creative" as one of the 19 characteristics. Walkup (1971) suggested that most individuals have a good estimate of their own creative level. The researcher's personal communications with two well-respected creativity researchers (G. A. Davis, personal communication, September 4, 1998; M. I. Stein, personal communication, June 23 1998), suggested that people who believe they are creative

would act and think in a creative manner. Studies by Khatena (1972, 1977) determined that people who perceive themselves as highly creative are experimentally and power oriented, have less need for structure and possess relatively high intuition. Halpin, Halpin, and Torrance (1974) found that when adults perceive themselves as creative, they tend to be more verbally original and imaginative. However, it was evident that no strong research, either quantitative or qualitative, dealt directly with the role self-efficacy plays on creative performance in adults.

Previous studies seem to be addressing "self-perception for creativity," which is not the same as self-efficacy for creative performance within a specific domain or situation. Specifically, they do not address a person's belief in his or her ability to be creatively productive in a given situation, the strength of his or her convictions, and how these factors influences creative performance. Second, the tests used in the studies outlined above do not directly address self-efficacy and creative performance in adults working in a specific domain. Bandura (1997) indicated that efficacy beliefs need to be measured in terms of particularized judgments of capability that could vary across a wide range of activity, under different levels of task demands within a given activity domain, and under different situational circumstances. No one creativity instrument could meet this requirement.

Another experiment, that indirectly investigated an adult's belief about his or her creativity and self-efficacy, trained twenty-one volunteer undergraduate university students (12 male, 9 female) in the use of self-instructional statements about creative behavior (Meichenbaum, 1975). Results of this study, involving a pretest-posttest control group design, showed that the self-instructional training group, relative to the focused

training group, and the untreated waiting list control group, demonstrated a significant increase in originality and flexibility on tests of divergent thinking ($p < .05$), an increase in preference for complexity, a significant increase in human movement responses to an inkblot test, and concomitant changes in self-concept. The study showed a statistically significant increase in originality and flexibility on tests of divergent thinking, an increase in preference for complexity, a statistically significant increase in human movement responses to an inkblot test, and concomitant changes in self-concept. Although this study indicated that self-statements could have an influence on an individual's creativity, specifically originality and flexibility, it did not address creative self-efficacy directly and it only addressed one source of self-efficacy, verbal persuasion. In addition, the small sample size makes it difficult to generalize the findings to other populations.

In summary, there has been minimal research conducted on creative self-efficacy, and what has been done has been directed mostly at children. What is evident is that there has been no study directed at the essential experience of creative self-efficacy as described by adults who have experienced it. The research that has been conducted thus far, however, does point to self-efficacy playing a role in creative production. It will be valuable to link back to this research when discussing the findings resulting from this study. Specifically, whether there is an interaction between self-efficacy and creative performance in adults, and the nature of that interaction.

The Phenomenological Approach to Investigate Creativity

After investigating the literature on phenomenology and creativity, the researcher found several dissertations using a phenomenological approach. These studies, however,

mostly investigated the phenomenon of artistic creativity or studied children. Useful frameworks for this study are provided within the work of Conrad (1990), Bindeman (1998), and Melrose (1987, 1989).

Conrad (1990) conducted a phenomenological analysis of artistic creativity based on Husserl's principles of phenomenology. She added to the much-debated discussion on the problem of defining creativity, stating that the problem with defining creativity is "in the rigid dichotomy between objects and mental processes" (p. 105). To correct this problem she suggested that researchers ask how creativity makes sense as a human experience. By suggesting that artistic creativity involves composition rather than creativity, Conrad (1990) claimed it can eliminate the theoretical and methodological difficulties involved in delimiting and measuring an internal mental attribute, and that "this framework may suggest more ecologically valid tests or assessments of artistic ability" (p. 118). She suggested that in the initial stages of inquiry, interviews and field observations would yield valuable information to better understand creativity than controlled laboratory tasks. The design of the methodology for this research study is based on Conrad's perspective. In this case, it is believed that in-depth interviews will provide valuable information about the meaning and essence of the experience of self-efficacy for R & D scientists.

Bindeman (1998) also has the perspective that "creativity, when studied from both psychological and philosophical perspectives, emerges as a significant and uniquely human experience" (p. 69). He used the phenomenological method to interpret findings concerning the human experience of the creative process, by studying and contrasting the writings of Nietzsche and Poincare's analysis of the creative process with more recent

theories of creativity. He viewed creativity through "the medium of a phenomenologically informed process orientation, which excludes both the idea that creativity has as its end a finalized product, and the idea that the personal traits of the artist somehow completely determine this product" (p. 69). He concluded that the creative process involves a breakdown, both consciously and unconsciously, in our old pattern-making or pattern-recognizing activities, resulting in a final stage of working through the implications of the new idea. Although Bindeman's concluding remarks on the creative process offer several insights, this research will specifically look at the influence of self-efficacy on the creative process. Gaps still exist and thus this research will investigate whether an adult's belief in his or her ability to be creative influences his or her ability to break down old pattern-making activities for the creative process to occur, and if so, is this done at a conscious or unconscious level. Bindeman's work also supports studying the human experience of creative self-efficacy using a phenomenological approach.

Melrose (1987, 1989) investigated the personalities and creative processes of eleven especially creative individuals. These individuals worked in a variety of fields, were viewed by their peers as being exceptionally creative, and were supporting themselves financially through their creative endeavors. Melrose (1987) collected her data using an open-ended interview guide in a face-to-face interview setting and data were analyzed qualitatively using a phenomenological approach. She discovered that certain experiences and characteristics facilitate creative development. Specifically, Melrose (1987) concluded that creativity is fostered in childhood if the child faces and overcomes perceived hardship. As children, creative people experience psychological

distance in their relationships with their parents, and in early life, creative people turn inward because of perceived adversity and later project that experience outward in the form of a creative product. This is supported by the work of Simonton (1988) and Albert (1980) who found that traumatic events, with accompanying unhappy childhoods, may contribute to creative eminence. They proposed that adversity, as a potential influence on creativity, cannot be understood without recognizing individual differences.

Melrose also concluded that solitary time in childhood fosters creative development, and that creative people usually begin expressing themselves creatively as children. She also concluded that creative people can be described as risk-takers, meaning makers and question askers, who are anti-authoritarian, enduring, determined, hard working, intelligent, and demonstrate a sense of humor.

Melrose's findings indicated that serendipity and synchronicity are vital to the creative process and can be encouraged by focusing on and expecting them to occur and by moving beyond causal thinking through altering decision-making and behavioral patterns. Finally, she concluded that creativity rewards and perpetuates itself. Melrose's results offer many insights on the personalities and creative processes used by creative people that can be referred back to during the discussion phase of this research. The richness of her findings validates the strength of using a phenomenological approach to study the essence and meaning of the experience of creative self-efficacy for R & D scientists.

Both Melrose and Bindeman, much like Gardner (1993), have studied creativity from the perspective of well renowned exceptional people. Not to negate this very important research and its contribution to the literature, this research study seeks to

understand the human experience of creative self-efficacy from the perspective of laypeople, in this case, creative adults working as Research and Development (R & D) Scientists within a high technology organization. The next section will describe the nature of the work of an R & D Scientist, specifically as it relates to creative performance.

The Research and Development (R & D) Scientist

What are the main characteristics of creative R & D scientists working in high technology organizations? An R & D Scientist working in a high technology organization, as defined in this study, is one with either a computer science, physics, or engineering background employed in a design capacity either on hardware or software design of telecommunications products and services in a high technology company. Although it was expressed that creativity in engineering design was important given the competitiveness of this fast-growing industry, the literature in this area is minimal (Thompson & Lordan, 1999). Thus, one goal of this study is to contribute to the knowledge base in this area.

Blade (1963) differentiated scientists from engineers in terms of their individual creative processes and in their creative products as follows:

> Scientists are concerned with discovering and explaining nature; engineers use and exploit nature. Scientists are searching for theories and principles; engineers seek to develop and make things. Scientists are seeking a result; engineers are engaged in solving a problem for practical operating results. Scientists creative new utilities of thought; engineers invent things and solve problems. This is a different order of creativity (p. 111).

Given this distinction between scientists and engineers, the participants in this study are engineers engaged in solving technical problems creatively.

Offner (1967) suggested that:

> Engineering by its nature is creative; in many definitions of creativity and engineering, one can notice a generic relationship. As an engineer, I view creativity as a dynamic process for obtaining a realizable solution to a need. This process occurs in a mental reactor, is fired by imagination, controlled by reason, and results in the critical fusing for the first time of selected elements from a stockpile of knowledge and experience (p. 21).

Creative engineering utilizes both technology and scientific principles in combination with a decision-making process, to obtain means, processes, or systems to satisfy a desired goal (Offner, 1967). This process includes both synthesis and analysis, and ideation and judgment. Examples of creative engineering can be found everywhere – from wireless technology and cell phones, fiber optic cables, to any of the technological advances that we take for granted.

Creativity is seen as an essential part of the engineering design process, specifically in the concept generation and evaluation stages (Thompson & Lordan, 1999). Although an engineer does not experience the same freedom of action as a scientist, often due to restrictions often imposed on an assignment, other opportunities for the engineer to create do exist (Blade, 1963). For example, if the assignment is to make a switch do X and Y, such a switch must be made. The materials out of which it is made, and the functions the switch may have, are up to the engineer.

Using a sample of 740 chemists and psychologists, Chambers (1964) found that creative research scientists were significantly more dominant and self-sufficient than non-creative control scientists (cited in Sternberg & Lubart, 1995). A belief in oneself, and having the courage of one's convictions were deemed as necessary to be a creative research scientist (Sternberg & Lubart, 1995). In terms of conformity, studies have shown that high creative industrial research scientists conformed consistently less often to the group's opinion than low creative scientists (see Sternberg & Lubart, 1995, p. 229). For example, high creative industrial research scientists conformed ten percent of the time, whereas low creative scientists conformed eighteen percent of the time.

Although identified attributes were not specific to R & D Scientists, Kay (1990) identified the characteristics of a creative "hi-tech" professional as being motivated by winning recognition in their chosen field, deriving great satisfaction from having defined and solved a difficult technical or scientific problem, and as having an exaggerated standard of excellence to the point of perfectionism. Kay found that the drive for the successful "hi-tech" professional is to increase one's knowledge. They tend to work in a solitary work-style and place little emphasis on developing personal relationships beyond what is necessary to get the problem solved.

Anne Roe (1952), a pioneer in the field of relating occupation to personality, found that creative physical scientists were very open to experience, highly observant and prone to see things in unusual ways. They were extremely curious, accepting of unconventional thoughts, ready to recognize and reconcile apparent opposites and tolerant of ambiguities but liking to resolve disorder into order. She also found them to be appreciative of complexity, highly independent in judgment, thought, and action, self-

reliant and not responsive to group standards and control. In addition, Roe found that when circumstances permit, creative scientists would exhibit great perseverance and personal discipline. These traits parallel the findings of other researchers (Amabile, 1990; Amabile & Gryskiewicz, 1988), and point to creative scientists having an intrinsic motivational orientation. Finally, Bailey (1978) maintained that disciplined creativity, in addition to analytical ability was needed by the engineer in all known engineering functional work areas.

Although the studies discussed above were not directed specifically at R & D scientists, the characteristics and descriptions provided serve as a comparison with the descriptions of creative self-efficacy provided by R & D scientists in this study. A study on R & D scientist's creative self-efficacy would contribute to the literature base in a number of ways. First, no study has investigated the influence of self-efficacy on creative performance with R & D scientists before. Although the data suggests that R & D scientists are both creative and self-efficacious, it has not been proven empirically. Finally, a key part of the new economy is to know how R & D scientists operate so that organizations can provide and environment conducive to their reaching their potential.

Conceptual Framework of Model

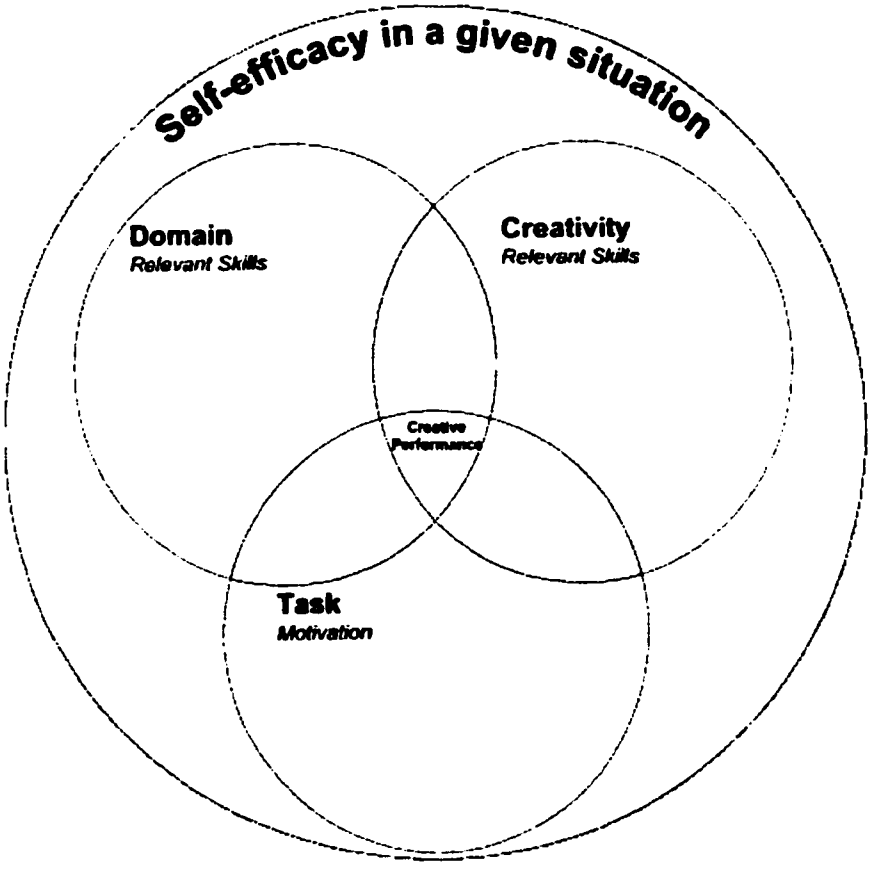
The combination of the theories of Bandura (1977a, 1977b, 1986, 1997) and Amabile (1983a, 1988, 1996) lends itself to study self-efficacy beliefs and creative performance in adults for several reasons. First, both involve interaction between behavioral, cognitive, and environmental influences that lead to productivity. Both self-efficacy and creative performance are specific to a particular activity, situation, or

domain. Both theories have been studied extensively, are well grounded, yet lend themselves to further investigation.

Figure 1 provides a conceptual model that combines Amabile's (1983a, 1996) componential conceptualization of creativity and Bandura's (1977a, 1977b, 1997) self-efficacy theory. In this diagram, Amabile's components of creative performance - domain-relevant skills, creativity-relevant processes, and task motivation – are embedded within Bandura's self-efficacy theory to examine the role self-efficacy plays in creative performance in adults.

Figure 1

Conceptual Model



Source: Adapted from Amabile (1983a, 1983b, 1996) and Bandura (1977a, 1977b, 1997)

Domain-relevant skills are specific and include knowledge about and experience in the task domain, special technical skills required for work in the domain, and domain-specific talents. Creativity-relevant processes operate at the general level and include heuristics for generating creative ideas as well as cognitive styles, working styles, and personality traits. Creativity-relevant processes include the cognitive, work, or personal styles that are conducive to generating novel and useful ideas in any domain. They may be innate, but it is clearly possible to develop them through education and experience (Amabile & Tighe, 1993). Task motivation is seen as a narrowly specific component because it can vary importantly from one task in a domain to another. Task motivation includes motivational variables that determine an individual's approach to a given task. It is not clear at this point whether self-efficacy would influence creativity-relevant processes or task motivation only, or whether it overlays the entire componential framework for creative performance. My study will attempt to shed light on this.

Amabile (1983a, 1983b, 1996) described ways in which the componential framework on creative performance could be used to understand the creative process, specifically, to describe the way an individual might assemble and use information in an attempt to arrive at a solution, response or product. She outlined the steps in the creative process as problem or task identification, preparation, response generation, response validation and communication, and outcome (Amabile, 1996). Based on Amabile's (1983a, 1996) description of the creative process and Bandura's self-efficacy theory, several speculations could be made. First, how efficacious a person feels about creative abilities would influence how he or she initiates and sustains the creative process, and whether or not he or she solves it creatively. For example, once a problem or task has

been identified an individual has several choices on how to solve it. How efficacious a person feels about his or her ability to solve it with novel and appropriate solutions would lead one to initiate and sustain each step within the creative process.

Second, the strength of his or her creative self-efficacy might influence the conviction he or she has in the belief that one can apply the creative process no matter how difficult the problem or task is. Bandura (1997) proposed that the strength of self-efficacy will determine whether a behavior is initiated, the amount of effort devoted to pursuing the task or situation, and the degree of persistence the individual will have in the face of difficulty.

Third, the strength of creative self-efficacy might also influence whether the creative process could be applied to other tasks or problems within or outside of the specific domain. Prior experience and successful performance in solving problems creatively may lead to applying the creative process to other problems. Bandura suggested that performance accomplishment serves as the most influential source of self-efficacy. Finally, the social environment, including feedback from others, might have an influence on a person's self-efficacy to be creatively productive within his or her domain. How much will a person persevere in creative efforts despite innumerable difficulties and obstacles he or she faces, and what role does creative self-efficacy have in this?

Self-efficacy beliefs vary on three dimensions that have important performance expectations: 1) level - variations across different levels of tasks, such as increasingly complex technical problems; 2) generality - the transfer of self-efficacy beliefs across activities, for example, different technical areas; and 3) strength - degree of certainty that one can perform given tasks (Bandura, 1977b, 1997). In exploring the role self-efficacy

plays in creative performance, it will be important to explore these three dimensions further. In a previous study conducted by this researcher (Laws, 1995), it was discovered that adults working within a high technology company who declared themselves as not creative, and had low scores on the Torrance Test of Creative Thinking (Torrance, 1974), had difficulty describing times when they felt most creative in the workplace. The purpose of this study was to explore the role of creativity in performance, specifically, the conditions necessary to bring out intrinsic motivation, therefore creativity, in adults working in a high technology organization. Subjects included 60 Research and Development designers, evenly divided into those who were identified as high performing and solid performing. The results indicated that while the designers scored high on creativity, there was no significant difference between high and solid performers on the level of intrinsic motivation and creativity. In stage two of the study, 12 subjects were interviewed using a Critical Incident Interview approach. Factors such as taking initiative, the need for interesting and challenging work, hands-off management, and recognition and encouragement, were what differentiated high performers from solid performers. This study builds on these results to determine the influence of perceived self-efficacy on different types of tasks requiring creative ability.

The generality dimension needs to be explored further, specifically, to determine if an adult who believes in himself or herself as a creative producer, initiates and sustains creative performance with other tasks or problems that occur within or outside his or her domain. Given that strength of perceived efficacy is measured by degree of certainty that one can perform given tasks, one could predict that persons with low creative efficacy would be less likely to attempt solving a problem creatively. They would be more likely

to back away from solving problems creatively if they faced resistance in the organization than would a person with a high creative self-efficacy.

Bandura identified four sources of information upon which people base self-efficacy judgments: (a) performance accomplishments -- successes or failures with the target behavior or those similar; (b) vicarious experiences -- learning from models; (c) verbal persuasion; and (d) one's emotional or physiological state (Bandura, 1977a, 1977b). Performance accomplishment, that is the successful completion of the target behavior, serves as the strongest source of self-efficacy. Next, vicarious experiences, such as watching others perform the task, can act as an important source of efficacy information. Verbal persuasion and low physiological arousal are seen as less effective sources of self-efficacy for the individual than performance and vicarious experiences (Bandura, 1982). In a study of the role self-efficacy has on creative performance, it would be helpful to understand the sources of information on which adults base their self-efficacy judgment about their creative performance. Specifically, what sources have the most influence on creative performance?

In summary, a gap in the literature exists in understanding the essence and meaning of the experience of creative self-efficacy from the perspective of adults working in a high technology organization. Although extensive research on self-efficacy has shown a strong two-way relationship between self-efficacy and action, and that self-efficacy beliefs are a strong predictor of behavior, research-based efforts to better understand creative self-efficacy have been virtually non-existent. No studies investigating the essence and meaning of creative self-efficacy to R & D scientists have been reported. The incompleteness of our understanding of creative self-efficacy among

R & D scientists presents a unique challenge that can be best explored through a phenomenological approach; an approach that is aimed at unraveling the meaning of experience. The conceptual framework, using a model combining Bandura's and Amabile's theories, will be useful as R & D scientists describe their experience of creative self-efficacy in providing an understanding of the role self-efficacy plays in creative performance. The next chapter describes the methodology used to conduct the study. Following this is a presentation of the data.

CHAPTER THREE

Methodology

"As far back as I can remember I have sought to know the truth of things through my own intuition and perception, learning from my own direct experience and from awareness and reflections that would bring meanings to light (Moustakas, 1994, p. 41)."

Introduction

In this chapter, the method of this exploratory study of R & D scientists' experience of creative self-efficacy is described. The chapter begins by establishing the rationale for using a qualitative approach to investigate the perceptions of creative self-efficacy. The chapter continues by providing a philosophical perspective of the phenomenological approach, followed by a description of the methods and procedures developed in preparing to conduct the study, in collecting the data, and in organizing, analyzing, and synthesizing the data. Finally, procedures for standards of quality and verification are addressed.

Rationale for Qualitative Research Approach

Qualitative research philosophical and theoretical underpinnings are based on a phenomenological position, "using qualitative and naturalistic approaches to inductively, and holistically understand human experience in context-specific settings" (Patton, 1990, p. 37). Qualitative research seeks to examine "people's words and actions in narrative or descriptive ways more closely representing the situation as experienced by the participants" (Maykut & Morehouse, 1994, p.2). The outcome of qualitative research is not to get a generalization of results, but to gain a deeper understanding of the experience from the perspectives of the participants under study. With this in mind, this study is designed to gain a better understanding of perceptions, feelings, and experiences of

creative self-efficacy that are not easily quantifiable. The researcher wanted to better understand, from those who have experienced creative self-efficacy, how R & D scientists perceive and describe their experience of creative self-efficacy within a high technology organization. Second, given the multi-faceted nature of creativity (MacKinnon, 1975) and the need to have a good conceptual analysis of the relevant domain of functioning when researching self-efficacy (Bandura, 1997), a qualitative research approach was deemed as best suited for this research study.

The philosophical assumption that guided this study was ontological in nature – "something is real when it is constructed in the minds of the actors involved in the situation" (Creswell, 1998, p. 255). In this case, the individuals involved in the study constructed their own reality of creative self-efficacy. Specifically, the multiple realities that existed in this study were those of the researcher, those of the participants being investigated, and those of the reader who will interpret the study. Furthermore, the use of qualitative methods grounded in phenomenology, allowed the researcher to encounter and probe the multiple realities that participants brought to the study, and to report multiple statements representing the diverse perspectives of creative self-efficacy, the phenomenon under investigation. The job of the researcher is to make sense of, or interpret, the phenomena in terms of the meaning people bring to them (Creswell, 1998).

Although the research was grounded in phenomenology, the design incorporated several elements of naturalistic inquiry as described by Lincoln and Guba (1985) including the natural setting, the human instrument, and utilization of tacit knowledge, naturalistic sampling, and inductive, emerging, and ongoing data analysis. The element of being able to explore multiple constructed realities holistically has already been

discussed. However, it is important to note that this process of inquiry most often raises more questions than answers so that prediction and control are unlikely outcomes, although some level of understanding can be achieved (Lincoln & Guba, 1985). Again, the goal of this study was not to predict and control but to explore and discover the phenomenon of creative self-efficacy to gain an understanding of it that could lead to explanation. It is difficult to establish criteria of relevance and usefulness for research studies without a clear grasp of the meaningful structure of an experience, in this case the experience of creative self-efficacy (Dukes, 1984).

This research was conducted in a work setting, within a high technology organization, where R & D scientists solve technical problems creatively, on a daily basis. The human instrument element of naturalistic inquiry was emulated with the researcher and participants acting as the primary data-gathering instruments "because it would be virtually impossible to devise a priori, non-human instruments with sufficient adaptability to encompass and adjust to the variety of realities that will be encountered" (Lincoln & Guba, 1985, p. 39). This was important, since a review of the literature found that there is no one instrument that can measure the multiple realities of creative self-efficacy. Only those who have experienced creative self-efficacy are capable of grasping and evaluating the meaning of creative self-efficacy.

Furthermore, both the intuitive and felt knowledge (tacit) along with knowledge that was expressed in language form (prepositional) were used to examine the multiple realities and nuances that occurred between the researcher and participants under investigation (Lincoln & Guba, 1985). Polanyi recognized that each person, novice or expert, has great stories of tacit knowledge with which to build new understandings (as

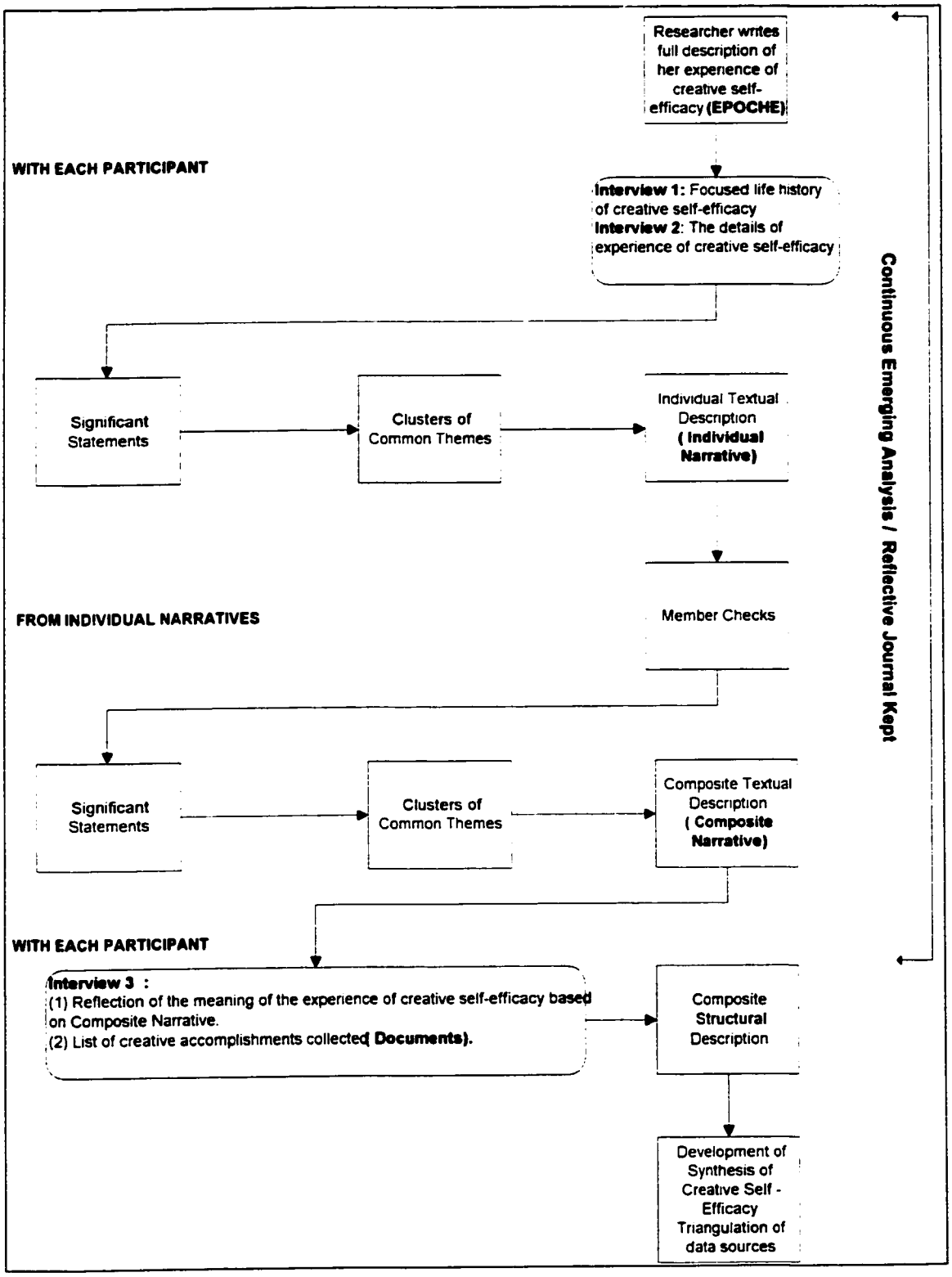
cited in Stake, 1978). From tacit knowledge, the human instrument builds many insights and hypotheses that can be transmitted into prepositional form (Lincoln & Guba, 1985). In this study, participants shared their experiences of creative self-efficacy, from when they were growing up to the present time. The researcher took on the persona of someone who had never heard participants' stories before, with fresh eyes, in order to get at an understanding of creative self-efficacy.

Figure 2 outlines the research design followed in this study. It involved several interactions with participants, in their natural setting, to more easily encounter and probe the multiple realities that composed the data of the study, and a phenomenological methodology. The analysis of data was inductive, emerging, and ongoing in an effort to identify the multiple realities in the data, to better describe fully participants' experiences of creative self-efficacy, and "to make decisions about the transferability to other settings easier" (Lincoln & Guba, 1985, p. 40).

Other characteristics of a naturalistic study followed in this study included naturalistic sampling, negotiated outcomes, idiographic interpretation of data, and that of tentative application. Participants who had experienced creative self-efficacy were selected for this study to maximize the information, and not to generalize. Second, participants had an opportunity to check their individual narrative to ensure that the information they provided was captured accurately and to make changes that were necessary. Third, it is understood that the interpretation of the realities of creative self-efficacy will have different meaning for R & D scientists than for individuals in other settings. The realities of participants are multiple and different from setting to setting.

Figure 2

Research Design



Criteria for trustworthiness of naturalistic inquiry – credibility (in place of internal validity), transferability (in place of external validity), and dependability (in place of reliability), and confirmability (in place of objectivity) – were also included in this study (Guba, 1981). Triangulation, clarifying researcher bias, prolonged engagement, member checks, and a rich, thick description were used to address each of these elements (Creswell, 1998).

In summary, this research study used qualitative techniques, incorporating several elements of naturalistic inquiry to explore and discover the phenomenon of creative self-efficacy. The involvement of human instruments facilitated an emerging, inductive analysis that assisted in confirming the dependability of the interpretation of data. Using the philosophical approach of phenomenology to study creative self-efficacy requires a brief description of the phenomenological method and how it was employed in this research study. This will be discussed in the next section.

Phenomenological Research Approach

Phenomenology is dedicated to describing the structures of experience as they present themselves to consciousness. It involves "entering the field of perception of participants; seeing how they experience, live, and display the phenomenon; and looking for the meaning of the participants' experiences" (Creswell, 1998, p. 31). Phenomenology is considered pre-empirical, pre-experimental, and pre-statistical, setting the stage for more accurate empirical investigations by lessening the risk of a premature selection of methods and groupings (Van Kaam, 1966). Phenomenology gives public shape to the lived experiences themselves, and reveals descriptive truths before theorizing (Harper, 1981).

In this study, the phenomenon of creative self-efficacy was explored to gain a better understanding of its meaning for R & D scientists who are required to solve technical problems creatively on a daily basis. In order to ascertain the nature and meaning of creative self-efficacy as it pertains to this study, it is necessary to identify the perceptions concerning creative self-efficacy that R & D scientists hold as they carry out their job functions.

The phenomenological approach developed by the German philosopher Edmond Husserl provides a new way to view creative self-efficacy. Husserl maintained that phenomenology is based on two premises (1) "human experience is intelligible – it makes sense – to those who live it, prior to all interpretation or theorizing", and (2) "the sense or logic of human experience is an inherent structural property of the experience itself; not something constructed by an outside observer" (as cited in Dukes, 1984, p. 198). Hence, the task of this researcher is to see the "inherent logic" of the experience of creative self-efficacy and to articulate that logic or sense faithfully, without distortion (Dukes, 1984). The philosophical phenomenological approach includes three interlocking steps: (1) the phenomenological reduction, (2) description, and (3) search for essences (Giorgi, 1997). First, phenomenological analysis requires that a researcher place to one side all knowledge one has about a phenomenon, so that one can examine it without preconceptions, as it exists at that moment. Before collecting data, the researcher wrote a full description of her experience of creative self-efficacy. Throughout the data collection phase, the researcher attempted to put aside her prejudices and biases by imagining she was a child experiencing the phenomenon for the first time.

