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DEDICATION

For my mother, my sisters, and all who have believed in me,

especially my guide

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ABSTRACT

Creativity has attracted increasing interest over the past seven decades. Scientific researchers from numerous academic fields as well as business managers, creativity practitioners and educators, are all interested in the subject of human creativity, its stimulators and inhibitors. Such interest is based on the belief that creativity is a motor of innovation, a key factor in future development of humanity. It is thus also believed that if we are able to understand the underlying factors that enhance human creativity we can design training programs to help employees and future generations to reach their full creative potential to the benefit of the entire humanity.

The purpose of this dissertation is to examine the effect of training on creative performance. Training has been long indicated to have the potential of enhancing creative abilities. As result many creativity training programs have been developed by organizations and educational institutions alike (Sawyer, 2006). Yet, the empirical evidence regarding the effectiveness of creativity training programs is limited to few such programs. Rather than being focused on the effectiveness of specific training programs this dissertation is centered on the effect that the delivery format may have on the creative performance of groups that have received creative training. This way the researcher seeks to ascertain whether the way in which creativity is taught to trainees affects post-training creative performance. Specifically this study examines the effect of two such formats namely lecture-based training versus an experiential-learning

approach. In addition, the study also examines the effects that the type of problem (real-life versus fictitious) may have on creative performance.

One hundred and nine groups of employees of forty five Spanish companies (981 participants overall) participated in different training experiences conducted to ascertain if and how the aforementioned factors (type of training and problem realism) affect creative performance. Each group was submitted to a specific training experience and group creative performance was measured by using three measures: fluency, originality, and elaboration of ideas produced. Statistical analysis of performance differences between each training experience and each measure was conducted using Student's t-test and analysis of variance (ANOVA). Results of the data analysis reveal a positive effect of training on creative performance and also showed that training based on experience is better suited for creativity training. In addition the empirical results also reveal that working on real-life problems as opposed to fictitious ones, enhances creative performance.

The contribution made by this study to the field of creativity research is twofold. First it provides additional empirical evidence regarding the factors conditioning the effectiveness of creativity training. Specifically, the empirical application looks at training delivery method and task realism. These factors have been under examined by previous creativity research literature.

The empirical findings of this study indicate the existence of a relationship between training delivery method and post-training ideation performance. Specifically, ideation performance is enhanced by training delivery based on experiential learning. The groups that received this type of training generate more than twice as many ideas as the groups that received no training (9.07 vs. 4.34) and almost three times more ideas than the groups that received lecture-based training (9.07 vs. 3.67). In comparison to the ideas generated by the groups that received lecture-based training, the ideas generated by experiential learning groups received superior rating scores for originality and elaboration. In addition, a relationship was also established between problem realism and post-training ideation. The groups that worked on solving real problems and were trained through experiential learning rated higher on the degree of elaboration of the ideas generated than both lecture-based trained groups (3.47 vs. 3.39) and untrained groups (3.74 vs. 3.47). Experiential learning groups also produced more ideas and were rated higher on the originality dimension than lecture-based training groups (3.98 vs. 3.78).

Another, less direct contribution, is that the study also provides evidence regarding the relationship between creativity training and creative performance. Specifically, the empirical findings establish a positive relationship between training and creative performance. Trained groups, produced more ideas and also show superior results in terms of originality and elaboration as compared to untrained groups.

By examining the post-training creative output of groups that received training in different formats and have worked on different types of tasks, the study provides evidence regarding the effectiveness of training, valuable not only to academia but also to practitioners in their quest of developing the most effective creativity training programs.

Keywords

Creativity, creative thinking, creativity training, group creativity, organizational creativity, problem realism, delivery method, experiential learning, empirical research, quantitative study.

Chapter 1 – Introduction: Creativity enhancement through training

There are many reasons to consider the possibility that creativity can be enhanced. Most obvious may be that there are clear benefits in applied settings, such as schools and any organization that is concerned about innovation. There is, however, much more to enhancement than this. There is, for example, the idea that each of us has creative potential that can be fulfilled. If creative potentials are fulfilled, or at least maximized, the benefits of creativity (e.g., for psychological and physical health) are the most likely to be realized. The benefits will be apparent on both societal and individual levels [...]. You might even say that there is a clear need for creativity on both social and individual levels, and thus a need to invest in techniques and programs that are designed to enhance creative skills. (Runco, 2007:320)

1.1. On the importance of creativity enhancement

Many agree that creativity is a key factor that drives the civilization forward (Hennessey and Amabile, 2010). As the humanity is progressing into the 21st century it faces major challenges in an incessantly changing environment. At a global level, the humanity is

facing interdependent challenges such as energy, food and water shortages, environmental and health issues, the problem of poverty and war, issues related to population growth and limited resources, etc., all of them demanding for novel and creative solutions. To be solved, some of these problems require groups of individuals, institutions and even the co-operative effort of whole countries; others can be solved by a single individual with a good idea (Sawyer, 2006). Albert Einstein once said that "the significant problems we face cannot be solved at the same level of thinking we were at when we created them" (Calaprice, 2005) and that "a new type of thinking is essential if mankind is to survive and move toward higher levels" (New York Times, 1946). The progress of the entire humankind hinges upon its ability to envision innovative ways to solve current problems and on its adaptability to the fast paced environmental change.

Innovative solutions to problems require creativity. As pointed out in Csikszentmihalyi (1996:11) "new solutions […] will not appear magically by themselves. Problems are solved only when we devote a great deal of attention to them and in a creative way". There is a shared view among academics, educators, business leaders and policy makers that "it is only with creativity that we can hope to address the myriad problems facing ours schools and medical facilities, our cities and towns, our economy our nation, and the world" (Hennessey and Amabile, 2010:570).

In a turbulent global environment that is changing faster than ever, the need to understand creativity and the creative process has intensified. Some argue that "the study of creativity must be seen as a basic necessity" (Hennessey and Amabile, 2010:

570). Sawyer (2006) indicates several reasons for this. First, a proper understanding of creativity can "help us identify and realize every person's unique creative talents. If we hope to solve all of the pressing problems facing our society and our world, we must take advantage of the creative talents of everyone." (Sawyer, 2006:4). Second, a thorough understanding of creativity can also "help our leaders to respond better to the challenges facing modern society" (ibid). Creativity is a fundamental characteristic of effective leaders who need to be "especially effective at handling novel challenges that force them to go outside the typical routines" (ibid). Finally, a proper understanding of creativity can help us all to be better problem solvers in our every-day lives, which in turn can help us solve bigger societal problems and challenges as "some of these problems can be solved simply by a single individual having a good idea; others will require groups of individuals to work together creatively as a unit" (Sawyer, 2006:5).

The world we currently live in is also becoming more complex. This increased complexity is heavily driven by the fast paced technological change. Technological change is increasing at exponential rates and it is profoundly affecting the world we live in. As argued by Runco (2004) although in some ways the new technology has made our life easier, in other ways it has made it more difficult also. Rapid technological developments place new demands on people adopting them, as they need to constantly update their skills to operate new technology. According to Runco (2004:658) all this changes and the increased complexity of the world make creativity to be "more important now than ever before […] because creativity is a useful and effective response to evolutionary changes. In addition to what may be its most obvious function,

namely a part of the problem-solving process […] creative ideation allows the individual to remain flexible.[...]. Creativity is usually tied to original behavior, and indeed, originality is needed for creativity, but it is not sufficient. Creativity is a syndrome or complex […] and flexibility is an important part of it. The flexibility of creative persons is what gives them the capacity to cope with the advances, opportunities, technologies, and changes that are a part of our current day-to-day lives."

Summarizing the above, creativity – often defined as the production of novel and useful ideas in any domain (Amabile, 1996) – is key in order to solve the challenges posed by the highly complex and fast changing world we live in nowadays. As put by Sir Ken Robinson, in order to deal with the increasing world complexities and to realize our true potential we must learn to be creative (Robinson, 2011). Around the globe, more and more academics, educators, policy makers and business leaders acknowledge the need for a more creative workforce and society in general. There is an increased recognition of creativity as "an economic driver for generating wealth and employment, sustainable development of world cities, technological changes, business innovation and enhancement of competitiveness of individual cities and countries" (Hui, Ng and Mock, 2004:26). Based upon such arguments, there is an increasingly wide spread agreement that more attention should be given to nurturing creativity.

1.2. Nurturing creativity through training

According to Scott, Mumford and Leritz (2004: 361) several approaches have been used to nurture and encourage creativity. Such approaches include: 1) providing the right incentives (Collins and Amabile, 1999; Eisenberger and Shanock, 2003); 2) acquiring the needed expertise (Ericsson and Charness, 1994; Weisberg, 1999); 3) effective structuring of group interactions (King and Anderson, 1990; Kurtzberg and Amabile, 2001); 4) optimizing the climate and culture (Amabile and Gryskiewicz, 1989; Anderson and West, 1998; Ekvall and Ryhammer, 1999); 5) identifying the necessary career development experiences (Zukerman, 1974; Feldman, 1999) and 6) training to enhance creativity (Torrance, 1972; Cropley, 2000; Nickerson, 1999). Of these interventions, the authors argue that training "has been a preferred, if not the favored, approach for enhancing creativity" (Scott et al., 2004:361).

The idea that creative abilities are trainable emerged in the 1950s when a few psychologists and creativity scholars such as J.P. Guilford, S. Parnes and P.E. Torrance disagreed with their colleagues who thought that creativity is a characteristic fixed at birth and which could not be increased deliberately (Sawyer, 2006: 296). Instead, they viewed creativity as a common characteristic of all human beings rather than being a trait reserved to a few gifted individuals (e.g. Guilford, 1967; Torrance, 1963,1972). These authors also proposed that creative abilities are trainable and measurable through measures such as fluency, flexibility, elaboration and originality. As a result, creativity

training has become widespread and numerous training programs have been designed and deployed over the years.

The claims that creativity is a common trait that can be found to some degree in everyone and that creative abilities are trainable and measurable triggered, along with an increased academic interest in the subject of creativity, the creation of numerous techniques and training programs designed to enhance creative thinking in people. The rationale is that if creative abilities are trainable, just as proper training helps enhance any ability, creativity training can help increase creative performance. As put by Runco (2007:372) "[v]irtually all human behaviors are flexible. They each have a range of reaction. The range is genetically determined, and the skill or behavior is a reaction to the experience that influences that potential. The amount of muscle built will depend on genetic potentials and the amount of exercise. Creative talents depend on the same two things […] the programs and techniques […] will very likely increase the likelihood that the individual will behave in a creative fashion." Runco (2007:371) further argues that creativity can be enhanced in each individual (micro-level) through the teaching and training of tactics, programs and techniques designed to stimulate creative thinking and enhance creative performance. In addition to teaching, encouragement rewards and models are also needed. According to the author, "[t]hese may have maximal impact when they target the attitudes about creativity and when they teach and reinforce specific tactics. These tactics must be appropriate for the group and domain […]."

As seen from above, teaching creative tactics and providing training in creative thinking techniques can be one way of encouraging and enhancing creativity in individuals and groups. Consequently, research regarding effects of creativity training on creative performance is highly relevant as it has the potential to provide understanding regarding the techniques that can be employed to effectively nurture creativity in people. Yet, compared to other streams of creativity research (e.g. research focused on individual differences between people showing different creativity levels, or research examining personality characteristics and cognitive factors affecting creativity) the examination of the factors that affect the effectiveness of creativity training have been relatively scarce (Hennessey and Amabile, 2010). Although most empirical research on the effectiveness of training indicates a positive relationship between receiving training and subsequent creative performance, some studies show the opposite (e.g. Svensson et al., 2002), indicating that the available evidence is still inconclusive. In addition, some of the relevant aspects (such as the delivery method, or task realism etc.) have not yet been thoroughly examined. Finally, although there is a multitude of programs designed to enhance creative thinking, just a few have been examined through rigorous academic studies regarding their effectiveness. Hence, further evidence in this sense is in order.

1.3. Purpose of the study and research questions

Departing from the assumption that creative ability is trainable, it follows that individuals that are trained in creative thinking will exhibit better post-training creative

performance than untrained individuals. This study explores the question whether creativity training can improve creative performance of groups working to generate ideas. Further, it is also the purpose of the current study to ascertain to what extent different training delivery formats may produce different performance results and to examine the possible effects of problem realism on creative performance. A brief argumentative discussion follows below.

Training has long been recognized by creativity researchers as having the potential to enhance creative performance (e.g. Parnes and Brunelle, 1967; Torrance, 1972; Rose and Lin, 1984). Nevertheless, as it was observed by the author of this study, training delivery (i.e. the specific format in which training is provided to trainees) is rarely examined within previous research of factors affecting training effectiveness and post-training creative performance. Nevertheless, education research studies provide evidence that different educational approaches produce different results. For example, research comparing active learning programs (e.g. experiential learning and problem-based learning[1]) reveal performance differences between individuals and/or groups educated through such training methods as compared to lecture-based education (Stepien, Gallagher and Workman, 1993; Boaler, 1997; Penuel and Means, 2000; Adams, Kayes and Kolb, 2005). If different training methods yield different post-training performance outcomes, it may be that different training formats of creativity enhancement programs bare different effects on post-training creative performance.

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[1] In problem-based learning students are engaged in the learning process by being exposed to real-life problems. Experiential learning is a method of education based on practical experience in the subject matter.

Thus, the present study aims at examining both the effect of training on creative performance as well as the effect that different training delivery methods may have on the creative performance of individuals. In this sense, the following research questions are proposed.

Research Question 1: Does training affect creative performance? If so, what is the direction of the relationship between training and creative performance?

Research Question 2: Do different training methods produce different performance results?

Some researchers suggest that the nature of the task upon which groups and individuals are asked to work may affect the quality and quantity of the outcomes (Watson, Michaelsen and Sharp, 1991). For example, some idea generation researchers indicate that the type of problem to be solved may have an effect on the performance of the ideation process by affecting both the quantity and the quality of the ideas generated (e.g. Isaksen, 1998, Mongeau and Morr, 1999).

Unsworth (2001) proposes a conceptual framework for studying creativity that explicitly takes into consideration the type of problem as determinant of the creative response and, consequently, creative performance. According to this author, the type of problem (e.g. closed vs. open problem) bares an effect upon people's engagement in the creative process. Indeed, motivational research (e.g. Deci and Ryan, 1987) has established that behaviors are either initiated through self-determined choice, or as

responses to external demands. Self-determined behaviors are those in which "people experience themselves as initiators of their own behavior" (Deci and Ryan, 1987: 1025) and researchers suggest that an intrinsic type of motivation (performing an activity for its own sake and not for external rewards) underlies this kind of behavior. Creativity researchers suggest that, as compared to extrinsic motivation (performing an activity in pursuit of external rewards), intrinsic motivation favors creativity and enhances creative performance (see for example Amabile, 1983, 1988, 1996, 1999, 2012).

The distinction between closed and opened problems and their impact on creativity was previously discussed by problem-finding theorists of creativity (e.g. Getzels and Csikszentmihalyi, 1976; Getzels, 1982). According to these authors, the formulation of the problem is key for creative achievement. A closed problem is one for which the solving method is known (e.g. an algebra problem [Getzels, 1975]) whereas an open problem is one for which the participant is required to find, invent or discover the problems (according to Dillon (1982) most artistic endeavours), (Unsworth, 2001). According to Getzels and Csikszentmihalyi (1976: 81) for creativity to occur in problem solving the solver must become a problem finder and her task should be not only to find the solution but also discover the problem itself.

Unsworth (2001) takes into consideration the type of problem as a dimension of creativity engagement, and develops four distinct types of creative behavior (e.g. responsive, expected, contributory and proactive). Because the level of engagement is different across these types of creativity, the underlying motivation may be also

different and, hence, the four types may yield different creative performance outcomes (e.g. one person may show superior creative performance during the ideation process if that person is creative because is expected to behave so, as compared when is proactive or voluntarily wishes to contribute to solve the problem).

There is yet another way in which the type of problem can affect creative results, namely its realism. Most empirical research examining the factors affecting creative performance is based on laboratory studies that use fictitious problems with little, if any, relevance to the solvers. According to Isaksen (1998) fictitious problems lack ownership. A task has ownership if: (1) is of interest, (2) can be acted upon or actually influenced by a member of the group, or (3) if it engages the imagination of the problem solver because it demands a fresh new approach which is meaningful (Isaksen, 1998: 16). These aspects defining problem ownership have the potential of affecting the level of engagement into the creative process, as well as the type of motivation and, on this basis the creative outcomes. However, problem realism appears to be neglected by previous creativity research. Hence, a second aim of this study is to examine the extent to which problem realism affects creative performance. To this end the following research question is formulated.

> *Research Question 3: Does problem realism affect creative performance? If so, what is the direction of the relationship between problem realism and creative performance?*

1.4. Significance of the study

This study may be relevant to different groups interested in the topic of creativity and to who a study of the relationship between training and creative performance is of high relevance. First, the study is relevant to business organizations and creativity practitioners. The organization's ability to constantly innovate and come up with fresh solutions that will improve products, services and processes is a key ingredient for success in today's competitive environment characterized by rapid and constant change. Achieving high level of creative performance is crucial for innovation to occur thus, additional empirical knowledge about the factors that affect creative performance is valuable to business organizations in their quest to achieve and maintain their competitive advantage within today's turbulent conditions.

By providing empirical evidence regarding two factors that have the potential to effect creative performance, the study is relevant to business organizations and creativity practitioners alike. Knowing about the effect of the type of creativity training on creative performance can help human resource managers and creativity consultants to implement the most efficient training programs to boost employees' creative performance. Similarly knowing about the relationship between the nature of the task and creative performance may help managers to structure and formulate tasks in such way that they stimulate creative responses.

The factors and conditions that affect creative performance are relevant not only for business organizations but also for the academia. Although the study of creativity can be

traced back to the Greek philosophers, more systematic research efforts have started in the 1950's with the pioneering work of J.P Guilford and E.P. Torrance (e.g. Guilford, 1950; 1967; 1968; Torrance, 1968; 1974). Since then, the study of creativity has intensified and the field is now multidisciplinary. As such, many different theoretical perspectives have proposed a multitude of factors that affect creative performance. So far, however, most of research developed in this sense has examined only a limited set of factors that affect creative performance, such as personal characteristics and individual personality traits, cognitive styles, creativity skills, ability and experience and certain contextual factors. Yet, given the high complexity of the topic, there are many other factors that have been either under-examined or not researched at all. The present study is thus relevant to the academic research in creativity as it aims to examine the effect that the type of training and problem realism have on creative performance in groups. These factors are relatively under-examined by previous research and, hence, extending the empirical evidence to such factors may help understand the most effective ways of nurturing creativity through training.

This study is also relevant to education research and education policy makers. One of the factors under examination is training delivery method. Although it has been recognized that training in creative thinking enhances creative performance as it provides trainees with both knowledge and skills in creativity techniques, little is known about the relationship between the type of training and creative performance. Training can be provided in different formats (e.g. lecture-based training, active learning, etc.) and such formats should be adapted to the learning audience (e.g. children vs. adult

learning). This thesis examines the effect that different teaching-learning formats in which knowledge and skills in creative thinking are transmitted to the trainees, affect their creative performance. The results of such an investigation are therefore relevant to educators and education policy makers in their quest for the optimum teaching plans and programs that deliver the best results.

1.5. Structure of the dissertation

The reminder of this dissertation is organized as follows. Chapter 2 introduces the reader to the concept of creativity and ends with a discussion around the problem of defining creativity. Chapter 3 discusses the subject of creativity training and the factors that affect its effectiveness as reflected by previous research literature. The hypotheses to be tested in the empirical application are presented at the end this chapter.