Second, Mitchell (1990) described the process of phenomenological description as requiring that "the researcher returns again and again to the phenomena in order to see clearly, to perceive directly within a minimum of biases, and to grasp the meaning of what is viewed" (p. 261). A phenomenology of creative self-efficacy includes a description of behaviors, beliefs, intentions, values, feelings, and thoughts that make up the total experience of an adult's creative self-efficacy. The phenomenological description tries to describe what people experience and how they experience what they experience (Patton, 1990).

Third, a basic assumption of phenomenology is that there is an essence or essences to shared experience, meaning that, "essences are the core meanings mutually understood through a phenomenon commonly experienced" (Patton, 1990, p. 70). An essence is the most invariant meaning for a context. The process to do this is called imaginative variation, where "one freely changes aspects or parts of the phenomenon or object, and one sees if the phenomenon remains identifiable with the part changed or not" (Giorgi, 1997, p. 242). This process involves seeking all possible meanings, seeking divergent perspectives, and varying frames of reference about the phenomenon (Moustakas, 1994). In this study, the experiences of R & D scientists' creative self-efficacy will be bracketed, analyzed, and compared to identify the essence of the phenomenon of creative self-efficacy. Although the descriptive summary of the phenomenon of creative self-efficacy will be specific to participants of the study, it should "evoke the reader's similar and different experiences of the phenomenon and, through this resonation, convey a validness of the findings" (Becker, 1992, p. 48).

In summary, a phenomenology of creative self-efficacy is a way to study creative self-efficacy from a very different perspective. The phenomenological method contributes to what is really needed in the field of creativity, i.e., the development of a view of creative self-efficacy that is based on adults' perceptions of creative self-efficacy while solving problems creatively within their domain of expertise. Although the phenomenological method cannot be expected to provide a final understanding of creative self-efficacy, the fact that it can nullify the influences, biases, and presuppositions of other studies is reason enough to utilize it as a new and different method of study.

Preparing to Conduct the Study

Participants for this research were drawn from the Optical Internet division within a high technology company. Support was provided from the division's Vice President of Human Resources to conduct the research study. At the time of the study, approximately 30 percent of the company's workforce worked in Research and Development (R & D) and technology. Participants were drawn from the pool of R & D scientists working within the Optical Internet division, via an email sent internally to 45 R & D Scientists (of whom 38 were male and 7 female), requesting volunteers for the study (see Appendix A).

When selecting participants for a phenomenological study, Moustakas (1994) states that it is essential that:

> The research participant has experienced the phenomenon, is intensely interested in understanding its nature and meanings, is willing to participate in a lengthy interview (and perhaps a follow-up interview), grants the investigator the right to

tape-record, possibly videotape the interview, and publish the data in a dissertation and other publications (p. 107).

The participants selected for this study, met these requirements and ultimately twelve participants were purposefully selected for interviews (Creswell, 1998). Specifically, participants who self-selected for this study felt that they met the requirements described in the email that was sent out to them: "creative innovators to participate in a study on how an individual's belief in his or her ability to be creative in the workplace influences how creative he or she is in the work place". The email was very specific in describing what was required of them if they were to participate in the study. Two males responded to the initial email sent March 15, 2001, and three more males responded to a reminder email sent out on March 26, 2001. On April 2, 2001, the researcher began to contact everyone, via telephone, on the list of 45 R & D scientists to enlist the remaining participants required for the study. The researcher reiterated the information in the email to the person, and asked if he or she felt that he or she met the requirement of the study and would be interested in participating in the study. This resulted in the remaining seven participants signing up for the study. Those who did not sign up felt that they did not meet the requirements of the study or that they were too busy.

Although the sample size for a phenomenological study need not be large, a sample size of three to ten can minimize the danger of the researcher's "either seeing what we want to see—rather than what is there to be seen—or falling prey to the contingent facts of a particular case" (Dukes, 1984, p. 200). In the case of this study, twelve were selected to compensate for participants potentially dropping out of the study, but none did. It is important to note that while not all twelve entered the study intensely

interested in the nature of creative self-efficacy and its meanings, their interest grew as the study progressed.

The twelve participants of this study consisted of ten males and two females, three of whom were not born in Canada. Their experiences as R & D scientists range from three years to over twenty years. Their ages ranged from early 20's to mid 50's. Finally, four out of the twelve were managers and five held Ph.D. degrees. Each participant is described in more detail in Chapter four, beginning on page 67. Participants were asked to sign a consent form, which explained the project (See Appendix B) and contained a promise of confidentiality.

Collecting the Data

Since the focus of a phenomenological study is based on what people experience and how they interpret the world (Patton, 1990), the primary sources for collecting data were interviews. Secondary sources included a review of documents (each participant's list of creative achievements and accomplishments), and the researcher's reflective journal, which were used for triangulation purposes. Each is described in more detail below.

In-depth Interviews

In-depth interviews of one and a half to three hours, using open-ended questions, were held with each participant selected (see Appendix C). As outlined by Seidman (1991), three in-depth interviews were conducted to compose the phenomenological inquiry. Dukes (1984) suggested that "contact with the subjects needs to be extensive and prolonged enough to see the experience as they see it, to establish the strongest shared understanding, and to elicit their own account of the experience, rather than provide them

with a ready-made structure to impose upon their experience" (p. 200). To allow for this, the first interview focused on participant's past experience of creative self-efficacy – questions developed were drawn from the literature on self-efficacy and creative performance. They were aimed at getting a better understanding of participant's experience of creative self-efficacy. The second interview focused on present experience – questions were developed to get a better understanding of both the over-arching question and secondary questions in this study. The third interview presented a "composite" narrative of an anonymous participant's essential experience of the phenomenon – questions developed were meant to validate participants' understanding of their creative self-efficacy in their life.

As a result of the first two interviews, three additional questions were added: (1) How does the narrative capture the creative process you follow and your confidence level as you move through each step? (2) Out of the steps you follow to solve problems technically, which would you identify as creative and which are analytical or come from your engineering/scientific training? and, (3) How do you conceptualize creativity in your experience? Besides the interview protocol (see Appendix C), the researcher asked questions only when it was necessary to clarify what the participant was relating to the meaning of the experiences they selected for discussion.

During interviews, the researcher attempted to be completely open, receptive, and naive while listening and hearing research participants describe their experience of creative self-efficacy. The phenomenon was revisited freshly, naively, in a wide-open sense, from the vantage point of the participant. The researcher followed the process of Epoche, the first step in the phenomenological approach, where the researcher is

systematic and disciplined in setting aside biases and prejudgments before the phenomenon is investigated (Creswell, 1998; Moustakas, 1994). To do this, the researcher captured her experience of creative self-efficacy before the interviews took place and then set this aside until all interviews were completed.

The first two interviews were spaced between three to five days apart, and were dependent on the schedule of the participant. The final interview was conducted approximately three weeks later to allow time for member checks to be made and the composite narrative to be formed. The short period between interviews was deliberate in order to reduce the number of possible idiosyncrasies between interviews (Seidman, 1991). Participants were asked to respond as best and as honestly as they could. To encourage this, participants were told that information would be kept anonymous in reports. All interviews were held in a meeting place of mutual convenience. The interview was tape-recorded to ensure accuracy and transcribed, by a transcriber, using coded numbers only to identify participants. Participants could ask to have the tape recorder turned off at anytime. To ensure confidentiality, participants were informed that only grouped data would be reported and no names would be used in any subsequent reporting of findings. Data, in this study, are reported anonymously, individuals are not identified, and summaries of patterns and themes are grouped and reported.

Documents

Working documents from the participants interviewed were collected in the form of a list of patents, awards, publications, and artifacts showing creative accomplishments or achievements. These documents/artifacts provided supporting evidence for data collected through interviews, and provided an understanding of creative performance.

Although personal documents, specifically diaries and journals, have been criticized for their subjective nature, they have been widely used as a source of sociological data by sociologists dating back to 1918 (Hammersley & Atkinson, 1993). In this study, participants provided a list of their awards, patents, and publications that were a result of objective evaluation in their field.

Researcher's Reflective Journal

During the data collection stage, the researcher kept a detailed journal capturing any insights, reflections, and specific body language/behaviors observed while interviewing the participants, after each interview, and throughout the data collection process. In the journal, the researcher noted learning, emerging patterns and themes emerging and assumptions she brought to the research.

Organizing, Analyzing and Synthesizing of the Data

Interview data as recorded were transcribed verbatim for each participant. Data from interviews, perceptions regarding the documents/artifacts, and entries from the researcher's journal were captured in NVIVO, a computer software program. NVIVO is a qualitative analysis tool that allowed the researcher to follow Moustakas's (1994) approach, grouping text from data into significant statements, to develop larger meanings that occurred related to the statements, to group the meanings into themes, and to assist in writing the synthesis of creative self-efficacy (Creswell, 1998). The researcher used NVIVO to help organize and analyze the data, however, the majority of the analysis and synthesis was done manually (e.g.; reading of the transcripts several times, making notes in the margins, comparing the analysis captured in NVIVO with original transcripts,

synthesizing the data into the essence and meaning of creative self-efficacy for the R & D scientist). NVIVO also served as a useful place to store and organize all files.

Data were analyzed using the phenomenological analysis approach developed by Moustakas (1994) discussed earlier. The procedural steps used were as follows:

1. The researcher began by writing a full description of her experience of the phenomenon. This process is called Epoche or bracketing, where the researcher is systematic and disciplined in setting aside prejudgments regarding the phenomenon being investigated. This was captured in NVIVO.
2. All participants' descriptions, in the form of transcribed interviews, were read in order to acquire a feeling for them. The researcher entered participants' transcribed interviews, from interview one and two, into NVIVO.
3. The researcher then looked for statements in the interview data resulting from the first two interviews, about how each participant experienced the phenomenon, then listed these significant statements, treating each statement as having equal worth, and worked to develop a list of nonrepetitive, nonoverlapping statements. With NVIVO, the researcher was able to code these significant statements into nodes, initially under each interview question. Once a node was created all remaining statements could be applied into that node.
4. The researcher clustered the statements into themes or meaning units removing overlapping and repetitive statements. Specifically, as the researcher read the data, she asked herself, what stands out about the phenomenon. What is the most important aspect? What is next in importance? How do these different themes fit together? Using NVIVO, the researcher was able to create a node for each theme, and to

develop a tree diagram, which is essentially a "picture" of the analysis, the major categories, the minor categories, and how the information from the text was grouped. Results of this analysis was printed and compared with the original transcripts to ensure that nothing was missed.

5. From here, description of the "textures" (what) of the experience were written, including verbatim statements for each participant. The researcher then formulated individual textural descriptions (individual narratives), synthesizing the invariant meaning units and themes, for each participant.
6. To ensure credibility of the data collected, participants were asked to review and confirm or alter their individual narrative to ensure they captured their perception of the experience.
7. After the member checks were completed, the researcher wrote a composite textural description (composite narrative) capturing the meaning and essence of the experience of all participants. Using the individual narratives, the same steps that were followed for each participant were completed, but at a higher level of generalization. Specifically, the researcher read each individual narrative, identified common themes, and reordered themes to provide a description of the experience for the group as a whole.
8. Participants were asked to read this composite narrative at their final interview and respond to questions that related to them and their experience of creative self-efficacy in their life. This process served to validate the reductions that have been made by the researcher. Again, each participant's transcribed third interview was entered into NVIVO.

9. Reflecting on the individual textural experiences and the composite textural experience, the researcher used imaginative variation to construct a description of the structures of the experience for each participant and then for all twelve participants. This involved looking for all possible meaning, seeking divergent perspectives, and varying the frames of reference about the phenomenon in an attempt to find the underlying and precipitating factors that accounted for what was being experienced; in other words the "how" that speaks to conditions that illuminate the "what" of experience.
10. The development of the final synthesis of creative self-efficacy (essential invariant structure or essence) was created integrating the composite textural and composite structural descriptions, providing a synthesis of the meanings and essences of experience. My goal was to reduce the textural (what) and structural (how) meanings of experiences to a brief description that typified the experience of all participants in the study. "All individuals experience it; hence it is invariant, and it is a reduction to the 'essentials' of the experience" (Moustakas, as cited in Creswell, 1998, p. 235). This allows the reader to transfer the information to other settings where the contexts are highly similar.
11. Triangulation of the data sources, interviews, documents/artifacts, and the Researcher's Journal was conducted to overcome potential weaknesses and biases of the design.

Addressing Standards of Quality and Verification

To address standards of quality and verification in this research study, important when doing qualitative research, the research included the following procedures. First,

the study involved prolonged engagement and persistent observation of participants (Creswell, 1998). The total time spent with each participant during the duration of the study varied from approximately 1½ hour to four hours over three different days. Before, during, and after each interview the researcher took note of her observations. The researcher paid particular attention to the researcher-participant relationship by taking the time to put each participant at ease and build trust, and to help him or her attend to and describe experiences without being evaluative.

Second, member checks were conducted to add credibility to the finding and interpretations. Lincoln and Guba (1985) consider this "the most critical technique for establishing creditability" (p. 314). Each participant was given one week to review his or her individual narrative in order to ensure that the narrative fully captured his or her experience of creative self-efficacy. They were also encouraged to add any comments or important experience(s) that may have been neglected. Of the twelve participants only, six made minor modifications to their individual narrative. Finally, the act of having participants read the composite narrative and respond to questions related to it (see Appendix C) in the final interview, served to validate the reduction made by the researcher.

Third, the process of triangulation was conducted. In triangulation, the researcher combines multiple and different sources, methods, investigation, and/or theories to provide corroborating evidence (Creswell, 1998). Lincoln and Guba (1985) suggest that no single item of information should ever been given serious consideration unless it can be triangulated. In this study, corroborating evidence from different data sources –

interview data, documents, and the researcher's journal - was used to shed light on the phenomenon of creative self-efficacy.

Fourth, the process of bracketing, where the researcher is systematic and disciplined in setting aside prejudgments regarding the phenomenon being investigated, is thought to have helped control for researcher bias.

Finally, as previously discussed, the creation of a final synthesis of the phenomenon of creative self-efficacy allows the reader to make decisions regarding the transferability of the information to other settings. It is recognized by the researcher that to generalize the findings to other populations would be impossible. Any suggestions or speculations made should be seen as a "working hypothesis, not a conclusion" (Cronbach, 1975, p. 125).

To summarize, this chapter presented the rationale for the qualitative and phenomenological approach that was used in this study. The research design showed the various phases of data collection and demonstrated the process of continuing, emerging analysis of findings. The use of the phenomenological analysis approach developed by Moustakas (1994) was also described, and the procedures for addressing standards of quality and verification for the study were addressed. The next chapter will present the data, followed by Chapter Five, which provides a discussion of the findings, specifically, returning to the conceptual model, and comparing and distinguishing the findings from prior research found in the literature relating to creative self-efficacy.

CHAPTER FOUR

Presentation of Data

Introduction

In this chapter, the data are presented. The chapter will begin with a brief description of the environment in which participants worked and of each participant. Following this, the data are organized and analyzed, and synthesized, as suggested by Moustakas (1994), using verbatim examples throughout to illustrate the meaning and essence of the experience of creative self-efficacy for R & D scientists. A synthesis of creative self-efficacy was produced by the integration of the results of analysis. This is followed by the details of the triangulation of data sources. The chapter ends with a summary of the core findings of the study and limitations of the study.

Description of Environment

Participants of this study worked in a high technology company headquartered in Ontario, Canada. Participants were spread out in four different buildings of the company. As one participant was located in the United Kingdom, I was not able to meet him in person. The four buildings were all designed specifically for high technology workers. There were bright colors and interesting shapes on the walls, live plants throughout the building, quiet rooms and games rooms on each floor, and several indoor gardens with waterfalls on the main level of the building. Cafeteria areas were more like a food court in a shopping mall with a variety of eating places and cafes. Each site had a company store/tuck shop, fitness center, and outdoor eating area. Outside two of the buildings were nature trails. Each participant worked with state-of-the-art computers and equipment, but many working in labs part of the time.

During the time of the interviews, this company was experiencing a major downsizing of its employees, and the high technology sector was beginning to experience an economic downturn. Stock prices had been cut by almost half and high technology companies were beginning to report poor quarterly results. Within this company, whole departments and projects were being cut and employees were being laid off. For some employees, the current environment could serve as a potential for distraction as they attempted to engage in their work.

Participants

The following provides an overview of each participant and their recollections of creative self-efficacy. All participants of this study had been identified by the company as either a scarce skill resource (the company's term to describe someone who has skills in high demand and seen as scarce in the marketplace from which they are hired) or critical resource (the company's term to describe someone who seen as vital to the company for the unique set of skills, knowledge, and contribution that they bring to the company's business). Participants are described in the sequence in which they were interviewed. The names used below are pseudonyms; real names have not been used. The interviews were conducted following the interview guide found in Appendix C.

Jim. Jim had a quiet energy about him, and was extremely confident. He was not overly talkative, but was very articulate when he spoke. He was friendly and open to sharing his creative experiences; at times, he was quite animated while talking about them. He described many experiences related to his creative self-efficacy. Our interviews together lasted forty-five minutes to an hour each time we met.

Jim looked to be in his mid to late 30's. Jim believes that he is a very creative person, with this belief in himself going back to early childhood. He told me that he always knew he was different. I have to say that by the end of my interviews, I too, thought that he was unique compared to the other participants.

Jim has a Ph.D. in Engineering and is currently working as a manager in the company. Jim was adamant that I know that he lives a creative life outside of work. He told me that he writes poetry and music from time to time, plays in a band, and likes to study creative people. He is currently studying Van Gogh.

Jim came to our final interview with detailed notes and his list of creative accomplishments, which he had me go over with him. It was obvious that he took this experience of being part of my research study seriously. Jim was very curious about my research study, and offered much encouragement for what I was doing. Jim remarked on the fact that he enjoyed participating in this study very much.

Joe. Joe was very playful and used a lot of humor throughout our interviews together. He was very friendly, greeting me each time as if we had known each other for years. He was quite talkative and animated, often going off on interesting mental tangents. He had high energy. Every interview I had with Joe lasted between sixty to ninety minutes. He had no trouble describing his experiences related to his creative self-efficacy.

Joe told me that he was 32 years old, and that he was born in Holland. His mother was Norwegian, and his father Iranian. When he was growing up, he spent half his time in Holland and the other half in Iran. Joe came to Canada to pursue his graduate studies.

He indicated that he started to believe in his creative abilities between the ages four and eight.

Joe graduated in December 2000 with a Ph.D. in Electrical Engineering, is working as an Individual Contributor (non-management) in the company. He described many creative activities in which he was involved outside of work, specifically, those things related to his upcoming nuptials. For example, instead of sending out formal wedding invitations, he and his fiancée created a two-page newsletter with pictures and text related to their upcoming marriage.

Joe came to our final interview with his list of creative accomplishments, and gave me a copy of his wedding invitation. He was very curious about the research study asking many questions about the methodology and what I hoped to achieve.

Sam. Sam was very talkative and had high energy. When we met the first time, he was very friendly and happy to see me again (I had worked with Sam about five years earlier). Every interview I had with him went the whole hour and a half. He had no trouble describing his creative experiences.

Sam is in his 50's and is of Italian descent, having been born in Italy. He came to Canada as a teenager. Sam is a natural born storyteller and had many stories to tell me about himself as a child and adult. Although Sam never told himself that he was a creative person, he believed that his creative abilities went back to his early childhood.

Sam has a college diploma in computer technology, and is currently working as a manager in the company. He told me that he had just celebrated 30 years with the company, and that he has never been so relaxed in his job.

Several times during our interviews, Sam would go to the whiteboard in the room to draw and explain how he solved problems creatively. He also gave me copies of his drawings from our first two interviews at our final interview. Sam e-mailed me his list of creative accomplishments after our third interview.

Sarah. Sarah was very quiet, almost shy, and reserved; however, she did show confidence when she felt strongly about something. Our interviews together were always at 5:00 pm so that it would not conflict with her work, and were much shorter than the interviews I held with other participants, lasting about a half an hour each time we met. I often felt intrusive and had to pull hard for information from her.

She was in her early 20's. Although she did not express a strong belief in her ability to be creative in our first two interviews together, she did describe many creative experiences going back to around age eight or nine. Sarah told me that she was identified as gifted as a child, but chose not to go into a gifted program in high school.

Sarah graduated with a Bachelor in Chemical Engineering just three years previously; this was her first full time job in the company, and she was working as an individual contributor (non-management).

My third interview with Sarah took me by surprise, given how hard it was to draw information from her during my first and second interview with her. Not only did she tell me that the composite narrative provided a good description of her experience of creative self-efficacy, but also she mentioned that the study was good for her and got her thinking about her creativity. She also came to this last interview prepared with her list of creative accomplishments.

Raymond. Raymond was a quiet articulate man. While he was somewhat uncomfortable at times during our interviews together, he became quite excited when he spoke about things that interested him, such as some of his creative experiences throughout his life. I noticed that he dressed in dark colors and had longish, wild hair; he resembled Einstein. Our interviews together lasted from forty-five to sixty minutes each time we met.

Raymond was likely in his late 40's, early 50's. Raymond believed that he was a reasonably creative person and linked this belief back to age eight to ten. He had no trouble during our interviews together articulating his experiences as they related to his creative self-efficacy.

Raymond has a Ph.D. in Physics and works in the advanced technology area as an individual contributor (non-management). When I first met, I noticed that he had several plaques in his honor on his wall; one in particular was a US Patent award in 1998 and had the work "Inventor" on it. My impression of Raymond was that he was extremely intelligent and creative.

Much to my regret, however, Raymond did not provide me with his list of creative accomplishments so I never did get to see what I perceived would be an extensive list of his creative achievements/accomplishments.

Ron. Ron was quite tall, with long wildish hair. He was very friendly and outgoing each time, I met with him. As he spoke about his experiences, he seemed very confident and articulate; at times, his thinking was quite profound. For example, in our last interview together he was imagining aloud what it would be like if we were all

consciously connected at a creative level yet each had our own individual creativeness. Our interviews together ranged from an hour to ninety minutes each time.

He was in his early 30's. Ron expressed that he had a good sense of his creative ability and linked this back to around age seven or eight. Ron had no trouble describing his experiences related to his creative self-efficacy.

Ron has a Bachelor of Engineering degree; he is working as an individual contributor (non-management) within the company. Ron told me that he also leads a creative life outside of work; he does woodworking, plays the guitar and hand drums. When I pointed out the lovely view he had from the window beside his cubicle, Ron said that although he enjoyed the view, it sometimes became a distraction for him, causing him to dream about his land and the tractor he wanted to buy. Ron indicated that he had gone through several life changes over the last few years – he had been married and divorced, he and his current partner had a seven month old child, and he had recently moved from the city to the country.

Ron commented in the third interview about how our interviews together and reading the composite narrative made him think about his own creativity and himself. Although I sent many reminders, I regretted that Ron did not send in his list of creative accomplishments.

Caroline. Caroline was somewhat reserved, and even looked a bit stressed during our first interview but became more relaxed during the last two. She met with me each time at 5:00 pm, so that it would not conflict with her work. The interviews with Caroline lasted about forty-five minutes each time we met.

Caroline was in her 40's; she was born in Germany, only coming to Canada for her graduate studies. During our first interview, she had trouble recalling her past experiences as a child since she did not see the things she did as creative but more as using her imagination, which she felt was common to all children. She did describe herself as curious as a child. When she came to her second interview, she told me that she had been thinking all week about a problem to discuss and about her childhood and other creative endeavors.

She has a Ph.D. in Chemistry, and is currently working as an individual contributor within the company. Caroline attributed her ability to solve problems creatively as an analytical faculty, as just common sense. She was quite confident in her technical creative abilities.

Caroline was very curious about my research study, and wondered if the study would be different if I had interviewed underprivileged youth. At the end of our third interview, she remarked that my study caused her to reflect about her creative self-efficacy. She came to this interview with her list of creative accomplishments in her head, which I captured in my reflective journal.

Marcus. My interviews with Marcus were held over the telephone since he was located in the company's United Kingdom office. Therefore, it was difficult for me to develop as a detailed an impression of him, as I was able to of the others. He has been working in the UK as an expatriate from Canada for the last few years and was due to come back in July, 2001. Our interviews together lasted about thirty minutes each time we spoke. The fact that we did these over the telephone, I believe, was a contributing factor.

I would suspect that Marcus was in his late 30's, early 40's from how he described himself. During our first interview Marcus seemed to have trouble recalling his experiences, however, I found out in the second interview with him this hesitancy was due to the fact that he was in an open area and felt uncomfortable speaking about himself. Fortunately, he was much more open and expressive during our second and third interview because he was in a private conference room. I chuckled when Marcus told me that his children would describe him as a "mad scientist." Marcus believed he became creative in getting things to work, a process that began in his early childhood.

Marcus has a Ph.D. in Physics, and works in the advanced technology area of the company, as an Individual Contributor. Leading a creative life outside of work was equally important to Marcus as leading one at work. Playing with his children acted as a great source of creativity for him.

Marcus e-mailed me his list of creative accomplishments well ahead of our third interview.

Jacques. Jacques greeted me in a friendly manner, which he maintained during the course of our three interviews together. Jacques was very confident and expressive, and had no trouble describing his experiences related to his creative self-efficacy. Our interviews together ranged from thirty to forty-five minutes each time we met.

Jacques was a French Canadian man in his early 30's. Although he expressed the opinion that his creativity came out in his athletics (he was a gifted athlete as young man), he believed that he was very creative in every aspect of his life.

Jacques has a Bachelor of Electrical Engineering degree, and works in the company as an Individual Contributor (non-management). While waiting for Jacques for

our second interview, I sat in his office and noticed a football on his chair, pictures of his child, and a Murphy's Law quote on his cabinet. When he arrived, he looked stressed and tired, and told me that he had just come from the lab, and had been working on a difficult problem.

Our third interview was much more relaxed; Jacques was as pleasant and expressive as he was during our first interview. He remarked on how amazed he was that the composite narrative captured his experience of creative self-efficacy. He was curious as to where I was going with my study. Jacques e-mailed me his list of creative accomplishments after our third interview.

Richard. Richard seemed very down-to-earth and friendly when I met him. Richard had a quiet energy about him and presented himself very confidently. He was very articulate when he spoke. Our interviews ranged from forty-five minutes to an hour each time we met.

Richard looked to be in his late 20's, early 30's. Richard was very confident about his creative ability both at work and in his personal life. He had no problem describing his experiences related to his creative self-efficacy. He told me that he believed he developed this belief about his creative abilities around his pre-teen years. Richard has a Bachelor of Electrical Engineering Degree. I was quite surprised when he told me he was a Manager because he looked so young.

When we went over the composite narrative together in our third interview, it was important for Richard that I knew he was creative in all parts of his life, and that he gained more satisfaction from the creative things he did outside of work. For example, he told me that he plays in a band, writes music, does woodworking, and designs furniture.

Richard was very curious about my study and what I was going to do with the data. Richard e-mailed me his list of creative accomplishments shortly after our third interview.

Justin. Justin was pleasant, and quite open to sharing his experiences during our interviews together. Justin came to his second interview quite tired (he had been up all night with a sick child), yet, as with his first interview he had no problem describing his experiences related to his creative self-efficacy. Each interview I held with him lasted about forty-five minutes to an hour.

Justin was French-Canadian likely in his 30's. He referred to his two children and partner several times during our interviews together. Justin described himself as creative in a practical sense. This perception goes back to his childhood when he lived on a farm and was constantly building, repairing, and creating things. He, too, was identified as gifted as a child but masked his giftedness by becoming the class clown. Justin has a Bachelor of Electrical Engineering Degree, and is currently working as a Manager with the company.

Justin's only concern, after the first interview, was that he would not be able to provide me with an inventory of creative accomplishments since some of his work was proprietary. As he had warned, Justin did not provide his list of creative accomplishments after his third interview. He did remark, however, how valuable our interviews had been for him in terms of him recognizing his creativity and how important it was to him.

Paul. Paul was very pleasant and confident during our interviews together. I noticed that Paul seemed to enjoy talking about his childhood and creative endeavors; his

eyes sparkled and he smiled as he was describing them. Our interviews together ranged from thirty to forty-five minutes each time we met.

Paul was French-Canadian and appeared to be in his early to mid 30's. Paul had no problem describing his experiences as they related to his creative self-efficacy. He claimed that his confidence in his creative abilities came around age 10 to 12. Paul also told me that he is an avid cyclist, at one time participated in triathlons, and cycling competitions. He had just returned from a cycling vacation. He has a Bachelor of Engineering Physics degree, and is working as an Individual Contributor (non-management) within the company.

Paul came to his third interview prepared and had his list of creative accomplishments. Paul thanked me for having him participate in the study and told me that he had learned a lot about himself.

In summary, although all participants were unique they did share some common attributes. Seven out of the twelve exuded confidence, and seven appeared as very friendly. Five commented on how much they enjoyed being in the study and how it got them thinking about their creative self-efficacy. Although half of the participants were animated and talkative, and the rest were quietly energetic and reserved, all freely shared their experiences of creative self-efficacy. Finally, all were curious about the research study, how I got their names, and where I was going with my results.

Analysis of Interview Data

For each participant, I extracted and recorded all statements of significance for the description of the experience of creative self-efficacy from interview one and two, and then eliminated duplicate statements. This then became a list of nonrepetitive,

nonoverlapping statements. Examples of significant statements for two participants are presented in Appendix D and E.

Meanings were then formulated from the significant statements. The researcher arrived at these meanings by reading, rereading, and reflecting upon the significant statements in the original transcriptions to get the meaning of the participant's statement in the context. For each participant, the collection of formulated meanings was organized into clusters of themes. Two examples of the clusters of common themes can be found in Appendix F and G.

From the clusters of themes, a description of the "textures" of the experience was written, including verbatim statements, for each person forming the individual narrative. Individual narratives for all twelve participants can be found in Appendix H. Participants were then e-mailed their individual narrative and were asked to do the following: "Would you please review the entire document? Be sure to ask yourself if this narrative fully captures your experience of creative self-efficacy. Please feel free to add any comments or important experience(s) that may have been neglected." All twelve participants conducted a member check of their individual narrative before the third interview. Seven of the twelve participants stated that their individual narrative captured the meaning and essence of their experience of creative self-efficacy. The remaining five participants made minor modifications to their individual narrative, but believed that it captured the meaning and essence of their experience of creative self-efficacy.

After each participant had checked his or her individual narrative, the researcher pulled together the clusters of themes that came out of and were common to all of the

participant's descriptions. Table 2 captures the clusters of themes for all twelve participants. To validate the clusters the researcher went back to the original descriptions.

Table 2

Clusters of Common Themes for All Participants

1. *Belief about ability to be creative* - The ten male participants felt very confident in their ability to be creative, expressing this explicitly. The two women linked creativity to the arts and not to their technical career, seeing the act of coming up with a practical solution as logic or an analytical faculty. Participants could not pinpoint specific event in their life that led to creative self-efficacy, however most linked it back to childhood, between ages four to twelve. Building things or getting things to work, as a child, contributed to developing participant's confidence in his or her ability to be creative.

2. *Confidence in abilities*- Participants generally had confidence in their technical ability. Several participants felt confident in their ability to come up with different ways of doing things. Many participants generally felt they could do anything they set their mind to.

3. *Influence of the Environment on creative self-efficacy (as a child growing up)* - Parents, followed by family members and teachers, played a significant role in providing the support and encouragement to be creative. Although both parents were seen as supporting creativity in one way or another, seven participants pointed to his or her father and/or grandfather having a significant influence on his or her creative self-efficacy. Exposure to different perspectives had an impact on the development of participant's creative self-efficacy. Using imagination, curiosity, and/or experimenting were words used by participants in describing their creativity as children. All participants pursued many different types of creative endeavors as children.

4. *Influence of the Environment on creative self-efficacy (as an adult)* - Overwhelmingly participants felt that having managers who were supportive and left them alone versus micromanaging them was an important factor in relation to their creative self-efficacy. Equally important for participants was having flexibility and freedom to do creative work. Working with creative, knowledgeable people where they can bounce ideas, along with working in an environment conducive to people's having ideas and trying them out was seen as important for participants.

5. *Influence of feedback on creative self-efficacy* - For all participants positive feedback was seen as important, reinforcing confidence in their creative abilities. Positive results and/or creative successes acted as a feedback mechanism to participants in terms of their creative performance. Receiving rewards for creative endeavors was seen by some participants as having an influence on their creative self-efficacy.

Table 3 continued

Clusters of Common Themes for All Participants

6. *Sustaining creative self-efficacy* - Several participants pointed to creative successes being important to sustain creative self-efficacy. Getting encouragement from others, and/or having the confidence in their creative ability also helped. Several participants took time out to sustain his or her creative self-efficacy.

7. *In solving problems creatively* - Participants described this process as first making a problem understandable, often breaking it down into manageable parts, or going back to the basics. They would discuss the problem with colleagues and often go to the literature. Although their confidence starts off low until they fully understand the problem, they would quickly gain confidence by trying different things and experimenting until a solution was found. They would try to seek different perspectives and to break formal ways of thinking about the problem. Intuition, gut feeling played a major part in terms of the direction the participant would take, or the idea they come up with. They would persist and often concentrate on the problem for long periods of time until a solution was found. One participant described it as "retreat, gain feedback, rearrange, and try again" until a solution was found.

8. *Where one can be creative* - Participants saw solving technical problems creatively as being part of their job. Many found that they tapped into their creativity when faced with an interesting or challenging problem or task. Two participants spoke of the need to get into their zone or groove to be creative.

9. *Role creativity plays in participant's life* – Participants saw solving technical problems creatively as being important to their creativity and providing a sense of purpose. Creativity served as a source of happiness and satisfaction in both their personal and work life. Several participants saw themselves doing creative things all the time, often more at home than at work.

10. *How others view her creativity* - All participants reported that people in their lives, who knew them well, would describe them as creative in some way.

Each description was examined to ensure there was not anything in the original that was not accounted for in the cluster of themes, and that the cluster did not propose something that was not in the original.

The researcher then proceeded to write a composite narrative capturing the invariant meanings and themes for every participant and depicting the experiences of the

group as whole (see Appendix I). The composite narrative was used in the third interview as a final validation with all twelve participants, asking them if the composite narrative validated their experience of creative self-efficacy, and as an impetus for reflection on the meaning of experience of creative self-efficacy for themselves. Data from my final interview with all twelve participants are discussed below.

Essence and Development of Creative Self-efficacy

All participants felt that the composite narrative captured the essence of creative self-efficacy for them and their beliefs about what contributed to it. Although some things applied to them and some other things may not have seemed to apply, all participants felt that there was no inconsistency for them in the description. For example, Marcus stated how the composite narrative made him reflect on what contributed to his creative self-efficacy, and although he could not pinpoint anything specifically in his childhood, he narrowed down his creative self-efficacy to "an overwhelming desire to make things work" (personal interview, June 6, 2001). All participants, except Jim and Richard, believed that the composite narrative captured the role creativity plays in their lives. Joe summarized it as "that the particular passion *for a project* opens up the channels for creativity" (personal interview, June 7, 2001). Jim and Richard, on the other hand, felt that creativity played a larger part in their life than the narrative implied: that they get creative satisfaction in many other parts of their life outside of work. Jim summarized this as:

> I do a lot of things at work that are creative, and they are definitely very important to me and very important to the corporation, and very important to my success and my career. But, equally so, I have the creative output at home, in different

areas that I can't explore inside work. So there are things I can do there that I don't have the opportunity to do at work. It is just as important, if not more so, to me in some cases. Whether I am being creative at work or not, I can fulfill my own creative output (personal interview, June 6, 2001).

In response to the question related to the factors that had an impact on participants' creative self-efficacy, all participants could identify with most, if not all, the factors presented in the composite narrative. Many participants saw factors that applied to them but which they had failed to mention in their first two interviews. These factors included comments made regarding the role of a grandfather, how they used the resources available to them as a child, and a parent telling them when they thought something was creative.

Influence of Environment and Feedback on Creative Self-efficacy

As for how the composite narrative captured the environment's role in encouraging or discouraging creative self-efficacy, participants spoke about this from the standpoint of their childhood and the work environment. Whether, participants had limited or many resources available to them, they enjoyed most creating things with limited resources. "This was something interesting to me, *the idea of* doing a lot of things without a lot of resources _____so you had to create, you have to be innovative...Now I grew up in a family that was fairly well off, and we had a lot of stuff. But when if comes down to it, the things I enjoyed most were not the things provided to me, but the things that I did myself." (Jim, personal interview, June 6, 2001). Both Jim and Joe spoke about how they quickly got bored with the existing computer games and made little programs up on their own around age 10.

All participants felt that the description provided about the work environment's encouraging or discouraging creative self-efficacy matched their self-perception overall. Specifically, they commented on the importance of having managers who were supportive, gave the freedom, and "thought space" to be creative. "It's much easier to be creative if you're stimulated by the environment, by the sort of things that you're asked to do, and also that people give you the freedom to do that" (Caroline, personal interview, June 5, 2001).

Although many participants stated that micro-management often discouraged their creative self-efficacy, several commented that they had never worked for a manager who micro-managed. Several participants reiterated that working with creative and knowledgeable people contributed to their creative self-efficacy. The only point in the composite narrative that several participants disagreed with was in reference to "stress having a negative impact on creative self-efficacy." Many participants felt that stress, generated from external forces in the work environment, did not or rarely affected their belief in their ability to be creative. Marcus perhaps captured it best, "I haven't been stressed or depressed to the point where it would've impacted my creativity, I don't think; I have never been worried about losing my job" (personal interview, June 6, 2001).

Although participants confirmed that the composite narrative captured the importance of feedback in regards to their creative self-efficacy, several had a reaction to the point in the narrative, "I'll be creative for my own sake in a lot of situations." Joe, Caroline, and Justin felt that they did this to a lesser extent, that they needed a context or reason to be creative. The motivation from within came into play when Ron saw that something he took on would contribute to a greater purpose.

When asked whether they wanted to change, adapt, or revise the narrative to better describe their experience of their creative self-efficacy and creative performance, only Sam, Jim, and Marcus wanted some changes made. The others felt that the composite narrative provided an accurate description of their creative self-efficacy. Sam, in particular, wanted the words "visualization", "networking concepts" and "putting a puzzle together" to be included when describing the creative problem solving process for him (personal interview, June 4, 2001). Marcus commented, "I don't feel that there has been a really strong guiding or enabling instance or process or environment that's really changed the way I've been creative. I feel that being creative is just part of being human" (personal interview, June 6, 2001).

The most interesting comment was from Jim who stated that the composite narrative felt "average" for him, that he felt somewhat different from the others, although he were a "standard deviation" in how he saw creativity in his life and how he applied it. This same participant commented in his first interview that he always felt that he was different from others, going way back in his early childhood. Although Richard did not come out and say it, I believe he would echo Jim's comment, based on our discussion about how the importance of creativity in his life was not captured for him, and on some of the other subtle comments, he made. From their descriptions of creative self-efficacy, it seems that if there were a continuum, Jim and Richard would be at the high end.

Influence of Creative Self-efficacy on the Creative Process

As stated in chapter three, three additional questions were added to the Interview Protocol based on the researcher's first two interviews. Again, the three additional questions were added: (1) How does the narrative capture the creative process you follow

and your confidence level as you move through each step? (2) Out of the steps you follow to solve problems technically, which would you identify as creative and which are analytical or come from your engineering/scientific training? and, (3) How do you conceptualize creativity in your experience? In response to question one, nine participants stated that they were happy with how this section of the composite narrative captured their experience of the creative process and their confidence level going through each step of the process, and only three had reservations. Sarah commented "not so much the detailed parts but the narrative overall" captured the creative process for her (personal interview, June 6, 2001). Participants specifically highlighted again the following steps they use in solving problem creatively as: breaking it down into small problems, almost like a puzzle; brainstorming and generating ideas; talking to colleagues about the problem; and seeking information. Many participants commented again on their intuition or "gut feeling" playing an important part in the creative process; "there is like a magnet force that says 'there's got to be something about that'" (Sam, personal interview, June 4, 2001). They saw their intuition being supported by past experiences and successes.

Richard remarked that he is not someone who gets away from the problem and lets the solution come to him, as described in the narrative, but becomes obsessed with the problem until a creative solution is found. He also commented on how often someone will plant a seed for creativity in him. "Someone else would either state the problem in a different way or suggest something that maybe is off the wall, but completely wrong, which would lead me to different ideas. Maybe not completely wrong but just make me think of something else" (personal interview, June 8, 2001).

Caroline described the creative process for her as "gradual *where she* works through a process of looking at the problem differently, turning it around, and looking at it from different angles" (personal interview, June 5, 2001). Paul and Joe mentioned that the team approach to solving problems creatively worked a lot better for them because it brought different perspectives and approaches.

In terms of the participant's confidence level as they solve problems creatively, several participants reiterated that their confidence level starts off low as they first get the problem, but as they start to explore it and tackle it, their confidence level goes up as they start to see a solution forming. All indicated that they are confident that they will eventually find the solution. Several participants remarked that their confidence to solve problems creatively is built on the training they received in their field and the experiences that they have had. Richard remarked that, "The real creativity part is in ourselves. It [*the training and experience*] gives you some tools and background information to draw from for ideas" (personal interview, June 8, 2001).

In response to question two, participants highlighted the difference between the creative and analytical steps as it is through the rearranging, the manipulation, and re-jigging so that you come up with something different that creates the output to be creative or unique.

> There are lots of ways to solve any particular problem and not all of them require creativity. Like this person here describes some analytical faculty of applying something that you know to a different situation. It may not necessarily be creative, but when you have to start bending it a bit and forcing it into something that it wasn't meant for, you end up doing something completely different which

> you hadn't done before, and to me that is creative...So the medium is there for you to bend it for your own purpose, and the subject is only complete when you're happy with the results...It comes back to also what someone said here, 'trying new things and just rearranging the familiar' (Jim, personal interview, June 6, 2001).

Raymond found it difficult to separate his formal technical training from the creative part of what he does: "the scientific training gives you a stronger basis of things that stimulates you to try to see the reasons why of things, or to understand the basic stuff and that gives you the tools you need to solve other similar problems" (personal interview, June 7, 2001).

Gender Differences

In response to question three, although participants' conceptualization of creativity varied somewhat, most included the element of a "novel" or "new" approach to solving problems as part of their conceptualization. For Caroline and Sarah, while it was difficult to come up with a definition, both indicated that my research study had caused them to think about it more. Caroline concluded that "I guess it is that stage where you put all your experience, your training together, and through whatever process, consciously or subconsciously you end up having ideas...the gut feeling that this should be worthwhile" (personal interview, June 5, 2001). Interestingly, Caroline told me that the questions I asked her in our first two interviews prompted her to think more about how she solved problems creatively, seeing it now as "actually a creative act" versus the analytical faculty she talked about in our first interview.

Sarah commented, "I'm trying to get my head around it more lately because I've been thinking about this stuff. I guess I see it as having just a slightly novel approach to not just problem solving, well I guess everything is a problem" (personal interview, June 6, 2001). As Jim expressed to me often, "people don't recognize [*themselves as being creative*]." I believe Caroline's and Sarah's difficulty in conceptualizing creativity throughout our three interviews is attributed to this fact: there is lots of evidence from my three interviews with them that they are creative individuals, and believe they can solve technical problems creatively. When both women read the Composite Narrative, they felt that it mostly represented what they had said. It was as if the act of reflecting about their belief about their creative abilities during and in-between the three interviews I held with them re-kindled their creative self-efficacy.

I was most intrigued by Jacque's conceptualization of creativity as:

> Do a garden of roses in your backyard. Where are you going to put it? Which color are you going to put? What kind of mix of colors you're going to put? Sun-shade-water, nuisances like little bugs that can go to it. Where can I put it to have the least bugs? So, this is really complex; it looks like simple to do a garden of roses but it is not. And it you had a wall of roses how can I going to go the other side to cut the dead roses or the good ones? This is creativity. You are saying 'do something', create. It looks simple but it's not (personal interview, June 6, 2001).

His definition seemed analogous to the creative process described by many participants.

Finally, at the end of this third interview Jim wanted to review his list of creative achievements/accomplishments with me. As he was handing it to me he said, "I had to fight about it when I went through this creative accomplishments list. I really had to fight

with myself about it to say 'was I really creative'? 'Was that something that was creative?' 'Did I do something creative in order to do this?' and I thought, 'yes I had'" (personal interview, June 6, 2001). Again, I think this really points to Jim's being somewhat different from the other participants because creativity was so important to him, both at work and in his personal life.

After the third interview, the researcher constructed, with the use of imaginative variation, a Composite Structural Description of creative self-efficacy representing the group of participants as a whole (See Appendix J). This involved creating a vivid account of the phenomenon of creative self-efficacy, seeking all possible meanings, divergent perspectives, and varying frames of references about it (Moustakas, 1994).

The final step, in the phenomenological analysis approach, involved integrating the composite textural and composite structural descriptions to produce a synthesis of the phenomenon, providing a combination of the behaviors, beliefs, intentions, values, feelings, and thoughts, making up the total the experience of creative self-efficacy for the R & D scientist. The synthesis of creative self-efficacy is presented below.

Synthesis of Creative Self-efficacy

The experience of creative self-efficacy operates below the surface of awareness for the R & D Scientist, positively influencing his or her creative performance. Creative self-efficacy is not something the R & D Scientist has frequently thinks about. "I guess I feel like an observer, I just happened to go along and created, creativity is part of what I do...it's part of me" (Marcus). Yet, when asked, the R & D Scientist will acknowledge that he or she believes in his or her creative ability. "Because without it [*creative self-efficacy*] I would not be creative, you have to believe in yourself first" (Justin). The

foundation for creative self-efficacy for the R & D scientist comes from creative successes and accomplishments that began in childhood.

Through living a creative life, at work and outside of work, the R & D Scientist gathers creative experiences that give him or her more and more confidence in his or her ability to solve problems creatively. The more experience the R & D scientist has, and verification that he or she can do things creatively, leads to increased confidence in his or her creative abilities. Living this creative life brings satisfaction and enjoyment; it is important to the R & D scientist.

Somewhere in his or her childhood, probably around age four to twelve, the R & D Scientist develops a sense of creative ability. The act of building things or making things work, with limited or self-created resources, had an effect on confidence in creative abilities early on in life. Just trying new things and re-arranging the familiar, whether it was experimenting with cooking or clothing, or making something to play with, was what fascinated the R & D Scientist as a child.

The encouragement and support the R & D Scientist has experienced, both as a child and as an adult, has contributed to creative self-efficacy. As a child, the R & D Scientist grew up in an environment where curiosity and creativity was never discouraged, and where the freedom to be creative was provided. Hearing the words, "That's creative" and always being able to ask a question, no matter how silly it might have been, was a common occurrence. "I certainly credit the family members and friends that encouraged the sense of curiosity [*in me*]; I want to call it childlike wonders, being encouraged to look and questions and to see the world as a wonderful place" (Ron).

Exposure to different perspectives and creative role models, often the father or grandfather, only served to support creative self-efficacy.

As an adult, the R & D Scientist experiences creative self-efficacy in a work environment where management offers the freedom and the "thought space" to be creative, and where he or she has the opportunity to work with creative and knowledgeable people. For the R & D Scientist, it is much easier for them to be creative if they are stimulated by the environment, by the sort of things that they are asked to do, and people giving them the freedom to be creative.

Equally important to creative self-efficacy are creative successes and feedback. "I've always been given good feedback so I guess I've developed more and more confidence and that always contributes to success" (Richard). By working on or choosing projects that he or she thinks will come to fruition, the R & D Scientist feeds back positive results to creative self-efficacy. Although feedback from others is important to him or her, the R & D Scientist has his or her own feedback system that supports creative self-efficacy.

Creative self-efficacy remains constant for the R & D Scientist, even in the face of adversity. Pressures from the external environment do not affect the R & D Scientist's creative self-efficacy in a negative way. "I haven't been stressed or depressed to the point where it would've impacted my creativity" (Marcus).

Using novel or new approaches to come up with practical solutions to technical problems is part of an R & D Scientist's job, and is fuelled by belief in creative ability. Although confidence may start off low, especially when first faced with a difficult

technical problem to solve, it builds quickly as he or she begins to explore the problem and sees a solution forming. There is confidence that a solution will be found eventually.

The R & D Scientist's approach to solving technical problems does not have a rigid structure. However, their approach seems to imitate creativity from childhood, particularly the act of experimentation. Re-arranging, manipulating, re-jigging the problem in order to attain something different contributes to an output that is creative or unique. This process mirrors activity done as a child.

The R & D Scientist's creative process involves breaking down the problem into smaller problems, almost like taking apart a puzzle and putting it back together again. It includes some sort of brainstorming – fleshing out or generating ideas, either individually or in combination with others, and of "visualizing and networking ideas." Talking with colleagues helps to better understand the problem or gather additional information on how to solve it. However, it is most often his or her intuition or "gut feeling" that provides guidance on how to proceed in solving the problem or about which way to go or what to try. "There is like a magnet force that says 'there's got to be something about that'" (Sam). The R & D Scientist sees intuition as supported by past experiences and successes.

Triangulation of Data Sources

Documents

Hocevar (1979) suggests that using a simple and straightforward inventory of creative achievements and accomplishments acts as the best measurement as it is direct, observable, and validated in research as the best predictor of future creative behavior. By asking participants to describe creative accomplishments, one can assess the actual

creative output of the individual. Many participants indicated in their interviews that forcing them to really think about what was a truly creative achievement/accomplishment and what was not was not an easy task. This could be the reason why only nine of the twelve participants submitted their list of creative achievements/accomplishments either at or shortly after the third interview.

The lists varied in length and in what was included. For example, Jim, Sam, and Richard had very long lists that included both work and personal related creative achievements/accomplishments. The lists Jim and Richard made were balanced equally between work and personal creative achievements/accomplishments. This was not surprising given how each of them stated in my interviews with them, that creativity was equally important in their personal life as in their work life. Caroline and Jacques lists, on the other hand, were much shorter than the others. This could be attributed to the fact that they had less work experience than the other participants who submitted their lists.

In reviewing the lists, I noticed that three participants included childhood examples of creative achievements/accomplishments. Examples included: painting, building, and inventing simple things, music or short story composition, developing computer games, and photography. Again, these examples supported information provided by participants as they described their experience of creative self-efficacy in my interviews with them. Only Sam, Jacques, and Sarah included work-related examples of creative achievements/accomplishments (examples that were different from receiving patents or awards), for example, creative ways to get venture capital, creating a project-oriented school, special design projects. Four participants had at least 45 publications among them. In terms of having patents or patents pending, Sam, Richard, Joe, Jim and

Marcus listed several. Words like "invented" and "co-inventor" were used to describe the creative accomplishments on their lists. All included examples of awards they received for their creative efforts except for Sam and Jacques. Finally, all but four participants cited personal examples of creative achievements/accomplishments. They provided examples of being "self-taught" in an area of music, art, or woodworking. It was interesting to note that Richard, Paul, and Joe cited woodworking, designing and building furniture on their list, which could be linked back to the information they shared in our interviews together.

Besides the list of creative achievements/accomplishments, Sam submitted the drawing from our first two interviews that describes the creative process he used and another process he uses called the "method methodology process." I recall the interviews where he was drawing these, and after reviewing them see them as an example of how Sam visualizes and networks ideas. Joe provided me with his Wedding Newsletter invitation, which was as creative as his list of creative achievements/accomplishments. I can imagine his getting into that "creative zone," as he called it, with his fiancée and the two putting this together.

Recalling Hocevar's (1979) work which suggests that an inventory of creative achievements and accomplishments can be used as a predictor of future creative behavior, I noted that seven of the nine participants' lists of creative achievements and accomplishments appeared to be direct and observable indicators of future creative behavior. Their lists were inclusive of patents, publications, awards, and recognition in recognition for their creative performance. Overall, a review of the lists of creative achievements and accomplishments, and my recollection of the discussion I had with

those participants who did not submit their lists, led me to conclude that my participants could be deemed as creative people.

Researcher's Reflective Journal

Before, during, and shortly after my involvement with my participants I kept a Researcher's Reflective Journal. Here I captured my description of the phenomenon of creative self-efficacy, details of each participant from each interview I held with them, and notes to myself on the patterns and themes I saw emerging.

A review of the Researcher's Reflective Journal acted as supporting evidence to the experience of creative self-efficacy as described by my research participants. The patterns and observations I noted during the interview process were confirmed as I analyzed and synthesized the interview data. Like my participants, my creative self-efficacy is task specific within my domain area of expertise, facilitating adult learning. As a child, I also had the influence of my father in developing my creative self-efficacy. I grew up in an environment, much like my participants, one that supported creativity and imagination. Feedback from my peers is important to me, as it is for my participants, to sustain my creative self-efficacy. Yet, I, too, use my own feedback system to remind myself of my creative abilities.

My journal entries also supported many of the themes that emerged from the interview data. Specifically, I noted the influence of a male figure (father or grandfather), early on in childhood, in building their confidence in creative ability; the specific time in the participant's life (between age four and twelve) when they started to believe in their creative abilities; and how as they gained more experience solving problems creatively they became more confident when faced with other problems requiring creative solutions.

I noticed that all participants seemed not only confident in their creative abilities and but were confident in their domain area of expertise, as research scientists solving technical problems, confidence gained through experience and positive feedback. I also noted that they all seemed to be intrinsically motivated, solving technical problems creatively for the enjoyment and challenge that it brought to them. The resourcefulness they developed as a child, played out in their work as an R & D scientist as they looked for new ways to solve technical problems that they had not experienced before. Looking back over the entries, I was reminded again of how important creativity was for each of them in their life, and how important it was for them that I noted that in my study. In summary, if placed on a continuum for creative self-efficacy some participants would probably have a higher level than others, yet each participant was able to describe the meaning and experience of creative self-efficacy as someone who has lived it.

Summary of the Findings

Before moving into a discussion of the findings, found in the next chapter, five themes, summarizing the core findings, from this study are captured below.

Essence of creative self-efficacy

Creative self-efficacy is not something my participants had thought much about until it was brought to their attention. Creative self-efficacy seems to operate below the surface of awareness for the R & D scientist, positively influencing creative performance. Participants felt that if they did not have confidence in their ability to be creative they would not be able to solve technical problems creatively. Living a creative life was important for them, allowing them to gather creative experiences and giving them more confidence in their ability to solve other problems creatively, leading to personal

satisfaction and enjoyment. Creative successes, starting early in my participant's life, served as the most influential source of creative self-efficacy. The strength of participants' creative self-efficacy supported their ability to solve problems creatively no matter how difficult the problem, and remained constant even in the face of adversity. Participants, who felt efficacious about their ability to solve technical problems creatively, tended to transfer this belief towards solving other problems in their work and personal life.

Development of creative self-efficacy

All research participants traced the development of their creative self-efficacy to childhood. Creative self-efficacy was developed between the age of four to twelve, by gaining confidence building things or making things work as a child, with limited or self-created resources. Participants experienced an environment where curiosity and creativity were encouraged and supported by family members and friends, where the freedom to be creative was provided. Participants, who felt efficacious about their creative abilities, were exposed to perspectives or creative role models, often their father or grandfather.

Influence of the environment and feedback on creative self-efficacy

Creative self-efficacy was fostered in participants when they felt they had the freedom and thought space to be creative, and when they were working with other creative, knowledgeable people. Feedback from management and peers played an important role contributing to participants' confidence in their creative ability, and creative performance. Along with feedback from others, several participants relied on their own feedback mechanisms to tell them they were creative.

Influence of creative self-efficacy on the creative process

Creative self-efficacy is vital to the creative process providing participants with the confidence to use novel and new approaches to solve technical problems. Solving technical problems creatively was viewed as part of their job. Although confidence may start off low, especially when first faced with a difficult problem to solve, it builds quickly as he or she begins to explore the problem and sees a solution forming. Past experiences and successes solving technical problems creatively, provide participants with the confidence that a solution will be eventually found. Although their approach to solving technical problems did not have a rigid structure, participants tended to imitate several creative behaviors from their childhood, specifically, the act of re-arranging the familiar, manipulating, and re-jigging the problem to come up with a creative output or something unique. Participants' intuition, supported by past experiences or successes, provided them with guidance on how to proceed when solving problems.

Gender Differences

Initially the two women did not seem as confident as did the men in the study, about their creative abilities. Compared to the men, they were more reluctant to talk about themselves. On the other hand, in the second interview they provided many examples of where they solved technical problems creatively. Although each participant's conceptualization of creativity varied somewhat, most included the element of "novel" or "new" approach to solving problems as part of their construct. Interestingly, the two women initially linked creativity to the arts and not to the technical work they did. By the third interview, they concluded that the process they followed did include consciously or

subconsciously coming up with ideas or using a slightly novel approach to solving a technical problem.

Limitations of the Study

The most significant limitation of a phenomenological approach is that the findings of a phenomenological study cannot be generalized: the findings are specific to each R & D scientist working in a high technology organization. Therefore, causal relationships and applications to other work settings can only be tentative as they are expressed as perceptions of R & D scientists and not measured psychometrically.

Second, the study is limited to the nature and availability of the data collected. Specifically, participants' views are retrospective and the data collected are subject to individual selection, recollection, and honesty. Some participants, had difficulty to recalling their childhood experiences of creative self-efficacy. In addition, although participants in the study were diverse, it is with regret that the researcher did not have participants of Asian/Indian decent in the study. They did not volunteer because they were either too busy or did not feel they were suited for the study.

Third, because of the researcher's lengthy experience with the organization under investigation and the relationships that have been established, objectivity may be compromised. It may be difficult to withhold biases, during the investigation or as data are being interpreted, of the individuals or of the topic under investigation. In phenomenological data analysis, it is important that the researcher sets aside all prejudgments, his or her experiences, and relies on intuition, imagination, and universal structures to obtain a picture of the experience (Creswell, 1998). The researcher's ability to do this along with triangulation of the data, member checks, and the development of a

thick description helped toward the trustworthiness of the study, and the resulting conclusions.

Finally, the fact that only nine of the twelve participants provided their list of creative achievements/accomplishments may have had an affect on the richness of the data provided by this data source. The researcher concluded that she did uncover a complete picture of the phenomenon under study in that she captured repetitive verbal information about creative achievements/accomplishments from the three participants who did not return their list. For one individual, Raymond, she observed several patents and rewards on his wall in his cubicle, which substantiated what he revealed in her interviews with him.

In summary, this chapter provided a brief description of the participants and their environment, followed by a presentation of the data leading to the final synthesis of creative self-efficacy. The details of the process of triangulation and limitations of the study were then provided. The next chapter will provide a discussion of the findings, seeking to compare and distinguish the findings of this study from that what was found in the literature review. Chapter six begins with a summary of the entire study, and ends with possible future research, contributions to scholarly knowledge, and implications of the study.

CHAPTER FIVE

Discussion

This chapter provides a discussion of the findings in response to the broad research question of study, how do adults, working in an R & D environment, perceive and describe their experience of creative self-efficacy? The research contributions, from this study, are related to the elements of self-efficacy and creative performance as presented in the conceptual model that was presented in Chapter two. Finally, the research findings are compared and distinguished from prior research studies.

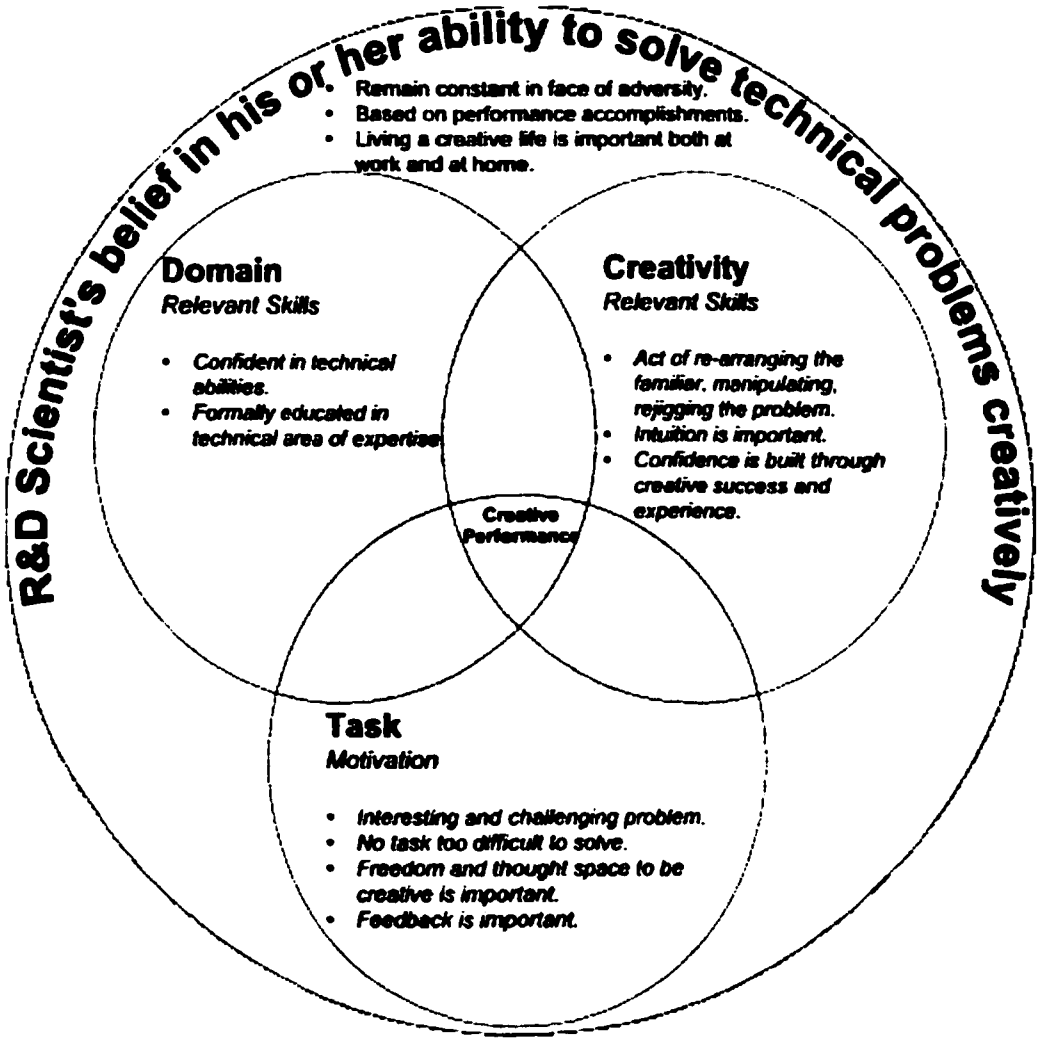
The broad question motivating this study was answered. The results of this phenomenological investigation provide a description of the essence and meaning of the experience of creative self-efficacy from the perspective of an R & D scientist working in a high technology organization. Creative self-efficacy seems to operate below the surface of awareness for the R & D scientist. It is not something he or she would have thought about until asked, and positively influences creative performance. Creative self-efficacy can be traced back to age four to twelve through the act of building things and making things work. It is influenced by having the freedom and thought space to be creative, along with positive feedback. Finally, creative self-efficacy contributes to the creative process instilling confidence in the R & D scientist to use novel and new approaches to solve technical problems. This particular synthesis of creative self-efficacy has not been noted elsewhere in the literature to date and therefore adds significantly to an understanding of the experience of creative self-efficacy for an R & D scientist.

Revisiting the Conceptual Model

Returning to the conceptual model as presented in chapter two, Figure 3 illustrates the research contributions that emerged from the study as they relate to the elements of self-efficacy (Bandura, 1977a, 1977b, 1997) and creative performance (Amabile, 1983a, 1983b, 1996).