In Chapter 4 the methodology employed in the empirical study is presented. The chapter starts by presenting a summary of the data and how it was collected as well as a full description of the procedures followed. This chapter ends with a discussion of the measures employed to assess creative performance and to compare it among different groups.

Chapter 5 presents the empirical findings regarding the stated hypotheses. As an extension, Chapter 6 provides a discussion of the results presented in Chapter 5. The

dissertation concludes with Chapter 7 which includes the major conclusions of the study based on the empirical findings as well as discussion of the main implications of such findings, the main limitations of the current research and the directions for further empirical investigations.

Chapter 2 – Conceptions of Creativity

Genius. Invention. Talent. And, of course, creativity. These words describe the highest levels of human performance. When we are engaged in the act of being creative, we feel we are performing at the peak of our abilities. Creative works give us insight and enrich our lives.

Creativity is part of what makes us human. Our nearest relatives, chimpanzees and other primates, are often quite intelligent but never reach these high levels of performance. And although advanced "artificially intelligent" computer programs hold the world title in chess, and can crunch through mounds of data and identify patterns invisible to the human eye, they still cannot master every-day creative skills. (Sawyer, 2006:3)

2.1. Introduction

Without a doubt, creativity is a bewildering topic. Research into creativity is not new, some of the earliest efforts to understand creativity can be traced back to ancient Greek philosophers (Treffinger et al., 2002). Systematic research efforts to explain creativity and creative thinking have been documented as early as the 19th century (Becker, 1995) with the work of Sir Francis Galton (Galton, 1869) on the hereditary transmission of genius. Given the increasing attention placed on creativity as a major source of human development and economic and social growth (Florida, 2002), researchers from a

multitude of scientific disciplines have tackled the topic over the years. Yet, as pointed out in Woodman, Sawyer and Griffin (1993), after many decades of theory development and empirical research, researchers have not yet reached consensus regarding what creativity is and what are the best ways to improve creative performance and, they "still know surprisingly little about how the creative process works" (Woodman et al., 1993.:316).

The purpose of this chapter is to provide a general theoretical setting for the study. In this sense a brief overview on the field of research in creativity including a short history of the field as well as the main theoretical approaches are provided here. Given this study is focused on business organizations the main theoretical approaches to organizational creativity are also presented. The chapter will end with a brief discussion of definitional issues regarding creativity.

2.2. Creativity: a multidisciplinary field of research

In 1950 the American psychologist J.P. Guilford, after examining the index of Psychological Abstracts and finding that only 186 articles out of 121,000 titles indexed were on the subject of creativity, drew the attention upon the relevance of scientific research on creativity and upon the scarcity of research on the topic (Guilford, 1950). In addition, he also proposed a psychometric approach to the study of creativity and made the claim that creativity is not limited only to eminent individuals and geniuses but can

be also observed in the everyday life of regular individuals. As put by Guilford himself: "creative acts can therefore be expected, no matter how feeble or how infrequent, of almost all individuals" (Guilford, 1950:446).

Guilford (1967) also identified the following three dimensions to be measured by creativity researchers: fluency (quality of the idea), flexibility (variability of idea categories) and originality (idea uncommonness) of mental operations involved in creative thinking. These dimensions were later incorporated in many composite measures designed to measure creativity; Torrance's (1968, 1974) tests of creativity which, to date, "remain the most widely used assessments of creative talent" (Sternberg, 2006:87).

Since Guilford's (1950) pioneering work, the field of creativity research has blossomed, and numerous researchers developed batteries of creativity tests and composite measures in order to examine the creative potential of regular people in the general population. By the end of the same decade over one hundred different definitions of creativity were formulated (Taylor, 1959). Feist and Runco (1993) note that in the following 30 years about 9,000 creativity references have been added to the literature. Nowadays, the field evolved to become a very fertile ground characterized by pluralism of approaches and multidisciplinary, the topic of creativity attracting the attention of researchers in diverse fields, e.g. psychologists, economists, entrepreneurship scholars, organizational researchers, sociologists, and cultural theorists among others (Kozbelt, Beghetto and Runco, 2010).

Table 2.1 presents a summary of the main categories of creativity theories as classified in Kozbelt et al. (2010).

Table 2.1. Main theoretical approaches on creativity

Approach	Primary Assertion	Major studies
Developmental	Creativity develops over time (from potential to achievement); mediated by an interaction of person and environment	Albert and Runco (1989); Helson (1999) Subotnik and Arnold (1996)
Psychometric	Creativity can be measured reliably and validly, differentiating it form related constructs (IQ) and highlighting its domain-specific nature	Wallach and Kogan (1965) Guilford (1968)
Economic	Creative ideation and behavior is influenced by "market-forces" and cost-benefit analyses	Rubenson and Runco (1992) Sternberg and Lubart (1992, 1995) Florida (2002)
Stage and componential process	Creative expression proceeds through a series of stages or components, the process can have linear and recursive elements	Wallas (1926) Runco and Chand (1995) Amabile (1999)
Cognitive	Ideational thought processes are foundational to creative persons and accomplishments	Mednick (1962) Guilford (1968) Finke, Ward and Smith (1992)
Problem-solving and expertise based	Creative solutions to ill-defined problems result from a rational process, which relies on general cognitive processes and domain expertise	Ericsson (1999) Simon (1981, 1989) Weisberg (1999, 2006)
Problem finding	Creative people proactively engage in a subjective and exploratory process of identifying problems to be solved	Getzels and Csikszentmihalyi (1976) Runco (1994)
Evolutionary	Eminent creativity results from the evolutionary-like processes of blind generation and selective retention	Campbell (1960) Simonton (1988, 1997)

Approach	Primary Assertion	Major studies
Typological	Creators differ along key individual differences, which are related to both macro- and micro-level factors and can be classified via typologies	Galenson (2001, 2006) Kozbelt (2008)
Systems	Creativity results from a complex system interacting and interrelated factor	Gruber (1981) Csikszentmihalyi (1988) Sawyer (2006)

Note: Works cited in the third column can be found in the original article by Kozbelt et al. (2007). Source: Adapted from Kozbelt et al. (2010: 27-28)

Each theoretical perspective has its own assumptions regarding what may affect creative performance. The developmental theories of creativity (e.g., Albert and Runco, 1989; Helson, 1999; Subotnik and Arnold, 1996) examine the roots of creativity by looking at the background of acknowledged creative people. Early theories belonging to this category were developed by examining the lives and background of eminent creative people and suggested a correlation between developmental paths and creativity.

The psychometric theories e.g., (Wallach and Kogan, 1965; Guilford, 1968) focus on measurement and are concerned with the reliability (i.e. consistency of measurement) and validity (i.e. accuracy) of creativity assessment. By focusing on measurement, psychometric theories inform all other theories of creativity (Kozbelt et al., 2010).

The economic approaches claim that creative performance is determined by market-forces or by the relationship between the demand and supply of creative ideas (e.g.

Rubenson and Runco, 1992; Sternberg and Lubart, 1992; 1995; Florida, 2002). These theories focus on the creative efforts which are conceptualized in terms of investments and examine creative processes as resource allocation mechanisms dictated by the demand and offer existing in markets for creativity.

The stage and componential theories of creativity (e.g. Wallas, 1926; Runco and Chand, 1995; Amabile, 1999) set out to understand the nature and structure of the creative process in terms of stages which can be sequential or recursive, or underlying componential cognitive processes (Kozbelt et al., 2010). Given that most part of conceptualizations as well as of the empirical research on organizational creativity rely on stage and componential approaches, a more detailed discussion will be provided on these theories later in this chapter.

Cognitive theories of creativity (e.g. Mednick, 1962; Guilford, 1968; Finke, Ward and Smith, 1992) depart from the assumptions that creative performance has a basis in cognition and that differences in cognition can play a major role in creative achievement and, that creative individuals have some specific cognitive abilities. There are also some theories based on problem solving and expertise (e.g. Ericsson, 1999; Simon, 1981 and 1989; Weisberg, 1999 and 2006) which draw on cognitive psychology to emphasize problem-solving processes and expert knowledge as fundamental to creative performance. As a reaction to the problem-solving approach to creativity, the problem-finding theories (e.g. Getzels and Csikszentmihalyi, 1976; Runco, 1994) propose that creative achievement results from the act of problem finding.

Drawing on ideas from evolutionary biology, evolutionary theories of creativity (e.g., Campbell, 1960; Simonton, 1988 and 1997), focus on "identifying dispositional and developmental idiosyncrasies associated to creative achievements" (Kozbelt et al., 2010:35). According to such theories, each individual starts with a different creative "potential". Through learning, a creative individual expands her potential and hence, increase her creative performance.

Typological perspectives aim to understand individual variations among creators by creating typologies of creative personalities, working methods, etc (e.g. Galenson, 2001 and 2006; Kozbelt, 2008). These theories consider that differences in creative performance are due to key individual differences between creators on both macro- and micro level factors.

Finally, the systems perspectives (e.g. Gruber, 1981; Csikszentmihalyi, 1988; Sawyer, 2006) consider that creativity emerge from a complex system with interacting components and that creative performance is conditioned by the socio-cultural environment in which the creator lives, aside from her personal characteristics. Such theories are very broad and take a qualitative contextual view on creativity (Kozbelt et al., 2010)

Summarizing the above, although the theoretical perspectives on creativity abound, none of them provides a single, widely accepted, explanation of the phenomenon. The field is characterized by a lack of a broad agreement on a single theory of creativity

(Treffinger, 1986). Over the decades, as it can be observed in the table, many scholars in fields so diverse such as psychology, sociology, anthropology, economics, organizational behavior or biology, have proposed theoretical models to explain and understand creativity. It is worth adding that the subject of creativity is also studied by neuroscience (Dietrich, 2004; Andreasen, 2005; Vartanian, Bristol and Kaufman, 2013) and psychiatry scholars as well (Andreasen, 1987; Andreasen and Glick, 1988; Ludwig, 1997). Yet, although the field is in continuous advancement, there are still many questions opened regarding what exactly creativity is or how to improve it.

2.3. Theories of organizational creativity

Business organizations are also facing a fast paced and ever changing and turbulent environment to which they need to respond adequately in order to survive and succeed. As described by Ikujiro Nonaka, the renowned organizational theorist and knowledge management expert, today's business organizations are facing "an economy where the only certainty is uncertainty" and, in which "markets shift, technologies proliferate, competitors multiply, and products become obsolete almost overnight". Under such conditions, "successful companies are those that consistently create new knowledge, disseminate it widely throughout the organization, and quickly embody it in the new technologies and products. These activities define the 'knowledge-creating' company, whose sole business is continuous innovation." (Nonaka, 2007:162)

In addition to the external environment, there are also internal considerations that make creativity to be seen as the key to innovation in today's organizations. As explained in Zha et al. (2006) in order to be successful organizations need leaders with creative vision. In addition, given it is believed that about 70% of a product's cost is determined by design decisions (Daetz, 1987; Sheldon et al, 1990), creative designs can lead to significant cost savings. Hence, the increased interest of organizations in building and/or acquiring a creative workforce and in increasing the creative abilities of their current employees. Given such interest, many training programs have been developed and are marketed to organizations' human research managers as effective tools aiming to enhance employees' creative abilities. Yet, although many of these programs are embraced by organizations worldwide as part of their human resource training policies, little evidence is available regarding their effectiveness and the extent to which they increase employee's creative performance, calling for further research and empirical evidence (Scott et al., 2004, Puccio et al., 2006).

Most attempts of theorizing on organizational creativity belong to the stage and componential approach to creativity (see the fourth raw in Table 2.1 above). The common feature of the theories and models grouped under this category is that they focus on how the creative process takes place within organizations by envisioning "the structure and nature of the creative process in terms of stages, which can be sequential or recursive, or underlying componential cognitive processes" (Kozbelt et al., 2010: 30). Departing from Wallas's (1926) pioneering model, which depicted the creative process as a linear transition from one stage to another (i.e. preparation, incubation, illumination

and verification) until the creative idea is generated and verified, more recent approaches (e.g. Amabile, 1983, 1988, 1996, 1999; Woodman et al., 1993) have defined the creative process in terms of component mechanisms rather than stages (Kozbelt, et al., 2010). Such an approach moves beyond the linearity of Wallas's (1926) model to recognize the higher complexity of the creative process and of the factors that affect it (e.g. knowledge, information, motivation, social influences, etc).

Among the stage and componential approaches to creativity, Amabile's (1983, 1988, 1996, 1999) *componential theory of creativity* and Woodman, Sawyer and Griffin (1993) *interactionist approach to creativity* are the most frequently cited in research studies that aim to explain different aspects of creativity in organizations and working settings. Given that creativity in work environments is the core topic of the current dissertation, more details about these two theoretical approaches are provided in the following sections.

2.3.1. The Componential Theory of Organizational Creativity

Amabile's (1983, 1988, 1996, 1999) componential theory of creativity, partially based on the componential model of the social psychology of creativity, is one of the most influential models concerning creativity in the workplace and represents one of the first comprehensive and grounded theories of employee creativity. The theory posits that there are three key components of creativity: domain-relevant skills, creativity relevant

processes and task motivation. A graphical representation of the model is presented in Figure 2.1.

Domain relevant skills refer to factual knowledge and expertise in a given domain. They tend to be affected by formal and informal education, and individuals' perceptual, cognitive and motor abilities. Creativity relevant processes refer to explicit or tacit knowledge concerning the appropriate strategies for producing creative ideas, appropriate cognitive styles and work stiles for creative idea production. According to Amabile, creativity-relevant processes are likely to be positively affected by the level of training in creative skills and strategies for producing new ideas, by experiences in creative activities and by possessing certain personality characteristics.

Task motivation includes individuals' attitudes toward a task and their perceptions of his or her motivation for working on the task. In general, an individual's motivation can be intrinsic or extrinsic in nature. Intrinsic motivation is defined as "any motivation that arises from the individual's positive reaction to the qualities of the task itself; this reaction can be experienced as interest, involvement, curiosity, satisfaction, or positive challenge" (Amabile, 1996: 115).

Figure 2.1. The Componential Model of Creativity
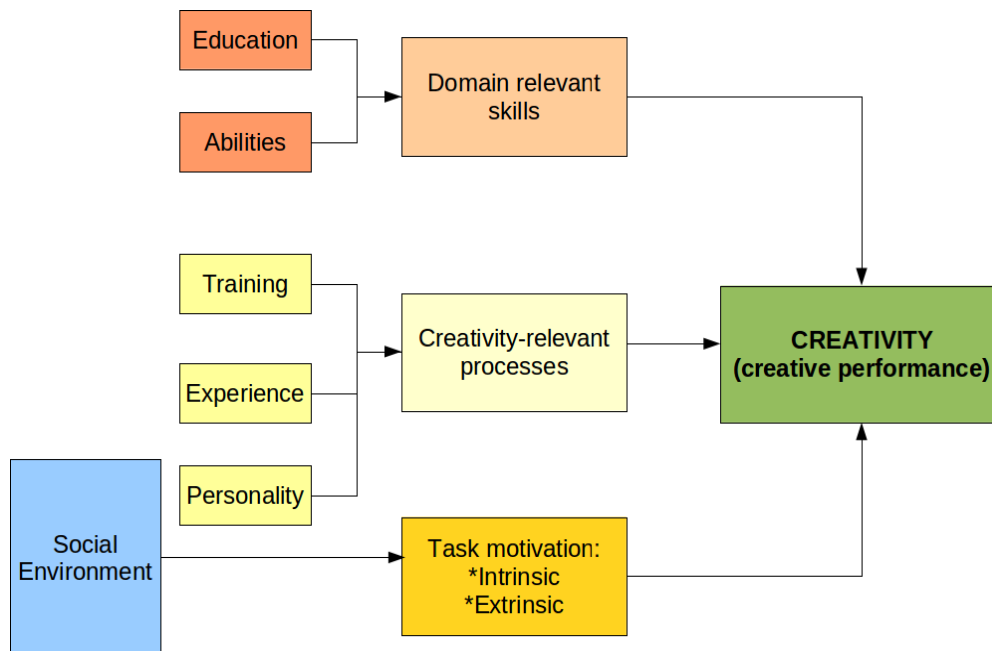
Source: Self devised based on Amabile (1996, 2012)

Extrinsic motivation can be defined as "any motivation that arises from sources outside of the task itself" (Amabile, 1996:115). Extrinsic motivation is driven by the desire to attain some goal that is apart from the work itself – such as achieving a promised reward or meeting a deadline or winning a competition. Although intrinsic and extrinsic motivation for doing a task may coexist, one is likely to be primary. Amabile proposed that a primarily intrinsic motivation will be more conducive to creativity than a primarily extrinsic motivation (Amabile, 1996: 7).

Summarizing, the *Componential Model* suggests that organizational creativity appears at the interplay between organizational components that are deemed necessary for overall innovation (such as, organizational resources, management practices and organizational motivation) and components of individual/team creativity (i.e. creativity skills, task motivation and expertise). The model takes into account creativity training as an important factor that affect individual/team creativity, by affecting creativity-relevant processes which, in turn, affect creative performance. The creativity-relevant processes are a cognitive component of the model that refers to the cognitive style and the work style and can be influenced by training and experience in generating ideas.

According to the model a positive relationship should be expected for the effect of training on creativity. In this sense the current study will compare post-training creative performance exhibited among groups that received creativity training using different training delivery methods (i.e. lecture-based training versus experiential learning approach).

2.3.2. The Interactionist Approach

Similar to Amabile's componential theory of creativity Woodman et al. (1993) propose an *interactionist* model premised on the idea that creativity is an individual level phenomenon that can be affected by both dispositional and situational variables. A graphical representation of this model is presented in Figure 2.2. Creative performance

is more fully predicted by the interaction of individual's disposition and contextual factors. Woodman's et al. (1993) model explicitly stresses the importance of the interaction between the person and the situation, and is based on the theoretical base of interactional psychology.

Figure 2.2. The interactionist approach to creativity
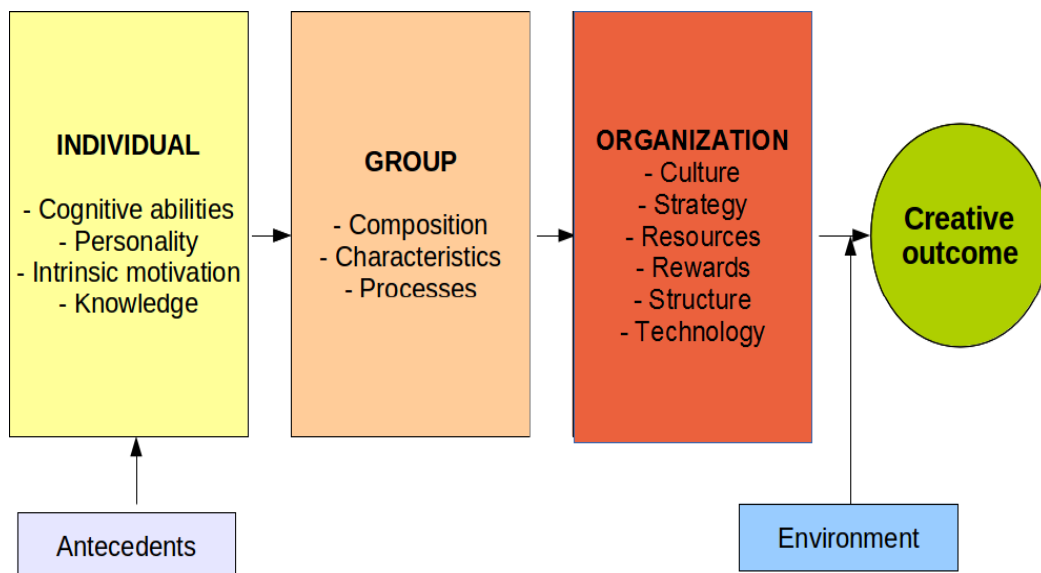
Source: Self devised, based on Woodman et al. (1993)

According to the interactionist approach, creative performance in organizations is a function of individual, group and organizational characteristics that interact to enhance or constrain creativity. Important individual characteristics proposed by this approach are the cognitive abilities and style, personality, intrinsic motivation and knowledge. The group characteristics discussed includes norms, cohesiveness, size, diversity, roles,

task and problem solving approaches. Organizational characteristics such as culture, resources, rewards, strategy, structure and technology are highlighted. The model proposes that creative persons, groups and organization are inputs that are transformed in some way by the creative process and the creative situation, which includes enhancers and constraints for creative activities. The potential outcome of this transformation of the inputs is a creative product.

Similarly to the componential model, the interactionist approach also considers cognitive abilities as factor that affects creativity in individuals which in turn, affect the creativity of the group which, according to its composition, characteristics and processes, affect creativity at an organizational level and hence, the overall level of creative performance. This model does not specify the potential influence of training on creative performance directly. However, the authors rely on Amabile's (1988) argumentation regarding the importance to creativity of "creativity relevant skills" (Woodman et al., 1993:301). Knowledge, learning and experience, as parts of such skills relevant for creativity, are considered as having a positive impact on creative performance, although the authors also acknowledge Stein's (1989) assertion that in some situations previous experience or knowledge may lead to a "functional fixedness" that prevents individuals from producing creative solutions (Woodman et al., 1993:301). As in the case of the componential model, the interactionist approach does not take into account the specific effect of the type of task (e.g. real-life or fictitious) may have on creative performance.

2.3.3. The "componential interaction" model –a unified view

As indicated in Eder and Sawyer (2008) although the empirical research in organizational creativity has had a divergent history with the componential model in one direction (emphasizing major personal attributes and how they affect the creativity of individuals) and with the interactionist approach in the other direction (emphasizing the importance of individual as well as environmental and contextual variables, working together to influence creativity) the two theoretical perspectives on organizational creativity are, nevertheless, complementary. They both analyze creativity at an individual level and consider similar factors as being determinants of creative performance. In fact both models consider creativity as the result of the interplay between individual characteristics (e.g. abilities, skills, cognition, personality, etc.) and the (working) context which has them involved in creative processes (e.g. organizational features, group characteristics, the support received, etc.). The main difference is that Woodman's et al. (1993) model places more emphasis on the relationships developed within organizations (i.e. individual-group-organizations interaction that are conducive to creative performance) whereas Amabile's model is centered on identifying the components that work together for the enhancement of creativity. According to Eder and Sawyer (2008) the two models can be even integrated into a single "Componential Interaction" model. Under this approach the proposed components of Amabile's model are interactive. Specifically, the combination of high intrinsic motivation, high domain-relevant skills, and high creativity relevant processes would encourage the greatest creativity on the job.

Drawing on these two approaches frequently used within research on organizational creativity, in this dissertation creative performance is considered to be the result of people's knowledge, skills, abilities, education, cognitive abilities, personality and motivation. Such determinants of creative performance in individuals, along with inter-group processes will determine the creative performance of groups. In addition, among the process specific factors that may affect creative performance we consider training delivery method and problem realism. A detailed discussion regarding the relevance of these two factors as well as a summary of previous research is further provided in Chapter 3.

2.4. Creativity defined

Not only that there is a lack of agreement on a single theory of creativity but also there is a lack of agreement on how to define creativity. Runco (2007) explains that the difficulty of defining creativity is related to its diversity, the same word being used to describe different processes (from an individual inventing a breakthrough technology to a child exhibiting original artistic expression). A first aspect of such diversity is its diverse expression, creativity playing a role in various fields from technical innovation to arts, from sciences to business, etc. Second, a distinction is also made between eminent creativity ("big C") and everyday creativity ("little c"). As indicated by Runco (2007: ix) "[m]any famous people have earned their reputation from their creativity […] Other adults are highly creative, though perhaps in the everyday sense of coping,

adapting and solving novel problems". Third, there is a lot of ambiguity regarding how to define creativity given its connections to other concepts such as innovation, imagination, intelligence, originality, invention, discovery, serendipity, adaptability; each associated with creativity but also distinct concepts (Runco, 2007: 376).

Although the debates regarding the definition of creativity continue today, most researchers and theorists agree upon two definitional criteria namely novelty and value (Hennessey and Amabile, 2010). For example, some influential definitions of "big C" creativity consider creativity to be "the achievement of something remarkable and **new**, something which transforms and changes a field of endeavor in a significant way […] the kind of things that people do to change the world" (Feldman, Csikszentmihalyi and Gardner, 1994: 1; emphasis added) or "a person's capacity to produce **new or original** ideas, insights, restructurings, inventions or artistic objects, which are accepted by experts as being of scientific, aesthetic, social or technological value" (Vernon, 1989: 94; emphasis added).

The newness and usefulness criteria also appear in definitions of "little c" creativity. Puccio et al. (2006:19) indicate that the production of novel ideas that are made useful is the most widely accepted definition of creativity. This can also be observed in the stream of research focused on creativity in organizations. For example, Amabile (1996) defines creativity as the production of novel and useful ideas in any domain. In the same fashion, Woodman et al. (1993) propose a definition whereby the creative result is a

new product, service, idea, procedure or process that is valuable and useful and was produced by individuals working together in a complex social system.

Although the concept of creativity receives different definitions from different theoretical approaches, many authors agree that creativity is related to the ability to conceive, find or do something novel and useful (e.g. Woodman et al., 1993; Amabile, 1996; Lubart, 2001; Sternberg, 2001). As pointed out in Scott et al., (2004: 362) "[c]reativity ultimately involves the production of original, potentially workable, solutions to novel ill-defined problems of relatively high complexity". The current researcher ascribes to such definitions and defines organizational creativity as the production of novel and original ideas regarding how to solve a specific problem with given organizational value.

As previously discussed creativity has a broad value. Sternberg and Lubart (1993: 3) say it is a "topic of wide scope that is important at both the individual and societal levels for a wide range of task domains". On different levels both business organizations and public institutions frequently look to support and encourage creativity. Yet, as put by Sawyer (2006) being creative is not easy. "Creativity research shows that creativity is hard work; creativity is usually an incremental step beyond what has come before; creativity often emerges from a team, not a solitary individual; and increasing creativity often requires substantive organizational change" (Sawyer, 2006: 301).

Regardless of the theoretical approach or the definition of creativity, most paradigms of creativity share the assumption that all human beings have a potential for creativity and this potential can be enhanced if the right training is applied (Plucker and Runco, 1999; Runco 2007; Sawyer, 2006). As will be further discussed in the next chapter, these ideas generated a multitude of creativity training programs and, although for some of them there is some evidence indicating that they are effective (Scott et al., 2004) such evidence is still inconclusive as to which of these programs work best, under what circumstances and how to test their effectiveness (Nickerson, 1999).

2.5. Chapter Summary

Although early efforts to understand creativity can be traced back to ancient Greek philosophers, the beginnings of systematic research in creativity and creative thinking are of a more recent vintage. Specifically, the academic research on the topic started in 1950's after J.P. Guilford raised the attention on the importance of understanding creativity and what stimulates it. This chapter presented a brief summary of the theoretical work available on creativity with a special emphasis on creativity in organizations.

Over the past six decades the field of research in creativity has developed to become a multidisciplinary one. Scholars in diverse research fields – e.g. psychology, sociology, anthropology, economics, biology, organizational behavior, among others – have

proposed many, equally diverse, theoretical models to explain and understand creativity. The field is characterized by a lack of consensus on a single theory of creativity. In addition, the concept itself is an ambiguous one as there is also a lack of agreement on how to define creativity.

Albeit a theoretically diverse field, it can be observed that there is some agreement. Although definitions of creativity differ, they have in common their emphasis on the ability that people, either individually or in groups, have to produce products that are not only valuable but also novel. In addition it can also be observed that most of the existing research programs on creativity incorporate the assumption that creativity is not a special trait reserved for those gifted by nature but is an ability that exists to a certain extent in any individual, regardless of their intellectual level. Furthermore, this ability can be further developed should the right programs and tactics be discovered and employed.

A similar agreement can be observed in the case of major theoretical approaches to organizational creativity (e.g. the componential model and the interactionist approach). Both perspectives analyze creativity at an individual level and consider that creativity is the result of the interplay between individual characteristics (e.g. abilities, skills, cognition, personality, etc.) and the (working) context which has them involved in creative processes (e.g. organizational features, group characteristics, the support received, etc.).

In this dissertation we examine the creativity of post-training ideation results based on these two approaches frequently used in research on organizational creativity. As such, we consider creative performance as the result of people's knowledge, skills, abilities, education, cognitive abilities, personality and motivation. Such determinants of creative performance in individuals, along with inter-group processes determine the creative performance of groups, which represent the unit of analysis in the empirical application of this dissertation. Along with such determinants, among the process specific factors that may affect creative performance we also consider training delivery method and problem realism. The discussion of these two factors is provided in the next chapter.

Chapter 3 – Creativity training

[T]raining has been a preferred, if not the favored, approach for enhancing creativity. Both organizations and educational institutions have invested substantial time and resources in the development and deployment of creativity training. [...] 25% of the organizations employing more than 100 people offer some form of creativity training. Creativity training has been developed for occupations ranging from marketing, business management and educational administration, to medicine and engineering. Creativity training, moreover, executed as either distinct course segments or embedded exercises, is often a key component of educational programs for the gifted and talented. Creativity training, in fact, has been developed for virtually every student population [...]. (Scott, Leritz and Mumford, 2004:362)

3.1. Introduction

The view that everyone, regardless of their intellectual level, can enhance their creativity if they find, develop and practice the right tactics (Plucker and Runco, 1999), attracted the attention not only of creativity scholars but also that of corporate executives interested in ensuring the creativeness needed for innovation to occur in their organizations. As a result, not only creativity scholars but highly paid management

consultants as well (Sawyer, 2006) designed and proposed multiple techniques, tactics and programs aimed at improving creative thinking.

Such abundance of programs and techniques aimed at helping people to think creatively have contributed to the view of the field of creativity as lacking of scientific rigor and created an image of "a noisy and crowded bazaar in which merchants compete to sell their 'creativity wares'" (Puccio et al. 2006: 19). Such an image led some creativity scholars to question the validity of creativity enhancement methods. For example, Lubart (1999:6) argues that such methods lack any theoretical basis as well as serious attempts to validate them.

Early reviews of training programs concluded that creativity can be enhanced with training (e.g. Parnes and Brunelle, 1967; Torrance, 1972; Rose and Lin, 1984). Evaluations of the effectiveness of creativity training programs provide some indications that at least some of the programs available have the potential to increase post-training creative performance (e.g. Torrance, 1972; Parnes, 1993; Ma, 2006; Scott et al., 2004). However, other studies provide a divergent conclusion indicating conceptual and methodological problems in most evaluation studies (Mansfield, Busse and Krepelka, 1978).

The purpose of this chapter is to provide a literature review on the subject of creativity training with special emphasis on two factors that may affect post-training creative performance namely, training delivery method and problem realism. The chapter is

organized in topical sections. The main content areas include a summary of the main creativity training programs along with a discussion regarding their effectiveness. Next, the meta studies that evaluate the effectiveness of creativity training are also presented and commented. A discussion regarding the need to extend the study of training effectiveness to new factors and the formulation of hypotheses regarding training conclude this chapter.

3.2. On the effectiveness of creativity training

As mentioned previously, multiple creativity training programs have been developed over the years based on the premise that creativity is a characteristic inherent to all individuals and that people can be taught how to be creative. The main argument of those that point out to the importance of creativity training is that, by providing people with tools they can use to increase their creative thinking abilities, it has the potential to enhance creative performance. Nevertheless, many of these programs have been criticized for not being grounded in a theoretical foundation and for being based on biographical reports and case studies (Runco, 2007:368) meaning that they are not fully generalizable but may "only work for some people, some of the time".

Empirical examination of the effectiveness of creativity training programs begun in the late 1950's with the work of E. Paul Torrance (and colleagues) who was the first to report some results indicating that creativity training could work (Sawyer, 2006).

Further evidence in this sense was provided by Torrance again, when he identified 142 studies showing that creativity training could enhance creative performance (Torrance, 1972). Torrance's findings inspired practitioners and researchers to develop a variety of creativity training programs aimed at instilling and improving creative thinking abilities in people.

3.2.1. Creativity training programs

Nowadays, there are numerous creativity training programs available. There are many methods and techniques that have been designed aimed at the development and improvement of creative abilities in people. The six most notorious creativity enhancement training programs (Mansfield et. al, 1978; Sawyer, 2011) include the following:

1) Creative Problem Solving (e.g. Osborn 1963, 1967; Parnes, 1969);

2) The Productive Thinking Program (Covington et al., 1974);

3) The Purdue Creative Thinking Program (Feldhusen, Treffinger and Ghalke, 1970; Feldhusen, Speedie and Treffinger, 1971);

4) Khatena's Training Method (Kathena, 1970; 1971; 1973; Kathena and Dickerson, 1973);

5) Myers – Torrance Workbooks (Myers and Torrance, 1964, 1965, 1966, 1968);

6) The Cognitive Research Trust or CoRT, founded by Edward de Bono (deBono, 1973).

According to Plucker and Runco (1999) anyone, regardless of their intellectual level, can enhance their creative abilities if they discover and practice the right tactics. Nevertheless, and although the aforementioned programs are widely adopted and used, little is actually known about their effectiveness and, in case they are effective, what makes them to be so. One frequent critique of creativity training programs is that they lack both a theoretical basis as well as empirical validation (Sternberg and Lubart, 1999).

3.2.2. On the effectiveness of Creative Problem Solving

According to Puccio et al. (2006:19) the *Creative Problem Solving* (hereafter *CPS)* has been "one of the rare exceptions" of *marriage* between theory (via scientific research) and practice (via applications in real-world situations). The research conducted over the years on this topic generally indicates that *CPS* training does have an effect on attitudes towards creativity, new idea generation and divergent thinking, among other aspects (Basadur, Graen and Green, 1982; Basadur and Hausdorf, 1996; Basadur, Pringle and Taggar, 1999; Basadur, Runco and Vega, 2000).

Other studies in the area of the effectiveness of *CPS* indicate that training enhances creativity-related abilities at the individual level – e.g. fluency, originality and flexibility in thought; problem finding, evaluating ideas – (Basadur et al., 1982; Kabanoff and Bottger, 1991; Runco and Basadur, 1993; Basadur et al., 2000; Wang and Horng, 2002). A third sub-area of research in this stream examined whether training affects group creativity (Firestien and McCowan, 1988; Firestien, 1990; Fontenot, 1993, Basadur, Pringle, Speranzini and Bacot, 2000) and provides evidence that trained groups show higher creative performance in problem finding, improved communication skills in the case of small groups (i.e., participants got more involved in the problem-solving process; criticized ideas less; supported ideas more; smiled and laughed more; and produced significantly more ideas than groups that did not receive training, [Puccio et al., 2006: 27]).

According to Runco (2007) there have been so many studies that examine the effectiveness of creativity training "that a number of review papers have been published that do not report any new data but merely summarize and compile findings from the large number of earlier studies [meta-analyses]". The most recent effort in this sense is reviewed in the following section.

3.2.3. Evaluations of creativity training effectiveness research

Scott's et al. (2004) meta-analysis of 70 empirical studies of the effectiveness of creativity training takes into account not only the content but also the delivery method of the different programs. Overall, the findings of this analysis indicate that training bares a positive influence on creative performance as well as on creativity related attitudes and behavior. The results obtained indicate that creativity training positively affects creative performance in various settings and for distinct age groups and also for differences in the intellectual capabilities. However it has been also observed that creativity training has a particularly strong effect on creative performance in the case of those creative thinking programs focused on divergent thinking and problem solving. When focusing on the content of the different creativity training programs examined the results indicated those programs that focus on the development of cognitive skills and the heuristics involved in skill application as the most effective creativity training programs.

Scott et al. (2004) have also examined the effect that training delivery method (i.e. course design, type of media used and the type of practice exercises) may have on the effectiveness of creativity training programs. The purpose of examining these aspects was to provide evidence indicating how the basic parameters of instruction influenced the relative effectiveness of training programs. Course design variables included course duration (number of days and number of minutes in the course) and intensity (distributed versus massed training), the general model applied, domain specificity, the

realism and amount of practice included in the course, the depth and difficulty of the material, holistic training, component skill trained and, the amount of instructional feedback. Taken together, course design was found as having an important effect on the effectiveness of creativity training. In general, it was found that the most effective training programs are longer in duration, distributed over longer periods of time (as opposed to massed, intensive courses), are based on a specific theoretical model of creativity (as opposed to and ad-hoc assembly of creative thinking techniques) and focus on the development of cognitive skills. In addition, these effective courses base their practice on realistic exercises and are using course material that is presented in such way that it facilitates the initial acquisition of relevant concepts and procedures.

The media used in creativity training also appears as influencing its effectiveness. The authors examined the influence of ten different media options namely: lectures, exposure to audio-visual material, computer assisted course, individualized coaching programmed instruction, discussion, social modeling, behavior modification, cooperative learning and case based courses. The overall results indicate that the use of media that provides information is positively related to the success of creativity training. The use of lecture-based instructional techniques and audio-visual media were positively related to course effectiveness. In addition, media that encourage knowledge application (specifically the use of social modeling, cooperative learning and case-based instruction) was also found to positively influence training outcomes.

The findings in Scott's et al. (2004) analysis regarding training delivery method and creative performance are in line with findings of education research indicating that different educational approaches produce different results in learners. For example with the exponential growth in internet usage, more and more schools and universities have adopted web-based training (Khan, 1997; Martins and Kellermanns, 2004; Wang and Wang, 2009). Some research studies examining the performance of such training indicate that students tend to show higher performance in web-based courses (Khan, 1997; Rivera and Rice, 2002; Kearns, Shoaf and Summey, 2004).

There is also empirical evidence that indicates that individuals trained through active learning[2] methods exhibit different learning performance than individuals and groups trained trough traditional training methods (e.g. teacher-centered and lecture based training). Research in the effectiveness of Problem-Based Learning – an approach to learning that challenges students to learn by engaging them in a real problem and placing them in the active role of problem-solvers confronted with ill-structured problems – indicates that students enrolled in this type of training performed better on assessments of content knowledge as compared to students in traditional classes (Gallagher, Stepien and Rosenthal, 1992; Stepien, Gallagher and Workman, 1993;

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[2] Active learning refers to interactive approaches to education such as role plays and scenario based training, inquiry-based dialogues, experiential learning activities and exercises, small group work, problem solving exercises, case study exercises, problem based learning exercises. (Zoller and Harrison, 2007). Active learning refers to any instructional method that engages students in the learning process, requiring students to do meaningful learning activities and think about what they are doing (Prince, 1993: 223). Such methods include a wide range of instructional activities "from listening to practices to help students absorb what they hear, to short writing exercises in which students react to lecture material, to complex group exercises in which students apply course material to "real life" situations and/or new problems" (Faust and Paulson, 1998:4).

Gallagher, Sher, and Stepien, 1995; Boaler, 1997; Penuel and Means, 2000). Similarly research examining the effectiveness of Experiential Learning – a learning approach based on Kolb's (1983) experiential learning theory according to which experience should be used in teaching as it is a rich source of learning and adult development – provides evidence that teams are more effective if they learn from experience (Adams, Kayes and Kolb, 2005).

The findings reported by Scott et. al (2004) indicate that the specific way in which creativity training is delivered to trainees (i.e. the teaching method, course contents and duration, the media used and the type of practice offered) affects the outcomes of such training. Nevertheless, to the author's knowledge, except for the aforementioned study, the relationship between training format (delivery method) and creative performance is an understudied topic within creativity research in general and, especially in organizational creativity research (Scott et. al [2004] draw the attention upon the fact that very few of the analyzed studies were conducted in organizational settings).