Figure 3

Research Contributions Relating to Conceptual Model



These findings suggest that there is an interaction between self-efficacy and creative performance in R & D scientists working in a high technology company. The interaction between the belief participants had about their creative ability (cognitive), the creative experiences and successes they had (behavioral), and the influence of the environment and positive feedback may well have led to their level of creative performance. As proposed by Bandura (1986, 1997), "psychological functioning involves a continuous reciprocal interaction between behavioral, cognitive, and environmental influences" (Bandura, 1988, p. 344). People's judgments about what they can accomplish act as influential arbitrators in human agency, and, as such, are powerful determinants of their behavior (Bandura, 1986, 1997). The research has led me to conclude that R & D scientists' belief in their capability to execute their creative abilities to solve problems in their jobs, that required novel or new approaches, led the R & D scientist to perform creatively. Components such as intelligence, diligence, perseverance, for example, factors that not investigated in this study, may also have contributed. Since my study did not include anyone who was not a creative performer, or someone who did not see themselves as efficacious creatively, the variables under consideration are not completely differentiated and would require further investigation.

Creative Self-efficacy

The study found that R & D scientists who declared themselves as creative had a strong belief in their creative abilities in general, and in their ability to solve technical problems with novel and appropriate solutions. The fact that they were creative people was supported not only by themselves identifying themselves as creative, but from the

descriptions they provided of how other people would describe their creativity, and the list of their creative achievements and accomplishments.

Creative self-efficacy remained constant for participants in face of the adversity they were experiencing at the time of the study. Specifically, at the time of the study participants were experiencing major downsizing within the organization, something that could have caused stress and distractions. Yet, participants in this study claimed that this did not have a negative affect on their belief in their ability to solve technical problems creatively. Bandura and Wood (1989) found that when presented with a social environment with surmountable barriers, people who have a high sense of efficacy will be able to exercise more control over it and will view it as more changeable than self-doubters who give up quickly in the face of difficulties. This seemed to be the case for participants of this study.

Participants had different levels of belief in their ability to solve problems creatively. This varied across different levels of tasks. Most of the problems participants solved creatively ranged from moderate to a high level of difficulty. For most participants, facing a difficult problem meant putting more energy into it. Although confidence level will be low at first, when solving a problem creatively, confidence increases as he or she begins to solve the problem and sees solutions forming. The data support Bandura's (1997) hypothesis that the stronger the sense of personal efficacy the greater the perseverance and the higher likelihood that the chosen activity will be performed successfully. Mastery of difficult tasks gives new efficacy information that raises belief in one's capabilities (Bandura, 1997).

Most participants transferred their creative self-efficacy to their personal life (Bandura (1977a, 1977b, 1986, 1997) calls this generality). Creativity was important to them as it served as a big part of their every day life, making them feel happy and alive, contributing to their sense of self, and perhaps making them somewhat different from other people. Bandura (1997) proposed that people display enduring interest in activities at which they feel efficacious and from which they derive self-satisfaction. The data also support his view that people may judge themselves as efficacious across a wide range of activities. Participants cited many examples of where they were creative in their personal life, such as teaching themselves how to play guitar or building things out of wood, writing poetry or musical composition.

The strength of the participants' creative self-efficacy influenced the conviction that they could solve problems creatively. If they did not feel that they were creative they would be much more hesitant to take on new tasks. Many participants believed they could creatively solve any problem thrown at them. A wide range of participants' experiences were described in relation to how they sustain their creative self-efficacy, from developing the ability to be introspective about creativity or how interesting or challenging the problem was to solve or by continually experimenting and making improvements to products on which they were working on. Many participants described how they solved problems through persistence, not giving up until the problem was solved, even if it took a long time. This finding was consistent with the literature that the strength of self-efficacy will determine whether a behavior will be initiated, the amount of effort devoted to pursuing the task or situation, and the degree of persistence the individual will have in face of difficulty (Bandura, 1997).

Sources of creative self-efficacy, for R & D scientists, were most often based on performance accomplishments. Creative successes, starting early on in life, served as the strongest source of creative self-efficacy for the R & D scientist. Bandura (1982, 1997) claimed that performance accomplishments provide that most influential source of efficacy information because they can be based on authentic mastery experiences. Creative successes served to heighten perceived self-efficacy. Many participants reported that they developed confidence in their creative abilities, as children (between age four to twelve), by building things or getting things to work.

Positive feedback, from managers, peers, and/or family members, helped participants realize that their creative performance was appreciated and that they were creative. This finding relates somewhat to another source of efficacy beliefs – verbal persuasion – telling the person that he or she is capable of performing a behavior. Wood and Bandura (1989) found that people improve their self-efficacy when they receive realistic encouragements; the more credible sources of encouragement will have a stronger effect on the development of self-efficacy.

In summary, the data gathered in this research answers the secondary research questions relating to the sources of creative self-efficacy for R & D scientists, and the level, strength, and generality of beliefs as they relate to the R & D scientist's creative performance.

Components of Creative Performance

Domain-relevant skills. Domain-relevant skills include the factual knowledge, technical skills, and specific talents in the domain in question (Amabile, 1996). She sees relevant skills as the set of cognitive pathways for solving a given problem or doing a

given task. All my participants were very confident in their technical ability. Solving technical problems using creative approaches was seen as part of their job. This finding is supported by previous research that found male and female technical and scientific personnel described themselves as "self-confident" in their domain of expertise (Van Zelst & Kerr, 1954; Bachtold & Werner, 1972).

Many participants relied on their theoretical knowledge or technical expertise they gained through their formal education and experience, information they gathered from their peers, experts or the literature, and/or talking with colleagues to flesh out ideas as part of the creative process they used. They saw their technical training supporting their ability to solve technical problems creatively. This finding is consistent with the work of Ward, Smith, and Finke (1999) who claimed, "creative performance is tied to expertise in a particular field, which enables the person to retrieve information and to recognize when a new idea is likely to be valid or significant" (p. 208). Finally, Amabile (1996) pointed to evidence in the literature that exposure to a wide array of information in a domain can enhance creativity.

Creativity-relevant processes. Creativity-relevant processes, for participants included: the process of experimenting; brainstorming ideas on their own or with others; or trying things out and not being afraid if they fail or break; playing with it, writing little programs to test it; making calculations or making a sketch of the situation or problem; and/or manipulating a problem to find a solution. The act of re-arranging the familiar, manipulating, re-jigging the problem, which could be traced back to childhood, tended to be the heuristic R & D scientists used to approach and solve technical problems. This behavior was consistent with the findings of several creativity researchers who have

studied heuristics used for generating novel ideas (e.g., Gordon, 1961; Newell, Shaw, & Simon, 1962). Several participants spoke of work style behavior as focusing on the problem only and ignoring everything else or thinking about it intensely, often becoming obsessed about it, dreaming about it at night or visualizing the problem while doing something else. This was also discussed in the literature, such as the ability to concentrate effort and attention to a problem for long periods of time and the ability to persist in the face of difficulty (e.g., Csikszentmihalyi, 1996a; Davis & Rimm, 1977; Feldman, 1989; Stein, 1974).

An interesting facet of this research was participants' description of the experience of getting into his or her "zone" or "groove" to be creative; a very pleasant, almost addictive, therapeutic state where he or she doesn't worry about anything. Csikszentmihalyi (1990) relates this to what he calls *flow*, or *optimal experience*, which he believed is the sensations and feelings that come when an individual is actively engaging in an intense favorite pursuit – which could be anything from rock climbing to playing the piano. Although this study was not attempting to study the element of flow and creative self-efficacy, it would be interesting to explore this aspect further in future investigations. Specifically, how does creative self-efficacy support being in your zone?

Many participants spoke of having a "sort of feeling" or "gut feelings" on how to proceed in solving a problem. Policastro (1995) described this as intuition or the "vague anticipatory perception that orients creative work in a promising direction" (p. 99). As was suggested by Slaate (1983), "instinctive insight" is fundamental to creativity and is not something that is trained or cultivated empirically but rather brought to one's experiences. This was true for participants of this study whose intuition, supported by

experience and creative successes, provided them with guidance on how to proceed when solving a technical problem creatively.

In summary, the data supported previous findings on the creative personality that point to a complex cluster of attributes such as being smart, intuitive, confident, and persistent or perseverant (Caudron, 1994; Coopersmith, 1967; Csikszentmihalyi, 1996a, 1996b; Roe, 1952; Stein, 1991).

Task Motivation. In regards to task motivation, participants identified the importance of enjoyment, challenge, and learning as reasons why they would solve a technical problem creatively. Amabile (1996) calls this intrinsic motivation and proposes that this state is most conducive to creativity. The research of Amabile and her colleagues (Amabile, 1979, 1982, 1996; Amabile & Gitomer, 1984; Amabile, Hennessey, & Grossman, 1986; Amabile, Hill, Hennessey, & Tighe, 1994) suggests that creativity will increase if one's motivation is intrinsic, such as that experienced by participants in this study, rather than extrinsic (performing an activity for an external reason, such as a reward).

The data is also aligned with Kay's (1990) work. Participants of this study, derived great satisfaction from having solved, and in some cases defined and solved a difficult technical problem. Although participants appreciated receiving awards, it was not what motivated them to solve technical problems creatively. The data support Bandura's (1997) claim that positive incentives foster performance accomplishments.

Participants felt the environment they worked in was an important factor for creative self-efficacy and creative performance. Many participants felt that they were fortunate to work in an environment where there were many "creative, knowledgeable,

hard-working people" like them and where there was freedom to pursue creativity. The opportunity to use the tools and the means to do many different things where they had to be creative added to the belief that they can be creative. Several participants described their managers as being supportive by offering them the time, resources, flexibility and "thought space" to be creative. These findings are consistent with the hypothesis that self-perceptions of personal freedom are seen as necessary for creative thought and expression (Amabile, 1996). In addition, the data support previous findings on factors that stimulate creativity within high technology organizations, specifically, freedom and control, the allocation of time for creative work, a "loose-rein" management style, and a collaborative atmosphere (Amabile & Gryskiewicz, 1985, 1987, 1988; Morgan, 1988).

As stated previously, feedback, from managers and peers, also played an important role in contributing to the R & S scientist's confidence in his or her creative abilities. Feedback encouraged them to be creative, which in turn, reinforced their belief in their creative abilities. These data are in line with Bandura's (1989; 1997) contention that feedback that one's work is of good quality progressively raises perceived efficacy, which then predicts subsequent performance.

In summary, coming back to Amabile's componential conceptualization of creativity, participants were confident (self-efficacious) in their domain area (domain expertise), which supported their creative self-efficacy. Their creative self-efficacy contributed to their ability to generate novel and useful ideas to the problem they were trying to solve (creativity-relevant processes). The strength of their creative self-efficacy supported them as they tackled difficult problems creatively. They were motivated to take on a task because they saw it as interesting or challenging (task motivation). Thus, the

data answers the questions relating to the influence of self-efficacy on the creative process and the environmental conditions that affect creative self-efficacy in the R & D scientist. The data furthers our understanding of the interaction between creative self-efficacy and the different dimensions of creativity discussed in the literature, specifically, the creative person, process, product, and environment. The study did not address, however, creative self-efficacy in relation to Amabile's claim that the higher the levels of domain-relevant skills, creativity-relevant skills, and intrinsic motivation, the higher the level of creativity in a given product. For example, what influence would creative self-efficacy have on high versus low levels of creativity in a given product? This would need to be explored further.

Comparing Research Findings with Prior Studies

The findings also supported previous studies on creative self-efficacy, specifically, about the role of past and future performance on creative self-efficacy (see Schack, 1989; Starko, 1988; Locke, Frederick, Lee, & Bobko, 1984), and characteristics associated with creative individuals (Halpin, Halpin, & Torrance, 1974; Khatena, 1972, 1977; Michalko, 1992; Stein, 1974). Participants of this study saw their creative successes contributing to their creative self-efficacy (past performance). Their belief in their abilities to solve any problem creatively gave them the confidence to take on other problems in the future (future performance).

The findings were also in line with findings relating to creative performance and the self. Attributes of internal locus of control, persistence, high self-esteem, intrinsic motivation, and divergent thinking were seen in participants of this study. The findings also mirrored some of the characteristics of creative personality described in Melrose's

(1989) study: for example, my research participants expressed themselves creatively as children; "serendipity and synchronicity" seemed to describe the creative process for some participants; and the element of "creativity rewards and perpetuates itself" would probably resonate with participants. However, Melrose's finding that creativity is fostered in childhood if the child faces and overcomes perceived hardship, and when the child does not receive psychological support from parents, was not seen in my research participants.

The findings from this research are consistent with the finding that the nature and quality of children's relationships with others helps shape their creative development (Melrose, 1989). For participants of this study, parents played the most significant role in providing support and encouragement to be creative. This took the form of: giving permission to be creative; always answering a question, no matter how silly; creating a carefree environment to experience creativity; never discouraging them from trying to build things; encouraging them to solve their own problems; saying things like "That's creative"; encouraging them to read; and/or exposing them to different perspectives. Several participants cited a male figure, the father, or grandfather, acting as a creative role model or as encouraging them to pursue their creative talent. Family, friends, and teachers, specifically a science teacher, also played an important role in the development of creative self-efficacy.

Participants' conceptualization of creativity as including the element of "novel" or "new" approach to solving problems, and consciously or subconsciously coming up with ideas or using a slightly novel approach to solving a technical problem, supported definitions provided in the creativity literature (Amabile 1983a, 1988; 1996; Isaksen,

Puccio, & Treffinger, 1993). Their description of the creative process as re-arranging the familiar, manipulating, or re-jigging the problem was consistent with Bindeman's (1998) findings regarding the creative process. The findings from this study suggest that creative self-efficacy may have an influence on the R & D scientist's ability to consciously or unconsciously break down old pattern-making activities for the creative process to occur.

The findings provide verification to the importance of an engineer having the freedom of action to create (Blade, 1963), and the importance of creativity in engineering design (Offner, 1967; Thompson & Lordon, 1999). The research findings extend Sternberg and Lubart's (1995) research suggesting that not only a "belief in oneself, and having courage in one's convictions" is necessary to be a creative research scientist, but rather having a belief in one's ability to be creative in a given situation (creative self-efficacy) seems to be equally necessary.

Distinguishing Research Findings From Prior Research

My study is the only one of its kind to date that provides the essence and meaning of the experience of creative self-efficacy for an R & D Scientist working in a high technology organization. Previous studies have focused on specific aspects of creative self-efficacy as they relate to creative performance and have tended to study children. Other studies have investigated the creative personality of renowned adults and have not sought to understand creative self-efficacy from the perspective on a layperson. No other research has looked at the phenomenon of creative self-efficacy as experienced by R & D scientists working in a high technology organization, thus this study provides valuable information for future inquiry. The findings of this study suggest that for this population creative self-efficacy positively influences creative performance.

The study found that creative R & D scientists had a strong belief in their creative abilities in general, and in their ability to solve technical problems with novel and appropriate solutions. Although past research has suggested that people who believe they are creative would act and think in a creative manner, no research to date has provided research evidence to support this claim. The findings from this study suggest that the creative R & D scientist believed he or she was creative, which resulted in acting and thinking in a creative manner. Further investigation would be necessary to explore this further.

The results of this study extend the research of Schack (1989) and Starko (1988) to an adult population. Although my findings are consistent with their findings in regards to the effect of performance accomplishments, they did not provide a synthesis of the whole experience of creative self-efficacy for adults. In my study, R & D scientists reported that their creative successes contributed to their creative self-efficacy, and their belief in their ability to solve any problem creatively gave them the confidence to take on other problems in the future. In addition, the use of self-statements, as found in Meichenbaum's (1975) research, was not a source of creative self-efficacy for my participants.

Although there have been many studies investigating the creative process that creative people follow, this study provides insights of the interaction between creative self-efficacy and the creative process. My participants reported that their belief in their ability to be creative, based on previous creative successes, contributed to their ability to generate novel and new approaches to solving problems they encountered in their work.

In Melrose's (1987, 1989) study of the personalities and creative processes of creative people, she found that "creativity is fostered in childhood if the child faces and overcomes perceived hardship, that as children, creative people experience psychological distance in their relationships with their parents." My participants did not report anything related to this. On the contrary, they reported experiencing carefree environments where they had freedom and encouragement to be creative.

A surprising aspect of this study was that the two women did not seem as confident, at least initially, as the men in the study about their creative abilities. They were more reluctant to talk about their creative self-efficacy as the men, and until the third interview, saw creativity bound in the arts and not in the technical work they did. Although there has been research related to gender differences in occupational self-efficacy (e.g., Hackett & Betz, 1981; Matsui & Onglatco, 1991), there has been no research that addresses gender differences in creative self-efficacy. This research had led me to speculate that the differences found could be related to the fact that these women were working in a domain that is still very much male dominated, where stereotypic masculine attributes, such as viewing aggressiveness and competitiveness as necessary to be successful, could have been a factor. Also, Hackett and Betz's (1981) finding that women's beliefs about their capabilities and career aspirations are shaped by the family, educational system, the mass media and the culture at large, could have a similar affect on creative self-efficacy in women. Further investigation is needed.

This study served to circumvent some of the methodological and theoretical difficulties experienced in other research studies. The use of in-depth interviews and field notes, in this study, led to an synthesis of the essential experience of creative self-

efficacy, which is necessary for an initial stage of inquiry. This was deemed important given that there is not a widely accepted structural framework or synthesis of models or definitions for creativity, and that there is no one instrument to measure creativity.

CHAPTER SIX

Summary, Outcomes, and Implications

This chapter provides a brief summary of the study from its inception to the final synthesis and discussion of the data. Contributions to scholarly knowledge and implications are provided, based on what I have discovered about the experience of creative self-efficacy and its relevance to creativity research, research on self-efficacy theory, education, and organizational development. Finally, I will close the chapter with the essence of the study and its inspiration to me in my professional and personal life.

Summary of Entire Study

In chapter one, I described how I became interested in studying the phenomenon of creative self-efficacy, linking this with the need for organizations, particularly high technology organizations, to find ways to tap into the creative potential of all employees. I pointed to the need for more research on creative self-efficacy, specifically a gap in the literature of what is the essence and meaning of creative self-efficacy from the perspective of an adult working within a high technology organization. The purpose of my investigation was to examine "how do adults, working in a R & D environment, perceive and describe their experience of creative self-efficacy?"

In chapter two, I researched creative self-efficacy, beginning with a focused review of the literature on creative performance and self-efficacy theory as it related to this study. I concentrated on studies that were related to creative self-efficacy. As I did this, I noticed that there was not only minimal research on creative self-efficacy, but also very few investigations that studied creative self-efficacy in adults. Although the literature pointed to a strong relationship between self-efficacy and action, minimal

research was conducted on how an adult's belief in their creative abilities would influence their creative performance. Given this, I felt I needed to step back and look at the phenomenon of creative self-efficacy with fresh eyes. Combining Amabile's (1983a, 1996) componential conceptualization of creativity and Bandura's (1977 a, 1977b, 1997) self-efficacy theory as the conceptual framework, served as a guide in my efforts to bring light to this phenomenon.

Chapter three provided an examination of the phenomenological research approach that I employed. I began with a rationale for using a qualitative approach, and a philosophical perspective of the phenomenological approach. My intent was to inductively and holistically understand the human experience in context-specific setting, to understand the experience of creative self-efficacy of R & D scientists working in a high technology setting. I purposefully chose to study R & D scientists since I was not looking at the general adult, but someone who is already known as creative. My research design, based on how a phenomenological study should be conducted, followed the approach of Moustakas (1994). Significant statements extracted from transcriptions from in-depth interviews, became my raw data for analysis. The process of phenomenological analysis was used to get at the essence of creative self-efficacy. Finally, I triangulated the data with the data collected from documents and my reflective journal.

Chapter four elucidated the structures and textures of the meaning and essence of the experience of creative self-efficacy for the R & D scientist, and led to a synthesis of the experience of creative self-efficacy for the R & D Scientist. I discovered what I believe to be an interaction between the belief participants held about their creative ability, the creative experiences and successes they had, and the influence of the

environment and feedback which may have led to creative self-efficacy and creative performance. Core findings from this study were summarized under the following themes: essence of creative self-efficacy, development of creative self-efficacy, influence of the environment and feedback on creative self-efficacy, influence of creative self-efficacy on creative performance, and gender differences.

In chapter five, I provided a discussion of the findings, specifically addressing how the findings answer the broad research question, *how do adults, working in an R & D environment, perceive and describe their experience of creative self-efficacy?* I discussed how the significant findings relate to the conceptual model presented in chapter two, and compare and distinguish my research findings from prior research.

Contributions to Scholarly Knowledge

My contribution to scholarly knowledge is in the construction of R & S scientists' experience of creative self-efficacy as something that seems to operate below the surface of awareness for the R & D scientist. It is not something he or she would have thought about until asked. Creative self-efficacy seems to positively influence the creative performance of the R & D scientist. Creative self-efficacy can be traced back to age four to twelve through the act of building things and making things work. It is influenced by having the freedom and thought space to be creative, along with positive feedback. Creative self-efficacy contributes to the creative process providing the R & D scientist confidence to use novel and new approaches to solve technical problems. These findings, developed from R & D scientists' description of their experience of creative self-efficacy, have heuristic value. The study and synthesis of R & D scientists' experience of creative self-efficacy contribute to further development of the evolving theory and practice of

creativity. Specifically, the findings suggest that creative self-efficacy is an important element of creative performance and should be incorporated into any framework that describes creative performance. The descriptions certainly expand and clarify our understanding of R & D scientists' experience of creative self-efficacy and stimulate further exploration in the study of creative self-efficacy.

This study contributes to the literature on qualitative research methods used to study creativity. As discussed earlier, most qualitative studies have focused on creative performance in exceptional artists and scientists. This study used a unique methodology, a phenomenological approach, to provide a better understanding of the role self-efficacy plays on creative adults, specifically R & D scientists working in a high technology company. The richness of my findings validates the strength of using a phenomenological approach to study self-efficacy and creative performance.

This research study contains numerous observations of patterns and themes that surfaced and offers tentative theories as explanations of the construct of creative self-efficacy for creative adults. As suggested earlier, a phenomenological investigation is not intended to provide a generalization of results, but to gain a deeper understanding of the experience of creative self-efficacy from the perspectives of the participants under study. Nevertheless, the findings of this phenomenological study add credence to the need for more research on creative self-efficacy. For example, are these findings from these twelve R & D Scientists true for creative people coming from other populations? Given that there were only two women in the study, would findings be the same if the population included all women? How would these findings be different for people who do not believe in their creative abilities or who are not seen as creative? The patterns and

themes from this study, summarized below, provide a starting point for developing further the construct of creative self-efficacy, and have led to additional questions for research. Future research is needed to answer the questions and substantiate or refute the patterns and themes offered.

1. Creative people believe they are creative (feel efficacious about their creative abilities), which contributes to their acting and thinking in a creative manner. How would the findings differ for those who do not believe that they are creative?
2. Creative self-efficacy is not something creative people think about. Creative self-efficacy seems to operate below the surface of awareness until a person is stimulated to reflect upon it. Could one change how efficacious a person feels about their creative abilities, particularly if it is a negative feeling, by having the person reflect upon it?
3. The interaction between a creative person's belief in his or her ability to be creative in a given situation (cognitive), the creative experiences, and successes he or she has had (behavior), and the influence of the environment contributes to creative performance. Are there different degrees of importance to the interactions?
4. Living a creative life, both at work and at home is important for those who feel efficacious about their creative abilities; it allows them to gather creative experiences that give them more confidence in their ability to solve other problems creatively. It gives them satisfaction and enjoyment. Is this true for all cultures?
5. Creative self-efficacy is developed at around age four to twelve in the creative person. This is developed through the act of building things or making things work as a child

with limited or self-created resources, and encouraged by family and friends. Are there other factors that have an impact on the development of creative self-efficacy?

6. Creative people, who feel efficacious about their creative abilities, were exposed to creative role models, for example, their father or grandfather. How do females act as creative role models?
7. Creative self-efficacy is fostered in childhood when the child lives in an environment where his or her curiosity and creativity are rarely discouraged, and where freedom to be creative is provided. In what other ways does the environment affect a child's creative self-efficacy?
8. Creative self-efficacy is fostered in the work environment when creative people feel that they have the freedom and thought space to be creative, and when they are working with other creative, knowledgeable people. In what other ways could the work environment affect creative self-efficacy? How might these environments be different for men and women?
9. Sources of creative self-efficacy are often based on performance accomplishments. Creative successes, starting early on in a creative person's life, serve as the most influential source of creative self-efficacy. What are the strongest sources for creativity in one classed as a "late-bloomer"?
10. The strength of a creative person's creative self-efficacy supports his or her ability to solve technical problems creatively no matter how difficult the problem. Does this change when the person is solving other types of problems, for example, problems outside of his or her domain of expertise?

11. Creative people who feel efficacious about their creative abilities transfer this belief towards solving other problems in their work and personal life. How does self-efficacy differ from self-agency?
12. Creative self-efficacy remains constant for the creative person even in the face of uncertainty. What types of adversities will have a negative affect on a person's creative self-efficacy?
13. Creative self-efficacy contributes to a creative person's ability to generate novel and useful ideas to problems requiring creative solutions. What influence would creative self-efficacy have on high versus low levels of creativity in a given product?
14. Feedback plays an important role contributing to a creative person's confidence in his or her creative self-efficacy, and creative performance. What affect does negative feedback have on creative self-efficacy and creative performance?

Phenomenological research can never exhaust the investigated phenomenon. The results of this study set the stage further for qualitative research on the topic and for more specific empirical investigations. It is my hope that other interested researchers, either those conducting creativity research or research on self-efficacy theory, will undertake this task.

Implications

The insights and understandings that emerge because of this study have tremendous value in the areas of educational practice, the professional development of the R & D scientist, organizational development, and society.

Implications for Educational Practice

From an educational perspective, the findings from this study can be used to inform practice. They point to the need for educators to create an environment, one of freedom and flexibility, for children to develop and experience their own creative self-efficacy. It was evident, from this study, that teachers who supported creative self-efficacy in the child, through encouragement and support, had a positive impact on the development of the child's creative self-efficacy. Given that creative successes and feedback are important in the development of creative self-efficacy in children, teachers need to look for opportunities in their teaching to acknowledge and reward creative successes.

Since creative self-efficacy seems to be an important element of creative performance, there is a need for adult educators to incorporate this knowledge into any program designed to enhance creativity. For example, using the principles of Transformative learning (Mezirow, 1991) the adult educator could have the adult go back to his or her childhood experiences about creativity to become critically aware of how and why the presuppositions about creative self-efficacy have come to constrain the way he or she perceives, understands and feels about creative performance. Then individuals could re-formulate these assumptions into a more inclusive view of their creative self-efficacy. Directed reflections can be useful exercises towards this end.

Implications for Professional Development of the R & D Scientist

As stated in chapter two, there has been minimal research on creativity in engineering and science, specifically, what are the essential characteristics of a creative R & D scientist. Results from this research point to the importance of creative research

scientists', working in high technology organizations, feeling efficacious about their ability to solve technical problems creatively. The knowledge gained from this study can be used to assist in the development of creative R & D scientists, both in the workplace and in their academic development.

First, the findings could be incorporated into university curricula on creativity and innovation, specifically, within Schools of Management, Faculty of Computer Science, or the Faculty of Engineering. A course of this nature would not only cover awareness and knowledge about creativity and innovation but skill building and practical examples to help students integrate what they are learning. For example, topics could include: the characteristics of creative people; a self-assessment of what characteristics the students have and would need to develop in this area; blocks to creativity and innovation, including one's belief about the ability to be creative; the stimulants and obstacles to creativity and innovation; the creative process and tools and techniques for generating and evaluating ideas.

Second, the knowledge gained from this research could be used to develop a quantitative instrument for measuring an R & D scientists' creative self-efficacy. The concepts identified within the research contributions relating to the conceptual model, found in chapter four, could be incorporated into a quantitative instrument to measure creative self-efficacy in R & D scientists. This would not only assist in understanding the level of creative self-efficacy of an R & D scientist, but could assist in identifying areas for further development.

Implications for Organizational Development

The findings provide credence to the need for organizations to provide an environment that offers the freedom and thought space for creative self-efficacy. Organizations that create a culture of freedom and flexibility for employees to be creative will contribute to their creative productivity. The implications for organizations point to the need for management to assess how their current operation fits this culture, and if not, how they can create a culture of creativity and innovation. A commitment is needed on the part of the organization to incorporate creativity and innovation into all business functions. To support creativity and innovation management must not only invest financially, but in providing the space, freedom, and safety for creativity and innovation to occur. For this to occur, senior management must act as "creativity and innovation" champions and lead the way.

As organizations journey through the new economy, they need to develop the best organizational and management practices that lead to creativity and innovation. The findings from this study offer a starting point for organizations as they seek to develop competencies to foster creativity and innovation. Creativity, the root of innovation, is a process and a skill that needs to be developed and managed throughout the entire organization. For managers who may be lacking the skills and knowledge necessary to create an environment for creativity and innovation to occur, further development may be necessary. A program on "Leading Creatively" could be offered that would include structured experiences, group discussion, lecturettes, and case studies to teach managers how to become creative catalyst that stimulate and maintain creativity with in their organizations. Topics could include: the characteristics of a creative leader and the

behaviors they use to foster and nurture a creative climate; how do creative leaders talk to allow for creative thinking; strategies used by the creative leader to maximize their organization's creativity; and how to enable individuals, groups, and teams to work through a creative process to help solve organizational and personal challenges. For those employees who may be lacking creativity skills, development programs can be offered to enhance them. For example, many organizations have provided the Creative Problem Solving Workshop to their employees to teach them the creative problem solving process and the skills that go with it. The element of creative self-efficacy could be build into this existing program.

In addition, the knowledge gained from this study can be used in the development of a creative performance dimension that incorporates creative self-efficacy that can be used to attract, select, and retain creative talent. The creative performance dimension could be defined as: a belief in his or her ability to solve problems creatively, and as a result can produce novel and appropriate solutions to open-ended problems within his or her domain of expertise. For example, this creative performance dimension could be seen as an addition to the other performance dimensions important to an R&D scientist's job, such as technical expertise, analytical skills, interpersonal skills, and team member skills. Interview questions can be developed to attract and select candidates who satisfy this dimension. This dimension can also be included in the performance criteria for the job and measured accordingly.

Implications for Society

Finally, addressing the importance of the parents' role in developing creative self-efficacy in their children also has implications for society, especially in terms of parent

education. Efforts need to be made to heighten parents' awareness about the important role they have in developing creativity in their children. If we hold the premise that we are all born with a general level of creativeness, although one could argue that some children are innately more talented or gifted creatively than others, then at some point in a child's development belief in his or her creative abilities is either supported or negated by the parents. For example, parents can support their child's curiosity and answer their questions not matter how frustrating it may seem. They can point out to their child when he or she has been creative; for example, when their child comes to them with a drawing to point out the use of colors and unique design or just say "that's creative." Parents can develop a child's creativity by encouraging their children to use their imagination. Finally, parents can expose their children to different perspectives and environments as best they can.

Conclusion

In summary, since the research question of this study was based on an adult's perception of his or her experience of creative self-efficacy, the phenomenological analysis of transcribed interviews was an appropriate methodology. Data were analyzed using the phenomenological analysis approach developed by Moustakas (1994). Each step of the analysis was guided on two counts: (1) to describe the essential meaning of what the R & D Scientist's description revealed about creative self-efficacy, and (2) to remain faithful as possible to the R & D Scientist's original description. The documents collected and Researcher's Journal were triangulated to the description of creative self-efficacy.

This study sought to understand creative self-efficacy as experienced by R & D Scientists who lived and experienced it. The essential essence of creative self-efficacy was allowed to show itself and speak for itself; it was not translated or defined by external criteria. I now pass it on to others to make decisions for themselves about the transferability of the findings to their setting.

In ending this study of creative self-efficacy, I feel like I have come full circle, meaning that my curiosity about creative self-efficacy has been sparked even more. Although I believe that the textural and structural descriptions of creative self-efficacy that were derived from my data add unique and significant portrayals to existing knowledge, I feel that I have just opened the door a crack in my effort to understand the phenomenon itself. My study has identified to some extent what I felt was important to creative performance: that a person's belief in his or her ability to be creative in a given situation will influence how creative he or she is within that situation. However, I want to open the door wider to expand my understanding further.