3.2.4. The need for further evidence on training delivery methods

Based on the above, it appears to be a need for further empirical evidence regarding the influence that delivery method may bear upon creative performance. While the studies reported in Scott et al. (2004) examine the effect of training formats such as lectures, cooperative learning and case – based learning, other training formats that were not

considered by previous research. In addition, given the nature of the study, the analysis provided by Scott et. al (2004) does not compare among different training formats. Nevertheless, as mentioned above there are findings provided by education research suggesting a relationship between training format and training effectiveness (Gallagher et al., 1992; Stepien et al., 1993; Gallagher et al., 1995; Boaler, 1997; Penuel and Means, 2000; Adams et al. 2005).   Hence comparisons among different delivery methods may provide useful evidence that may help improve the effectiveness of extant creative training programs.

In this study the effectiveness of creativity training is set to be explored by comparing post-training creative performance among groups that have received creativity training with that of groups that have not received such training. In addition, two delivery methods will be compared namely lecture-based training versus creativity training delivered through experiential learning.

Experiential learning was chosen as delivery method alternative to lecture-based training for several reasons. First, the importance of previous experience to creativity has long been recognized (Amabile, 1988, Csickszentmihalyi, 1988; Sawyer, 2006). Research in organizational creativity also shows that having experience in a particular field is necessary for creative success (Amabile, 1988; Runco and Chand, 1992; Runco, Dow and Smith, 2006).

Second, experiential learning is a form of adult learning. Organizational actors (employees, supervisors, managers, etc.) are all adults. According to education research there are certain teaching approaches that are more adequate in the case of adult learners (i.e. adult learning theories). Adult learning theories (also known as andragogy theories, e.g. Knowles, 1950; 1970; 1980) de-emphasize lecture and other teacher-centered forms of instruction and emphasize the value of the process of learning, recommending active approaches to learning that are problem-based and collaborative rather than didactic (Fidishun, 2000). Given that, as education research suggests, some training methods (e.g. adult learning) may lead to better learning results in the case of adults, it may be the case that adult learning based training may produce better creative performance results as compared to individuals trained within traditional teaching-learning paradigms. To the knowledge of this author, existing research on how the training affects creative performance does not specifically examine the differential effect of distinct types of training; research is needed to tackle on this issue.

Last but not least, another reason for selecting experiential learning is based on suggestions of education research according to which traditional schooling methods, based on instructionism (Papert, 1993) – i.e. a view of education which considers that knowledge is a collection of static facts and procedures, known by teachers, which have the task to get these tasks and procedures in students' heads (Sawyer, 2011) – are not adequate for teaching creativity. According to Sawyer (2011) findings from cognitive science are indicating that "the conceptual understanding that underlies creative behavior emerges from learning environments in which students build their own

knowledge" (Sawyer, 2011:8). For stimulating creative behavior, a constructivist view of schooling is proposed, according to which learning is always a creative process based on experimentation, building on previous knowledge and collaboration. Given that, experiential learning is a method of adult training that uses the experience to build knowledge in learners, it may be an excellent candidate for teaching creativity and creative thinking.

3.2.5. Hypotheses regarding training delivery method

Research on training and creative performance clearly indicates that trained individuals perform better (alone or in groups) at creative problem solving tasks. Based on indications found in previous research regarding the existence of a relationship between delivery method and training effectiveness (Gallagher et al., 1992; Stepien et al., 1993; Gallagher et al., 1995; Boaler, 1997; Penuel and Means, 2000; Adams et al. 2005; Gallagher et al., 1992; Stepien et al., 1993; Gallagher et al., 1995; Boaler, 1997; Penuel and Means, 2000; Adams et al. 2005) and on indications that creativity enhancement may depend, among other factors, on the delivery method used for training programs (Scott et al., 2004), the present dissertation proposes that the delivery method in training programs may also affect post-training creative performance.

In addition, it has been shown by education research that different educational approaches have different results (Gallagher et al., 1992; Stepien et al., 1993; Gallagher

et al., 1995; Boaler, 1997; Penuel and Means, 2000; Adams et al., 2005). It seems therefore that different teaching methods yield different performance outcomes. As learning styles and teaching methods affect the way people acquire information, skills and abilities, characteristics which empirical research indicate that affect creative performance, we have enough certification to propose that different teaching-learning methods would produce different effects on creative performance. Based on such considerations, in this dissertation we hypothesize that training affects creative performance and that the educational method employed to train participants will also affect creative performance during ideation. The following set of hypotheses will be tested:

Hypothesis 1: A positive relationship exists between creativity training and creative performance such that groups that generate ideas and have received creativity training will show better ideation performance than untrained groups.

Hypothesis 2: Groups trained in creativity techniques via experiential learning approaches will exhibit higher creative performance during ideation than groups that received training via lecture-based sessions.

In the empirical part of this dissertation, Experiential Learning, was chosen as an active learning approach for teaching and learning creative thinking techniques (a more detailed description of this training method is provided in APPENDIX 2). The rationale of this selection is indicated in the literature that the type and amount of experience

people have in the creative process (i.e. how they go about generating new ideas and creating novel and useful products, services and processes) has a direct effect on creative performance. Put differently, the more experience one has in providing creative solutions to problems, the more likely those solutions are creative (i.e. original, novel, useful). For example, in her componential theory of creativity Amabile (1983, 1988, 1996, 1999) highlights previous experience as a determinant of creativity. Experiential Learning, as the name itself indicates, consists in training individuals by exposing them to real-life experience. It is possible that a more direct transfer of experience may take place between the teacher and a student through this method of training. In turn, lecture-based training is less focused on practical experience and more concerned with transferring conceptual and abstract knowledge. Hence, if as suggested by Amabile (1988), experience enhances creativity, it may be the case that experience based training will provide more creative thinking experience to the trainees than traditional, lecture-based training.

3.3. Problem realism as factor affecting the effectiveness of creativity training

The second factor examined in this study for its potential to affect creative performance is problem realism (relevance). This factor was chosen to be examined given there are indications found in several streams of research (i.e. research on organizational

creativity and on the effectiveness of brainstorming and, education research) according to which people may be more creative when solving realistic or real-life problem than when they are solving fictitious problems.

Creativity research provides some indications that the nature of the task or problem to be solved may directly affect the type motivation people feel when asked to solve a problem creatively (i.e. intrinsic vs. extrinsic motivation). In addition, the Scott et al. (2004) meta-analysis of creativity training performance has shown that training improved performance only in the case of those training programs that used realistic exercises appropriate to the domain at hand. This is one indication that problem realism may be an important factor affecting the end results of a creative problem solving activity. Education research also indicates that students show better performance results when they are asked to solve real-life problems (Newmann, Wehladge and Lamborn, 1992; Shernoff et al., 2003).

Within organizational creativity research, Unsworth (2001) proposed a theoretical framework that factors in the type of problem (open vs. closed problems) to explain creative behavior and, identifies four different categories of creative thinkers based on the type of problem and the type of motivation (driver) in pursuing the creative activity. Some brainstorming researchers argue that people will show higher creative performance when they work on problems which are realistic and, hence, with which they can identify. By contrast, they will be less motivated to provide solution ideas to fictitious problems. In addition, education research is also pointing to the importance of

realism, indicating that students that work on real-life problems show higher levels of performance (Shernoff et al., 2003) All these, are indications that the type of problem used to practice and learn creative thinking has the potential to affect creative performance. In this section we draw on the aforementioned research literature, to present the expected relationship between problem realism and creative performance in group ideation.

3.3.1. The relevance of the problem according to Unsworth's creativity theory

Following the same line of reasoning based on the level of engagement and the type of motivation that people have in solving problems or behaving creatively, Unsworth's (2001) creativity theory provides some indication that the type of problem affects creative performance. Her model explicitly takes into consideration the type of problem as determinant of the creative response and, consequently, creative performance. According to this author, the type of problem (e.g. closed vs. open problem) bares an effect upon people's engagement in the creative process. Indeed, motivational research (e.g. Deci and Ryan, 1987) has established that behaviors are either initiated through self-determined choice, or as responses to external demands. Self-determined behaviors are those in which "people experience themselves as initiators of their own behavior" (Deci and Ryan, 1987: 1025) and researchers suggest that an intrinsic type of motivation (performing an activity for its own sake and not for external rewards) underlies this kind of behavior. Creativity researchers suggest that, as compared to extrinsic motivation

(performing an activity in pursuit of external rewards), intrinsic motivation favors creativity and enhances creative performance (see for example Amabile, 1983, 1988, 1996, 1999, 2012).

Based on these ideas, Unsworth developed a matrix of four creativity types that vary on two dimensions. The first dimension is given by the driver for engagement in creative activities, which can be either external or internal to the individual. The second dimension is given by the type of problem, which can be either open (problem or ideas that are discovered by the individual) or closed (ideas presented to the individual). This conceptualization results in four creative types presented below in Figure 3.1.

Figure 3.1. Creativity types according to Unsworth (2001)

	Open problem	Closed problem
Internal driver	**Proactive**	**Contributory**
External driver	**Expected**	**Responsible**

Source: Self-devised based on Unsworth (2001)

A closed problem is one for which the solving method is known (e.g. an algebra problem [Getzels, 1975]) whereas an open problem is one for which the participant is required to find, invent or discover the problems (according to Dillon (1982) most artistic endeavors), (Unsworth, 2001). The author, considering the type of problem as a dimension of creativity engagement, develops four distinct types of creative behavior (e.g. responsive, expected, contributory and proactive). Because the level of engagement is different across these types of creativity, the underlying motivation may be also different and, hence, the four types may yield different creative performance outcomes (e.g. during ideation, one person may generate more ideas which are also if that person behaves creatively because she is expected to behave so, as compared when she is proactive or voluntarily wishes to contribute to solve the problem).

3.3.2. Evidence from brainstorming research

In addition to training, the type of problem or tasks to be solved during the creative process may also influence creative performance. Some researchers suggest that the nature of the task upon which groups and individuals are asked to work may affect the quality and quantity of outcomes (Watson et al., 1991). There are indications, coming from different fields of research that the type of task is relevant when creative performance is evaluated.

One indication of the relationship between the type of problem and creative performance is given by idea generation researchers which indicate that the type of problem to be solved may have an effect on the performance of the ideation process by affecting both the quantity and the quality of the ideas generated (e.g. Isaksen, 1998, Mongeau and Morr, 1999). According to Isaksen (1998) fictitious problems lack ownership; people do not identify themselves with this type of tasks and, hence, they engage less in the solving process. In his literature review of brainstorming research Isaksen (1998) found that only 8 out of the 54 tasks used in the studies analyzed could be described as having ownership and concluded that "[i]t would appear that most of the empirical literature falls short when considering the reality of the tasks used to study brainstorming" (Isaksen, 1998:17). The author recommends future experiments to focus more on the kinds of challenges and opportunities for which brainstorming was designed, rather than utilizing contrived and presented problems for which ownership is lacking" (ibid). According to Isaksen (1998: 16) a task has ownership if: (1) is of interest, (2) can be acted upon or actually influenced by a member of the group, or (3) if it engages the imagination of the problem solver because it demands a fresh new approach which is meaningful. A summary of the type of problems and tasks employed within the previous research studies in idea generation is presented in Table 3.2.

Table 3.2. Problems and tasks utilized in previous research on idea generation using brainstorming

Problem or task	Description	Ownership	Occurrence
Thumbs	What would be the advantages and disadvantages of having a sixth thumb on each hand?	**Low**	**2**
Campus	Improve campus safety. Solve campus parking problem.	**High**	**3**
Campus restaurant	A restaurant located next to campus is losing customers. What can the restaurant do to retain its clients?	**Moderate**	**1**
University	How to improve the university over the next years?	**Moderate**	**4**
Junk mail	How to deal with junk mail?	**High**	**1**
Tourist	Generate as many ideas as possible to attract more tourists in the area	**Low**	**2**
Violent crimes	How can violent crimes be reduced?	**Low**	**1**
The spread of AIDS	How can the spread of AIDS be reduced?	**Moderate**	**1**
Tin can	Find as many uses as possible for a tin can	**Low**	**1**
Drug dealing roommate	All the possible things you could do if one day you catch your new roommate dealing drugs	**High**	**1**

Source: Self devised

As it can be observed in the table above idea generation research relies mostly on low-ownership problems (e.g. the thumbs, tin can or tourist problems) although an increasing use of higher-level ownership tasks (with which subject easily identify themselves) can also be observed (e.g. to list all the possible thing one could do if one day they catch their roommate dealing drugs, how to deal with junk mail or how to deal with campus parking space shortage). Yet, there is a scarcity of studies that use real problems in their experimental approach, and most of the conclusions derived from such empirical studies refer to groups working on fictitious tasks little being actually known

about creative performance in the case of real problems. Mongeau and Morr (1999) also comment on the need to examine creative performance when groups solve real-life problems saying that there is a need to examine "real groups discussing real topics of relevance to group members".

Another reason why individuals working on a real-life problem may produce better creative results during ideation than individuals working on a fictitious one, is that people are more motivated and feel more engaged in solving a problem they have contact with in their daily life (Isaksen, 1998). According to Amabile's componential model of creativity, the creative performance of individuals is greatly influenced by the type of motivation underlying the creative act and it is the intrinsic motivation of individuals (performing the task for its own sake) rather than external rewards what enhances their creative performance (Amabile, 1983, 1988, 1996, 1999, 2012).

The intrinsic motivation is a concept that has long been examined by the proponents of the Self Determination Theory (Deci and Ryan, 1987). This theory makes the distinction between extrinsic motivation (motivation generated by external stimulates such as, for example, pecuniary rewards) and intrinsic motivation (an internally driven interest in accomplishing a certain task for its own sake rather than for external rewards). According to this theory the level of interest that people have in an activity provides the basis of becoming engaged with a topic for its own sake (increased intrinsic motivation). Deci and Flaste (1995:50) point out at research indicating that "people perform less well at problem solving when they are working for an extrinsic reward

than when they are intrinsically motivated. In fact, several studies have confirmed that the performance of any activity requiring resourcefulness, deep concentration, intuition or creativity is likely to be impaired when controls are used as a motivational strategy". Thus if the type of problem to be solved affects the level of interest in the problem-solving activity which subsequently affects the intrinsic motivation, given that intrinsic motivation enhances creativity, the type of problem may also affect the level of creative performance.

3.3.3. Evidence from education research

Additional support to the assumption that real-life problems may generate better creative outcomes is provided also by research on student engagement (defined as a person's active involvement in a task or activity – Reeve et al., 2004) which posits that students are more likely to become engaged with work that involves them intellectually in a process of meaningful inquiry to solve real life problems that extend beyond the classroom (Newmann et al., 1992). Shernoff et al. (2003) also provide evidence indicative of higher engagement when students experience high control over the situation and when instruction was perceived as having high relevance. The perception of high relevance was also associated with higher academic intensity (the challenge and importance found in classroom activities and the amount of concentration demanded).

Summarizing, there are indications in various streams of research that the type of problem affects creative performance. First, there is the issue of realism. Most empirical research examining the factors affecting creative performance is based on laboratory studies that use fictitious problems with little, if any, relevance to the solvers. These aspects have the potential of affecting the level of engagement into the creative process, as well as the type of motivation and, on this basis the creative outcomes. Second, there is the issue of motivation. According to motivational research people are more creative when they are intrinsically motivated. When asked to solve a fictitious problem, as seen from before, their interest and engagement may be lower than when asked to solve real life problems. If people do not identify with the problem they are asked to solve, their intrinsic motivation may be lower than when they are asked to solve a real-life, meaningful problem and, hence they may exhibit lower levels of creative performance.

3.3.4. Hypotheses regarding problem realism

Summarizing, problem realism was not directly taken into account in previous conceptualizations of organizational creativity as factor that may affect creative performance. Exception is Unsworth (2001) who creates a typology of creative behavior, by type of problem (i.e. open vs. closed) and the type of motivation underlying the creative behavior. This author considers the type of problem as a dimension of creativity engagement and asserts that different levels of creativity engagement may yield to different creative performance outcomes.

In this dissertation we expect the type of task to affect ideation outcomes in such way that groups that solve a real-life problem would show superior creative performance as compared to groups working on fictitious problems. Although problem realism is not taken into account directly by theoretical models of organizational creativity, the literature provides some arguments that support our assumptions regarding this factor. For example, Pinsonneault et al. (1999) argue that there are differences in brainstorming results according to the topic sensitivity. The nature of the problem employed may have a direct effect upon the motivation participants have in generating solutions to the proposed challenge. For example, some research studies provide evidence indicating that when generating ideas about a topic considered being socially sensitive (controversial) people are more motivated than when generating ideas about a less controversial topic (Fiske and Taylor, 1991; Karau and Williams, 1993). While fictitious problems usually show lower ownership and, thus, lower levels of implications in finding a solution, a real problem may be better given it "would not suddenly appear as a well-defined (and artificial) problem". The following hypothesis will be also tested in the empirical application of this thesis:

> *Hypothesis 3: A relationship exists between the nature of the task assigned for ideation and the creative performance during idea generation such that working on real tasks will produce higher outcomes than working on fictitious ones.*

3.4. Chapter summary

This dissertation aims at examining the effects of delivery method and task realism on the effectiveness of creativity training. Specifically we will examine how different training delivery - such as experiential learning and lecture-based instruction - as well as task realism, affect the creative performance in post-training ideation. Both these factors are relatively understudied by previous research calling for further examination. Drawing on the previous literature and the arguments exposed throughout this chapter, the model presented below in Figure 3.2 is followed in the empirical application.

Figure 3.2. Empirical model
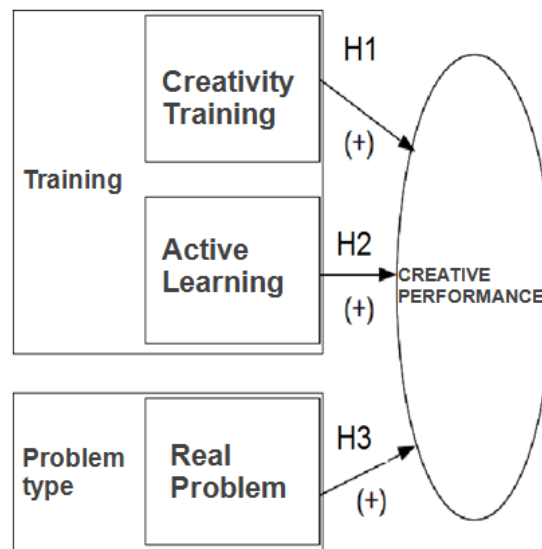
Source: Self devised

It has been long recognized that training in creative thinking enhances creative performance. Furthermore, education research suggests that different approaches to training (i.e. different delivery methods) produce different post-training performance results. Consequently, if different training delivery methods yield different performance outcomes, distinct delivery formats of creativity training programs may also produce different creative performance outcomes. Specifically the present study sets out to explore post-training performance differences between lecture-based training and experiential learning of creativity. The literature suggests that learning based on experimentation may stimulate creativity. Hence, based on the arguments previously discussed in Section 3.2., a positive relationship is expected between experiential learning of creativity and post-training creative performance (hypotheses stated in sub-section 3.2.4).

It is also suggested in the literature that task realism may also affect creative performance. Several streams of research (i.e. organizational creativity research, brainstorming research and education research) suggest that people may be more creative when they solve realistic problems than when they solve fictitious problems. The main reason may be that people identify themselves better with real life problems and perceive them as more interesting than fictitious tasks which may be perceived as meaningless. The increased interest in realistic tasks may stimulate people motivation in discovering more creative ways to solve such problems. Therefore, based on the argumentation presented throughout Section 3.3., a positive relationship is expected for problem realism and creative performance (hypotheses stated in sub-section 3.3.4).

Chapter 4 – Empirical method

The aim of this dissertation is to ascertain the extent to which delivery method and problem realism affect the effectiveness of creativity training for groups working to generate new ideas. This chapter outlines the methodology adopted in the empirical application to achieve such objective. The chapter begins with a description the research design followed by a description of the sample. Next, the empirical procedures are presented followed by a discussion of creativity measurement and the selection of the variables used within this study to measure creative performance. Finally, a brief discussion of the statistical instruments used to for the empirical study is also included.

4.1. Research design

As discussed previously in Chapter 3, three hypotheses are contrasted in the empirical application of this dissertation. The first and second hypothesis concerns the effect that training may have on post-training creative performance whereas the third, concerns the relationship between problem-realism and creativity.

In order to contrast these hypotheses post training ideation performance was examined and compared among different groups of individuals working together to generate ideas. To this end, post training ideation performance was examined and compared among different groups of individuals working together to generate ideas. Some groups were

provided creativity training within an Experiential Learning based environment, others

received lecture-based creativity training, whereas others have not received any training

in creativity but they were instructed about basic rules of brainstorming before the

ideation session. Similarly, some groups were asked to work on solving fictitious

problems whereas others worked on real-life problems. The post-training creative

performance was measured and compared among the different groups. A summary of

the different types of groups is presented below in Figure 4.1.

Figure 4.1. Types of training experiences

Brainstorming test	**Type of problem**[*]	
Type of training	*Real*	*Fictitious*
No training (basic brainstorming instructions provided)	**NKT$_R$**[**] (14)	**NKT$_F$** (13)
Lecture-based training	**CRE$_R$**[***] (15)	**CRE$_F$** (37)
Experiential learning	**ELT$_R$**[****] (30)	**---**

Notes: R=real problem; F= fictitious problem

[*] The number of groups per training experience is indicated in brackets
[**]NKT: no kind of training – brainstorming sessions conducted with participants that have no previous knowledge or experience in creative thinking and no training is provided
[***]CRE: lecture-based training in creative thinking is provided to the participants

[****]ELT: experiential learning training
Source: self-devised

Each of these types of experiences is explained in more detail in a further section within

this chapter. Student's t-test and analysis of variance (ANOVA) was used to examine

eventual differences between the means of the different groups analyzed. These two statistical techniques are appropriate for the comparison of two sets of quantitative data when the samples are collected independently of one another, which is also the case of data examined within this study: small independent samples of ideas generated by different groups.

4.2. Sample description

A total of one hundred and nine groups were observed for the empirical application. In each case, a group of employees was first provided with a specific training experience. Five different training experiences were used for this study (as will be further detailed within this chapter), each of them consisting of a distinct combination of training delivery and problem realism. After receiving training, its effectiveness was assessed by asking the groups to perform a creative task (i.e. ideation) and by measuring the post-training creative performance.

Each group had an average number of nine members (sd=3.4790; nine hundred eighty one participants for the entire study). The participants are employees at forty five Spanish organizations. In addition to business firms one non-governmental organization for cooperation and development and one public university also participated in the study. The business firms belong to a wide range of economic sectors such as energy (2), pharmaceutical industry (5), agriculture, food and beverages (5), technology (3),

business services (10), construction and real estate (1), banking industry (1), education and training (5), manufacturing industries (3), hotel industry (8). Most of these organizations are service providers.

4.3. Procedures

The sessions were conducted during the period 2006-2012, during creativity and innovation training workshops organized on demand for the organizations included in the study. These organizations commissioned to the experimenters the organization and development of creativity workshops during which participants were trained in creative thinking. All the participant organizations previously agreed that the researcher and her team collect data regarding the sessions and use that data for academic research purposes. Participants were selected by the management teams according to their needs. None of the selected participants have received any type of creativity or creative thinking training previous to participating to the workshops conducted by the research team, nor they had any knowledge about specific creative thinking techniques or tactics (as stated by themselves). The creativity training was provided by the experimenters in two different formats: lecture-based training (hereafter *CRE*) and experiential learning training (hereafter *ELT*). Both these formats will be presented in more detail later in this chapter. However it is worth mentioning that *CRE* training involved teaching different creative thinking techniques (see Appendix 3) in the regular workshop format. During this type of training and previous to the sessions, participants were lectured about

creative thinking and creativity techniques and were explained theoretically how this techniques work. By contrast, *ELT* training involved the learning of creative thinking techniques through experience (learning by doing).

After receiving training in creative thinking techniques the participants, organized in groups, were invited to a room where they were asked to generate solution ideas for either a fictitious or a real problem. For comparison purpose, control groups with participants that were not provided creativity training, were also created. Instead of providing creativity training (lecture-based or experiential), these participants were only informed about the purpose of the session (i.e. to generate as many solution ideas as possible for the problems assigned), about the ideation method to be used during the session (i.e. brainstorming) and about the problem to be solved. The sessions took place within a relaxed, no-stress atmosphere encouraging the free expression of any idea and encouraging employees to generate ideas regardless of rank or position. All sessions took place in rooms organized in the same fashion. In all the sessions, participants were seated in the room as shown in Figure 4.2.

Figure 4.2. Room configuration
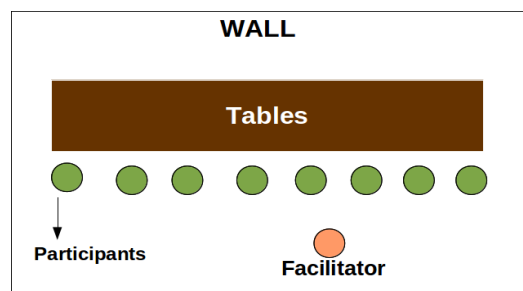
Source: Self devised

During the sessions the ideation technique known as brainstorming (Osborn, 1953 and 1957) was used by participants to generate solution ideas. Brainstorming (using the brain to storm a creative problem) is an ideation technique that it became so notorious that it is often thought as synonymous to idea generation. It was developed in 1941 by the advertising executive Alex Osborn in his quest of finding ways to improve employees' creative performance. Since its introduction the technique had become extremely popular among business managers and creativity practitioners and has been widely used in different organizational settings as a means of problem-solving and idea generation (Kavadias and Sommer, 2009). The technique, based on following four basic rules, is quite straightforward and relatively easy to use and implement. More detailed information about brainstorming, its rules and principles is provided in Appendix 1.

All the ideas generated by the groups during the workshops were recorded on paper and used by the experimenters to assess groups' creative performance. Creative performance was measured both objectively by employing *Torrance's Test of Creative Thinking* (Torrance, 1962; 1974), and subjectively, through the application of the *Consensual Assessment Technique* (Amabile, 1982; Hennessey, 1994, Hennessey and Amabile, 1999). Both these methods, as well as the distinction between objective and subjective measures of creative performance, will be discussed in more detail in section 4.4. The resulting performance scores were compared among groups with different types of training, including groups that have received no training at all, and among groups working on different types of problems.

4.3. Typology of training experiences

This section provides details regarding the training experiences conducted in order to test the hypotheses previously formulated in Chapter 3. Five training experiences were developed and applied (as presented previously in Figure 4.1, above). Each type of training experience was conducted in up to four distinct phases as described in Table 4.1., below.

Table 4.1. Training experiences – Description of phases

Phase	Training Experience	Description
(1) Initial training	*CRE, ELT*	*CRE*: initial training in creativity techniques including morphological analysis, analogy, bionics, brainstorming, empathy, lotus blossom, the 5 Whys, and Scamper *ELT*: participants went through an experiential learning based innovation process, previous to the brainstorming session.
(2) Problem statement	*NKT, CRE, ELT*	Participants are provided with a description of the problem set by the top management. The problem is explained both visually and written on a piece of paper handed to each participant. All the information available regarding the problem (e.g. data, statistics, sensations, opinions, perceptions, among other factors) was also provided during this phase.
(3) Idea generation	*NKT, CRE, ELT*	**Idea generation rules:** • Do not judge ideas • Be unconventional • Quantity is more important than quality. • Build on the ideas of others **Idea generation instructions:** ➢ Each participant must provide each of her ideas on a sheet of paper; ➢ Every idea must have a title, a picture and an explanation of how it solves the problem ➢ Each participant should explain her idea to rest of the group and hang it on the wall

Phase	Training Experience	Description

➢ Participants are allowed to ask questions to clarify their doubts regarding the proposed idea

➢ Participants are allowed to brainstorm on ideas already raised by other participants in the group

➢ Participants are asked to generate specific solution ideas

➢ Participants are asked to provide solution ideas as more detailed as possible

➢ The facilitator will be present in the room throughout the session

➢ The facilitator's role is to lead the session, to create a fun and relaxed atmosphere involving everyone, taking care not to fall into reviews, and performing any function it deems appropriate to conduct the meeting in the best and most creative way.

Material employed:
➢ White paper sheets (A4)
➢ Thick color markers (minimum 2 different colors per participant)
➢ Scotch tape
➢ Scissors

Procedure:
➢ Each participant brings each of the ideas generated written on a A4 paper in front of the room and hangs it on the wall

➢ Each idea should be given a title, a graphical representation and a short description

➢ Each participant should hang her idea to the wall and present it to the rest of the group

➢ The other participants can ask questions or clarifications regarding the proposed idea

➢ Participants are also allowed to build on previously presented ideas, generating new solution ideas

Phase	Training Experience	Description
(4) Idea evaluation	*NKT, CRE, ELT*	**Procedure:** ➢ Evaluation criteria are established by participants ➢ Each idea is assessed against the chosen criteria ➢ A shorter list of potentially feasible ideas is created.

Source: Self devised

Regardless of the type of training experience they were exposed to, all groups were allotted the same amount of time for idea generation (i.e. 60 minutes). All sessions took place within a relaxed, no-stress atmosphere encouraging the free expression of any idea and encouraging employees to generate ideas, regardless of rank or position. All sessions were conducted in rooms organized in the same fashion (as presented previously in Figure 4.2).

A moderator (facilitator) was present in all sessions. In *ELT* sessions the role of the moderator is to solely conduct the session. The moderator was not responsible with recording the ideas generated during the sessions (as in *NKT* and *CRE* sessions); each participant recorded all the ideas generated by the group. Further details for each type of training experience are provided below.

4.3.1. Training experience I: Ideation with no previous training (NKT)

The *NKT* are the control groups used in this study. In the case of control groups participants did not receive any previous creativity training. Participants were only informed about the basic principles and rules of the ideation technique to be used during the session. Brainstorming basic rules and principles were provided to participants prior to the beginning of the session.

This type of workshop was conducted for total of twenty seven groups, with an average number of eight participants per group. Fourteen groups solved real problems [NKT_R] and thirteen groups solved fictitious problems [NKT_F]). Every session counted with the presence of a facilitator, a creative thinking and brainstorming expert in charge of conducting the session.

In the case of groups working to solve real problems, the problems were proposed and formulated by the company's management team. These problems represented real challenges that the companies were facing at the time the session was conducted. By contrast, in the case of NKT_F training experience, the challenge to be solved was based on a fictitious problem. In other words, in NKT_R training experiences the focus was on internal company meetings oriented towards solving a determined problem using brainstorming as ideation technique. Hence, the main objective of the session, as presented to the group members was to use brainstorming to generate as many ideas as possible in any phase of the creative process, in order to respond with a creative solution to the real challenge that the company was facing at the moment.

Each session was structured in three phases as follows: (1) Problem statement; (2) Idea generation; (3) Ideas evaluation and analysis. In the case of NKT training experience, as there was no prior creativity training, the sessions started with a preliminary phase dedicated to the clarification of the problem to be solved. Each group received then a description of the problem to be solved (as set by the top management) and each group

was informed that they are expected to express as many "potentially innovative ideas" as possible.

At the very beginning of the session, once all participants have taken their seats, they were informed about the purpose of the meeting i.e., they are expected to provide solution ideas regarding the problem set by the management. During the *(1) Problem statement* phase the groups were provided with a description of the problem set by the top management, both visually as well as written on a piece of paper handed to each participant. In order to reach a clear understanding of the problem statement the participants were also provided with all the information available regarding the problem (e.g. data, statistics, sensations, opinions, perceptions, among other factors).

After being exposed to the problem and after making sure that all participants understood the problem statement the session was interrupted for a 15 minutes break. After the break participants were seated in the room (see Figure 4.2. above) and the *(2) Idea generation* phase started with a reminder of the problem to be solved during this phase.

After making sure all participants understood the challenge, they were asked to generate solution ideas and they were reminded of the basic rules of brainstorming (as detailed above in Table 4.1). In addition to providing Osborn's brainstorming rules the groups were also provided with working materials such as white paper sheets, colored markers,

scotch tape, and scissors and were informed about how to employ the material during the session.

During the third phase of the session, i.e. (3) *Idea evaluation and analysis*, the participants were first asked to establish evaluation criteria. These criteria were usually established through a consensus among the participants regarding the feasibility of the proposed ideas. Once evaluation criteria were established, each of the proposed ideas was assessed against the selected criteria. To proceed with the evaluation, the group selected those ideas that were considered as potential solutions for the challenge. At the end of this process a shorter list of ideas was obtained according to their degree of compliance with the evaluation criteria.

The total time per session was 2 hours and 45 minutes, allocated to each phase as follows: (1) 30 minutes for the problem statement; (2) 60 minutes for idea generation and, (3) 30 minutes for idea evaluation and analysis. Two breaks were taken between phases, with a 15 minute break between phase (1) and (2) a 30 minutes break between the second and third phase.

4.3.2. Training experience II: Ideation after lecture-based creativity training (CRE)

During the *CRE* sessions, participating groups received training in creative thinking techniques, in a conventional, lecture-based format. The objective of such initial training was to familiarize the participants with different creative thinking techniques frequently employed in the business world. The participants were trained in the following techniques: (1) *Morphological Analysis*, (2) *Analogy*, (3) *Bionics*, (4) *Brainstorming*, (5) *Empathy*, (6) *Lotus Blossom*, (7) *The 5 Whys* and, (8) *Scamper*. Each of these techniques is briefly explained in Appendix 3. Similarly to the NKT_R groups the main objective for the groups in the CRE_R groups was to provide solutions to a real problem set by the company's management. By contrast, in CRE_F sessions the challenge was based on a fictitious problem.

Similarly to *NKT* groups, the objective was to have groups generating as many ideas as possible. Every session counted with a facilitator (brainstorming expert in charge of conducting the session). A total of 52 groups (37 working on fictitious problems and 15 working on real problems) with an average number of nine members per group participated in this type of sessions. Team members were carefully chosen by the top management of the companies, no third parties being invited to the sessions. All sessions took place in the same room as presented in Figure 4.2 above. After inviting them in, the groups were presented with a problem (established by the company's management team) and they were informed that the objective was to express the biggest

number of "potentially innovative" solution ideas. Similarly to *NKT* groups, the sessions were broken down into four distinct phases: (1) Initial creativity training; (2) Problem statement; (3) Ideation; (4) Evaluation. A detailed description of these phases follows (for a summary please see Table 4.1 above).

During the *(1) Initial creativity training* phase, participants watched a video recording explaining the typical brainstorming session, the expected behavior and the process through which participants were supposed to contribute ideas. Participants were also given written instructions comprising basic brainstorming rules and procedure. It is worth mentioning also that prior to the session participants received training in creativity techniques (as detailed above).

In the case of *CRE* groups the training received was more theoretical than practical given that the purpose of training for this type of participants was mainly informational – i.e. to expose them to different creativity techniques so they acknowledge and employ them during the training experience –. Specifically the brainstorming technique was explained to the participants as well as other creativity related concepts such as Edward de Bono's *Lateral Thinking*. This phase concluded with *a* presentation of the problem to be solved during the training experience.

As with any brainstorming session, before generating solution ideas the participants need to understand the problem to be solved. Thus, the purpose of the second phase – i.e *(2) Problem Statement* – was to make sure that all participants understood clearly the

problem to be solved. To this end, all the necessary information was made available by the management – both quantitative (e.g. data, statistics, etc.) as well as qualitative information (e.g. perceptions, sensations, feelings, etc.). After making sure that all participants understood the problem to be solved the third phase – i.e. *(3) Idea generation* – followed. This phase followed the same format as phase *(2) Idea generation* described in the case of *NKT* sessions (see Table 4.1 for details regarding the instructions and materials provided as well as for the procedure followed during this phase).

The fourth phase – i.e. *(4) Idea evaluation* – followed a similar format as in the case of the *NKT* sessions. The purpose of this phase was to assess and select the best solutions out of all the ideas generated during the session. To this end, participants were first asked to establish the assessment criteria. Once such criteria were established, the best solutions were selected. At the end of this process a shorter list of ideas is obtained according to their degree of compliance with the evaluation criteria.

For this type of training experience the total time per session was 3 hours and 25 minutes, allotted to each phase as follows: (1) 30 minutes for the initial training; (2) 30 minutes for problem statement; (3) 60 minutes for idea generation and, (4) 30 minutes for evaluation and analysis. Two breaks were taken between phases, with a 15 minute break between the second and the third phase and, a 30 minutes break between the third and fourth phase.

4.3.3. Training experience III: Experiential Learning training (ELT)

The *ELT* experience involved groups of employees from companies that have undergone an innovation process by means of experiential learning within the organization. A total number of 30 groups (10 people per group; 300 participants in total) participated in this type of sessions. The aim was to generate as many ideas as possible in any phase of the innovation process by using different creative techniques. Therefore, it was decided to develop a completely different approach, in which the activities prior to the ideation session are supplemented by an innovation process based on experiential learning (i.e. learning by doing).

Similarly to the training experiences described above, the *ELT* sessions took place within a relaxed, no-stress atmosphere promoting the free expression of any idea and encouraging employees to generate ideas regardless of their rank or position. As in the previous cases, the *ELT* sessions were also organized into four different phases (see Table 4.1 above for a summary of these phases).

For this type of training experience the total time per session was 3.5 hours allotted to each phase as follows: (1) 45 minutes for the initial training; (2) 30 minutes for problem statement; (3) 60 minutes for idea generation and, (4) 30 minutes for evaluation and analysis. A 15 minute break was taken between the first and second phase and, a 30 minutes break was taken between the third and fourth phase.

4.4. Measures

Creativity training effectiveness was measured via the creative performance exhibited by the groups during post-training ideation. Measuring creative performance is not an easy task. In fact, as some authors suggest, creativity measurement is one of "the most controversial issues in creativity research" (Sharma and Rastogi, 2009:9). Runco (2009:394) points out that measuring creativity is challenging given most definitions of creativity involve both originality and novelty and, because it is also usually unpredictable. In other words, the problems of measuring creativity stem from the complexity of the concept but also from the multiple definitions given to it over time (Baer and McKool, 2009; Sharma and Rastogi, 2009; Runco, 2009).

Cropley (2000) comments that some approaches are focused on the creative product and, hence they rely on instruments which measure creativity-related features of the outcome of undertaking a creative task (e.g. the *Creative Product Inventory* [Taylor, 1975] and, the *Creative Product Semantic Scale* [Besemer and O'Quinn, 1987]). Other approaches measure creativity by looking at different aspects of the creative process (e.g. Guilford, 1976; Torrance, 1966; Mednick, 1962; Sternberg, 1997). Finally, those approaches that place the creative person under the spotlight, propose instruments such as biographical inventories (Taylor and Edison, 1968; Michael and Colson, 1979; Runco, 1987); or measure creativity by looking at special personal properties (e.g. Johnson, 1979; Kirschenbaum, 1989; Rimm and Davis, 1980; Colangelo et al., 1992; O'Neil, Abedi and Spielberger, 1994; Azumedi, Villa and Abedi, 1996; Kumar,

Kemmler and Holman, 1997) and, motivations and attitudes (e.g. Williams, 1972 and 1980; Byrd, 1986; Kirton, 1989; Gough, 1992; Basadur and Hausdorf, 1996).