As a researcher, I want to continue the journey I have started to understand how creative self-efficacy plays out in other populations. For example, given the subtle differences I found in the women in my study, how would these be described in other women? Would I find gender differences in regards to the experience of creative self-efficacy? Second, in what ways might I use the data to develop a measure of creative self-efficacy that could be used to gain more understanding from a larger population base? From an organizational standpoint, I am curious as to how an organizational culture, one where employees are efficacious about their creative abilities, would perform creatively. Would they be more innovative or creative because of this phenomenon? As

an adult educator, I would like to work with adults, who may not have a strong belief in their creative abilities, to help them transcend this belief to one where they do belief in their creative abilities. Finally, as a parent I want to continue to create an environment of encouragement and support, for my children to experience their creative self-efficacy. My journey continues.

References

Albert, R.S. (1980). Family positions and the attainment of eminence: A study of special family experiences. Gifted Child Quarterly, 24, 87-95.

Amabile, T.M., (1979). Effects of external evaluation on artistic creativity. Journal of Personality and Social Psychology, 37, 221-233.

Amabile, T.M. (1982). Social psychology of creativity: A consensual assessment technique. Journal of Personality and Social Psychology, 43, 997-1013.

Amabile, T. M. (1983a). The social psychology of creativity. New York: Springer.

Amabile, T. M. (1983b). Social psychology of creativity: A componential conceptualization. Journal of Personality and Social Psychology, 45, 357-377.

Amabile, T. M. (1988). A model of creativity and innovation in organizations. In B. M. Staw, & L. L. Cummings (Eds.), Research in organizational behavior, Vo. 10. (pp. 123-167). Greenwich, CT: JAI Press.

Amabile, T. M. (1990). Within you, without you: The social psychology of creativity, and beyond. In M.A. Runco and R.S. Albert (Eds.), Theories of Creativity (pp. 61-91). Newbury Park, CA: Sage Publications.

Amabile, T. M. (1996) Creativity in context: Update to the social psychology of creativity. Boulder, CO: Westview Press.

Amabile, T.M., & Gitomer, J. (1984). Children's artistic creativity: Effects of choice in task materials. Personality and Social Psychology Bulletin, 10, 209-215.

Amabile, T. M., & Gryskiewicz, S. S. (1985). Creativity in research and development, Technical Report. Greensboro, NC: Center of Creative Leadership.

Amabile, T. M., & Gryskiewicz, S. S. (1987). Creativity in the R&D laboratory. Technical Report Number 30. Greensboro, North Carolina: Center for Creative Leadership, 1-31.

Amabile, T. M., & Gryskiewicz, S. S. (1988). Creative human resources in the R&D laboratory: How environment and personality affect innovation. In R.L. Kuhn, Handbook for Creative and Innovative Managers (pp. 501-525). New York, NY: McGraw-Hill Book Company.

Amabile, T.M., Hennessey, B.A., & Grossman, B. S. (1986). Social influences on creativity: The effects of contracted-for reward. Journal of Personality and Social Psychology, 50, 14-23.

Amabile, T.M., Hill, K.G., Hennessey, B.A., & Tighe, E.M. (1994). The work preference inventory: Assessing intrinsic and extrinsic motivational orientations. Journal of Personality and Social Psychology, 66(5), 950-967.

Amabile, T. M., & Tighe, E. (1993). Questions of creativity. In J. Brockman (Ed), Creativity: The reality club 4 (pp.7 – 27). New York, NY: Simon & Schuster.

Arad, S., Hanson, M. J., & Schneider, R. J. (1997). A framework for the study of relationships between organizational characteristics and organizational innovation. Journal of Creative Behavior, 31(1), 42-58.

Bachtold, L. M., & Werner, E. E. (1972). Personality characteristics of women scientists. Psychological Reports, 31, 391-396.

Bandura, A. (1977a). Social learning theory. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1977b). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84, 191-215.

Bandura, A. (1982). Self-efficacy mechanism in human agency. American Psychologist, 37, 122-147.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1988). Reflection on nonability determinants of competence. In R.J. Sternberg & J. Kolligian, Jr. (Eds.), Competence considered: Perceptions of competence and incompetence across the lifespan (pp. 315-362). New Haven, CT: Yale University Press.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: Freeman.

Bandura, A. & Wood, R. E. (1989). Effect of perceived controllability and performance standards on self-regulation of complex decision-making. Journal of Personality and Social Psychology, 56, 805-814.

Barling, J., & Abel, M. (1983). Self-efficacy beliefs and tennis performance. Cognitive Therapy & Research, 7, 265-272.

Barling, J., & Beattie, R. (1983). Self-efficacy beliefs and sales performance. Journal of Organizational Behavior Management, 5, 41-51.

Barling, J., & Snipelisky, B. (1983). Assessing the determinants of children's academic self-efficacy beliefs: A replication. Cognitive Therapy and Research, 7, 371-376.

Baron, R. M., Cowan, G., Ganz, R. L, & McDonald, M. (1974). Interaction of locus of control and type of performance feedback: Consideration of external validity. Journal of Personality and Social psychology, 30, 285-92.

Barron, F. (1968). Creativity and personal freedom. New York: Van Nostrand.

Becker, C. S. (1992). Living and relating: An introduction to phenomenology. Newbury, CA: Sage Publications.

Bindeman, S. (1998). Echoes of silence: A phenomenological study of the creative process. Creativity Research Journal, 11(1), 69-77.

Blade, M. F. (1963). Creativity in engineering. In M. A. Coler (Ed.), Essays on creativity in the sciences (pp. 110-122). New York, NY: University Press.

Burnside, R. M., Amabile, T. M., & Cryskiewicz, S. S. (1988). Assessing organizational climates for creativity and innovation: Methodological review of large company audits. In Y. Ijiri & R. L. Kuhn (Eds.), New directions in research for creative and innovative managers (pp. 169-185). Cambridge, MA: Ballinger.

Campbell, N. K., & Hackett, G. (1986). The effects of mathematics task performance on math self-efficacy and task interest. Journal of Vocational Behavior, 28, 149-162.

Cauldron, S. (1994). Strategies for managing creative workers. Personnel Journal, 73(12), 104-113.

Chambers, J. A. (1964). Relating personality and biographical factors to scientific creativity. Psychological Monographs, 78 (7, Whole No. 584).

Conrad, S. D. (1990). Towards a phenomenological analysis of artistic creativity. Journal of Phenomenological Psychology, 21(2), 103-120.

Coopersmith, S. (1967). The antecedents of self-esteem. San Francisco, CA: W.H. Freeman & Company.

Creswell, J. W. (1998). Qualitative inquiry and research: Choosing among the five traditions. Thousand Oaks, CA: Sage Publications.

Cronbach, L. (1975). Beyond the two disciplines of scientific psychology. American Psychologist, 30, 116-127.

Csikszentmihalyi, M. (1988). Society, culture, and the person: A systems view of creativity. In R. J. Sternberg (Ed.) The nature of creativity (pp. 325-339). New York, NY: Cambridge University Press.

Csikszentmihalyi, M. (1990). Flow: The psychology of optimal experience. New York: HarperCollins.

Csikszentmihalyi, M. (1996a). Creativity. New York: HarperCollins.

Csikszentmihalyi, M. (1996b). The creative personality. Psychology Today, 29, 36-40.

Davis, G. A., & Rimm, S. (1977). Characteristics of creatively gifted children. Gifted Child Quarterly, 21, 546-551.

Davis, F. W., & Yates, B.T. (1982). Self-efficacy expectancies versus outcome expectancies as determinants of performance deficits and depressive effect. Cognitive Therapy and Research, 6, 23-35.

DiClemente, C. C., Prochaska, J .0., & Gibertini, M. (1985). Self-efficacy and the stages of self-change of smoking. Cognitive Therapy and Research, 9, 181-200.

Dowd, E. T. (1989). The self and creativity: Several constructs in search of a theory. In J. A. Glover, R. R. Ronning, & C. R. Reynolds (Eds.), Handbook of Creativity. New York: Plenum Press.

Drucker, P. F. (1993). Post-Capitalist Society. New York: Harper Collins.

Dukes, S. (1984). Phenomenological methodology in the human sciences. Journal of Religion and Health, 23(3), 197-203.

Ekvall, G. (1997). The organizational culture of idea-management: A creative climate for the management of ideas. In M. Joyce, S. Isaksen, F. Davidson, G. Puccio, C. Coppage, & M. A. Maruska, (Eds.), An introduction to creativity (pp. 157-161). Second Edition. Acton, MA: Copley Custom.

Feldman, D. H. (1989). Creativity: Proof that development occurs. In W. Damon (Ed.), Child development today and tomorrow (pp. 240-260). San Francisco: Jossey Bass.

Gardner, H. (1993). Creating minds: An anatomy of creativity seen through the lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi. New York, NY: Basic Books.

Giorgi, A. (1997). The theory, practice, and evaluation of the phenomenological method as a qualitative research procedure. Journal of Phenomenological Psychology, 28(2), 235-260.

Gordon, W. (1961). Synectics: The development of creative capacity. New York: Harper & Row.

Gruber, H. E. (1988). The evolving systems approach to creative work. Creativity Research Journal, 1, 27 – 51.

Gruber, H. E., & Wallace, D. B. (1989). Creative people at work: Twelve cognitive case studies. Oxford, UK: Oxford University Press.

Guba, E. G. (1981). Criteria for assessing trustworthiness of naturalistic inquiries. Educational Communication and Technology Journal, 29, 75-92.

Guilford, J. P. (1986). Creative talents: Their nature, uses, and development. Buffalo, NY: Bearly.

Hackett, G. (1985). Role of mathematics self-efficacy in the choice of math-related majors of college women and men: A path analysis. Journal of Counseling Psychology, 32, 47-56.

Hackett, G., & Betz, N. E. (1981). A self-efficacy approach to the career development of women. Journal of Vocational Behavior, 18, 326-339.

Halpin, G., Halpin, G., & Torrance, E. P. (1974). Relationships between creative thinking abilities and a measure of the creative personality. Educational Measurement, 34, 75-82.

Hammersley, M., & Atkinson, P. (1993). Ethnography: Principles in practice (2nd Ed.). Routledge: London.

Harper, W. (1981). The experience of leisure. Leisure Sciences, 4(2), 113-126.

Hill, T., Smith, N. D., & Mann, M. F. (1987). Role of efficacy expectations in predicting the decision to use advanced technologies. Journal of Applied Psychology, 72, 307-314.

Hocevar, D. (1979). Measurement of creativity: Review and technique. ERIC Document no: 175916.

Isaksen, S. G. (1987). Introduction – An orientation to the frontiers of creativity research. In S. G. Isaksen (Ed.), Frontiers of creativity research: Beyond the basics (pp. 1-26). New York, NY: Bearly.

Isaksen, S. G., Puccio, G. J., & Treffinger, D. J. (1993). An ecological approach to creativity research: Profiling for creative problem solving. Journal of Creative Behavior, 27(3), 149 – 170.

Kanter R. M. (1995). Constructing the future. In Northern Telecom's 1994 annual report: A world of networks (pp. 27 - 29). Toronto, ON: Northern Telecom.

Kay, R. (1990). Managing Creativity in Science and Hi-tech. New York, NY: Springer-Verlag publishers.

Khatena, J. (1972). Attitude patterns as providing validity evidence of something about the researcher. Perceptual and Motor Skills, 34, 563-564.

Khatena, J. (1977). The Khatena-Torrance creative perception inventory for identification, diagnosis, facilitation, and research. Gifted Child Quarterly, 21, 517-525.

Kiernan, M. J. (1995). Get innovative or get dead! Vancouver, BC: Douglas & McIntyre Ltd.

Koestler, A. (1964). The act of creation. New York: Macmillan.

Laws, J. L. (1995). An examination of the interaction between intrinsic motivation and the fostering of creativity in adults within a high technology organization. Unpublished masters thesis, University of Ottawa.

Lee, C. (1984). Accuracy of efficacy and outcome expectations in predicting performance in a simulated assertiveness task. Cognitive Therapy and Research, 8, 37-48.

Lent, R. W., Brown, S. D., & Larkin, K. C. (1987). Comparison of three theoretically derived variables in predicting career and academic behavior: Self-efficacy, interest congruence, and consequence thinking. Journal of Counseling Psychology, 34, 293-298.

Lincoln, Y. S., & Guba, E. G. (1985). Naturalistic Inquiry. Newbury Park, CA: Sage.

Locke, E. A., Frederick, E., Lee, C., & Bobko, P. (1984). The effect of self-efficacy, goals, and task strategies on task performance. Journal of Applied Psychology, 69, 241-251.

MacKinnon, D. W. (1965). Personality and the realization of creative potential. American Psychologist, 20, 273-281.

MacKinnon, D.W. (1975). IPAR's contribution to the conceptualization and study of creativity. In I. Taylor & J. Getzels (Eds.), Perspectives in Creativity (pp. 60-89). Chicago, IL: Aldine.

MacKinnon, D. W. (1978). In search of human effectiveness: Identifying and developing creativity. Buffalo, NY: Creative Education Foundation.

Matsui, T., & Onglatco, M. L. (1991). Instrumentality, expressiveness, and self-efficacy in career activities among Japanese working women. Journal of Vocational Behavior, 41, 79-88.

Meichenbaum, D. (1975). Enhancing creativity by modifying what subjects say to themselves. American Educational Journal, 12, 129-145.

Meier, S., McCarthy, P. R., & Schmeck, R. R. (1984). Validity of self-efficacy as a predictor of writing performance. Cognitive Therapy and Research, 8, 107-120.

Melrose, L. W. (1987). The creative personality and the creative process: A qualitative perspective. Dissertation Abstracts International, 48-08, Section B, 2489.

Melrose, L. W. (1989). The creative personality and the creative process: A qualitative perspective. Landham, MD: University Press of America, Inc.

Mezirow, J. (1991). Transformative dimensions of adult learning. San Francisco, CA: Jossey-Bass.

Michalko, M. (1992). Tips for creative thinking. Training & Development Journal, 7, 11.

Mitchell, J. (1990). Re-visioning educational leadership: A phenomenological approach. New York, NY: Garland publishing Inc.

Mitchell, C., & Stuart, R. B. (1984). Effects of self-efficacy on dropout from obesity treatment. Journal of Consulting and Clinical Psychology, 52, 1100-1101.

Maykut, P., & Morehouse, R. (1994). Beginning Qualitative Research: A Philosophic and Practical Guide. London, England: The Farmer Press.

Morgan, G., (1988). Riding the Waves of Change: Developing Managerial Competencies for a Turbulent World. San Francisco, CA: Jossey-Bass Publishers.

Moustakas, C. (1994). Phenomenological research methods. Thousand Oaks, CA: Sage.

Mumford, M. D., & Simonton, D. K. (1997). Creativity in the workplace: People, problems, and structures. Journal of Creative Behavior, 31, 1-6.

Newell, A., Shaw J., & Simon, H. (1962). The processes of creative thinking. In H. Gruber, G. Terrell, & M. Wertheimer (Eds.). Contemporary approaches to creative thinking. New York: Atherton Press.

Ohmae, K. (1995). Competitive advantage in the information age. In Northern Telecom's 1994 annual report: A world of networks (pp. 19-21). Toronto, ON: Northern Telecom.

Offner, D. H. (1967). Energizing the creative potential in future engineers. Journal of Creative Behavior, 1(1), 15-21.

Osborn, A. F. (1963). Applied imagination (Third ed.). New York, NY: Scribners.

Pajares, F., & Kranzler, J. (1995). Self-efficacy beliefs and general mental ability in mathematical problem solving. Contemporary Educational Psychology, 20, 426-443.

Pajares, F. & Miller, M. D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. Journal of Educational Psychology, 86, 193-203.

Patton, M. Q. (1990). Qualitative evaluation and research methods. Newbury Park, CA: Sage.

Perkins, D. A. (1988). The possibility of invention. In R. J. Sternberg (Ed.), The nature of creativity (pp. 362-385). New York, NY: Cambridge University Press.

Policastro, E. (1995). Creative intuition: An integrative review. Creativity Research Journal, 8, 99-113.

Rhodes, M. (1987). An analysis of creativity. In S. G. Isaksen (Ed.), Frontiers of creativity research: Beyond the basics (pp. 216-222). Buffalo, NY: Bearly.

Roe A., (1952). A psychologist examines sixty-four eminent scientists. Scientific American, 187, 21-25.

Rogers, C. (1962). Toward a theory of creativity. In S. J. Parnes & H. F. Harding (Eds.), A source book for creative thinking (pp. 63-72). New York: Scribners.

Rotter, J. B. (1966). Generalized experiences for internal versus external control of reinforcement. Psychological Monographs, 80, (1, Whole No. 609).

Rotter, J. B. (1982). The development and applications of social learning theory: Selected papers. New York: Praeger Publishers.

Rotter, J. B., Chance, J. E., & Phares, E. J. (1972). Applications of a social learning theory of personality. New York: Holt, Rinehart, & Winston.

Schack, G. D. (1989). Self-efficacy as a mediator in the creative productivity of gifted children. Journal for the Education of the Gifted, 12(3), 231-249.

Schunk, D. H. (1981). Modeling and attributional effects on children's achievement: A self-efficacy analysis. Journal of Educational Psychology, 73, 93-105.

Schunk, D. H. (1982). Effects of effort attributional feedback on children's perceived self-efficacy and achievement. Journal of Educational Psychology, 74, 548-556.

Schunk, D. H. (1983). Ability versus effort attributional feedback: Differential effects on self-efficacy and achievement. Journal of Educational Psychology, 75, 848-856.

Schunk, D. H. (1984). Enhancing self-efficacy and achievement through rewards and goals: Motivational and informational effects. Journal of Educational Psychology, 78, 29-34.

Seidman, I. E., (1991). Interviewing as a qualitative research: A guide for researchers in education and the social sciences. New York, NY: Teachers College Press.

Sheldon, K. M. (1995). Creativity and self-determination in personality. Creativity Research Journal, 8 (1), 25-36.

Simonton, D. K. (1988). Scientific genius: A psychology of science. Cambridge, England: Cambridge University Press.

Slaatte, H. A. (1983). The creativity of consciousness: An empirico-phenomenological psychology. Lanham, MD: University Press of America.

Stake, R. E. (1978). The case-study method in social inquiry. Educational Researcher, 7, 5-8.

Starko, A. J. (1986). RDIM, creative productivity, and self-efficacy. Unpublished doctoral dissertation, University of Connecticut.

Starko, A. J. (1988). Effects of the Revolving Door Identification Model on creative productivity and self-efficacy. Gifted Child Quarterly, 32(3), 291-297.

Stajkovic, A. D., & Luthans, F. (1998). Self-efficacy and work-related performance: A meta-analysis. Psychological Bulletin, 124, 240 – 261.

Stein, M. I. (1974). Stimulating creativity. Vol. 1: Individual procedures. New York, NY: Academic Press.

Stein, M. I. (1991). Creativity is people. Leadership and Organizational Development Journal, 12, 4-10.

Sternberg, R. J. (1988). The nature of creativity. New York, NY: Cambridge University Press.

Sternberg, R.J., & Lubart, T. I. (1995). Defying the crowd: Cultivating creativity in a culture of conformity. New York, NY: The Free Press.

Strickland, B. R. (1989). Internal-external control expectancies: From contingency to creativity. American Psychologist, 44, 1-12.

Stump, S. A., Brief, A. P., & Hartman, K. (1987). Self-efficacy expectations and coping with career-related events. Journal of Vocational Behavior, 31, 91-108.

Tapscot, D., & Caston, A. (1993). Paradigm shift: The new promise of information technology. New York, NY: McGraw-Hill.

Tardif, T. Z. & Sternberg, R. J. (1988). What do we know about creativity? In R. J. Sternberg (Ed.), The nature of creativity (pp. 429-440). Cambridge, UK: Cambridge University Press.

Taylor, M. S., Locke, E. A., Lee, C., & Gist, M. E. (1984). Type A behavior and faculty research productivity: What are the mechanisms? Organizational Behavior and Human Performance, 34, 402-418.

Tesluk, P. E., Faar, J. L., & Klein, S. R. (1997) Influences of organizational culture and climate on individual creativity. Journal of Creative Behavior, 31(1), 27-41.

Thompson, G., & Lordan, M. (1999). A review of creativity principles applied to engineering design. In Proceedings of the Institution of Mechanical Engineers, Part E, 213, 17-31.

Torrance, E. P. (1965). Rewarding creative behavior. Englewood Cliffs, NJ: Prentice-Hall.

Torrance, E. P. (1974). Torrance Tests of Creative Thinking, Thinking Creatively with Pictures -- Figural Booklet A & B. Bensenville, IL: Scholastic Testing Service.

Torrance, E. P. (1979). Search for satori and creativity. Buffalo, NY: Bearly.

Torrance, E. P. (1988). The nature of creativity as manifest in its testing. In R.J. Sternberg (Ed.), The nature of creativity (pp. 43-75). Cambridge, UK: Cambridge University Press.

Treffinger, D. J., Sortore, M. R. & Cross, J. C. (1993). Dimensions of creativity. Sarasota, FL: Center for Creative Learning.

Van Kaam, A. (1966). Phenomenological analysis: Exemplified by a study of the experience of "really feeling understood". Journal of Individual Psychology, 15(1), 66-72.

Van Zelst, R. H. & Kerr, W. A. (1954). Personality self-assessment of scientific and technical personnel. Journal of Applied Psychology, 38, 145-147.

Wallas, G. (1926). The art of thought. New York, NY: Harcourt, Brace, & World.

Woodman, R. W., & Schoenfeldt, L. F. (1990). An interactionist model of creative behavior. Journal of Creative Behavior, 24, 10-20.

Walkup, L. (1971). Detecting creativity: Some practical approaches. Journal of Creative Behavior, 5(2), 88-93.

Ward, T. B, Smith, S. M., & Finke, R. A. (1999). Creative cognition. In R. J. Sternberg (Ed.), Handbook of creativity (pp. 189-212). Cambridge, UK: Cambridge University Press.

Wood, R., & Bandura, A. (1989). Social cognitive theory of organizational management. Academy of Management Review, 14(3), 361-384.

Wood, R. E., & Locke, E. A. (1987). The relation of self-efficacy and grade goals to academic performance. Educational and Psychological Measurement, 47, 1013-1024.

Youngblood, M. D. (1997). Leadership at the edge of chaos: From control to creativity. Strategy & Leadership, 5, 6-14.

Zimmerman, B. J. & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. American Educational Research Journal, 31, 845-862.

Appendix A: Email to Participants

To: (Distribution list of Research & Development Scientists)

From: Judy Laws

Subject: Volunteers needed for Research Study on Creativity

Wanted: Creative innovators to participate in a study on how an individual's belief in his or her ability to be creative in the workplace influences how creative he or she is in the work place.

I am looking for about 12 people who:

- have demonstrated creativity and innovative problem solving strategies at work
- represent both genders
- are in a design capacity, either hardware or software design of products and services for the high performance internet
- are of different cultures

Research data will be collected by means of: (a) three in-depth interviews with each participant, 90 minutes each (b) review of documents - working documents from the participants interviewed will be collected in the form of patents, awards, publications, and artifacts showing creative accomplishments or achievements, and (c) researcher's reflective journal - a detailed journal capturing any insights, reflections, and specific body language/behaviors observed while interviewing the participants, after each interview, and throughout the data collection process. All interviews will be held in a meeting place of mutual convenience. Data will be analyzed, triangulated, and validated by the researcher.

Anonymity and privacy will be assured in the following manner:

- The email sent to participants by the researcher, requesting volunteers, will be sent in a manner that only the receiver will see his or her name (e.g. the whole distribution list will be hidden).
- Tape recordings of interviews and other data collected will be kept in a secure manner, specifically in a locked cabinet in the researcher's home. Data held on the computer will be password protected. No one will have access to the data other than the researcher.
- When interviews are transcribed into printed form for analysis, all personal and place names and any other means of identifying you or any other participants will be deleted or replaced with code names known only to the researcher. The identity of the subjects will only be known to the researcher.
- No person's name will be associated with the study or used in any publication by the researcher reporting this research.
- All results will be reported in group format.
- Upon analysis, all recorded data will be destroyed.

- All information is protected under the Freedom of Information and Privacy Act, 1989 (Bill 49).
- Since the researcher is external to the Nortel Networks, there is no concern for dual relationships.

Your participation in this study would be entirely voluntary. You would be free to withdraw at any time, before or during an interview. You may refuse to participate; and refuse to answer questions without prejudice.

What's in it for you: You will not only will get a better understanding of your own creativity and ways to enhance it, but, by participating in the study, assist the researcher in providing new knowledge to the literature on the role individuals' beliefs about their ability to be creative plays in how creative they are in a work setting. If you would like additional information, please do not hesitate to contact me.

INTERESTED???? If so, reply to this email no later than _____ to let me know. I will contact you no later than _____ to confirm if you will be part of this study and to have you sign a Consent form. Thank you for your attention to this matter.

Kindest regards,

Judy Laws
Ph.D. Student, University of Ottawa
Phone: 613-841-1339
Email: jllaws@home.com

Appendix B: Information Sheet and Consent form for Participants

(Intend to use official letterhead from the Faculty of Education when sending this out)

Information Sheet for Informed Consent of Research Participant

Dear Participant:

I, Judy Laws, a Ph.D. student at the University of Ottawa within the Faculty of Education, am conducting a Ph.D. study on how an individual's belief in his or her ability to be creative in a given situation (creative self-efficacy) influences how creative he or she is within that situation. This research will be supervised by Dr. Janice Leroux, Faculty of Education, University of Ottawa. Permission to conduct this research study has been provided by Helen Cooper, VP Human Resources, for the Optical Internet Portfolio group. The purpose of the study is to understand how adults perceive and describe their experience of creative self-efficacy working within the Research and Development (R&D) area of a high technology organization. For purposes here, creative self-efficacy will be defined as an individual's belief in his or her ability to be creative in a given situation. Findings from this study will provide organizations with possible ways to tap into the creative potential of employees. From an individual standpoint, each participant will get a better understanding of his or her creative self-efficacy as it relates to his or her creative performance. I am writing to request your agreement to participate in this study.

Research data will be collected by means of: (a) three in-depth interviews with each participant, 90 minutes each (b) review of documents - working documents from the participants interviewed will be collected in the form of patents, awards, publications, and artifacts showing creative accomplishments or achievements, and (c) researcher's reflective journal - a detailed journal capturing any insights, reflections, and specific body language/behaviors observed while interviewing the participants, after each interview, and throughout the data collection process. All interviews will be held in a place of mutual convenience.

When interviews are transcribed into printed form for analysis, all personal and place names and any other means of identifying you or any other participants will be deleted or replaced with code names known only to the researcher. Likewise, no person's name will be associated with the study or used in any publication by the researcher reporting this research. You have the right to withdraw from the study at any time, in which case any data you have previously provided will not be used.

The Social Sciences and Humanities Research Ethics Board, University of Ottawa, has approved this research. If you have any questions concerning the research, you may contact the researcher, Judy Laws (613-841-1341) or her advisor, Professor Janice Leroux (613-562-5800, ext. 4159). For any questions regarding any ethical aspects of the research you can contact Lise Frigault, the Protocol Officer for Ethics in Research, Office of the Vice-Rector (Research), Room 246, Tabaret Hall, Phone: 562-5800 ext. 1787,

email: lfrigaul@uottawa.ca. A summary report of findings will be made available to interested persons after the study is completed.

I would appreciate you completing the attached consent form and returning it to me in the pre-addressed, stamped envelope. Thank you for your support and cooperation.

Sincerely,

Judy Laws,
Ph.D. Student

Participant Consent Form

Title of Project:	Self-efficacy Beliefs and Creative Performance in Adults
Researcher:	Judy Laws, Doctoral Student, University of Ottawa
Telephone no:	(613) 841-1341
Email Address:	jllaws@home.com
Research Supervisor:	Dr. Janice Leroux, University of Ottawa

The purpose of the study is to understand how adults perceive and describe their experience of creative self-efficacy working within the Research and Development (R&D) area of a high technology organization. For purposes here, creative self-efficacy will be defined as an individual's belief in his or her ability to be creative in a given situation.

If I agree to participate in this study, my participation will consist of participating in three interviews, approximately 90 minutes each, and providing a list of my creative achievements. Specifically, the first two interviews will be spaced, when possible, between three days apart. The third interview will be held approximately two weeks after the second in order for the researcher to formulate a narrative of my interview data and to have me review it for accuracy before conducting the last interview. The interviews will be audiotape recorded. Finally, at the end of my second interview I will be asked to bring a list of my creative achievements or creative accomplishments in all areas of my life, specifically, an inventory of my creative achievements and/or accomplishments. i.e., any rewards, patents, working documents and feedback for my creative efforts.

I understand that the contents will be used for research purposes and that my confidentiality will be respected. The researcher has also signed a non-disclosure agreement with Nortel Networks that bonds her to confidentiality.

If inadvertently a question is asked that causes me discomfort, I am free to discontinue with this line of questioning.

I have received assurance from the researcher that the information I will share will remain strictly confidential. I, in turn, assure other participants that I will treat in the same confidential manner any information I may obtain in the context of this project. Anonymity and privacy will be assured in the following manner:

- The email sent to participants by the researcher, requesting volunteers, will be sent in a manner that only the receiver will see his or her name (e.g.; the whole distribution list will be hidden).
- To ensure anonymity, the _____ group Management team will not receive any information about the identity of the participants of this study and will not be involved in any other process than providing the researcher with a list of names and email addresses.
- Tape recordings of interviews and other data collected will be kept in a secure manner, specifically in a locked cabinet in the researcher's home. Data held on the

computer will be password protected. No one will have access to the data other than the researcher.

- When interviews are transcribed into printed form for analysis, all personal and place names and any other means of identifying you or any other participants will be deleted or replaced with code names known only to the researcher. The identity of the subjects will only be known to the researcher.
- No person's name will be associated with the study or used in any publication by the researcher reporting this research.
- All results will be reported in group format.
- Upon analysis, all data will be stored for five years in a locked cabinet in the Researcher's home.
- Since the researcher is external to the Nortel Networks, there is no concern for dual relationships.

I understand that my participation in this study is entirely voluntary. I am free to withdraw at any time, before or during an interview. I may refuse to participate, withdraw from the study, or refuse to answer any questions without prejudice or fear that this decision will affect my employment situation.

Upon completion of the study, each participant will be able to receive an executive summary of the results if desired.

This research has been approved by the Social Sciences and Humanities Research Ethics Board of the University of Ottawa. If I have any questions concerning the research, I may contact the researcher, Judy Laws (613-841-1341) or her advisor, Professor Janice Leroux (613-562-5800, ext. 4159). For any questions regarding any ethical aspects of the research I can contact Lise Frigault, the Protocol Officer for Ethics in Research, Office of the Vice-Rector (Research), Room 246, Tabaret Hall, Phone: 562-5800 ext. 1787, email: lfrigaul@uottawa.ca. There are two copies of the consent form, one of which I may keep.

_____	_____	_____
Participant's Name (please print)	Participant's Signature	Date

_____	_____	_____
Researcher's Name (please print)	Researcher's Signature	Date

Optional: I wish to receive a summary of the findings of this study, which will be available by September 2001 (approximate date) at the following address:

_____

Appendix C: Interview Guide

In every interview, thank each participant for his or her participation in the study. I will explain that I am interested in how she experiences his or her creative self-efficacy. For purposes here, creative self-efficacy will be defined as an individual's belief in his or her ability to be creative in a given situation. Creative performance is defined as the ability to produce new and useful ideas to open-ended problems in any domain of human activity.

Interview One: Focused Life History of Creative Self-efficacy

1. Thank you for taking part in the study. I would like us to talk on what has influenced the development of your creative self-efficacy. Let's talk of your experiences, emotions, or memories about your ability to be creative?

    a) How would you describe your childhood, specifically, any creative endeavors you can remember?
    b) How would people closest to you describe your creative abilities?
    c) Tell me about the experiences and memories surrounding school, classmates, and teachers in regards to your creative performance?
    d) Tell me about the experiences and memories surrounding your career path in regards to your creative performance?
    e) I would like to ask you some questions related to your creative self-efficacy.
        - What do you believe about your own creative abilities?
        - When did you develop your belief about your creative abilities? What events took place in your life to have you believe in your creative performance in this way? Did you always see yourself as creative at that time? Why?
        - How confident are you in your ability to be creative?
        - Is this belief about your creative performance something that remains constant for you? Is there anything that can affect it, either positively or negatively? Is it situational? Be specific.
    f) How important was feedback to you in regards to your creative performance?
    g) How important is creativity to you and why?