One wide-spread way to measure creativity involves tests that measure/predict the creative outcome of individuals. The creation of such tests, started in the late 60's when J.P. Guilford and Paul E. Torrance developed tests to measure creative thinking – the *Guilford's Alternative Uses Test* (Guilford, 1950; 1967) and, Torrance Tests of Creative Thinking (Torrance, 1962; 1974), respectively. These tests consist in having takers list as many possible uses for a common object, such as a paperclip, a hanger or a tin can. Scoring, as proposed by Guilford (1967) should comprise of four components: originality, fluency, flexibility, and elaboration.

After such pioneering work the efforts to design instruments to measure creative thinking have intensified. In fact, the instruments proposed have mushroomed and nowadays there are at least 255 different tests of the creative thinking potential (Cropley, 2000). *Mednick's Remote Associates Test* (Mednick, 1962; Mednick and Mednick, 1967), the *Torrance Test of Creative Thinking* (Torrance, 1962), the *Wallach and Kogan Tests* (Wallach and Kogan, 1965), Gough's *Creativity Index* (Gough, 1979), Amabile's *Consensual Assessment Technique* (Amabile, 1982) and the *Rainmaker Index* (Stevens, Burley and Devine, 1998), are among the most commonly used tests.

Although, as indicated above, many tests were created to assess creative performance, to date the *TTCT* is "the best-known of the tests based on divergent thinking" (Cropley

2000:75) and also "the most widely used assessments of creative talent" (Sternberg, 2006:87). It can also be observed within the literature that, despite the abundance of measures proposed to assess creative achievement, the measures proposed by Torrance (i.e. fluency, flexibility, originality and elaboration) are most common (Cropley, 2000). Given its proven reliability and widespread use within creativity research in this dissertation creativity was also measured using the Torrance Test of Creative Thinking (Torrance, 1962; 1974). Creativity was assessed on three dimensions namely, the number of ideas generated by each group (i.e. fluency), the originality of those ideas and their degree of elaboration (further details regarding these measures are provided later in this chapter).

At this point one clarification is in order. The *Flexibility* dimension of creativity, which refers to the degree to which the ideas or solutions proposed relate to a diverse range of categories or themes (Torrance and Haensley, 2003), is not taken into account anymore by recent versions of the *TTCT* (Torrance, 1996; Torrance and Haensley, 2003). The rationale is twofold. First, flexibility is more difficult to measure than fluency because in many cases it is not clear how different two ideas have to be in order to be included in distinct categories. Second, this measure highly correlates with the fluency measure (Torrance, 1996; Torrance and Haensley, 2003). Given the above, in the present study the flexibility dimension of creativity was not taken into account.

One frequent criticism of the *TTCT* tests is that they measure creativity through specialized tests such as factor analysis, but never against an external measure of

creative performance (Hickey, 2001: 235). As such, these tests were criticized for having only apparent construct validity and lacking criterion validity (Brown, 1989). As an alternative to *TTCT*, Amabile (1983, 1996) proposed that the most valid way to measure creativity is to use experts and their subjective assessment of creative products (Hickey, 2001). As put by Amabile (1983:5) a product is creative "to the extent that appropriate observers independently agree it is creative". Based on such ideas, Amabile created the *Consensual Assessment Technique* (hereafter CAT; Amabile, 1982; Hennessey, 1994, Hennessey and Amabile, 1999), a measurement tool that includes the following basic steps: (1) subjects are asked to create something and, (2) experts in the domain are asked to evaluate the creativity of the things created by the subjects.

One major advantage of this approach to creativity measurement, as highlighted in Baer and McKool (2009), is that this technique is not tied to any particular creativity theory such that "[i]nstead of measuring things that might be associated with creativity, or that might be predictive of creativity, the Consensual Assessment Technique goes right to the heart of creativity by looking at the creative (or not-so-creative) products that subjects have produced". In addition, another advantage of this technique is that it is closer to reality than any theoretical model as it "*is based on actual creative performance or artifacts*" and it mimics the way creativity is assessed in the "real world" (Baer and McKool, 2009:3).

In this study, to complement the results obtained with *TTCT*, Amabile's *Consensual Assessment Technique* was used, to evaluate the originality as well as the degree of

elaboration of the ideas generated by the groups during post-training ideation sessions. The *Consensual Assessment Technique* is widely used to measure creativity in diverse fields (e.g. Hickey, 2001; Chen et al., 2002; Piller and Walcher, 2006: Hennesey et al., 2008; Kaufman et al., 2010). In addition there is also evidence that this measurement tool is highly reliable (e.g. Baer, Kaufman and Gentile, 2004; Kaufman et al., 2007; 2008).

For the *CAT* to work properly, certain guidelines should be followed. First, judges must qualify as "experts" in the specific domain of the creative product. "Experts" are people who have relevant experience in the domain in which the work was produced (Amabile, 1996). The second guideline for proper use of *CAT* requires the creativity of a product to be evaluated in relation to other elements in a particular study and not against an "absolute" level of creativity. The third guideline requires that all evaluations should be carried out without consultation, each judge making her own impressions, and judges must not confer. The fourth guideline requires all assessments to be made using the same numerical scale and at least one of the creative products should represent the lower end of the scale. Finally, creativity cannot exist in a vacuum separated from functionality. For an element to be considered creative it must be functional (i.e. the proposed solution should refer to something that is operative and capable of performing).

CAT ratings can also be employed to assess the inter-rater reliability of the resulting measure of creative performance. Statistical analysis of the internal consistency of the

scores can determine if there is agreement among judges, and therefore, one can assess the perceived "quality" of creativity (which, according to Guilford (1967) and Torrance, (1963 and 1972) among others, is actually a measurable concept,). As previously argued, creativity means different things to different people: there is no consensus regarding its definition (Woodman et al., 1993; Sawyer, 2006; Runco, 2011) and numerous measures were proposed to assess it (Cropley, 2002) making it difficult to quantify. Nevertheless, if independent judges agree on a given assessment criteria, we can deduce that their ratings are reliable. For example, in Hennessey and Amabile (1999) this method was used to quantify creativity and CAT has resulted in internal consistency scores ranging between 0.71 and 0.91, all for above the threshold of 0.70 for reliability. The three assessment criteria used in this study namely fluency, originality and elaboration, are presented in more detail below.

4.4.1. Fluency

Fluency is a measure of volume which captures the number relevant ideas (Kim, 2006) produced as solutions to a single problem. The *fluency* dimension measures the amount of ideas generated by an individual assuming that more creative individuals will generate more potential solutions to the problem. Fluency, thus, deals with the quantity of ideas and not their quality (Torrance and Haensly, 2003). Although by definition this dimension takes into account the abundant production of ideas, and solutions to situations or problems, in practice fluency as a sole measure of creativity is not

appropriate given it is possible to create many ideas that do not vary significantly and still achieve a high score of fluency. Clearly, although the ability to propose more alternatives to solve a given problem is one dimension of creativity, fluency alone is not sufficient to capture different aspects of the creative endeavor. In this dissertation fluency was measured by the average number of ideas generated by each group during each session. In addition to the fluency measure, creative performance was assessed by examining the originality and elaboration of the ideas generated.

4.4.2. Originality

Originality is the ability of individuals to generate fresh, different, unique and unconventional ideas. Given that originality is a measure of how unusual or rare an idea is (Torrance and Haensly, 2003) it can only be assessed in comparison with the responses suggested by generally normal population.

The originality of the ideas generated during the sessions was assessed by two independent judges (these judges also assessed the degree of elaboration of the ideas). The judges were selected for their knowledge and expertise in the field of creativity and creative thinking. The evaluation of ideas took place in the same rooms in which the ideas were generated. All the ideas generated during the sessions were presented for evaluation. The time spent to assess each groups' creative performance ranged between 30 to 120 minutes. The judges were selected and trained on *Amabile's Consensual Assessment Technique*.

Judges who participated were given the minimal instructions to carry out their task. They were told that for an idea to be considered creative, it should be relevant to the task. Judges were further instructed to follow the questionnaire provided to them and rate ideas on two specific aspects (general originality and the degree of elaboration of each idea) on a scale ranging from one (low level of originality and low degree of elaboration, respectively) to seven (high originality, and high elaboration). The judges were also instructed and asked to rate, for each group, the lowest and the highest ideas on originality and elaboration, respectively. This restriction was introduced to ensure that judges stay focused on the ideas generated by the groups and do not compare these ideas to any creative work that each of the judges had ever seen. Beyond these instructions, each judge rated each of the ideas based on their own subjective perceptions of the creativity. Idea assessment was performed independently and judges were not allowed to meet each other. Judges were not informed about the gender of the participants and were not informed of the hypotheses tested within this study.

4.4.3. Elaboration

Elaboration refers to the richness of detail in the responses or solutions produced. This measure also captures the ability to extend or modify an existing idea in more detail. As in the case of the originality measure, the level of elaboration can only be measured by comparison to the average person (generally normal population). In this study the degree of elaboration was assessed using *Amabile's Creative Assessement Technique*. As

explained above, two independent judges were asked to rate the ideas generated by the groups on a Likert type scale with 1 representing lowest level and 7 being the highest level of elaboration.

4.5. Chapter summary

In this chapter we present the methodology employed for the empirical application of this dissertation including a description the research design, the sample, the empirical procedures and variable selection and measurement.

To contrast the proposed hypotheses post training ideation performance was observed, measured and compared among different groups of individuals (109 groups in total) working together to generate ideas. The participants are employees at forty three Spanish business organizations from different industrial sectors, one non-governmental organization, as well as one public university. Most business organizations are service providers.

To test for the effect of training delivery on post training ideation performance the groups were exposed to different creativity training experiences. Some of the groups were previously trained in creative thinking whereas other groups received no training. Creativity training was provided in two formats. Some groups received training in a lecture-based approach whereas others were trained using an Experiential Learning

approach. Post training ideation performance was then compared between these three types of groups. To test for the effect of problem realism on creative performance some groups were asked to work on real-life problems whereas others were assigned fictitious tasks.

Post-training ideation performance was assessed by measuring three dimensions of creativity namely: 1) fluency (i.e. the amount of ideas generated); 2) originality (capturing the uniqueness and unconventionality of ideas) and 3) elaboration (i.e. the richness of detail). Regarding the measurement method, two complementary and highly reliable tools – widely employed within previous research on ideation performance – were used. First, the *Torrance Test of Creative Thinking* was applied. This method relies on using predesigned tests to assess creative performance. The second method namely, the *Creative Assessment Technique*, relies on the opinion of experts to evaluate creative performance.

Chapter 5 – Empirical Findings

In this chapter, we analyze the relative performance of groups during ideation. The purpose of the dissertation is to ascertain the effect that the type of training (no training at all, traditional creativity training and training through experiential learning) and problem realism (solving a real versus a fictitious problem) may have upon creative performance of groups engaged in ideation.

As indicated previously the ideation technique used was brainstorming and the creative performance of brainstorming groups was assessed using three measures frequently employed by previous empirical research on brainstorming performance. Specifically these measures are: (1) fluency – which measures the amount of ideas generated by the group during the session; (2) originality – which measures the amount of uncommon ideas generated by the group relative to the general population (as assessed by judges) and; (3) elaboration – which measures the depth of detain with which the ideas are presented.

The reminder of this chapter is organized as follows. In the next section the preliminary results are presented. Specifically, in this section we present descriptive results for each of the measures used to capture brainstorming performance as well as a summary of results obtained through data analysis. This section is followed by a detailed presentation of the data analysis regarding the type of training used – in section 5.2.–

followed by the presentation of the results obtained for the type of problem – in section

5.3–.

5.1. Preliminary findings

The average values obtained for the three performance measures observed (i.e. fluency,

originality and elaboration) are presented below in Table 5.1. These average values were

computed as follows. In the case of the fluency measure, the average was computed by

dividing the number of ideas generated by the number of participants.

Table 5.1. Descriptive results – average scores for each of the three performance measures

Type of training	Type of problem					
	Real			Fictitious		
	Fluency	Originality	Elaboration	Fluency	Originality	Elaboration
No Training (NKT)	4.87	3.89	3.47	5.33	3.14	3.11
Creativity training (CRE)	4.13	3.87	3.39	3.97	3.39	3.22
Experiential learning training (ELT)	9.21	3.98	3.75			

Source: Self devised

The mean values for the *originality* measure were obtained in two steps. First, the

average originality was computed for each assessment questionnaire submitted by each

of the judges (as explained earlier in Chapter 4, each judge assessed the originality of the ideas generated using a 1 to 7 scale, with 1 being not at all original and 7 being original). Secondly, and given that the results of the reliability tests were positive, the average originality score was computed.

The average *elaboration* values were also computed in two steps. First the average elaboration score was computed for each questionnaire submitted by the judges (using a similar 1 to 7 assessment scale, as in the case of the *originality* measure). Next, a single average for both judges was computed.

To ensure the consistency of originality and elaboration measures, an inter-rater reliability test was also conducted by computing the highest and the lowest correlation coefficient among the two judges that assessed the performance of the brainstorming sessions on these two dimensions. The results obtained for this test, which are presented in Table 5.2. below, indicate that there is consistency among judges regarding both the originality as well as the elaboration measure.

Table 5.2. Reliability test results

Performance measure	Pearson's R[*]	
	Highest value	**Lowest value**
Originality	0.9750	0.6961
Elaboration	0.9801	0.7509

[*] p<0.001 in all cases

Source: Self devised

As it can be observed in the Table 5.1., for the entire sample of participants, the highest average number of ideas (fluency) was obtained in the case of the groups solving real problems and that have received creativity training through experiential learning (*ELT*). These groups also scored the highest on the elaboration and the originality of the ideas proposed.

The groups that received creativity training through lecture-based training (*CRE*) produced the lowest number of ideas, both compared to *ELT* groups as well as with those groups that have not received training at all (*NKT*). Nevertheless, these groups showed superior performance in terms of originality and elaboration as compared to groups that received no training. The results are consistent when the groups worked on a real problem as well as when they worked on a fictitious one. Student's t-test and ANOVA analysis were performed in order to test the hypotheses stated in Chapter 3 and answer the research questions. These results are presented in the next section.

5.2. Results regarding training

Table 5.3 provides a summary of descriptive statistics for the brainstorming results obtained by the sample of participants analyzed during the session.

Table 5.3. Descriptive statistics – Type of training and creative performance

Results measure	Type of groups[*]	N	Sum	Mean	Variance
Fluency	NKT_R	14	68.2381	4.8741	2.1231
	CRE_R	15	61.9932	4.1329	1.4384
	ELT	30	276.3611	9.2120	4.2377
	NKT_F	13	146.9628	5.2380	2.3333
	CRE_F	37	69.2623	3.9720	1.0141
Originality	NKT_R	14	54.4949	3.8925	0.0562
	CRE_R	15	56.6504	3.7767	0.0928
	ELT	30	119.3573	3.9786	0.0095
	NKT_F	13	40.8822	3.1448	0.3176
	CRE_F	37	125.4929	3.3917	0.2321
Elaboration	NKT_R	14	48.6356	3.4740	0.0823
	CRE_R	15	50.8643	3.3910	0.1664
	ELT	30	112.3741	3.7458	0.0497
	NKT_F	13	40.4304	3.1100	0.1433
	CRE_F	37	119.1911	3.2214	0.1986

Notes: * NKT groups that received no training; CRE – groups that received regular training in creativity techniques; ELT –groups that received training in creativity techniques through an experiential learning program; R – real problem; F – fictitious problem.

Source: Self devised

As it can be observed in the table certain differences can be observed among the results obtained by the different groups according to the type of training they were exposed to. Specifically, for each of the results measures employed the groups that received creativity training via an experiential learning program obtained the best results during the brainstorming session. These groups generated about 9 per group (versus 4 ideas generated by groups that received traditional creativity training – i.e. CRE_R –; and

approximately 5 ideas per group generated by those participants that received no training at all − i.e. NKT_R). The *ELT* groups showed superior performance results in terms of originality and elaboration, although the differences between groups on these two measures are quite small. Interestingly the groups that received traditional creativity training and worked on solving a real problem (CRE_R) obtained the lowest results for all three measures considered within this study.

Interesting results are obtained for the case of groups that worked on a fictitious problem. These groups generated more ideas than the groups that have worked on real problems and received traditional training in creativity (CRE_R) and the groups that did not received training at all (NKT_R). Regarding the qualitative side of brainstorming results the preliminary descriptive results also point some interesting findings with CRE_F showing superior performance results in terms of originality and elaboration as compared to all the other groups analyzed whereas NKT_F groups have generated the least amount of original and elaborated ideas.

For data analysis, student's t-test and analysis of variance (ANOVA) was used to examine eventual differences between the means of the different groups analyzed. Student's t-test is appropriate for the comparison of two sets of quantitative data when the samples are collected independently of one another, which is also the case of data examined within this study: small independent samples of ideas generated by different brainstorming groups.

5.2.1. Fluency results according to training

T-test results regarding the fluency measure obtained for each type of training experience are presented in table 5.4.

Table 5.4. T-test results for the fluency measure according to the type of training received by participants (comparison of two samples assuming unequal variances)

Groups[*]	NKT_R	CRE_R	CRE_R	ELT	NKT_R	ELT	NKT_F	CRE_F
Mean	4.8741	4.1329	4.1329	9.2120	4.8741	9.2120	5.3279	3.9720
Variance	2.1231	1.4384	1.4384	4.2377	2.1231	4.2377	1.0141	2.3334
Observations	14	15	15	30	14	30	13	37
Hypothesized mean difference	0		0		0		0	
Df	27		42		35		48	
tStat	1.5002		10.4299		8.0152		2.9711	
P(T≤t) one-tail	0.07259		1.57283 E-13		9.83867 E-10		0.0023	
tCritical one-tail	1.7033		1.6820		1.6896		1.6772	
P(T≤t) two-tail	0.1452		3.14565 E-13		1.96773 E-09		0.0046	
tCritical two-tail	2.0518		2.0181		2.0301		2.0106	

Notes: * NKT groups that received no training; CRE - groups that received regular training in creativity techniques; ELT –groups that received training in creativity techniques through an experiential learning program; R – real problem; F – fictitious problem.

Source: Self devised

For the fluency dimension, the t-test does not indicate significant differences (p=0.1452) between CRE_R and NKT_R groups. However, significant differences are found for all the other groups analyzed. Specifically, the t-test indicates that the ELT groups generated on the average twice as more ideas than both NKT_R and CRE_R groups, and these differences are statistically significant at 1% confidence level (p<0.01 in both cases).

For the groups that have worked on fictitious problems, those that have not received creativity training (NKT_F) generated significantly more ideas than groups that have received training (CRE_F), ($p<0.01$).

The ANOVA test conducted for the fluency measure give further support to the findings reflected by student's – t test (these results are presented in Table 5.5, below). Excepting the comparison between NKT_R and CRE_R for which no significant differences were found (F=2.2505; p=0.1452), significant differences were found for all the other pairs compared.