Interview Two: The Details of Experience of Creative Self-efficacy

2. Thank you for taking the time to come to a second interview. In this interview, I would like to get more detail about how you are currently experiencing your creative self-efficacy.
    c) To do this I would like you to describe a problem/issue at work recently where you needed to come up with novel and appropriate solutions to solve it.
        - What was the specific problem/issue?
        - Had you faced something like this before?
        - What were your reasons for wanting to solve this problem/issue?
        - How difficult was this problem/issue to resolve (e.g.; easy, moderate, extremely)? Why was it so challenging?

- How did the level of difficulty affect your ability to come up with solutions to solve it?
- What specifically did you do that was novel and useful in solving this problem/issue (ask them to walk through what they did step by step, and for each step ask if they believed they were capable in executing that step and what their level of confidence was)?
- Is this typical of how you solve most problems/issues?
- On what information did you draw on to solve this problem/issue?
- How did your belief in your ability to deal with this problem/issue creatively impact the outcome?
- What information did you base this belief about your ability to deal with this problem/issue?
- What factors supported or hindered you in dealing with this problem/issue creatively, and your belief in your ability to solve it creatively?
- Did you face any obstacles or difficulties when trying to solve this problem/issue? If yes, how did you handle them? How did your belief in your creative abilities allow you to overcome them?
- How confident are you that you will be able to deal creatively with other situations/tasks/problems that come your way based on your experience with this one? Please give examples of the specific situations/tasks/problems are you thinking of.

b) How does working in this organization influence your creative self-efficacy?
c) How does management support your creative self-efficacy?
d) How do you think your belief in yourself as a creative person, assisted you in being creatively productive in the work that you do? Provide examples.
e) How has your belief in yourself, as a creative person, been reinforced in the workplace?
f) How have you sustained your belief in yourself as a creative person in the work that you do?
g) How do you handle your ability to be creative at work if you are frustrated or face opposition?
h) How does the level of difficulty of the situation affect your belief in your ability to be creative at work?

Finally, at your next interview would you please bring a list of your creative achievements or creative accomplishments in all areas of your life. I am looking for an inventory of your creative achievements and/or accomplishments, e.g. any rewards, patents, working documents and feedback for your creative efforts.

Interview Three: Reflection on the Meaning of the Experience of creative self-efficacy

3. Thank you for coming to the final interview. Given what you have said about your creative self-efficacy early in your life, and given what you have said about it currently, how does this narrative reflect you and your understanding of your creative

self-efficacy in your life? Provide participants with the narrative and give them time to read it over.

a) How does the narrative capture your beliefs about what contributed to your creative self-efficacy?
b) How does the narrative capture the role that creativity plays in your life?
c) How does the narrative capture the factors that have had an impact on your creative self-efficacy?
d) How does the narrative capture what you believe as the environment's role in encouraging or discouraging your creative self-efficacy?
e) How does the narrative capture what is the role of feedback in regards to your creative self-efficacy?
f) How would you change, adapt, or revise the narrative to better describe your creative performance?
g) Any further thoughts you would like to share?

Thank you for your sharing. You will receive an executive summary of the final results of this summary.

Appendix D: Significant Statements for Ron

1. I think that I do have a good sense of creative; I do have a good creative ability. I am very, very positive.
2. I will credit some of my creative self-efficacy to my grandfather, who was a very strong influence on me; he had a very profound interest in Science.
3. I certainly credit the family members and friends that gave me the sense of, encouraged the sense of curiosity; I almost want to call it childlike, encouraging childlike wonders; being encouraged to look and question and to see the world as a wonderful place.
4. I'd even try to credit the lack of television for this; my parents did not want that in the house; I had no preconception about how I was supposed to play with my toys. There was no instruction.
5. There is a certain amount of the inventor, the creator in me.
6. It would've had to have been a Christmas present I received one year, a hand-turned generator.
7. My father was responsible for fixing things when things got broke; at about age seven or eight he gave that up and some of that responsibility became mine.
8. There were a number of things that made school very difficult until I hit about grade five or six; I had a very difficult time early on with school...in terms of my self-identity and discouragement; I had a number of confusing role models.
9. From kindergarten to grade one I was right-handed. From grade one to grade seven I was left-handed. Grade Seven a teacher sort of sized me up and said, 'you know you're really a right-handed person. Why are you writing left-handed? Would you like to try this?' So now I'm ambidextrous.
10. I decided if I can't play the game why don't I photograph the game, and so I started taking up photography, and became quite good at it.
11. As high school went on I began to branch into other areas, I did theatre, I did drama, and I did photography, my other big interest.
12. I continually have a million ideas about things; ideas about things I want to create and build. I am definitely a dreamer.
13. I would have to say that creativity is actually essential for my emotional well being, my happiness, and my job satisfaction.
14. Mostly recognition...it would be anything from pure feedback to awards I've received in the past.
15. I get the benefit of degrees of freedom; where there is a certain degree of freedom to explore within the confines of boundaries, I am pretty confident. If the rules are too tightly imposed then there's little room to be creative.
16. The strength of this was the collaboration; because it was very much a collaborative effort; using people as sounding boards, I think is one creative vehicle; I find that a very, very effective one.
17. I am very fortunate to have had very good management all throughout my years at _____; very supportive, very hands-off policy.
18. To decompose a larger problem and break it down into pieces, to more manageable solutions, solvable pieces. Which in some cases becomes the seed of an idea; decomposing and then breaking, coming up with the kernel of an idea that might work and see how far it goes. Then tear it back down again, let's try something else, and then if this kernel of an idea is just working and building up on that.
19. Situational...if I had an environment where creativity and contribution is not encouraged, then I'd have to say absolutely.
20. Feedback encouraging a person to be creative, and also, the other thing would be the environment itself. If you are interested in the work, you'll definitely be creatively contributing to it. If you don't like the work and you're bored with it you will drag yourself through the day.
21. In terms of effects of environments, certainly having people around, having hallways around, having whiteboards, has been probably the place where I found most, some of my greatest creativity.
22. I think in most cases I haven't been given an insurmountable challenge that I've not been able to meet.
23. I will be creative in this job environment.
24. The confidence or my abilities comes down to very much the ability to reach the right people; to be able to persuade the right people; to be able to present creative alternatives.
25. In a lot of cases creative solutions are really about exploring, about getting into very one-on-one conversations and really throwing ideas back and forth; pulling the best of those ideas forward, and then building on top of that, and then working forward with that. That sort of creativity is really one of playing or taking advantage or being very effective interpersonally.
26. Most of it is actually just a gut feeling. I'm a very intuitive thinker; I tend to be intuitive first. It sort of builds up a big warehouse of experience that I can lean on.
27. The amount of time that's available to solving the problem; not so much the amount of time but the amount of time dedicated to focused effort that can be directed at a problem definitely have an influence on the whole creative process.
28. If I start designing or creating something I have uninterrupted block supporting confidence; your mind get into the "groove"; you get into the groove and you go, the ideas flow and churn; it is quite often a challenge.
29. I find my greatest creativity is probably spun not in individual work; I find my greatest creativity is actually in synergizing with other individuals.

Appendix E: Significant Statements for Paul

1. I believe that there is basically no limit to what I can do and I think that's what's pushing me to doing more and more and be creative.
2. They would say that I'm always thinking about new ways of doing things, and trying always to improve.
3. If there is a problem now that needs to be solved I will tend to solve it now, right away, and not wait or stop because there's something we can't solve; like reaching any means to reach what I want to achieve or get.
4. I guess it's very important (creativity), because that's kind of a big part of my life, of what I like to do and so on. It has a big influence on what I do everyday. I wouldn't see myself in a place where you can't do anything, can't think, or cant' come up with ideas. I see creativity as being always a part of what I do.
5. I do it by calculation or really experiment on it...I think it's really persistence, going until you've exhausted every resource you have. Either yourself trying again, two or three times or by asking other people.
6. I would say under too much stress I'll still try to be creative, but this will be less productive. Because I'll make more mistakes or try to go too fast and then it's not going to work the way I want.
7. And since I came out with some good ideas at that time I don't see why I couldn't come out with good ideas on anything that was presented to me.
8. I think I'm confident that I would have found ways to solve it.
9. Interaction with those people can add to your views or different ways of seeing things. Interaction with different people, different backgrounds and cultures helps a lot. Because it open your mind to many things.
10. I am not forcing it really (creative self-efficacy), I guess the sustain part comes by itself; I guess it's partly initiative. I try to sustain my creativities to really be pro-active, try to go in front of problems and solve them. Going after those little ones.
11. If I realize that it is too difficult for me I'll find books or help.
12. Maybe I was more influenced by my dad, as a role model, he was also an engineer; he did a lot of work with his hands and he has build a lot of stuff, like building a house or part of a house, or things like that. So I guess that's part of the influence.
13. And, the other influence, I guess, is the way I like to learn. I like to learn a lot. And I've always wanted to do it myself, also, just to learn. Even if people, beside me, could do it for me I was always saying no. And, often, I was arguing with my Mom. I wanted to learn how to cook and she'd say, 'No. No. No. Move away! I'll do it for you'. I was fighting a bit for, you know, to be able to learn. So...that's what's pushing me also to be creative. Learn some new things. And try, without, without fear of doing it wrong.
14. I really had a great time just to undo things. Like, there was old TV's at my Grandfather's place and I would just dismantle that just for the fun of seeing what's inside and play with those things. I think that's how I got to be more creative.
15. I started pretty young, around 10 or 12, the first creative things I've done was when I was playing with Lego. With the really old ones I was building all finds of stuff, basically what I've seen on TV, reproducing those specials and science fiction vehicles and things like that. Even sometimes creative something that doesn't do anything.
16. They'd given me projects to work on. And it was like, interesting because it was not only just like, theoretical, it was doing hands-on where I had to build a measurement instrument. And then, use basically, the limited resources of the lab and university to build it, because basically they that kind of instrument you could buy. But, because of money and so on, they wanted the student to do it. It was cheaper, so...it was quite interesting. And that's one example where I had to use what was available and create something that, you know, they needed.
17. Trying things and not being afraid of just trying, even if it's wrong the first time. I think that 's what helps creativities. It's just like brainstorm you throw an idea and you haven't thought about all the details of the idea, but if you have confidence that you can come out with some good stuff, doing than helps.
18. But you start with the positive attitude.
19. If I do something and somebody comes and says, 'Oh maybe you could improve this or improve that.' And oops! It kind of added ideas or it generates some motivation. To, even if something works well then make it better, so, that's the... That's...the encouragement... And I think it helps. Because, if I'm pushed, I can go further.
20. I do a bit of woodcarving and sometimes instead of buying something that exist now, make something special to hold whatever.
21. I spent a lot of time at my Grandfather's farm. We changed maybe six cities (while growing up).
22. It's important that the environment is really a god source of motivation for me. There are other people around you that like to discuss problems and throw ideas at you and things like that. Also the other point I would say it's flexible. If you want to work later because that's the day that you have good ideas, being able to make your own schedule.
23. Working on something that gives results, it's really important that it will serve a purpose.
24. Take a break; just go for a walk for an hour and then come back and things look different.

Appendix F: Clusters of Common Themes for Justin

1. Belief about ability to be creative:
    a. Feels that he is really creative
    b. Never had to think about it
    c. Very confident in ability to deliver something in creative ways.
    d. Belief is constant.
    e. Have to believe in yourself first; without it would not be creative.
1. Confidence in abilities:
    a. Quite adept in finding ways to overcome obstacles in order to get things accomplished.
    b. Sometimes feel not producing creatively as others
    c. Doesn't thing level of complexity of an issue effects confidence in abilities.
    d. Gifted in science and math, but went out of his way to not be seen as a nerd.
2. Influence of the Environment on creative self-efficacy (as a child growing up):
    a. Mother had influence on his love for reading.
    b. Parents challenged him a lot and encouraged his creativity; father challenged him intellectually.
    c. Raised on farm/worked in Dad's bike repair shop; had to use creative ways and do a lot of things with limited resources.
    d. Uncle bought him Lego because he thought he was good at building stuff.
3. Influence of the Environment on creative self-efficacy (as an adult):
    a. Experience of working in a small company at the beginning of his career.
    b. Management supportive allowing people to increase their breath, provide good feedback.
    c. He had good support from his family to pursue his passion.
    d. Working in a large organization like _____ is not good to improve your creativity.
    e. Politics about technical issues is really bad for creativity to grow.
4. Influence of feedback on creative self-efficacy:
    a. Important to him.
    b. More creative when apply positive pressure.
5. Sustaining creative self-efficacy:
    a. I always try to do what allows you to use your creativity.
6. In solving problems creatively:
    a. Jump into it, find ways to get information sit and think about it, step back and look at the global view of what is happening.
    b. Remove the emotion or pressure a bit
    c. When frustrated step away and decompress.
7. Where he can be creative:
    a. Tries to get a few projects that always keep his creativity going.
    b. It's our job to be creative.
8. Role creativity plays in his life:
    a. Get pride in job, its all a work of creation.
9. How others view her creativity:
    a. Mother told him he what someone who was practical and who had emotion.
    b. Comes up with crazy ideas.
    c. Has a reputation in his group for being practical.

Appendix G: Clusters of Common Themes for Richard

1) Belief about ability to be creative:
   a) Very confidant.
   b) Remains fairly constant.
2) Confidence in abilities:
   a) Can solve any problem thrown at him.
   b) Tends to be a perfectionist.
   c) Became aware about age twelve or younger.
   d) Built through feedback and creative successes.
   e) In coming up with technical solutions to technical problems.
3) Influence of the Environment on creative self-efficacy (as a child growing up):
   a) Grew up on farm; not a lot of parental supervision.
   b) Had to make everything themselves.
   c) Parents were supportive, each in a different way, and never discouraged their creativity.
   d) Parents divorced at age thirteen, half time on farm, half in city.
   e) Mother made him go to best schools with lots of creative outlets.
   f) Dad was quite creative, always solving own problems and fixing things.
   g) In high school encouraged in science and things; was told he was creative.
4) Influence of the Environment on creative self-efficacy (as an adult):
   a) Given the freedom to do whatever I needed to do.
   b) Early career experiences where had to use creative abilities.
   c) Conducive to people having ideas and trying them out.
   d) Has been fortunate to have lots of support and opportunity to exercise his creativity.
   e) Immediate manager is very supportive.
   f) When faced with opposition will try to gain an understanding of the other person' s perspective.
5) Influence of feedback on creative self-efficacy:
   a) Has always had positive feedback; nice to get good feedback.
   b) Recognition of creative successes.
   c) Sustaining creative self-efficacy:
   d) Motivation comes from within; confidence that he will satisfy himself.
6) In solving problems creatively:
   a) Brainstorm, sketch things out, research and analyzing.
   b) Prefers to start with blank sheet of paper.
   c) Use gut feeling often.
   d) Having an idea and going with that idea.
   e) Experimental versus theoretical.
   f) Relies on information and knowledge obtained through work and solving other problems.
   g) Think about it intensely; dream about it; constantly churning in his mind; obsess about it.
   h) When frustrated tends to dig down deeper and concentrate more or walk away for a while.
   i) Inclined to take risks.
7) Where he can be creative:
   a) The more difficult the more creative he is.
   b) Designing things from scratch rather than copy other people's designs.
   c) It is his job.
   d) Satisfaction of coming up with solutions that are new.
8) Role creativity plays in his life:
   a) I do creative things all the time.
   b) Makes you who you are, different from other people.
9) How others view her creativity:
   a) Would say that he is quite creative.

Appendix H: Individual Narratives for All Twelve Participants

(1) Individual Narrative for Jim

Jim believes that he is a very creative person. Although he cannot pinpoint this belief to any specific event in his life he thinks it goes back to childhood," I think it's something I've known for as long as I can remember." In general, Jim always felt that he had a great deal of ability. "I can do anything I set my mind to...And that kind of confidence is, I guess, what made me feel different." Jim has always felt different from other people..."It's a very strong feeling for me. I was different from my brothers. I had different interests. And for some reason my interests seemed to line up with what society wanted." "I've always known what I wanted to do. Throughout school, I knew I wanted to take Physics. Whereas most of the people by the time they got to grade twelve and were finishing up and ready to go to University still had absolutely no idea what they wanted to do. They were going because it was the right thing to do." Jim compared himself to people he has met in his life "that have some special gift that they can apply." Jim felt that if he didn't believe that he was creative he would be much more hesitant to take on new tasks and it would be impossible for him to solve problems creatively.

Jim reported that the fact that he was creative was instilled at a young age. He described himself as "really, really curious as a kid, especially about how stuff worked. I was constantly taking stuff apart." He said that he drove his parents crazy by doing this but they never really stifled it, "the only thing they would say is that I had to put it back together." Jim's father had an influence on him, specifically, he was a "a very creative person as well and very, sort of science oriented." One of things he remembers best about his parents is that "they'd always answer a question, no matter how silly it might seem. And I was never made to feel that I was imposing on them by asking 'why'." Sometimes his Dad wouldn't know the answer and together they would go find it out. His parents provided a carefree environment for him to experience his creativity. "...My parents were very supportive people. And, I think, you know, I'm doing something and they'd say, 'That's very creative.' You know. 'That's very good. You should keep doing that.' Or something like that."

Another significant experience in Jim's childhood was the impression a Science teacher had on him. She encouraged him to submit a Science Fair project that involved building a telegraph. He was about ten or eleven at the time. He wasn't part of her class at the time but she really motivated him to do it. It was this positive experience that led to his science endeavors. Music was another great creative outlet in his life. "It was more interesting for me to play by ear, and to transcribe that onto notes than it was to learn for sight reading." He went on to play the French horn in Grade six as part of the High School band. His creativity also came out in poetry and writing, although he claimed that this side of him was not nurtured or rewarded as much in his English classes; it developed later in his life. Because of his positive experiences in Science and music, it was a bit of a struggle choosing whether he went into Physics or music in university. Physics won as he felt he could get a "real career" out of it and "from the beginning I wanted to know how stuff worked, and how the universe worked. Physics seemed to be providing the most answers to these questions whereas a lot of other Sciences were more concerned with the

categorization of the problems." Later he pursued a Ph.D. in Engineering, specifically Optics, "because it was one of the aspects of Physics that I truly enjoyed."

Jim described how being exposed to different things at a young age helped develop his confidence and to see things differently. When he was ten, his family stayed in the States for six months and then in Europe for nine months. He indicated that being exposed to a new culture, new language and the experience of art and history at a young age allowed him to take on new learning and expand his mind; learning for the sake of learning. He told a story about his family taking him to see the Louvre in Paris. He was amazed at the art, however, when they took him to see the Mona Lisa he couldn't figure out what the big deal was. He had appreciated the technical elements and aesthetics of the other artwork so much more; the Mona Lisa seemed insignificant compared to them. When it was time to leave, he started to cry because he had not seen the Egyptian exhibit. His siblings had had enough and wanted to go back to the Hotel. His father decided to stay behind with him so he could see the exhibit while the rest of his family went back to the hotel. His dad did many things like this for him.

When asked how others would describe his creative abilities, Jim stated, "My wife would probably say I'm just a creative person...I like to delve a lot into a lot of different stuff. I like to write poetry from time to time. I like to write music sometimes. I play in a band. She'd probably think that was a creative thing. Some people who know me in that aspect would say I was creative in these kinds of ways. Other people who know me well, maybe through work or school, would maybe say that I was creative in some ways that I tackle problems." He reported that his best friends from school might say "I tend to think about things backwards...from the wrong end, forward...and gets to interesting solutions." Jim expressed that his creative abilities can cause him problems at times. "...When asking questions I tend to tell them the answer first...and you tend to challenge other people's ideas as much as you challenge your own. And so, by doing so, it appears that you're being, kind of self-righteous to those who don't have that same confidence in their own abilities. And they feel attacked sometimes, because, you're attacking their idea in the same way that you would take your own idea and pull it apart, to find out what it is, and what's in there. So, a lot of people could find that very intimidating. And they feel that the other people are being rather arrogant." Jim acknowledged that others could describe his belief in his creative abilities as "arrogance."

Creativity is important to Jim. He saw it as "one of my biggest sources of happiness." Being creative "makes me feel that I have life. That I'm alive and that I have purpose...it's one of the few things that we can contribute as humans." He described creativity as "the root of his understanding of things." Sources of creative self-efficacy for Jim is described as "I have to have my own feedback system that tells me I am creative...feedback is definitely important...I'll be creative for my own sake in a lot of situations." By developing the ability to be introspective, Jim can sustain his confidence in his abilities. External pressures or negative feedback seldom affect Jim's creative self-efficacy. He sustains his creative self-efficacy by exercising his creativity and doing things, he likes...something that is interesting and challenging, and where he can learn. It is important for him as a first level manager to maintain his "geek time" where he has his

hand in the technical and development side of his work. Jim also experiences working in his current organization "definitely has added to my belief that I can be creative...I've been given many opportunities to use the tools and the means to do lots of different thing where I have had to be creative." Even if Jim weren't applying creativity to his job, "I'd still feel I was a creative person because I tend to use it in my personal life as well."

Jim described himself as being lucky to work in an environment where there are a lot of creative people like him; an environment where people are passionate about their ideas, ideas are batted around, attacked, argued, and yet supported. He felt that his creativity has been rewarded formally and informally. He spoke of several times where he was given freedom to solve a problem with guidance but not being controlled. His creative self-efficacy has been reinforced... "Well, there's lots of things that reinforce it, for me. So, being given tasks of importance where I rely on creative input and, having my ideas challenged. And, sometimes accepted. Sometimes rejected for appropriate reasons that I hadn't thought about. But still, it's an acknowledgment that it's a creative idea that just hadn't... It didn't have all its facets thought through." "Other things that reinforce it...Early on, I was called into meeting at quite high levels in order to participate. Not just listen, but participate. Technical discussion with people who thought that I would come in as an expert to discuss this with them." Also, his management's willingness to put Jim in position of importance has given him positive reinforcement regarding his abilities.

When faced with problems that need creative solutions Jim reasons for solving them is that he is seeking the enjoyment or challenge that they offer or he is the one who is capable of solving them. Most of the problems he solves creatively vary from moderate to a high level of difficulty. If the problem is extremely difficult for Jim he can experience his creative ability being stifled,"You'd spend your time just trying to understand the problem and you end up spinning your wheels, so to speak." When describing a problem that was between moderate to highly difficult Jim reported the affect this had on him coming up with solutions to solve it as "It actually made me put more things together. It made me think of things much more thoroughly. So that I'd... I'd examine many more situations before I... I would ever come to a decision on anything in particular. It meant that I felt I had to be that thorough. And think about everything completely differently. Because, there was so many things that it could possibly affect. And for such a long time to come." Obstacles that could get in the way of Jim solving a problem creatively could include: "Prejudice against new technologies, sometimes is a hard thing to get around...the unwillingness to do something new and untried is a natural thing in engineering, actually. Oddly enough, if you haven't done it before, you have to be that much more careful. You see, you try to be careful to pick the things that are only necessary where you do something new. It's a catch 22." Often the scope of the problem can be an issue for Jim with too many choices to make and not enough time.

When solving problems creatively he will gather input from relevant experts, tap into his experience and expertise, or read up on anything related to the problem. He will often go to an opinionated person to flush out his ideas. Intuition plays a big part in his creative process... "That's another thing too, actually. I need to have an intuition for something in order to make it... Make a judgment call on it...in order to gain intuition on

those things I must make small decisions to start with. And carry them through to the end. To see if, when I get there, is everything still satisfied? Or, did I make a bad decision in the beginning?" It is a "gut feeling based on empirical data." "You have to be confident enough to try different things. To try things out and to see, "Am I on the right track? Am I not on the track? And don't be afraid to break something along the way. You have to have that, sort of, fearless outlook where you... Where you try stuff knowing that you might break something. But, also knowing that if you break something, you can probably fix it. And, in fixing it, you've learned not just, you know, how to break it and how not to break it. You learned how it works." His experience as a child taking things apart and putting them back together is replicated in how he solves problems creatively today. Jim will experience his confidence level when solving a problem low at the beginning but will increase as he begins to understand the problem and explore how it can be solved his confidence increases. His belief in his creative abilities and belief that it is a solvable problem will lead him to a solution.

(2) Individual Narrative for Caroline

As a child, Caroline experienced her creativity as curiosity. She reported, that her curiosity came out in taking things apart..."instead of taking apart all mechanical things, I would take apart garments, for instance, Pants. They'd say, 'Oh, I would like to have a pair of pants'. And I wonder how this is made." So, I would take it apart and figure out how to sew on flaps and make buttons and stuff like that...just the act of taking them all apart and seeing how they're build and then making your own creations after that". This served as a creative outlet for her for some time. Playing and having fun, as a child, was also very important to Caroline. Because of her circumstances, she and her friends had to come up with ideas much more because they didn't have all the ready-made toys and stuff. Because she was the leader of the group, "more of a tomboy than a nice little girl" she was the one that often used her imagination to come up with games and things to do. To Caroline, this was all part of everyday life as a child; she did not see it as being creative.

Caroline also experienced her creativity by experimenting with food at an early age. It began with the German tradition of making a cake each weekend, mainly because her mother didn't like doing it and she was good at it. Later, as a teen, she and her friends would experiment with "different sorts of stuff that we could make." When Tea Rooms became very popular they would experiment with different sorts of teas and try and recreate the Tea Room experience in their homes. "Food was always part of the creative process, if you could call it that." Caroline was exposed to classical music both at home and at school as a child. She played the violin early in life and took lessons for a long time but has not continued playing.

In school, Caroline had the impression that she didn't have to work hard to achieve; she always was a good student. But what frustrated her in school was that she wanted to have the things she was learning put into context; she wanted to understand the underlying mechanisms. While she was learning a lot and doing well she was not seeing a

connection to anything. This theme, of seeing connection and wanting to understand the underlying mechanisms, seems to play out in how she solves problems in general.

Caroline's parents were instrumental in her pursuing an academic path. They both did not have higher education, however, had confidence in her being able to handle higher studies when some of her teachers felt she did not have the attention span. As a result, she went into a high school that was offered languages, Maths, and arts. When she enrolled in University, she felt that she could have easily pursued chemistry or languages. She chose chemistry. Her interest in solving interesting problems led her to completing a Ph.D. in Chemistry. Her parents would never stifle her questioning when she was a child and always gave her answers when she asked them.

Caroline recalled experiencing different perspectives when she was young when her mother brought students into the house during Christmas vacation. They would share their different perspective and experiences that awakened her curiosity. She spoke of a young American artist that visited the family several times from age five to her teens. He would always encourage her and bring different perspectives..."he just had a different way of looking at life in general...he was traveling part of the time and would always come back with different ideas." With him and some of her friends, she visited Italy, France, and Spain at age 15. She feels he had an influence on her coming to America after high school. She also experienced different perspectives through several pen pals she had from England, Marseilles, and Australia that she would write to regularly.

Caroline does not describe her approach to solving problems as creative. She thinks of creativity as being "bound up with arts." She experiences her ability to look at a problem in different ways and from different perspectives as "just sort of an analytical faculty" not something creative. Because of this definition of creativity, she does not see herself as creative now. Interestingly, she provided many examples of where she solved problems by going outside the standard, going to a different field, Mineralogy in one case, exploring all possibilities in trying to solve it. She spoke of how she uses her creative abilities most often when she is camping or canoeing; being able to deal with situations she hadn't expected creatively. She reported that people who were closest to her would describe her creative abilities as "I think that most of them would say that I'm pretty good at coming up with something. And I don't usually get stumped. And, I might not always end up with the right answer. But I, at least, I try something and I don't just sit down somewhere. "I can do this." This confidence, which grew from the support of her parents and her experience through school and work, assists her in solving technical problems in this manner.

Caroline attacks problems by changing the way she thinks about them. She most often brings in other people to help her and initially she may have to convince them that they need to look at it differently or that it is a real problem..."once you overcome that you can start looking at solutions." The red flag for her often, when faced with a problem, is that something doesn't look right. Most problems she solves are in the moderate range of difficulty. She uses her expertise to do the right experiments pursuing all possibilities until she solves it. Her curiosity helps her analyze large quantity of data and make sense

of it. At first her confidence level wavers, however, as she gathers more evidence and starts to prove to her own satisfaction that there is something wrong she feels more confident. She may go away and read something or do some research and begin to connect different things and then pull it all together to solve the problem. She reported that she was taught to solve problems by not assuming the outcome. She referred to her approach to solving problems as common sense..."Well, quite often a lot of these problems, sometimes even the very difficult ones...if you break them down into components...you try and peel away extraneous things and if you can isolate the heart of the problem then you have a much better chance of understanding what it is". This approach of breaking the problem down into little bits and looking for common elements is typical of how she approaches a problem. She feels "pretty optimistic" that she will be able to deal creatively with other problems that come her way based on her experience of solving other problems. It may take her a long time but she will persevere if needed. Caroline sustains her creative self-efficacy by having successes and through feedback/acknowledgment from others. Her creativity is reinforced through rewards and salary increases.

Caroline spoke of the importance of stimulation to support her creative performance. She reported a period in her career where she felt frustrated, unhappy which led to not being very creative. After a few years, she made a change and went into an area that was totally out of her field and experience; it was here that she felt her creative came back. It was when she realized that she could use the tools that she required before and just apply them to this area that she started to feel a lot better; that she became a lot more confident in her technical and creative abilities. Positive feedback also reinforces her technical and creative abilities. She feels that the atmosphere she works in allows her to put ideas forward with have them get shot down. Her direct manager is very supportive and encourages her to think things through. Creativity is important to Caroline in that she felt that her inability to solve technical problems creativity would lead to frustration and "forever feeling stuck" and in the end her career not going very far.

(3) Individual Narrative for Joe

Joe not only defines himself as creative, he believes he can be very creative when he knows how to use the tools related to the problem/situation/task. This is especially true when a tool becomes an extension of him. For example he stated that "I think creative is not the correct question. I can be very creative. The question is how confidant am I that I can master the tool. Once the tool becomes an extension of my head I can be creative." Joe thinks his belief in his creative abilities radiates confidence and that it gives people the feeling that they can give him a task and he'll take care of it.

Joe relates his belief in his ability to be creative to when he was around six years old. His early creative endeavors began with building Lego and drawing. His ability to "experiment without the fear" played out throughout high school and University. In high school, for example, he expressed his creativity in photography and with computers. With photography, he spoke of simultaneously acquiring the technical skills and being creative. This theme repeats throughout his career as it relates to his creative

performance. With computers, he was more interested in graphic manipulation on the screen of a computer or writing his own computer game than actually playing with the game. Another creative highlight for him during school was the "Last School Day" project where he and his friends created a Candid Camera style video of his teachers being interviewed. He described himself as the key person in coming up with ideas for this endeavor. His teachers and professors throughout school rewarded him for both his artistic and engineering creativity. His love for explaining things, the influence of his father and his drive led Joe to pursue electrical engineering.

Joe reported that his parents played a big role when it came to creative self-efficacy. His father rewarded him for "all the great achievements he made, specifically academic ones." His mother was always the person that gave him creative encouragement. She would be the one to say "That's creative" whenever he produced something. It was very important to Joe's parents that he was creative. He indicated that they gave him permission to be creative. "My being smart was one thing but creative seemed to be just a little more important than being smart even."

Another important element in the development of Joe's creative self-efficacy was his exposure to different perspectives in his childhood. As a child, he experienced regularly different activities on the weekend with his family. From age three to ten, Joe lived in Iran, but spent summers in Holland with his grandmother where he experienced a difference in culture, climate, and people. Diversity played out in terms of the difference in freedom as a child; in Holland, he was free to play on the street, whereas in Iran there was always fear of danger. Food, colours, language, his Mom being Dutch, and his Dad being Iranian also contributed to his experience of diversity. He indicated that the cultural diversity he experienced as a child helps him see things through different perspectives.