Table 5.5. ANOVA results for fluency and type of training

Concept[*]	Type of variation	Sum of squares	df	Mean square	F-value	P	Critical F-value
NKT_R vs. CRE_R	Between groups	3.9790	1	3.9790	2.2505	0.14517	4.2100
	Within groups	47.7370	27	1.7680			
	Total	51.7160	28				
CRE_R vs. ELT	Between groups	257.9783	1	257.9783	77.5568	3.52548E-11	4.0670
	Within groups	143.0316	43	3.3263			
	Total	401.0098	44				
NKT_R vs. ELT	Between groups	179.6193	1	179.6194	50.1282	1.11674E-08	4.0727
	Within groups	150.4944	42	3.5832			
	Total	3301138	43				
NKT_F vs. CRE_F	Between groups	17.6861	1	17.6861	8.8274	0.0046	4.0427
	Within groups	96.1703	48	2.0035			
	Total	113.8564	49				

Notes: * NKT groups that received no training; CRE - groups that received regular training in creativity techniques; ELT –groups that received training in creativity techniques through an experiential learning program; R – real problem; F – fictitious problem.

Source: Self devised

Thus, ANOVA results also indicate that groups that received creativity training through experiential learning generated significantly more ideas than both the groups that were trained using a lecture-based approach (F=77.5568; p<0.01) and the groups that have not received training at all (F= 50.1282; p<0.01). Training does not appear as improving creative performance for the groups that worked on solving fictitious problems, when creative performance is measured as the volume of ideas produced (i.e. fluency). In this case, contrary to the hypothesized effect, the groups that generated ideas without having received training (i.e. NKT_F) generated almost twice as many ideas as trained groups (i.e. CRE_F) and this difference is statistically significant at conventional levels (F=8.8274; p<0.01).

5.2.2. Originality results according to training

T-test examination of data in the case of the originality dimension (Table 5.6 below) indicates statistical significance for the differences between groups only when CRE_R groups are compared to *ELT* groups (p<0.05). The differences in terms of originality for the remaining groups do not appear as being statistically significant.

Table 5.6. T-test results for originality according to the type of training received by participants (comparison of two samples assuming unequal variances)

Groups[*]	NKT_R	CRE_R	CRE_R	ELT	NKT_R	ELT	NKT_F	CRE_F
Mean	3.8924	3.7767	3.7767	3.9786	3.8924	3.9786	3.1448	3.3917
Variance	0.0562	0.0928	0.0928	0.0095	0.0562	0.0095	0.3176	0.2321
Observations	14	15	15	30	14	30	13	37
Hypothesized mean difference	0		0		0		0	
Df	27		43		27		48	
tStat	1.1363		3.3368		1.1363		1.5213	
P(T≤t) one-tail	0.1329		0.0009		0.1329		0.0674	
tCritical one-tail	1.7033		1.6811		1.7033		1.6772	
P(T≤t) two-tail	0.2658		0.0018		0.2658		0.1348	
tCritical two-tail	2.0518		2.0167		2.0518		2.0106	

Notes: * NKT groups that received no training; CRE - groups that received regular training in creativity techniques; ELT –groups that received training in creativity techniques through an experiential learning program; R – real problem; F – fictitious problem.

Source: Self devised

These results are supported by the ANOVA test as well. As it can be seen in Table 5.7, *ELT* groups show superior performance in terms of originality than *CRE_R* groups (3.98 versus 3.78 original ideas per group) and this difference is statistically significant (F=11.1342; p<0.05). However, for the remaining groups, the analysis of variance undertaken does not indicate any statistically significant differences between groups regarding the originality of the ideas generated.

Table 5.7.ANOVA results for originality and type of training

Concept[*]	Type of variation	Sum of squares	df	Mean square	F-value	P	Critical F-value
NKT_R vs. CRE_R	Between groups	0.0971	1	0.0971	1.2913	0.2658	4.2100
	Within groups	2.0304	27	0.0752			
	Total	2.1275	28				
CRE_R vs. ELT	Between groups	0.4076	1	0.4076	11.1342	0.0018	4.0670
	Within groups	1.5741	43	0.0366			
	Total	1.9816	44				
NKT_R vs. ELT	Between groups	0.0707	1	0.0707	2.9542	0.0930	4.0727
	Within groups	1.0057	42	0.0239			
	Total	1.0764	43				
NKT_F vs. CRE_F	Between groups	0.5865	1	0.5865	2.3142	0.1348	4.0427
	Within groups	12.165	48	0.2534			
	Total	12.7515	49				

Notes: * NKT groups that received no training; CRE - groups that received regular training in creativity techniques; ELT –groups that received training in creativity techniques through an experiential learning program; R – real problem; F – fictitious problem.

Source: Self devised

5.2.3. Degree of elaboration according to training

T-test results obtained for the elaboration dimension of brainstorming results are displayed in Table 5.8. It can be observed in the table that no significant differences were found for the elaboration of ideas generated by NKT_R groups as compared to CRE_R (p=0.5343). Statistically significant differences were found, however for the case of groups exposed to creativity training through experiential learning. These groups have generated significantly more elaborated ideas that both the CRE_R groups (3.74

versus 3.39 ideas per group; p<0.01) and the NKT_R groups (3.74 versus 3.47 ideas per group; p<0.01). In the case of the groups that worked on a fictitious problem, having been exposed to creativity training previous to using brainstorming does not appears as significantly enhancing the level of elaboration of the ideas generated during the brainstorming session (p=0.4257).

Table 5.8. T-test results for elaboration according to the type of training received by participants (comparison of two samples assuming unequal variances)

Groups[*]	NKT_R	CRE_R	CRE_R	ELT	NKT_R	ELT	NKT_F	CRE_F
Mean	3.4740	3.3910	3.3910	3.7458	3.4740	3.7458	3.1100	3.2214
Variance	0.0823	0.1664	0.1664	0.0497	0.0823	0.0497	0.1433	0.1986
Observations	14	15	15	30	14	30	13	37
Hypothesized mean difference	0		0		0		0	
Df	27		18		27		48	
tStat	0.6295		3.1423		0.6295		0.8034	
P(T≤t) one-tail	0.2671		0.0028		0.2671		0.2129	
tCritical one-tail	1.7033		1.7341		1.7033		1.6772	
P(T≤t) two-tail	0.5343		0.0056		0.5343		0.4257	
tCritical two-tail	2.0518		2.1009		2.0518		2.0106	

Notes: * NKT groups that received no training; CRE - groups that received regular training in creativity techniques; ELT –groups that received training in creativity techniques through an experiential learning program; R – real problem; F – fictitious problem.

Source: Self devised

The t-test results presented above are once again corroborated by results obtained through analysis of variance (ANOVA results are presented in Table 5.9, below). It can be seen that for the groups that worked on real problems, no significant differences were

found between NKT_R and CRE_R groups (F=0.3963; p=0.5343). Nevertheless, having been exposed to creativity training through experiential learning significantly improved the level of elaboration of ELT groups as compared both to CRE_R groups (F=14.3539; p<0.01) as well as with NKT_R groups (F=11.7912; p<0.01). ANOVA results also support the lack of statistical significance for the differences between NKT_F and CRE_F groups (F=0.6454; p=0.4257).

Table 5.9.ANOVA results for elaboration and type of training

Concept[*]	Type of variation	Sum of squares	df	Mean square	F-value	P	Critical F-value
NKT_R vs. CRE_R	Between groups	0.0499	1	0.0499	0.3963	0.5343	4.2100
	Within groups	3.4000	27	0.1259			
	Total	3.4499	28				
CRE_R vs. ELT	Between groups	1.2592	1	1.2592	14.3540	0.0005	4.0670
	Within groups	3.7721	43	0.0877			
	Total	5.0313	44				
NKT_R vs. ELT	Between groups	0.7053	1	0.7053	11.7912	0.0014	4.0727
	Within groups	2.5124	42	0.0598			
	Total	3.2177	43				
NKT_F vs. CRE_F	Between groups	0.1193	1	0.1193	0.6454	0.4257	4.0427
	Within groups	8.8708	48	0.1848			
	Total	8.9901	49				

Notes: * NKT groups that received no training; CRE - groups that received regular training in creativity techniques; ELT –groups that received training in creativity techniques through an experiential learning program; R – real problem; F – fictitious problem.

Source: Self devised

5.3. Problem realism and creative performance

A similar analysis to the one previously presented was conducted to examine the effect of the type of problem on brainstorming results measured in terms of fluency, originality and degree of elaboration of the ideas generated by the different groups analyzed. A summary of descriptive statistics is provided in Table 5.10. As it can be observed in the table, there are differences in the mean values between groups for each of the examined performance dimensions. Specifically, in terms of fluency, groups that received no training (*NKT*) and worked on real problems generated fewer ideas than their counterparts that worked on fictitious problems. These results are opposed to the hypothesized effect. Opposite results are observed for the trained groups in which case, groups that worked on real problems generated more ideas than groups that worked on fictitious ones. Differences in terms of the originality of the ideas generated were also observed. In this case, regardless of whether they received training or not, groups that worked on solving real problems showed superior performance results in terms or originality to groups working on fictitious challenges. A similar situation is observed for the degree of the elaboration of the ideas generated, more elaborated ideas being generated by those groups that worked on solving real problems.

Table 5.10. Descriptive statistics for brainstorming results according to the type of problem

Results measure	Type of groups[*]	N	Sum	Mean	Variance
Fluency	NKT_R	14	68.2381	4.8741	2.1231
	NKT_F	13	69.2623	5.3279	1.0141
	CRE_R	15	61.9932	4.1329	1.4383
	CRE_F	37	146.9628	3.9720	2.3334
Originality	NKT_R	14	54.4949	3.8925	0.0562
	NKT_F	13	40.8822	3.1448	0.3176
	CRE_R	15	56.6503	3.7767	0.0928
	CRE_F	37	125.4929	3.3917	0.2321
Elaboration	NKT_R	14	48.6356	3.4740	0.0823
	NKT_F	13	40.4304	3.1100	0.1433
	CRE_R	15	50.8643	3.3910	0.1664
	CRE_F	37	119.1911	3.2214	0.1986

Notes: * NKT groups that received no training; CRE - groups that received regular training in creativity techniques; ELT –groups that received training in creativity techniques through an experiential learning program; R – real problem; F – fictitious problem.

Source: Self devised

As in the case of training, two tests were employed in order to check for the statistical significance of the differences observed between groups namely, student's t-test and ANOVA analysis.

5.3.1. Fluency and problem realism

T-test results for fluency according to problem realism are presented in Table 5.11. The results indicate no statistically significant differences between the mean number of ideas generated by NKT_R groups as compared to NKT_F groups (p=0.3592). Similarly, no statistically significant differences are found between CRE_R and CRE_F groups (p=0.7172).

Table 5.11. T-test results for fluency according to the type of problem (comparison of two samples assuming equal variances)

Groups[*]	NKT_R	NKT_F	CRE_R	CRE_F
Mean	4.8741	5.3279	4.1328	3.9720
Variance	2.1231	1.0141	1.4384	2.3334
Observations	14	13	15	37
Hypothesized mean difference	0		0	
Df	25		50	
tStat	0.9340		0.3643	
P(T≤t) one-tail	0.1796		0.3586	
tCritical one-tail	1.7081		1.6760	
P(T≤t) two-tail	0.3592		0.7172	
tCritical two-tail	2.0595		2.0086	

Notes: * NKT groups that received no training; CRE - groups that received regular training in creativity techniques; R – real problem; F – fictitious problem.

Source: Self devised

These results are further corroborated by the analysis of variance (Table 5.12) revealing no statistically significant differences both between *NKT* groups (F=0.8723; p=0.3592) as well as for the CRE groups (F=1.327; p = 0.7172).

Table 5.12.ANOVA results for fluency and type of problem

Concept[*]	Type of variation	Sum of squares	df	Mean square	F-value	P	Critical F-value
NKT_R vs. NKT_F	Between groups	1.3877	1	1.3877	0.8272	0.3592	4.2417
	Within groups	39.7695	25	1.5908			
	Total	41.1572	26				
CRE_R vs. CRE_F	Between groups	0.2764	1	0.2764	0.1327	0.7172	4.0343
	Within groups	104.1378	50	2.0828			
	Total	104.4141	51				

Source: Self devised

5.3.2. Originality and problem realism

A different situation is observed when ideation results are measured in terms of originality. In this case, t-test results (Table 5.13) reveal statistically significant differences for both types of groups. Specifically, in the case of groups that received no training, the groups that worked on solving real problems (3.90 original ideas per group) showed better performance results in terms of originality than groups that worked on solving fictitious challenges (3.14 original ideas per group) and this difference is highly significant (p<0.01). A similar situation is observed in the case of groups that received training. On the average, trained groups which worked on solving real-life challenges

generated showed better originality results (3.78 original ideas per group) than trained groups working to solve fictitious problems (3.39 original ideas per group). These differences were also found to have high statistical significance ($p<0.01$).

Table 5.13. T-test results for originality according to the type of problem (comparison of two samples assuming equal variances)

Groups[*]	NKT_R	NKT_F	CRE_R	CRE_F
Mean	3.8925	3.1448	3.7767	3.3917
Variance	0.0562	0.3176	0.0928	2.3206
Observations	14	13	15	37
Hypothesized mean difference	0		0	
Df	16		50	
tStat	4.4333		2.8624	
P(T≤t) one-tail	0.0002		0.0030	
tCritical one-tail	1.7459		1.6759	
P(T≤t) two-tail	0.0004		0.0061	
tCritical two-tail	2.1199		2.0086	

Notes: * NKT groups that received no training; CRE — groups that received regular training in creativity techniques; R – real problem; F – fictitious problem.

Source: Self devised

These results are also supported by the results obtained through ANOVA testing. As it can be observed in Table 5.14, the superiority in terms of the originality of the ideas generated by the NKT_R groups over the NKT_F groups is highly significant statistically (F=20.7440; $p<0.01$). ANOVA results also support the finding that CRE_R groups scored better on originality than CRE_F groups.

Table 5.14.ANOVA results for originality and type of problem

Concept[*]	Type of variation	Sum of squares	df	Mean square	F-value	P	Critical F-value
NKT_R vs. NKT_F	Between groups	3.7685	1	3.7685	20.7440	0.0001	4.2417
	Within groups	4.5417	25	0.1817			
	Total	8.3103	26				
CRE_R vs. CRE_F	Between groups	1.5819	1	1.5819	8.1934	0.0061	4.0343
	Within groups	9.6537	50	0.1931			
	Total	11.2357	51				

Notes: * NKT groups that received no training; CRE — groups that received regular training in creativity techniques; R – real problem; F – fictitious problem.

Source: Self devised

5.3.3. Elaboration and problem realism

T-test results (Table 5.15) for group comparisons on the elaboration dimension reveal statistically significant differences for the groups that received no training. For these groups, those groups that worked on solving real problems generated more ideas than groups working on fictitious one (3.47 versus 3.11 elaborated ideas per group; p<0.01). However, in the case of groups that received training no statistically significant differences were found between those groups that worked on solving real-life challenges as compared to fictitious ones.

Table 5.15. T-test results for elaboration according to the type of problem (comparison of two samples assuming equal variances)

Groups[*]	NKT_R	NKT_F	CRE_R	CRE_F
Mean	3.4740	3.1100	3.3910	3.2214
Variance	0.0823	0.1433	0.1664	0.1986
Observations	14	13	15	37
Hypothesized mean difference	0		0	
Df	25		50	
tStat	2.8284		1.2722	
P(T≤t) one-tail	0.0045		0.1046	
tCritical one-tail	1.7081		1.6759	
P(T≤t) two-tail	0.0091		0.2091	
tCritical two-tail	2.0595		2.0086	

Notes: * NKT groups that received no training; CRE — groups that received regular training in creativity techniques; R – real problem; F – fictitious problem.

Source: Self devised

Table 5.16.ANOVA results for elaboration and type of problem

Concept[*]	Type of variation	Sum of squares	df	Mean square	F-value	P	Critical F-value
NKT_R vs. NKT_F	Between groups	0.8928	1	0.8928	7.1000	0.0091	4.2417
	Within groups	2.7901	25	0.1116			
	Total	3.6829	26				
CRE_R vs. CRE_F	Between groups	0.3069	1	0.3069	1.6185	0.2091	4.0343
	Within groups	9.4807	50	0.1896			
	Total	9.7876	51				

Notes: * NKT groups that received no training; CRE — groups that received regular training in creativity techniques; R – real problem; F – fictitious problem.

Source: Self devised

These results were also supported by results provided by the ANOVA test. As it can be observed in Table 5.16 the differences observed of the NKT groups are highly significant statistically (F=7.1; p<0.01). Nevertheless, no statistical significance was provided for the CRE groups (F=1.6185; p=4.0343).

5.4. Chapter Summary

In this chapter we presented the results of the empirical application of this dissertation. The creative performance of groups working to generate ideas was assessed and compared taking into account the type of training received and the realism of the tasks used during the ideation sessions. The creative performance was measured using two complementary measurement tools namely, the *Torrance Test of Creative Thinking* and *Amabile's Consensual Technique.* Creativity was assessed considering three distinct dimensions: 1) fluency; i.e. the number o ideas generated; measured as the average number per group; 2) originality; and 3) degree of elaboration. Both the elaboration and the originality of the ideas generated were measured using the average of the ratings provided by two independent judges. Data was analyzed using student's t-test and analysis of variance (ANOVA).

The results indicate differences between groups method on post-training ideation performance. The groups that were trained using an experiential learning approach exhibit the highest performance on each of the three creative performance dimensions

considered (i.e., fluency, originality and elaboration). These groups generated more ideas than both the groups trained using a lecture-based approach and the groups that received no training. Interestingly, of all groups, those that received lecture-based training and worked on solving real problems exhibit the lowest performance on all three dimensions considered. These results are consistent for both student's t-test and ANOVA.

The results obtained for the originality dimension indicate superior post-training creative performance only for the *ELT* groups when compared with groups trained using a lecture-based approach and which have worked on solving real problems. No significant differences were found for the rest of the groups. These results are also consistent for both student's t-test and ANOVA.

In the case of the degree of elaboration of the ideas generated in post-training ideation the results indicate superior creative performance in the case of groups that were trained using an experiential learning approach. These groups generated more elaborated ideas than both the untrained groups and the groups trained using a lecture-based approach. For the rest of the groups no statistically significant results were found. Once again, these results are consistent for both student's t-test and the analysis of variance.

For problem realism, no statistically significant differences were found between groups in terms of the volume of ideas (i.e. fluency). In the case of the originality dimension, the results indicate superior performance for the groups that worked on solving real

problems, regardless of whether they were previously trained in creative thinking or not. Finally, problem realism was found to also affect the degree of elaboration of the ideas generated by those groups that did not receive training. No statistically significant difference was found in the case of trained groups. For all three creative performance dimensions considered, the results are consistent for both student's t-test and ANOVA.

Chapter 6 – Discussion of results

A summary of the results obtained through data analysis is presented in Table 6.1. The purpose of this table is to give the reader a concise view of all the results obtained in the empirical application of the present dissertation. The purpose of this dissertation is to examine the effect that training delivery method and problem realism, have on post-training ideation results. Ideation results are measured through three distinct dimensions namely (1) the fluency, (2) the originality and, (3) the level of elaboration of the ideas generated by the participants. The empirical results indicate the following.

Table 6.1. Summary of empirical results

Type of comparison[*]	Significance[**]		
	Fluency	**Originality**	**Elaboration**
Type of training (real problem)	$NKT_R < ELT$ $CRE_R < ELT$	$CRE_R < ELT$	$NKT_R < ELT$ $CRE_R < ELT$
Type of training (fictitious problem)	$NKT_F > CRE_F$	X	X
Problem realism (no training)	X	$NKT_R > NKT_F$	$NKT_R > NKT_F$
Problem realism (creativity training)	X	$CRE_R > CRE_F$	X

NKT- no kind of training; CRE – regular creativity training; ELT – experiential learning based creativity training;
R-real problem; F-fictitious problem

[*]No results are reported for Problem realism in the case of ELT groups, given this groups worked on real problems exclusively.
[**]Only statistically significant relationships are presented in this table; X indicates that no significant differences were found between groups

Source: Self devised

When differences between groups are examined according to the delivery method it has been observed that the groups that received creativity training through experiential learning (*ELT*) obtained higher results on all three performance dimensions examined. Specifically, *ELT* groups produced more ideas than both the untrained groups *(NKT_R)* and the groups that were trained in creative thinking techniques using a lecture-based approach (*CRE_R*). Note that for this comparison only the groups that worked on solving real problems were considered, given *ELT* groups worked on solving real-problems exclusively.