Joe's sense of himself as being creative was supported by his perception of how others see his creativity. People close to him say he is very creative. He indicated that people come to him for creative solutions. When referring to how his fiancé would speak of him in terms of his creativity he responded, "Because she sees the way I take pictures. And then, I mean, I've got a photography project, then I've got this self-discovery project. Then I've got, you know, another project on a board that I'm at...You know, so there's a lot of things going on" she sees me as creative.

Verbal persuasion and emotional/physiological states seem to be the most important sources of creative self-efficacy for Joe. For example, in terms of verbal persuasion he stated several times the importance of making yourself "believe that you are creative." He constantly reminds himself of his successes to sustain his creative self-efficacy. In terms of emotional/physiological state, he talked about the importance of being in his "zone" where you "get addicted to that thing...a state where you don't have to worry about anything...therapeutic...as though it releases endorphins in your body. You just want to live in this world. Performance accomplishments seemed to come from his successes during his post-graduate studies. He reported that he started writing up his accomplishments as a reminder of his creative performance.

In terms of how he currently experiences creative self-efficacy in the work that he does, he is continually challenged to come up with answers to problems where no one knows the answer or to come up with a different approach. Although a lot of what he does is not creative per se, meaning that it is part of the engineering discipline, his creativity comes out in how he tackles solving the problem. Often the novel, creative approach comes at the beginning in how the problem is formulated. His strength is in his ability to formulate the problem so that novel and useful solutions can be found. In solving problems creatively his confidence comes from his expertise and experience from his academic background and previous work. His confidence in the tools he is using, specifically when it becomes an extension of his thinking, allows him to experiment until a solution is found. How difficult the problem is can affect his ability to solve it. "There is a sweet spot. That is, if it's, if the problem is very difficult, I'll have a very hard time working with it. If it's very easy, I'll have a hard time too, because, it's just not challenging any more. But, there's an area in between. Where there's a difficulty, where you feel that if you stretch yourself a little bit more, you'll be able to solve it." However, he is confident that he can solve problems creatively if he can put himself into the "zone" and the tools to solve it become an extension of himself. Two additional aspects supporting his creative self-efficacy has been his manager giving him the "thought space" and resources to help him in solving difficult problems, and being able to talk with his colleagues.

Threaded throughout Joe's interview regarding his creative self-efficacy was the importance of a challenge and ongoing learning and how being driven has helped him solve problems creatively. In the problems he described he indicated that the reason he wanted to solve it was because of his ability to learn and that he was the one capable of doing it. When describing his first experience with computers he spoke of taking home the computer during a holiday and completely submerging himself in it "to build something that was cool"... to have the "flexibility to play and discover" was important to him. Being able to concentrate for long periods of time when solving a problem is important to him.

For Joe, it was sometimes hard to go in and out of being creative. Stress becomes a distracter, specifically the layoffs within Nortel and the downturn in the stock. Also, any depression he may be feeling hampers his creativity. It is easier for Joe to get into his creative "zone" when he is free of stress and distractions such as when he is on vacation, traveling on an airplane or spending a day pursuing something he loves to do. Joe reported that he can get back into his creative zone by (a) changing his environment, specifically when he is frustrated; (b) anchoring with someone who you have shared positive creative experiences with; and (c) going to a special place, such as going for coffee at Starbucks or going home to Europe. At work, being in an environment with a bunch of very creative, very knowledgeable, very hard working people, having flexibility, and receiving regular feedback to keep him on track also supports his creative self-efficacy.

Creativity is very important to Joe specifically because he believes the core word of creativity is creating. "And, for me, it's very important to create something that hasn't

been created before, at least within my field of view... It's an idea that nobody else came up with. And, it's a bit of pride in that. But, it's a bit of, I think, demonstration that you master something, to a level, that you're no longer analyzing, but you start synthesizing. You start, you understand all the pieces, now you start putting all the pieces together, like nobody else has put them together."

(5) Individual Narrative for Sarah

Sarah experienced herself as being creative as a child in the area of cooking and taking things apart and putting them back together. She was not one to be told what to create; she always wanted to do her own thing. She did not like having a rigid structure to something that was supposed to be fun. Sarah started experimenting with cooking around age six. She described her experience of cooking as "trying new things and just rearranging the familiar." She commented "I've just always been really fascinated by the idea of making things different or putting things together...that's why I like cooking...that's why I like process engineering, now". In describing herself, she reported that she was sort of a neutral person interested in everything. Sarah had not thought about how important creativity is to her before our interview, however, when she did she reported that if was important in that it affects her ability to perform at work and in making her life/environment interesting.

Sarah's parents always encouraged her to solve her own problems and gave her the freedom to make her own choices, for example, being able to choose what she wanted in terms of clothing. She reported them as being "pretty laid back people... they would just expose us to whatever they were doing." Although she reported that she was closer to her Dad, both parents nurtured her creativity. When asked about how her Mom would describe her creative abilities related to her cooking, Sarah reported "She'd say I was curious, sort of, trying new things, or I would try to do things differently sometimes. But, mostly in terms of just rearranging the familiar."

An important element in the development of Sarah's creative self-efficacy was her exposure to different perspectives in her childhood. As a child, she traveled a fair bit, and did a lot of traveling in the car visiting family members spread out across Canada and in the United States. A highlight for her was a trip to Europe around age 11 where she tried different types of foods and experienced different landscapes, different trees, different languages. After she returned from Europe, she went to German School. As a child, she also experienced going to Montessori school where she had the freedom to "work through activities and ask questions." During elementary school, Sarah was in an extended program where she got to experience many different activities, while working in a small group of 6 – 7 children. Some of her activities included hatching ducklings and making a Claymation style movie. Although she could have continued this extended program in high school she choose not to as she wanted "to be in an environment where you'd be with a different bunch of people at the same time and have more variety."

When it came to university Sarah was leaning towards something like Liberal Arts, however, she choose Chemical Engineering because she wanted to be employable. She reported that she was at home sick at the time that she had to get the Application

Form for University in and her decision to check off Chemical Engineering turned out to be a good one. She really liked the idea of working in an area where "you could work with something tangible where you can make things more efficient or finds ways for things to be modified; this was really challenging and interesting to her. She had a lot of trouble with electronics and did not find science to be particularly interesting.

In her first job after university, she was thrown into an experience where she had to learn everything fast. She got to use her creative problem solving skills on a daily basis as she had limited experience and people around to assist her. Her manager at the time would send emails back some days saying, "That's a perfect example of problem solving..." His support and the support of her team helped her gain confidence in her abilities as a process engineer.

Sarah did not report herself as a highly creative person. She struggled with the definition of creativity and reported that she never really thought of creativity as being involved in a technical career. She related creativity to visual arts. She equated the aspect of taking ideas and turning them into practical solutions as logic. She stated that she was more creative before university where she had "a more varied, sort of list of interests and stuff." Before university, she did a lot of writing but due to medication, she took for depression and the workload of engineering school she stopped and has not continued. She confirmed that university kind of stifled her creative ability. She is just starting to think about developing that part of her life again.

In terms of solving problems creatively, Sarah likes working with something that is real. The more challenging the problem the better, especially problems that are interesting and need a fresh approach. These make her want to put energy towards it and to devote time to it. If she is enthusiastic about something, she is more confident that she can work out a favourable solution. If the problem is a reoccurring one, same old, same old, she will become bored and not really care about solving it. The newness of the problem or how interested Sarah is in the problem she is trying to solve sustains her belief in her ability to solve it creatively. Positive feedback from her colleagues is also valuable to her. In solving most problems, her general approach is to deal with what happens as she experiences it. She relies on her theoretical knowledge, information gathered by other engineer's experiments, and talking directly with those who own the problem in order to come up with solutions to solve it. Although her confidence is low when she first approaches the problem once she convinces herself that, she has to do it her confidence increases. When faced with opposition she tends to persist until she gets the information she needs or back down and then try to present things in a different way, "You know, retreat, gain feedback, re-arrange, try again."

Verbal persuasion and performance accomplishments seem to be the most important sources of creative self-efficacy for Sarah. For example, in terms of verbal persuasion she stated several times the importance of convincing herself that she had to solve the problem because that was what she was here for or talking herself into solving the problem. For example, she reported "mostly I think I just have to bully myself into not backing out." Her performance on the job and getting through each problem/situation one at a time provides her with more confidence to approach new problems/situations as

they arise. She reported, "...the more I've been doing, or the more I've been dealing with, the more confidence that I have. And the more productive, or more valuable I've become." Sarah was neutral about how the organization and management supported her creative self-efficacy. She has experienced her creative self-efficacy as being encouraged but at the same time has been micro-managed. When she has been working in situations where she was micro-managed, she indicated that this didn't give her a lot of confidence in her ability to solve problems creatively.

(6) Individual Narrative for Sam

Sam was raised in an innovative environment, with limited resources, where tapping into his creativity became a daily habit. "But, in Italy, as a child, we always lived a simple life. And I think, one of the innovations, if I look back, you say, "How do you get the innovation?" It's not that you have to be; it's the situation, more than anything else. You're in a, you live in a house where we had no fridge, no stove. You didn't have, we had to light a fire every night, you know, from wood. And, whatever you had is very limited. And so, when you look at that, we had, you've got to do a lot of things. And you want to do a lot of things. You have to, you know, I think the situation sometimes, you know, it forces the imagination. That's what I think." Imagination was something that Sam did not have to force. When he took his son back to Italy, a few years ago, one of his elementary teachers commented to his son "You're father was very imaginative." By seeing his grandparents and parents, with very little, Sam learned at an early age that he had to create/innovate with what you had to make things happen. This became natural for him. Sam believes that every person can be innovative given the environment or situation and what's available to them and what they have learned in from the past. This certainly has been the case for him and has led him to believe "Well, if they did it, I can do it."

Sam recalled countless experiences of his creative endeavors as a child. "So, way back, I basically was involved in doing things. And I think, one of the things that I noticed, is I can see, or conceptualize things, and then, just jump to it. And, in my early childhood, I did quite a bit a lot. And, I did, I used to do, you know, drawings with, you know, water color. And then, I got into oil painting. And in 1960, I was twelve years old at that time, I won a contest in Rome on, you know, painting. I, what else did I do that is innovative? I remember building little gadgets, you know. One of them was. you know, how you grind wheat. And, you know, just out of pieces you can collect, you know, like we didn't have Canadian Tire, those stores like this, you know. Things in cans, and you kind of shape them and you basically, like a little machine. And so on. I remember doing that quite a bit. I remember making skis out of bamboos, you know. So, where we lived, we got snow once in a while. So, it was very dull to just sit around and what have you. So, I said, "Let's going skiing." And so, we got these bamboos. Tied them all together. Made sure that we could put our, you know, tie some shoes to it. And that was our, those were the downhill skis, you know?" Sam might not have been strong in school but he was "innovative...I always had ideas."

Sam's love for experimenting came from his grandfather and father "and it really comes, I think it comes from the family. You know, my grandfather was a very known

person in our town. He was also in America. Always looking for new things to do. And, always with initiatives, you know? Not afraid to do that and try different things. My Father, not as much, but he also goes and gets what he needs and tries something. 'I'll just give it a shot and see what happens.' So, I guess I inherited a lot of that." Whether Sam was experimenting with light in the pyramids or making alcohol, creating an Intercom or games with pieces of stone or creating contraptions to bring up water from the well, he was always up to something that required his imagination and creativity. It was Sam's ability to take on a challenge that led him to convince his high school guidance teacher on the importance of getting experience before choosing a career. It was through his first "high school Coop" experience that Sam realized that he wanted to be a systems engineer.

People close to Sam say he is creative, especially in cooking and coming up with good ideas, whether it is for some kind of event or for renovating a house. He described his recently held 30th anniversary party where he was surprised at how many people came up to him and talked about what he has taught them and of his achievements. Sam reported that he had never really thought about himself as a creative person, but rather an outgoing person. "I have never told myself, 'I'm creative' or what have you." Although he had not thought much about how confident he was in his ability to be creative he did report that "whatever I take on I usually...it doesn't take me very much to day 'I can do it or no do it'." One of the areas Sam reported that he does have confidence was in his ability to put things together where most people can't..."putting the puzzle together." He described incidences where he created visual images for people to help them understand. "But you know, and the process of, you know, understanding, seeing something. And then, knowing who can help you to solve the puzzle is an art. I think that is what was novel is to create the picture so that the people around could understand the complexity level."

Sam described the steps he took in solving recent problem creatively as "so, what I did, is I visualized, you know, the problem. I visualized how that problem could've been emulated. I visualized, I have these pieces around me. And, if you, and then he says, "If I put this and this together, you know, that should work." And I said, 'I've got those people, he can tell me about this. He can tell me about this.' ... You know, like I said... And I think, you must say, "How did that innovation come?" Well, it goes back to the childhood. What did you, what is the, what are you trying to solve? What are your constraints? We had a very complex problem. We build all this. We have no tools. No methods. How do we do that? So, we have to think out of the box. So, you go out of the box and you say, "Well, what if I do this, this, this and this? And then one thing for another one, and before you know, you get it solved. It's just like learning." For Sam, "visualization is a very, very strong thing that I use. Be it in money. Be it in solving problems." This process of visualization can happen for Sam at odd times, usually when he is driving or cooking, however it is a very important part of his creative process.

When solving a problem Sam often goes through a process of "scenario building" of where he creates a picture where people can see the interjections and uncertainties. Focusing on "the simplest way of solving the problem...breaking down complex

problems into small parts" is key for him. In solving problems creatively, Sam will rely on information he gathers from consulting with people, and looking at some literature. "... It's a combination of...there is no single resource point, you know. It's multiple, multiple clues. Multiple inputs, and what have you. And, you basically got to... Got to put the puzzle together." He also relies on what he calls a combination of "coordination theory" and "object-oriented" design in his approach to solving problems. Equally important for Sam, when solving problems, is his intuition or "gut feeling." "And I found that that gut feeling, you know, that you get, you know, I've been fairly successful. And it's being, not just... It hasn't been just in the, like you know, the playing, even in the work. And I say, you know, "That's pretty obvious, we're going to have problems here this way." And, usually, you know, within reason, I've been pretty accurate." He reported that his intuition comes from wisdom and experience "and I think it's...well, this is one of these things when you say, 'you have a small decision. You make it with your mind' and 'a big decision, you make it with your heart'." It is this intuition and his lengthy experience that gives him the confidence that he can solve most problems creatively. His ability to talk with people and speak his mind, something he learned as a child, helps Sam deal with opposition to his ideas. He works hard to cooperate and not confront when in these situations. When faced with frustration in solving a problem, Sam will often turn to sports, specifically, soccer and "just get out and get way."

Creativity acts as relaxation for Sam "I find that creativity is for me like you're escape, you know, you can, you can be everything else and you go into this world where you feel free to think." Sam reason for solving problems, at work, is often because of pride or commitment, "it's the right thing to do." Sam has been fortunate to work in an environment that offers him flexibility and the time to do things. He reported that having the opportunity to work with "a wealth of people, diverse people, with a lot of experience" has been important to him. He has mostly had good support from his managers, although there have been a few who have tried to "micro-manage" him. Feedback is important to Sam in supporting his creative self-efficacy.

(7) Individual Narrative for Richard

Richard has a strong belief about his ability to be creative and has lots of evidence to support. "I believe I can solve any problem that's thrown at me...I have no doubts about my ability to be creative." This belief stems back to when Richard was around twelve..."maybe even younger, but I wouldn't have been aware of it then." Although the strength of his creative self-efficacy lies in the technical area, "sort of engineering type creativity...where I would come up with a technical solution to a technical problem" he started and has continued to develop his musical creativity in university. He plays the bass guitar, in a band, and has the confidence to write songs, play them, and record them. People closest to Richard will say that he is quite creative, "that I do creative things all the time." "I do a lot of things that I consider to be creative...designing furniture, woodworking, playing music...a lot of things like that...and almost never does it involve formal training" Richard reported that creativity is important to him "It's what makes you who you are... I guess, it's what makes you different from other people...what you create while you're here, maybe people will remember you by."

Richard experienced his creative self-efficacy early in his childhood. "Well, the earlier part of my childhood was spent growing up on a farm. And, there was probably a lot of opportunity for creativity in that there wasn't a lot of parental supervision or guidance at the time. So, this way, my brother and I, we were left to our devices to entertain ourselves...We had our hobbies, and, all kinds of things that we would do, particularly horseback riding...building and flying model airplanes...As far as creative things, it was just basically, creating our own games and whatever things to do...We would build things all the time...tree houses...everything we had to make ourselves, pretty much...because; we didn't have a lot of money, so we couldn't go and ask our parents to buy things for us." In school, Richard was involved in Science Fair projects and making things that were "basically creative." He was encouraged by some of his teachers in Science and remembered being told that he was quite creative.

Richard experienced his parents as "very supportive, I guess, the main thing was never, you know, telling us we couldn't do anything...never discouraging us from trying to build things." Although both parents had an influence on his creative self-efficacy, each did it in a different way. His father influenced him on the technical side "My Dad is, I've always considered as being quite creative. And he always solved his own problems, and you know, fixed things in his own way...as he works on the farm, if something breaks down, he'll try to it himself...rather than paying someone to build a structure, he'll just build it." His mother had more of an influence on the artistic side "she was into painting and things like that." Richard believed that the fact that his parents divorced when he was thirteen years old, leading him to spent part of his time on the farm and the other part in the City of Edmonton, may have made him a different person today in terms of his creative abilities. Moving to the city and going to the best, schools allowed him to pursue more creative outlets and academia that he may not have experienced in the country.

Richard reported that he has been fortunate in his career to have the opportunity to exercise his creativity as much as he has had. He has been able to choose projects that involved "working on something that hasn't been done before." He also spoke of the freedom to be creative that he had experienced both as an Engineering Coop and as employee. "I guess, the first opportunity I had to be creative (as a Coop)...was working for a power company. And, I was working at a generating station. And, the, there was an electrical engineer on site. But he resigned. And, they... So, I was pretty much the only person with electrical background, on site. And they'd ask me to do some, basically, just some design of how to move some alarms from system into another. And, I went through the process of, you know, just figuring out how to buy things. And, getting the equipment in and working with all the... The electricians to... Actually, just build it. And I was... I was amazed that they let me do that. Because, I'm sure they worked it out now. I'm sure it wasn't the best, implementation. But they didn't stop me... And they were quite happy that it worked. So... So, that was... That was very encouraging, I guess." After he graduated, he accepted this job on a contract position. The lack of management at the time gave him the opportunity to do creative work and get recognition as a creative designer. "In this case, I was doing a lot more exploratory work. Just, looking at how devices could be characterized. And, I was given, pretty much, a lab for myself. And, I

was allowed to play in there. And, come up with ways to test lasers and things like that, so... So, that was... That was very good. In that, I was able to do some sort of self-motivated research. And come up with techniques to be, to measure things, and also just, prototype things."

Richard prefers to "design things from scratch rather than to copy other peoples' designs." "So that's... That's where I find the most motivation for...Or, the most inspiration for creativity. If I think there's a problem that nobody has solved this problem before. As opposed to just, you know, doing research and finding how this problem's been solved before. Because, I know somebody's solved it before. Because there's, you know, equivalent products that are around." Although solving technical problems is part of his job, he tends to select ones that interest him or for enjoyment.

In describing the steps he takes in solving problems creatively, Richard reported that he typically follows the steps of "...just sitting down and kind of, almost brainstorming by myself. Like, I'll sketch things out...crossing it all out. Redoing it again. Again, going through someone else's calculations and process... doing enough analysis to come to the conclusion that it's likely a reasonable solution... research would include looking at the literature and the papers that people had published...You go do your research and analyzing. And, hopefully, you get enough evidence to support it, I guess...for me personally, rather than spending a lot of time studying all of the possible solutions to the problem and comparing them very, very methodically I'm more inclined to choose, based on a gut feeling of what would be the, sort of, the ideal component and run with it...And then, you prepare a spreadsheet and decide the pros and cons of making a decision. It's more creative to say, "Well. What's this? What's this new thing over here? And, let's see if it works." Richard described the first part of the process as structured "But, as far as the creative process of just having an idea and going with that idea, it's not nearly that structured." Richard is very inclined to be very experiential, when solving a problem, as opposed to being very theoretical. "So, usually, if I have an idea, I would run straight down to the lab and try it. And, sort of give myself enough confidence through experimentation that it's the right thing to do. So, as opposed to, doing a lot of work on paper to... I need a hands-on approach, kind of an analysis...Rather than spend a lot of time up front. Kind of, try to figure out what to do. I'd rather go down to the lab and try different things. Until it works." In terms of Richard's confidence level for each step of the creative process he tends to be less confident in the beginning but more and more confident as he gathers more information

When solving a technical problem creatively Richard tends to rely mostly on his technical background. "Information that I guess, just knowledge that I have obtained through work and through solving other problems." When faced with frustration "part of the process as the problems get harder and harder" Richard will tend to dig down deeper and concentrate more or he may walk away. Frustration, for Richard, "typically just means that I haven't solved the problem as quickly or as easily as I had hoped to. When faced with opposition to his ideas his interpretation of the level of respect he has for them will determine how he approaches it. In cases where he has mutual respect "I tend to want to go through with them and get a better understanding of their perspective...in

order cases where there's opposition and I don't really feel the person has the background or has the basis for that opposition, then I can turn him around."

A source of creative self-efficacy, for Richard, is "confidence that's built up through feedback and through creative successes." "I've always been given good feedback, so I guess, developed more and more confidence, and that always contributes to success." Since 1995, Richard has received, every year, significant rewards for his creative endeavors. Although Richard gets a lot of satisfaction when people recognize the creative things he does, feedback is not as important to him as when he is personally satisfied with the results. "I think the motivation to start something definitely comes from within, and it's nice to get good feedback. Richard has experienced his work environment as "generally been pretty conducive to people having ideas and trying them out."

Richard's belief in his creative abilities remains fairly constant for him. "Probably the more difficult the situation, the more likely I would consider myself to be creative in solving the problem...if the problem is difficult, and I believe that I can solve it, then it reinforces my belief in my creativity." "It doesn't matter the level of difficulty of the problem, your tendency is to take an risk and to try different things to solve it...to some extent I'm pretty include to take risks on these kind of things." Richard claimed that he tends to be a perfectionist; he will think about a problem intensely until he solves it. "In fact, normally, if I'm faced with a problem, it will... I'll think of it intensely. And, even dream about it at night too. Then, I find that I can sort of solve it in sort of ram sleep or something. You know, I get kind of obsessed with the problems. And, it really bothers me not to be able to solve the problem. So, if I find a problem that I haven't got the answer to, I would obsess about it until, usually I find the answer... Just, you know, constantly in the back of my mind, it's churning over this problem. But, it's very conscious that it's going on. That it's a bit, that I'm, you know, thinking about it. And, you know, to the point where I may need to spend the night and try to put all the pieces together. But, I find that it's not necessarily logical when I'm doing that. It's... It's more like, I don't know, it's quite hard to describe. But... Things can... Things can, because you're in a half sleep state, things can change into images that are kind of unrelated."

(8) Individual Narrative for Marcus

If you asked Marcus's wife and children to describe his creative abilities, they would probably describe him as a "mad scientist" or "inventor." Marcus stated that the fact that he has a number of patents is probably the reason why they would say this. In describing his "creative relationship" with his children Marcus declared, "I just tend to be a bit, off the wall, I guess." Others who know him well would "... probably say it's... I like, that I like the big picture view...I like understanding problems from a first principal level and getting to what I hope is a solution, a problem solving kind of approach rather than, hum, it's regimented. Or, I like thinking out of the box."

Marcus reported that he became creative in getting things to work. When asked how confident he was in his ability to be creative he reported himself a four out of five. Creativity is important to him in the sense that "I like things to work properly. Like

processes to work properly. I like equipment to work properly. I don't think I... I don't like it when things are glued."

Marcus's creative abilities were supported at home and in school. At school he remembered a grade eight teacher who "was encouraging as far as being creative...In high school I had quite a good set of fine teachers. So, they were... I don't know... I'm not sure they were encouraging creativity so much as allowing us to move beyond what was the core curriculum." He was encouraged to explore different perspectives, specifically in modern physics. He experienced brainstorming about what kinds of projects to do and topics to explore. His parents supported his creativity by exposing him to clay pots, encyclopedias, baking, and piano lessons. As a child, her made various things related to fishing, for example, he made a lure and a slingshot. At school, he participated in a lot of Math and Physics contests. Marcus always knew that he would pursue science or something like that. "Well, I can remember telling my Grandmother I was going to be an astronaut or a farmer (I think she was from a farming background so maybe to please her)." So, it isn't surprising that he pursued a Ph.D. in Physics. "My Ph.D. was experimental and I got to make a lot of really erotic equipment work which was good... I probably took more pleasure out of the gadgetry. Like, getting systems to work. Rather than what I took out of the Physics stuff. It became more of an exercise in making all this equipment work together. And produce some results rather than being interested in them. The result itself "

After university, Marcus joined Bell Northern Research (BNR), "known as the best in Canada in terms of labs and equipment." He got to work in the Advanced Technology Lab solving problems that were very important to the company. His whole career has been with BNR/Nortel Networks. In this environment, he has experienced the opportunity to develop his "creations" specifically if they were commercially viable. He described his managers supported his creative ideas in a short term way "if it doesn't line up with either the current thinking or the more political aspect of the organization, then I think some creative ideas have been squelched." He has experienced managers who "have been better at shielding you to allow you to do some creative work than others...and that's the difference of those that are more long termed focused." He reported that, up until recently, that during his career he has always stood behind strong managers. This has had an impact on his belief in his creative performance. "Yea, I'm not sure I always believed it. Because I always had quite, I guess, quite, a strong manager to go through in a way, overshadowing. But, hum, I seldom got... I guess, when I moved to England, I... I did take some of that with me. Just some of the ability to, I mean, just, I guess what they call "translation" ability. The ability to make things useful to people." Marcus described the feedback he has received in regards to his creative performance as enough to make him realized he was appreciated.

In solving problems creatively, Marcus tends to follow a consistent approach with a fairly high level of confidence. Marcus describes the creative process he follows as: "The first step I try to achieve is to make it understandable for myself"...then do a little bit of technical work, playing with it, writing these little programs to calculate things ..through discussions with colleagues he finds out what people are doing now

'believe it or not, you have colleagues out there that do similar things!' ... So, you talk to colleagues. You build little test cases for... Play with it. Play with it. And, talk to people who may have faced the problem before...And probably also let my incorrect assumptions lie for awhile until I find out they're not... it gets to be a bit provocative... I'll say things like, 'I question basic assumptions'...may do a literature search." As part of the creative process, Marcus relies intuition "I get sort of a feeling...this taste for something that's...that should seem viable."

Marcus relies on his technical experience, his belief in himself and his enjoyment of making things work when he his approached with a technical problem needing a creative solution. "...Certainly my belief in my, I guess, technical ability and in my belief in what's different have driven me to be effective in a technical environment." When faced with complex problems Marcus will "go back to the very simple ideas...or...change roads" until he can see a solution or possible solution." "I mean it could be a very...very, very tough road to go, but as long as I can see the end of the road I'll take it." His belief in himself as a creative person in solving technical problems, although he doesn't consciously try to sustain it, is sustained by seeing results, having a project be successful "...I always try to choose projects which I think will come to fruition. So in a sense I'm sort of feeding back positive results to my creative process." Marcus reported that when faced with opposition or frustration in the creative work that he does he tends to move or change jobs/projects. He reported that he is less confident going forward and can get depressed if he working on something and it gets terminated.

(9) Individual Narrative for Jacques

Jacques is someone who believes in his ability to be creative both in the work that he does and in his personal life. "I'm always very creative in every aspect. I'm just...and I...remember saying to my wife something, actually, 'this should exist' and somebody did it the year after...I'm always thinking about different ways of doing things" He relates creativity to learning, which is extremely important to him. "Learning is... you learn... O.K., there is a problem that you've found one way the next time you might do the same process or, something slightly different, so that's, creativity. But you can... 'O.K. you do this and you will...' You know, do little vengeance of this little problem, and, that's the creativity, but, you know from experience. Like, Monet or any painter... they didn't work extremely good at twenty years old. They were good at thirty-five, forty, forty-five. With experience, they were having more, you know..." Jacques reported that creativity is important to him because "you're growing with creativity. You're growing and you're learning. And that's why we're on earth. Like, you're creative, you're learning. And you basically give all these informations, and all these skills to your kids, eventually." If you asked Jacques wife about his creative abilities she would say, "He's always trying to make things more, you know, simple or more complicated." He reported that at his house "... I'm creative in a sense that, I can repair everything. I admit that I'm doing some booboo sometime. But, I can do... I'm painting as well. I'm... Like, when I did my land, I just cut, get it a shape, a pretty shape."

Jacques reported that his developed his confidence in his creative abilities by "...building things, like creating things. Building things, like one after each other. Getting

experience, getting confidence." He believes that his participation in team sports when he was a teen contributed to his confidence and creative abilities. "Basically, I was basically, nominated the best athlete in my city. I was playing volleyball. I was participating in all aspects of community, in school, out of school... And, it helped me throughout my life, actually." Jacques parents influenced his creativity by encouraging him to read. He remembered going to the library every Thursday. And that led him to creating cartoons and pictures on his own. He reported that he experienced some teachers in school that gave him freedom to think.

Jacques choose to come to Nortel, after completing an Electronic Engineering degree to work in a design capacity. He choose design because "Design is always creative...there's always something that you need to do in your design. If you say, 'Oh, gee you have to do something about this or that won't work out, obviously', or, new requirements from anybody...And that's what I like, keeps me on the edge. And there you go, there's always something to learn somewhere." His true validation of his creative abilities came when he received a patent for one of his designs.

When faced with a difficult problem to solve Jacques will tend to focus on the problem only and ignoring everything else around him. He will rely on his experience, ask someone else, or read what he needs to solve it. Jacques is continually reading to provide him with ideas on how to solve technical problems. He described his reason for solving a problem is usually to learn and because it is part of his job. He reported that he likes a mixture of problems to solve – not too many easy ones that can be boring, and a tough one now and then which causes him to learn a lot. "It's like, looking at the problem, I can think about something. I'm not always sure, one hundred percent that this will work, but I will go back to the drawing board. I will say, 'O.K. That might work.' And sometimes, you're going back and you calculate further more. And you say, 'Oh gee. That won't work. So, let's do this change. Oh, that will work. There you go...because, if you're not creative, and if you have...you're focusing on one thing, it's true, you won't find it; you won't find a solution to it. So, you have to be... saying, 'O.K. that works like this, and, it's... you seem to bend towards the mathematical solution, but, there's so many things that, around a problem, that are not mathematical. They can be physics, they can be magnetics, they can be mechanical, they can be process, and they can be, all of things, in other words. That's why you have to be creative."

Jacques approach to solving problems is one of experimentation "with my own creativity...trying to do things and saying 'let's do that, let's do this'...but you have your limit because you cannot go and free running and try something completely absurd." His approach is a very hands-on trial and error approach. "You go into the base, always, always go to the base of everything. In the circuit... You always say, 'O.K. What's the simplest thing that should work?' 'This and this O.K now, what else are you going to do more in details?' Because, it can be something extremely simple, and, you don't want to waste time by, going to something very complex. And, it's actually something extremely simple outside. You have to have the big view first. And, if you're not aware of the problem, you want to have... you want to ask questions to the right people. Because they can come to you and say, 'I have this problem or that...' and, you haven't seen anything.

So, you need to understand the problem."

Intuition plays an important role in how Jacques solves problems "It's, I guess, an impression that I have, because, you're not sure until you have it, measured it. And we haven't yet, but you believe that that's the way to do it. And, it might point to at least something else saying, "That's not it. That is not the problem." At least we know. We will know so we jump to something else. But for now, this is the way for it and I know that. It's by the experience. I know that it will point to something, by, what I've seen in the past. I've solved a lot of problems, obviously."

Feedback is important to Jacques in sustaining his creative self-efficacy "You always have to, you know, make... I know I'm creative. But, it's the belief of other people around that will make you, 'Yes! I'm creative' and, it's an every day thing for me...if my manager is asking, 'Can you solve that?' Then I will try to solve this. This is really, filling me with confidence, if I can solve it... It's not money wise. It's not... It's just to see the belief in...because your managers and your peers will give you the confidence that you need. And that's important." Jacques has been fortunate to work in an environment that has given him freedom and time to pursue his creativity. He described his managers as giving him support and space to be creative. When faced with opposition to his ideas Jacques will try to explain, in great detail, why they will work or to walk away if he sees he will get nowhere.

(10) Individual Narrative for Paul

Paul is quite confident about his creative abilities. "So I think I... like, I believe that there is basically no limit to what I can do and I think that's what's pushing me to doing more and more and be creative." As far as Paul can remember, he has had this confidence about his creative abilities. People who know Paul well would describe his creative abilities as "...they would say that I'm always thinking about new ways of doing things, and, trying always to improve...What I've either already done, or... and like... also they would say, like when, if there is a problem now that needs to be solved I will tend to solve it now, right away and not wait or stop because there's something we can't solve. Like reaching the... reaching any means to reach what I want to...to achieve or to get." Paul feels that his creative self-efficacy comes by itself; that he doesn't have to force it. "I guess it's... I guess it's partly initiative I would say. It's being willing to write. As soon as somebody, management or whoever, proposes, 'Oh, we would need to do that.' 'Oops. Yea, O.K.' so, if I have a bit of time, I take the initiative and try something and come out with an idea. So, I guess, that's how I try to sustain my creativities to really be pro-active or go...try to go in front of problems and solve them...they're available there. So, you have basically the ones, which are really the program and things like that, but there are always little ones around. So, I guess, going after those little ones. So, that's how I try to sustain it."

Paul believes that his dad had some influence on his creative abilities. "So, maybe, more influenced by...by my Dad a bit, but, more like a...as a role model. So, he's also an engineer and, he's also, like, doing a lot of... works with his hands, and he has

built a lot of stuff. Like, building a house or part of a house, or things like that. So, I guess that's... That's part of the influence." "And, the other influence, I guess, is the way I like to learn. I like to learn a lot. And I've always wanted to do it myself, also, just to learn. Even if people, beside me, could do it for me, I was always saying no. And, often, I was like, arguing with my Mom. So, I wanted to learn how to cook and she'd say, "No. No. No. Move away! I'll do it for you." " No." I mean like, "Maybe I'm not doing it right now, but I'll learn it. If you do it for me, I'll never know it." So...like we... I was fighting a bit for, you know, to be able to learn. So...that's, I think, what's pushing me also to be creative. Learn some new things. And try, without, without fear of... of doing it wrong." Paul also remembered tapping into his engineering creativity as a child "And, I remember also, that like I really had a great time. Just to undo things. Like, there was old TV's at my Grandfather's place and I would just dismantle that just for the fun of seeing what's inside and play with those things. I think that's how I got to be more creative." "So, I guess, one summer... So, we had this really old skidoo...I kind of decided, with the help of my Dad, to run... run with it during the summer. So, like, what we had done, with my Dad, was basically built some kind of wheels to go in front instead of the skis. And then, ride on the slide on the back. So, it was something, you know, so coming, that you don't see often."

Although Paul did not recall tapping into his creative abilities in school he did have a positive experience in fourth year university "and so there, at, they'd given me like projects to work on. And it was like, interesting because it was not only just like, theoretical, it was doing hands-on where I had to build a measurement instrument. And then, use basically, the limited resources of the lab and university to build it, because basically they that kind of instrument you could buy. But, because of money and so on, they wanted the student to do it. It was cheaper, so...it was quite interesting. And that's one example where I had to use what was available and create something that, you know, they needed." Paul's first job out of university was working in a small company in the R&D department as an engineer. Here he got to experience creativity under pressure where he had to design new products and "eliminate the problems one by one." His first job at Nortel, where he was "lucky enough to work on the first laser for DWM," gave him lots of visibility. He got "involved by developing the module and putting it into production." He and his team got the CO award and the President award that year "for coming up with a...for quite an innovation."

Paul main motivation for solving problems is that he likes to see successful results "working on something that will give results...where, to me, it's really important that it will serve a purpose." His process for solving problems often involves "...trying things, and not being afraid of...even if it's wrong the first time. I think that's what helps creativities but not...not be afraid of just trying. So, it's just like the brainstorm... you throw an idea and you think it's really...you haven't thought about all the details of the idea you just throw it, but, so I think, if you have confidence, that you can come out with some good stuff, doing that. That's... that helps." Paul will often do a lot of experimentation and calculations, manipulating the problem to find a solution. If a problem too difficult for Paul to solve he will go for help or try to find books that can help him. His confidence level will go up as he goes into more detail of figuring out if an idea is the right one.

Paul tends to solve problems with persistence "I think it's really persistence, yea. Going until you've exhausted every resources you have like, either yourself, trying again, two or three times, or, asking other people. That if you're really at their road block, then asking somebody to say, 'Look. I've done this. And, if you see something that I could've done wrong. Or...' So, either, I would say, yea. Either you've exhausted all your resources or that, the time frame that you had to come up with something." Paul pointed to his attitude as being important when solving problems "But you start with the positive attitude and so you hope that something, important people are...need this." Paul feels very confident that he can deal with any problem based on his attitude and experience. "And, since I came out with some good ideas at that time. I don't see why I couldn't come out with good ideas on anything that was presented to me." However, when under too much stress he will still try to be creative, but will be less productive. Too much pressure will cause him to make mistakes and not think right. When frustrated walk away, do something else, and then come back to it.

Feedback and working in an environment that supports his creativity is important to Paul "because it really motivates me. So, if I do something and somebody comes and says, 'Oh you... maybe you could improve this or improve that.' And oops! Its kind of added ideas or it generates some motivation. To, even if something works well then make it better, so, that's the... That's...the encouragement... And I think it helps. Because, if I'm pushed, I can go further." The support that Paul has received from management to come up with different ideas as also been encouraging to him; having the time, money and being rewarded for his work has been important to him. He believes that he has been able to work in an environment that stimulates his creativity.

Creativity is important to Paul "because that's kind of a lot, a big part of my life...of what I like to do and so on. It has a big influence on what I do every day and why, I guess, it's.... Yea, it's because it's really part of me and part of my every day...every day life. I wouldn't see myself being in a, I don't know if that place exists. But, some place where you can't.... can't do anything. And can't think or, can't come out with ideas or, you think about stuff and, you say, 'Maybe I should do this. Or, maybe I should do that'... No, no. I mean, not up to now I guess, I can... the other, the rest of my journey is when I retire, or, I see myself as being, you know, a handyman. Or having my workshop and things like that and continue, basically, creativity, but, as a hobby. So, I see creativity as being always part of what... What I do." Paul feels that the interaction that he has had with "different people, different backgrounds, and different cultures" has helped opened his mind to many things. "So I think, with interaction with those people, you can add to your... already to your views. You had other kind of I wouldn't call them tools, but, more like, ways of being more creative or seeing other things."

(11) Individual Narrative for Justin

Although he had never had to think about it, Justin reported that he has a strong belief in his creative abilities. "So I feel that I'm really creative, but I always keep the practical approach in my mind...I am very confident in my abilities to deliver something using creative ways." Justin reported that he has a running joke with his wife "If I say,

'Caroline, I have an idea.' She just says 'I don't want to hear about it.' She knows sometimes I come up with some crazy ideas about, like, I'd like to take a wall of to increase the room to our bedroom or things like that." Justin's practical approach to solving problems is what he is known for at Nortel "...Because, you always make sure that you're changing your way of thinking. I'm all... I'm always... I'm more practical, and I think my reputation in the group is that I'm someone who is really practical, like, 'Give Justin a goal or objective to achieve and let him find ways to achieve it. He'll come with something and meet the deadline... So, I'm all this reputation." Justin believes that his belief in his creativity affects it greatly "because without it I would not be creative. You have to believe in yourself first" He reported that this belief is something that remains constant for him; however, there are assignments or projects that he may have that will not require his creativity. For Justin, it is important that "I always try to get a few things that always keep my creativity on the, you know, working!"

Justin's belief about his creativity goes back to the environment he experienced as a child and to high school. "I remember my mother was saying that I was someone that was very practical... I guess, it's the way I was...I was raised by my parents. Like, always reading. And always... my parents challenged us a lot about... I remember my... when I was eight years old, my father... I sat with my father, and he explained to me how the... how the political system was working with deputies and so on, and he always... intellectually, he always challenging me." Justin reported that his mother had an influence on his love of reading. She worked in a library and would bring home boxes of books that Justin remembers "reading up to six in the morning." Justin also recalled his uncle, who would buy him Lego blocks each time Justin came to visit, as also nurturing his creativity. "And, he was always buying me that, because, he found...he found that I was really good at building stuff. He always told me that I would always do a mechanical engineer or an engineer. But, so, he...they were really impressed, like I was building a tower, a Lego Block tower that was up to the ceiling. So, and I was maybe seven or eight, right? And I was spending all... I was going to bed at two o'clock in the morning, only working on that, right, and they let me do it. Because, they said, 'Hey! It was good.'"

Justin grew up in a small town in the north part of Quebec. Because of limited resources, he had to find ways to solve the day-to-day problems that he experienced working on the farm and in his father's bike shop. "So, I remember since I was, maybe eight years old, we were... I was involved in this shop. So, every night... in fact, in the spring, when people were putting their bicycle in shape, we had to work very early in the morning before school and after. So this... I think I learned a lot there, how to... You know, my father was a... he was raised on a farm so; he was doing a lot of things with not a lot of resources... But, you also have to learn how to be resourceful... It's how to do stuff with... how to come up with an idea..." Basically, Justin, like his father, was someone who was quite adept in finding ways to overcome obstacles in order to get things accomplished, usually without the help of someone else. No matter what, he will find whatever he needed to get the task done without going out and buying it.

Although Justin was a gifted student, specifically in math and science, it was important to him that he not be labeled a "nerd." In order to avoid this label Justin would

play practical jokes and clown around. "So I had this reputation of the guy that...a little bit of a clown." He played out his creativity in his humor and pranks "I always find new resources to...to do those things." It was also important to him that he was different from his brother, who was very strong academically and went into medicine. Justin also felt he was somewhat different then other kids in his small town because he got to travel a lot to Quebec City and Montreal where he "was a little bit more exposed." Justin was a gifted athlete in hockey and wanted to invest more time in it until his father stepped in and told him if he neglected his studies, he would lose his support. He studied science in CEGEP, while still trying not to be tagged a "nerd" and then went into Electrical engineering "So, I decided to go into electrical engineering. I think it was my decision... when I decided to go...I did it, I had quite a success. In fact, I have to admit I enjoyed that, and I enjoyed the class. And, I still enjoyed my job today. So, I think I made a good decision at the end." Justin reported that originally he went into engineering not really knowing what he would do after her went "and I was more of the type of guy (again different from his brother) that let myself go with the waves..."

Justin had a chance to experience his creativity in his first job out of university. He worked with a small firm where he had an opportunity to do the roles of R&D, marketing, customer service, and he got to travel a lot to the US. "There, we had to use creativity all the time, because, we were very small. Again, it was a small company, we did not have a lot of resources." He recalled a tough problem that required his creativity "...and it was the first system that we deliver in the field. It was a 911 system. So, it was a really life critical system. So, they had some issues in the field in New Jersey. So, I had to go there and find the problem there, right? And, it's very technical. But, I had to...to write a lot of... well, we came there and we had we had no information to find what is the source of the problem. So, I came back to the office, and, it's been like a week, maybe three or four days, working almost twenty-four hours a day...and to bring some tool... to write some tool. And, I went back there. And, I put my new software in the box. And started to look at the tool. And, finally, in fact, I slept... well I, I spent like two...because, it was a problem that did not happen often. So, it happened like twice in the, at night, something like that, the 911 service. So, I slept in front of the box, right, waiting for the call but with the tools, my nature to find out the issue. And I came back, and, I basically had a "carte blanche." So, I had...the company presented me... 'You have two weeks to fix that. Do whatever. If you have to travel every day, do it.' So I managed to... to find it, fix the issue." After about nine years with this small company Justin joined Nortel where he felt that he experience he gained from the small company has benefited him tremendously. "...Based on the experience I have on the farm and so on I had abilities to find creative ways to find solutions of trying to influence something. But, working in this small company, this small company, every afternoon, I have improved, this, a lot, this approach."

Justin reported that in the job that he is in he has to use creativity everyday. He takes pride in solving technical problems. "And, that's basically why I like, I like this job...it's challenging, and when you can fix something like that, it's, you know... I'm proud of it." Justin described the process he uses for solving problems creatively as "One thing is that, I always go through those phases, typically, if we're talking about creativity for fixing issues. Because there is... I feel, that there is some other type of creativity, like

when... like, gradually I'm working on a feature where I have to think about new things. So, this is not the same type. But, creativity, when you're under pressure and you have to fix an issue, I would say that always go to the first phase where I... where you try to do it fast, and, you trying a quick fix. And, that one... And you lose track of all the manipulations you've done. And, typically, it's when you say, 'O.K. stop now think about it. Sit and think about it.' And take a step back and look at the global view of what is happening... and, the system you are really focusing on... And when I do this...this step back, that's where I... that's where typically, that I can find ways and I can become more creative... It's like... Like if you have to remove the emotion, or remove the pressure a little bit, and think about, more...to be at a more cold approach." The ability to persevere and focus is Justin's creative strong points. Justin feels he can be more creative when he has a little bit of pressure. "So that's maybe the part that... that it's good to have a positive pressure...you need pressure but, you need it to a certain limit. If you cross this limit, I think your creativity starts to decrease." When frustrated with a problem Justin will step away and decompress; he will often watch a movie.

Feedback is important to Justin to sustain his creative self-efficacy. "I know, every time I... I've got comments of my parents, of my friends, they say, 'Yea this is a good idea' and so on, of course, it gives you confidence." "Because, you would get a lot of feedback for the... 'Oh, yea you did a good job on that' and that... and after that, you get a little bit, alone and you say, 'O.K. you are creative' you know, it's certain variation. But, you know, it's certain variation on a constant line." Feedback from his managers has also been important to Justin. Also, having managers allow him to move and to explore different interests has supported his creativity. Justin believes that if he didn't receive the support from his family he could not express the level of passion he needs to do his job. Although Justin felt his creativity was supported at Nortel, he felt that because they were designing a complex product that it was "sometimes hard for people to really be creative when they focus only on a really small piece." The fact that sometimes you do not have all the information makes it difficult "to find a creative way to do something with a system."

Creativity is important to Justin "because I, to get some pride of my job. Because I'm, I think, again, not helping me to be creative, to know, to implement new stuff and to create new stuff, so it's all a work of creation...so, it's really important... for me, it's really important to get some pride for my work. I'm a little bit... I have some passion for what I'm doing. So, this is one aspect. And, the other aspect...inside of me, and in my job, I'm happy if I'm learning new stuff...or if I'm not learning new stuff or if I'm not creating new stuff I don't feel that I'm contributing. I don't feel... it's maybe related to the first one, but, I don't feel pride...proud about my job."

(12) Individual Narrative with Raymond

Raymond tapped into his creativity at a young age. "I was very interested in building various things. I always thought, maybe, my Father an influence because, he worked at, around engines and his job was with Avro Aircraft. There were a lot creative things going on there. But, I think that it was just as much that I was, just had a basic

interest in certain things. So, I built...I built little air engines. And, little machines that would drive across the back yard, things of this sort." Another example of his creative endeavors was "I was interested in. It just sounded like fun to me, to build... You know, I built like, a steam engine. And I built a steam boiler that ran the steam engine. I used compressed air from my Dad's pump, you know, that he had for pumping tires, to power some of them. I had one with a very, very long plastic tube that would run all the way out into the back yard, in the spring, when it was all filled with water. And, it would drive itself through, through the... This water filled area in the back of my lot." He described his Dad as a sort of a handy man. He did things around. And, I suppose, I'm pretty sure, I know I was impressed that he could do various things. Like, he could decide he wanted to do something, and go ahead and, you know, make some...Some part that he couldn't find. To fix the car or, you know, things of this sort. Where I... Well I seem to recall... Or toys I had, that I had broken. He always found a way to fix them. And very often had to make up a little piece or something to do it, so. I think that... I thought that was interesting."

As a child, Raymond did a lot of different things with his family. Every summer they traveled to a different place. They went to baseball and hockey games, visited friends, went on picnics; often they would just go somewhere for the fun of it. During his childhood, Raymond was always interested in the nature of the universe and practical devices and how they worked. When asked when he developed his belief in his creative abilities Raymond reported, "Well, I have... I remember even way back... But I, the things I was talking about when I dealt with these various devices and things. My aunt or my, you know, various relatives would... would comment very often. Because they thought it was, "It's amazing you can do that! You're only eight years old." or something like, you know, this kind of thing."

Although Raymond participated in activities that were creative in high school, such as photography, stage lighting, and amateur radio, it was in university that Raymond got to experience his creative self-efficacy further. Raymond knew by the end of high school that he wanted to go into engineering. In university, he experienced a much freer environment to experiment and create. "And so, we did all kinds of things. We'd come into certain Science labs early, you know, like an hour early. And do some, some little... Set up some little gimmicks. Or, do something that we wouldn't expect we'd probably get away with doing normally, you know?" It was also in university that Raymond got to experience car rallies both as a navigator and driver. After university he worked as part of a racing communication organization, and then joined a small company, owned by one of his friends, "because they were doing all kinds of interesting things." Several years later, one his professors pushed him to join a larger organization where he could be more challenged. "One of the other professors that I mentioned. A young professor from the Ukraine, I think. His name was Yukatinski who always impressed me very much. Really was after me. He knew I was working there. He said, "You've got to try to do something more challenging." Like, he didn't think it was... It was quite... It was quite good enough. And, he actually phoned around. He actually got me in an interview with BNR." Raymond has been his entire career at Nortel.

Creativity is important to Raymond because "you can break through barriers and

make big steps forward very often by taking the creative approaches to something and getting something that is efficient and practical." For Raymond, the work he does is very technical, where novel solutions are needed, and he feels this is where he can make a contribution because of his creative talents. Raymond has a strong belief in his ability to be creative in the work that he does "especially recently, I mean, in the past several years I've been working on a relatively high end area of optical devices." Raymond sustains his belief in his creative abilities by continually experimenting and making improvements to the products he is working on. "I guess first of all I've certainly tried to move forward. Even when it might've not have been a clear to try to make... prove this, you know to...like, presume there's going to be another generation, and actually have prepared in advance key aspects of it." Feedback is important to Raymond in terms of seeing success "One of the forms of feedback is that, you've done something and it's been quite successful. Another thing is, you've done a number of things, for example. And they've all been reasonable successful. It starts to give you quite a bit of confidence...it seems rewarding to do something that you are good at or that you're successful at. And that also is, maybe important. You feel is significant."

Raymond reported his process for solving problems creatively as "where you really had to, almost in some case, you had to totally break your former way of thinking. And, try something completely unconventional. Or... Or just, wild, you know? You'll see something useful in some of those wild ideas. And then, be able to build them into something... Because, you very often find that, some ideas that are very, like wild thinking, if you like, in one field, are very common in another field ...(involving others) It's very useful. It's sort of the same as, in a way, as going outside to other areas. But... But, to go and just discuss it with someone else who you think is, likely to have something to add." Raymond relies on "past experience in the design of circuitry, in general" when solving problems and "...like, one of Newton's laws, I'd be much happier to start with a couple of more basic things," he tries to synthesize the solution from the basics. Raymond will often rely on his intuition to solve problems "...or, there are aspects of it that you just don't have enough information on. And you... And you take a bit of a risk. You have a bit of a gut feeling that, you know how it works. And it's going to be fine. And, then, the fact that... And then, when it does work out. Well, most of the time." "Your mind just, without much effort or thought, your mind just sort of sort of sees the answer or sees a lot of things related to the answer."

Raymond described how the level of difficulty of the problem affects his ability to solve it as "...Sometimes it, you know, just the fact that it's really difficult means that it's equally more valuable and, so it draws you to try even harder...On the other hand, sometimes, it's... like, with the example we talked about, you feel pretty confident that you can make headway without too much effort. It draws you to just... to just getting on with it. Try to enjoy doing it. Doing the process, you know... And, I think it's important to have the right viewpoint to change your mind. Because, you find it's more difficult than you thought... your approach depends on how difficult you thought it might be. And, therefore, you better be ready, if it seems to change... If it seems to... if it's harder than you thought, you better be ready to, you know, change your approach a little bit." When faced with an extremely difficult problem to solve Raymond reported, "I think you

have to... first, you have to, sort of, set aside enough time to really have a longer interval of just like, unbroken consideration of the problem. And, maybe just have some imaginations about some things that might... maybe from other fields or whatever, that might have some aspect of them that's related. So, you could maybe go just do some reading on other, other areas, that might've had something." Raymond doesn't usually have trouble coming up with solutions for a problem but often what hinders him is zeroing in on which is the best one. When frustrated with a problem, Raymond will often "run off and try to, you know, take a break or do something else totally different for awhile."

Raymond has been fortunate to work in an environment that allows him to experience his creative self-efficacy. I think in general... It's helpful to be in Nortel because, there's the... there's more of a... I think there's more of an opportunity to spend time on creative things. Because, there's more slots for people, to do jobs, and so, it's easier for you to find one that fits the kind of thing you like to do. And, they also recognize the perks of a lot of these innovative things, so...there's a lot of support, in general. I mean I'm given lots of time and flexibility to work on things of this, I mean, I'm not hounded very much to give reports, and conferences...or, hour by hour, my time, I'm given lots of flexibility...I think by me being given some major, some very major and important, you know... given a lot of responsibility for some major and important projects...being treated with a lot of respect...being treated as perhaps, the expert, or the most knowledgeable person on various aspects of things." When faced with opposition to his ideas Raymond reported, "Well, I try to... certainly try to proceed with your main beliefs, anyway, If that's possible. Also, I'd try to convince, other people. If they have some kind of opposition, we try to convince them of your viewpoint...if you think it's the right one, or the better one...there's not too many things... You know, you don't, necessarily let other people stop you, just because they have some opposition."

Appendix I: Composite Narrative (Textural): Experience of Creative Self-efficacy

Research participants generally believed in his or her ability to be creative in the work that he or she do, and for many this extended into in his or her personal life. Many participants believed that he or she could solve any problem that was thrown at them creatively; solving problems creatively was part of his or her day-to-day job and what they were hired to do. For some participants his or her belief in his or her creativity greatly affected his or her creative performance. "Because without it I would not be creative, you have to believe in yourself first." For certain individuals, however, he or she did not see his or her approach to solving problems as creative. He or she thought of creativity being "bound up with the arts" and his or her approach of taking ideas and turning them into practical solutions as logic or "just some sort of an analytical faculty", not something creative. Interestingly, when participants were asked how others, who knew them well, would describe his or her creative abilities all reported that he or she would be described as creative in some way.

Although participants could not pinpoint to a specific event in his or her life that led to creative self-efficacy most linked it back to childhood. Many research participants reported that he or she developed his or her confidence in his or her creative abilities, as a child, by building things or getting things to work, while a few participants contributed it to the limited resources available to them while he or she were growing up. "It goes back to the environment, to what you had available, doing a lot of things with not a lot of resources...in doing so you create, you have to be innovative." Many participants related the experience of being really curious about how things worked and how he or she would take things apart and put them back together to get them to work again. For some participants, "trying new things and just rearranging the familiar," whether it was experimenting with cooking or making something to play with, was what fascinated them as a child.

Family, friends and teachers also played an important role in the development of his or her creative self-efficacy. All participants reported that his or her parents played the most significant role in terms of providing the support and encouragement to be creative. This took the form of: giving them the permission to be creative; always answering a question, no matter how silly it was; creating a carefree environment to experience his or her creativity; never discouraging them from trying to build things; encouraging them to solve his or her own problems; saying things like "That's creative"; encouraging them to read; and/or exposing them to different perspectives. Several participants experienced his or her father as having a significant influence on his or her creative self-efficacy. The fact that his or her father was creative and/or science oriented or that he or she were always solving his or her own problems and fixing things in his or her own way, had a positive influence on his or her creative self-efficacy. For others, it was a relative, often a grandfather, who acted as a creative role model or encouraged them to pursue his or her creative talent. Some participants described a Science teacher who told them that he or she were creative and encouraged them to exercise his or her creativity by participating in Science Fairs. Unfortunately, not all participants found the

school environment supported his or her creative self-efficacy. A few participants felt that the structured school environment had no impact or a negative impact on his or her creative self-efficacy.

Another important element in the development of creative self-efficacy for many participants was his or her exposure to different perspectives. Several research participants' experienced traveling to other places, for example, to another country or to places where his or her neighbours wouldn't commonly go, where he or she experienced different cultures, languages, climate, and people. For certain participants specific events in his or her life, such as, moving to the city from the country or a remote location; having visitors from another country; participation in team sports; not having cable television; or working for a small company early in his or her career contributed to who he or she is today and to his or her creative self-efficacy.

Sources of creative self-efficacy in the participant's adult life have been through performance accomplishments and in some cases verbal persuasion. Feedback and creative successes, which often began in university, have provided them with more confidence in his or her creative performance. "I've always been given good feedback so I guess I developed more and more confidence and that always contributes to success." Good feedback from managers and peers helped participants realize that his or her creative performance was appreciated and that he or she was creative. Several participants reported receiving rewards for his or her creative endeavors that has contributed to his or her creative self-efficacy. However, for some participants, getting feedback was not as important as being personally satisfied with the results or having done something and having it be successful. "I always try to choose projects which I think will come to fruition; so in a sense I'm sort of feeding back positive results to my creative process." For certain participants, having his or her own feedback system that tells him or her to be creative acts as a source for his or her creative self-efficacy. "I have my own feedback system that tells me I am creative; feedback is definitely important, however, I'll be creative for my own sake in a lot of situations." A few participants expressed creative self-efficacy as coming by itself and not having to force it.

Participants, in his or her adult life, felt the environment he or she worked in was an important factor in relation to his or her creative self-efficacy. Many participants felt that he or she were fortunate to work in an environment where there were lots of "creative, knowledgeable, hard-working people" like them and where there was freedom to pursue his or her creativity. The opportunity to use the tools and the means to do lots of different things where he or she has had to be creative has added to his or her belief that he or she can be creative. Several participants described his or her managers as being supportive offering them the time, resources, flexibility and "thought space" to be creative. However for some research participants', managers who "micro-managed" them or were too political or short-term focused, had a negative effect on his or her creative performance. Another negative impact on creative self-efficacy, experienced by some participants was stress or depression. The reasons for the stress or depression varied from experiencing too much pressure or frustration with the job or project or the impact of the recent lay-offs and economic downturn or having to work in a reactive environment. In

these cases, participants described getting out and taking a break or changing his or her environment or how he or she is looking at the problem/situation as a way to overcome the stress or depression.

A wide range of participants' experiences were described in relation to how he or she sustain his or her creative self-efficacy, from developing the ability to be introspective about his or her creativity or how interesting or challenging the problem was to solve or by continually experimenting and making improvements to products he or she are working on. In general, participants expressed the importance of the enjoyment, challenge, and learning as reasons for why he or she would solve a technical problem creatively. Similarly, the importance of creativity in the participants' life varied from acting as an escape or taking pride in creating and solving problems creatively or affecting his or her ability to perform at work. For several participants, creativity was important for them as it served as a big part of his or her every day life, making them feel happy and alive, making up who they are as a person, and perhaps somewhat different from other people.

Most of the problems participants solve creatively range from moderate to a high level of difficulty. For some participants, if the problem is too difficult his or her creative ability or motivation to solve it can be stifled. "You'd spend your time just trying to understand the problem and you end up spinning your wheels, so to speak." For others, when faced with complex problems it means putting more energy into it and possibly going back to the basics. "You go back to the very simple ideas or change roads...I mean it could be a very, very tough road to go, but as long as I can see the end of the road I'll take it." For some participants it means, "retreat, gain feedback, re-arrange, try again" or to "to take a risk and to try different things to solve it." Most research participants described his or her confidence level when solving a problem as low at the beginning but increasing as he or she begins to solve the problem and explore how it can be solved.

Although approaches to solving problems creatively varied slightly among participants, there was a lot of commonality. Specifically, many participants relied on their theoretical knowledge or technical expertise, information they gathered from their peers, experts or the literature, and/or talking with colleagues to flush out ideas as part of the creative process. Second, he or she will often focus on the simplest way to solve the problem, making it understandable for him or herself, and often involving breaking the problem down into small, manageable parts in order to solve it. Next, the process of experimenting was common amongst participants. This could involve brainstorming ideas on his or her own or with others; or trying things out and not being afraid if it fails or breaks; or playing with it, writing little programs to test it, making calculations or sketching it out, and/ or manipulating the problem to find a solution. During this time, he or she may talk to people who have faced the problem before or who can help question assumptions about the problem. For certain individuals changing the way he or she thought about the problem or trying something completely unconventional was part of his or her creative process. Several participants relied on his or her intuition when solving technical problems. Intuition takes the form of a "sort of feeling" or "gut feeling" on how to proceed in solving a problem or about which way to go or what to try. They reported

that this intuition comes from experience and past successes in solving problems creatively.

Several participants, in regards to his or her creative self-efficacy, described persistence and the ability to concentrate. Many participants described experiences of focusing on the problem only and ignoring everything else or thinking about it intensely, often becoming obsessed about it, dreaming about it at night or to visualizing the problem while doing something else. "In fact, normally, if I'm faced with a problem I'll think of it intensely, and, even dream about it at night too. Then, I find that I can sort of solve it when I am half asleep or something. You know, I get kind of obsessed with the problems. And, it really bothers me not to be able to solve the problem. So, if I find a problem that I haven't got the answer to, I would obsess about it until, usually I find the answer... Just, you know, constantly in the back of my mind, it's churning over this problem. But, it's very conscious that it's going on. That it's a bit, that I'm, you know, thinking about it. And, you know, to the point where I may need to spend the night and try to put all the pieces together. But, I find that it's not necessarily logical when I'm doing that." Many participants described how they solved problems through persistence, not giving up until the problem was solved, even if it take a long time.

Appendix J: Composite Structural Description: Experience of Creative Self-efficacy

Leading a creative life, both personally and professionally, is important to us, bringing us a sense of internal satisfaction and enjoyment. This creative life contributes to our belief about our creativity and this has built confidence in our ability to tackle problems creatively. If we did not have this belief in ourselves, we would not be creative. We are not sure if we have always thought about our creative self-efficacy at a conscious level, it is not something that we have really spent time thinking about it, it sort of percolates at an unconscious level; it's is just part of us.

We would have to say that we developed our creative self-efficacy somewhere in our childhood, probably between age four and twelve. Our confidence grew from the very act of making things work, of rearranging the familiar with limited or self-created resources. The support and encouragement we received from our parents, family members, friends, and in some cases teachers added to this confidence. Our father or grandfather was an important figure in our life serving as a role model for us. Our mother contributed to our creative self-efficacy in a more subtle way. Being exposed to different perspectives or specific events, as a child, also contributed to our creative self-efficacy.

The carefree environment to experience our creative self-efficacy we were exposed to as a child continues to be important to us in our work life. Working in an environment where we are given freedom and "thought space" by our managers to be creative, and having creative, knowledgeable people around us encourages our creative self-efficacy. Equally important, our creative successes and feedback act as a source for our creative self-efficacy. The strength of our creative self-efficacy remains constant even in the face of adversity caused by external pressures in the environment.

Solving technical problems creatively is part of our job. The creative part is to use novel or new approaches to come up with practical solutions to the problem we are trying to solve. We may start off with low confidence when we first start to solve the problem, but as we start to explore the problem and see a solution forming our confidence goes up again. We are quite confident that we can find a solution to any problem we face. This confidence in our ability to solve technical problems creatively goes back to our experiences and the training we had in making things work, and to the creative successes we have had throughout our life.

Our approach to solving problems creatively does not have any rigid structure or is formal in any way. It is one of experimentation, breaking down the problem into smaller problems, almost like a puzzle. We may brainstorm and generate ideas on our own or with others. We usually talk to colleagues about the problems, seeking the information we need. We rely heavily on our intuition or gut feeling, which is supported by our past experiences and successes. The very act of re-arranging, manipulating, re-jigging the problem so that we come up with something different that creates the output to be creative or unique is something we do, an act that has followed us from my childhood.