Similar results are obtained for the degree of elaboration of the ideas generated with *ELT* groups producing more elaborated ideas than both the untrained groups *(NKT_R)* and the groups trained using a lecture-based approach (*CRE_R*). In addition to the fluency measure, *ELT* performed better on the originality dimension than the groups trained using a lecture-based approach (*CRE_R*). No statistically significant differences were observed for this measure when comparing *ELT* to untrained groups *(NKT_R)*. A summary of these results is provided below in Table 6.2.

Table 6.2. Delivery method and post-training ideation performance – Summary of t-test results (mean values, significant differences in bold)

Groups[*] Creativity dimension	NKT_R	CRE_R	CRE_R	ELT	NKT_R	ELT	NKT_F	CRE_F
Fluency	4.8741	4.1329	4.1329	**9.2120**	4.8741	**9.2120**	5.3279	**3.9720**
Originality	3.8924	3.7767	3.7767	**3.9786**	3.8924	3.9786	3.1448	3.3917
Elaboration	3.4740	3.3910	3.3910	**3.7458**	3.4740	**3.7458**	3.1100	3.2214

Notes: * NKT groups that received no training; CRE – groups that received regular training in creativity techniques; ELT –groups that received training in creativity techniques through an experiential learning program; R – real problem; F – fictitious problem.

Source: Self devised

The effect of training was also examined for the groups that worked on solving fictitious problems. A summary of these results is provided in Table 6.3. In this case the comparison was limited to groups that received no training (NKT_F) and groups that were trained using a lecture-based approach (CRE_F) given *ELT* groups worked on solving real-problems only. For this case student's t-test and ANOVA results indicate that untrained groups (NKT_F) produced more ideas than groups trained using a lecture-based approach (CRE_F). No statistically significant differences were found for the originality and the degree of elaboration of the ideas generated by these groups.

Table 6.3 Problem realism and post-training ideation performance – Summary of t-test results (mean values, significant differences in bold)

Groups[*] Creativity dimension	NKT_R	NKT_F	CRE_R	CRE_F
Fluency	4.8741	5.3279	4.1328	3.9720
Originality	**3.8925**	3.1448	**3.7767**	3.3917
Elaboration	**3.4740**	3.1100	3.3910	3.2214

Notes: * NKT groups that received no training; CRE — groups that received regular training in creativity techniques; R – real problem; F – fictitious problem.

Source: Self devised

6.1. Does training affect creative performance?

The aforementioned results regarding the effect of training delivery method provide some support to the first set of hypotheses stated in this study. Hypothesis 1 states that a positive relationship exists between creativity training and creative performance in idea generation. The empirical findings discussed above, provide only partial support to this hypothesis. As mentioned previously, trained groups exhibited higher performance than untrained groups only in the case of groups that received experiential-learning based training *(ELT)*. These groups performed better on all the performance measures considered in this study and better than both the untrained groups and the groups that received training in a lecture-based format. Nevertheless, when groups worked on solving fictitious problems, the results obtained regarding the effect of training are the opposite of the hypothesized effects. In this case, the groups that received training generated fewer ideas than the untrained groups. Nevertheless, the groups that received

training and worked on solving fictitious problems generated fewer ideas than untrained groups solving fictitious problems. No significant differences were found however for the originality and elaboration measures. Hence, the results obtained provide only partial support to Hypothesis 1.

Hypothesis 2 states that groups that were trained in creativity techniques via active-learning approaches will exhibit higher creative performance in ideation than groups trained using a lecture-based approach. The results obtained in the empirical application of this dissertation provide full support to this hypothesis. As mentioned previously, the statistical analysis shows a clear superiority of the groups trained using an active-learning approach as compared to both the groups that received training using a lecture-based approach and the untrained groups.

Overall the data analysis provides additional evidence regarding the impact of creativity training on the enhancement of creative ability and performance. These results are in line with assertions made by many creativity theorists who claim that creativity is a trainable ability and that to individuals can be trained in order to enhance their creative skills and performance (e.g. Guilford, 1950, 1967; Torrance, 1962, 1972; Plucker and Runco, 1999; Sternberg, 2003; Runco, 2007, among others). In addition, these results are also in line with assertions made by organizational creativity theorists that point out to the importance of creativity training (e.g. Amabile, 1983, 1988, 1996, 1999, 2012; Woodman, et al., 1993) and claim that the skills and abilities people have in performing the creative act are essential for higher creative performance.

The empirical findings reported in this dissertation are also in line with findings of previous empirical research on creativity training. Studies like Basadur et al., 1982; Kabanoff and Bottger, 1991; Runco and Basadur, 1993; Basadur et al., 2000; Wang and Horng, 2002 all provide evidence that creativity training enhanced both the number and the originality of the ideas or solutions generated after receiving training in creative thinking. Also, these results are in line with research examining the effect of training on group creativity that shows that trained groups perform better than untrained ones (e.g. Firestien and McCowan, 1988; Firestien, 1990; Fontenot, 1993, Basadur, Pringle, Speranzini and Bacot, 2000). Finally, these results are also in line with the general conclusion drawn in Scott's et al. (2004) meta-analysis of 70 studies on the effect of training on creative performance according to which training has a particularly strong effect on creative performance in the case of those training programs focused on divergent thinking and problem solving (as is the case of the ideation technique – i.e. brainstorming – and the creative thinking techniques used during the sessions conducted for the empirical part of the current dissertation).

6.2. Does problem realism affect creativity?

The following situation was observed when groups were examined for performance differences according to the type of problem on which subjects worked during the sessions (i.e. – real-life versus fictitious challenges). For the fluency dimension of creativity, no significant differences were found between groups. In the case of

untrained groups, those groups that worked on solving real-life challenges showed superior performance in terms of originality and elaboration as compared to the untrained groups that worked on fictitious problems. Trained groups that worked on real problems also performed better on the originality dimension than trained groups that worked on fictitious challenges. These differences are statistically significant. No significant differences were found for trained groups with respect to the degree of elaboration of the ideas they generated during post-training ideation.

The third hypothesis states that there would be significant differences in post-training ideation performance between groups according to problem realism. The results obtained in the empirical application of this dissertation provide partial support to this hypothesis. Specifically, significant differences were found for the originality dimension. In this case, groups that were asked to provide solutions to a real problem performed better on originality than groups that solved fictitious problems. These results are consistent for both the trained and the untrained groups, providing support to the aforementioned hypothesis for this dimension of creativity.

For the elaboration dimension the hypothesis is supported by the empirical findings only in the case of for the untrained groups. In this case, the groups that solved a real problem generated more elaborated ideas than the groups working on fictitious challenges. However, no significant differences for this variable were found in the case of trained groups. In addition, no significant differences were found between groups for the fluency measure.

Summarizing the above, according to the empirical findings, problem realism matters only for the originality dimension of creativity. When creativity is measured according to the degree of elaboration of the ideas proposed, problem realism is relevant only in the case of untrained groups. These findings are quite interesting yet difficult to explain given the scarcity of research in the area (as explained in Chapter 3).

According to brainstorming research, quantity is assumed to breed quality (Rietzchel, Nijstad and Stroebe, 2006). Participants to group brainstorming are instructed and encouraged to create as many ideas as possible. Participants are also instructed to produce variations on the same basic idea and to speak out any idea may come to mind no matter how silly, unusual and foolish they may appear to be. The empirical findings in this study suggest that a real-life problem encourages participants to group brainstorming to perform better in terms of originality while it has no effect on the volume of ideas produced nor on their degree of elaboration. It may be the case, as suggested by Isaksen (1998) that real problem solving tasks call for the selection and implementation of high-quality ideas (Isaksen, 1998: 19). Fictitious problems are meaningless to people and, hence, they may be less motivated to invest energy in finding creative solutions. Not being used to solve fictitious, well defined problems that lack ownership, participants are less motivated to look for original solutions and simply focus on generating a high volume of solution ideas (as instructed according to brainstorming rules). In turn, people may identify themselves better with real-life problems and, hence, they may engage more with the solving process, showing better originality results.

Very interesting results were also obtained in the case of the degree of elaboration. Solving a real problem enhances creative performance only in the case of untrained groups. The degree of elaboration of the ideas generated was significantly higher for the untrained groups working on real problems than both untrained groups working on fictitious problems and trained groups working on real problems. It may be the case, as for the results regarding the originality measure discussed above, that working on a real problem improves the degree of elaboration because people identify themselves better with real-life problems (Isaksen, 1998), are more intrinsically motivated to solve them (Deci and Flaste, 1995) and hence produce higher quality ideas then when working on fictitious problems.

Albeit very interesting such results are opposed to what was expected and difficult to explain given the scarcity of research on the effect of problem realism on creative performance. We have not found in the literature a coherent and non-speculative explanation of such findings. One speculative explanation may be that trained groups working on real-life problems equate creativity with originality, become more focused on the originality of the ideas they generate placing less value on the volume of ideas or to the degree of elaboration. Given the speculative nature of these claims they should be further examined by future research.

6.3. Chapter summary

In this chapter we provided a discussion of the results obtained in the empirical application of the current dissertation. The results partially support the stated hypotheses. In the case of training delivery method and post-training performance, the hypotheses state a positive relationship between creativity training and post-training performance. The empirical results provide evidence supportive of this hypothesis only for the groups that received creativity training in an experiential-learning format. These groups generated more ideas of a higher originality and elaboration than both the groups trained using a lecture-based approach and the untrained groups. These results, however, provide support to the hypothesis stating that an experiential-learning approach to creativity training will lead to superior post-training creative performance.

The results regarding training are in line with assertions made by creativity theorists that training enhances creativity. In addition these results are also in line with empirical findings of previous research that examine the effect of training on both individual and group creativity.

The results provide partial support to the hypothesis regarding the effect of problem-realism on creative performance. This hypothesis stated superior creative performance in the case of the groups working to solve real problems as compared to groups that work to solve fictitious tasks. The findings indicate significant differences for the originality dimension. These results are consistent among groups regardless whether they have received creativity training or not. Nevertheless, only partial support was

found for the elaboration dimension. Only the untrained groups that worked on solving real problems showed superior elaboration. No differences were found for the fluency dimension.

These findings are interesting yet difficult to explain due to the scarcity of research in the area. Potential explanations may be derived from brainstorming research which suggests that people identify themselves better with real problems as opposed to fictitious tasks which are perceived as meaningless. This may encourage people engaged in idea generation to solve real-life tasks to call for higher quality ideas.

Chapter 7 – Conclusions, implications and directions for future research

The main purpose of the current dissertation was to examine the effect of delivery method and problem realism on post-training group creativity. Two factors relatively understudied by previous research were analyzed namely the delivery method and problem realism. Drawing on suggestions found in the literature, it has been hypothesized that trained groups will show better creative performance than non-trained groups and that the groups which received experiential learning based creativity training will show better performance results than groups trained under a lecture-based paradigm. It has been also hypothesized that differences in creative performance exist according to the type of problem on which groups are asked to work. More specifically it has been hypothesized that groups which work on solving a real-life problem will exhibit better results than the groups asked to solve a fictitious one.

Data analysis revealed statistically significant difference between groups on the variables examined providing some support to the aforementioned hypotheses. Specifically our results indicate that groups trained in creative thinking using an experiential based training program exhibit higher creative performance than groups that received lecture based training and groups that did not received any creativity training at all. These differences are present for the three performance measures observed in the study (e.g. fluency, originality and elaboration). In this chapter we

present the main conclusions and implications regarding these findings as well as the main limitations of the study and the directions for future research.

7.1. Main conclusions of the study

The empirical application of the current dissertation provides interesting results regarding the relationship between the delivery method and post-training creativity. The analysis of results regarding post-training ideation performance for 109 groups of employees at different Spanish companies, indicate that the format in which creativity training programs are delivered affects creative performance. Specifically the results provide evidence that creative performance is enhanced when creativity techniques are conveyed via experiential learning. Experiential learning groups showed superior creativity results that were superior to groups trained using a lecture-based based approach and also superior to groups that did not receive training at all. These differences were statistically significant in each case and for each of the three creativity measures employed (e.g. fluency, originality and elaboration).

These results provide an answer to the first set of research questions stated in Chapter 1. Specifically, the results show that the type of training received affects creative performance and that an active learning approach to creativity training enhances the most the post-training creative performance results obtained. To the author's knowledge, the current study is the first to examine creative performance in groups trained using

Experiential Learning. Although there is no previous evidence available within creativity research, these findings are in line with assertions made by educational theorists which propose that adults (as is the case of the subjects participating in the experiences analyzed for this study) learn more effectively when andragogical approaches are employed (Gallagher, et al., 1992; 1995; Stepien,et al., 1993; Boaler, 1997; Penuel and Means, 2000). Experiential Learning belongs to such approaches and the results of the current study provide evidence that adults participating in the sessions that received creativity training through Experiential Learning performed better than adults trained using a lecture-based approach.

Regarding the second variable examined, problem realism, results indicate that working on a real-life problem enhances group originality, regardless of the amount of training received. Also, groups trained in creative thinking scored better on originality when they worked on real problems. No statistically significant differences were found for fluency (number of ideas) nor according to the degree of elaboration of the ideas generated by the groups.

Thus, the empirical evidence provides some support to the idea that a real problem has the potential to enhance creative performance measured in terms of originality. These results provide answer to the second set of research questions previously stated in Chapter 1. Specifically the results indicate that problem realism affects the originality of the ideas generated and provide evidence of a positive relationship between problem realism and originality. The underlying argument is that people are more likely to

become engaged with work that involves them in a process of meaningful inquiry to solve real problems. Affecting the level of engagement in solving the problem, the type of problem used may have a direct implication upon the type of motivation people have in solving the task (Isaksen, 1998; Mongeau and Morr, 1999; Unsworth, 2001).

7.2. Implications

Overall, and in line with previous studies, the empirical findings of the current dissertation provides empirical findings indicating enhanced post-training creative performance. This is highly relevant in organizational settings suggesting that managers and supervisors that seek to encourage employees to think and behave creatively at the workplace should consider providing employees with creativity training.

The results obtained in this study do not only support the idea that training has the potential to enhance creative performance but also that the type of training provided and the nature of the task influence creativeness of outcomes. Specifically, it is suggested by the empirical findings that creativity training delivered in an experience-based format such as Experiential Learning leads to better post-training performance results than lecture-based training methods.

The nature of the tasks used to teach creativity also matter. Results show that real-life problems enhance the originality of ideas produced during post-training ideation. In

addition, managers and supervisors should also consider introducing creative thinking techniques and tactics (such as those presented in this dissertation; e.g. brainstorming, morphological analysis, synectics, etc.; see Appendix 3 for more details) as an essential part of how work routines are performed on a daily basis.

One major implication of the findings described above is regarding the type of training and creative performance. The results indicate superior performance in the case of groups trained using an Experiential Learning approach. One direct implication of such findings, relevant to both academia and the practitioners alike, is that of the adequacy of different types of training according to the characteristics of the trainee. If different delivery methods lead to different training results and, hence to different levels of creative performance, creativity researchers in general and, particularly researchers examining the effectiveness of creativity training should carefully examine the effect of different types of training on creative result. In a similar vein, practitioners should also pay attention to this aspect when they design and implement different creativity training programs.

There is at least one major implication also for the empirical findings obtained concerning the relationship between problem realism and creative performance. If the type of problem used positively affects originality, creativity training programs that seek to improve this dimension of creativity in trainees, should rely mostly on realistic problems, for a higher effectiveness of such programs. This implication is relevant to academia and practitioners alike. Practitioners should pay attention to the kind of

problems they select when they design creativity training programs for originality enhancement. Given that the topic of problem realism is relatively understudied, researchers should take into consideration this variable and further test it in different settings and for different samples to establish the extent to which problem realism affects creative performance.

For practitioners, there are at least two major implications of these findings. The partial support to the first hypothesis indicates that creative performance is dependent not only upon being trained in thinking creatively and finding innovative solutions to problems, but also dependent upon how this type of knowledge is transmitted by the instructor to the trainees. These findings indicate that a delivery method based on experience has the potential of producing creative performance results superior to those obtained when creative training knowledge is transmitted via a more traditional lecture-based format.

These findings also draw the attention upon the need of designing delivery methods for creativity training programs that are in line with the type of audience participating to such programs. In the case of adult learners, as is the case of the employees participating in these sessions, experiential based learning worked better than lecture-based one.

The partial support to the third hypothesis stated in this study indicates that creative performance is also dependent upon the type of problem being solved. This has direct implications especially for creativity training professionals and other types of educators

as well. The finding that solving real-life problems enhances originality outcomes should be taken into consideration by those interested in increasing the creative potential of people (being them employees, trainees or students) when designing the tasks to be solved. While fictitious problems are useful for warm-up and to exemplify the rules and/or how a specific creativity technique is supposed to work, training sessions and workshops should focus mostly on solving real problems that the organization is facing. This practice can also be seen as an additional source of creative solutions for organizational problems. In addition, working on solving real problems during training is equivalent to "learning by doing" which, according to the results of this study produces better creative performance results than a more traditional, lecture-based approach.

It was argued in the beginning of the current dissertation that creativity is one key element in today's organizations given that they need to constantly innovate in order to survive. Creativity is seen as a key ingredient of the innovation process, practically at any of the stages of the "innovation funnel" (a metaphor that illustrates how innovation goals, innovation teams, innovation actions and innovation results, interact with each other within the organization). The typical funnel comprises five different stages such as 1) Opportunity assessment; 2) Ideation; 3) Conceptualization; 4) Evaluation and benchmarking; 5) Decision. Evidently the results provided by the current study are especially relevant to the early stage of idea generation, but idea generation skills are welcomed in each of the stages.

The results may be highly relevant to human resource managers while planning creativity training policies. According to the results obtained in this study, adult trainees (which are also the case of employees in any organization) respond better to adult training techniques such as, the creativity training based on experiential learning. Human resource managers looking for different alternatives of creativity training that could be provided to firm employees should take such findings in consideration. This finding is also highly relevant to the practitioners that conceive and provide such training services to organizations.

7.3. Limitations and directions for future research

As with any other empirical investigation, this study is not by any mean perfect. There are certain limitations that need to be acknowledged. Such limitations identify the potential weaknesses of the study but also some opportunities and extensions for future research.

One limitation of this study is the sample size. This study provide empirical evidence after observing and analyzing data for a total number of 109 groups (with an average number of 9 participants; a total 981 individuals) for all types of training experiences and problem realism. Although 109 groups or 981 employees are important numbers, they are not by any mean representative. Furthermore, the number of groups participating for each creativity training experience and problem realism is relatively

small (27 groups received no training, 52 were exposed to creativity techniques via a lecture-based approach while 30 groups were trained in an Experiential Learning environment). It is thus possible that the lack of significance of the results obtained when examining the effect of problem realism for fluency and elaboration to be partly due to the limited sample of groups. Hence, generalizations of the findings reported in this study should be hence done with caution. Nevertheless, future research could address this issue by extending the number of subjects to larger samples.

A second limitation is that this study did not investigate the long-term advantage of using creativity training to improve employees' creative performance. The current study examines variations in performance only at the moment when the training experience was provided. Follow-ups and retesting the performance several weeks or months after receiving creativity training may provide interesting findings regarding the durability and persistence of creative thinking knowledge over time. Further observations of the subjects for on job application of the creativity techniques learned during the training program, may provide further evidence regarding the long-term effects of training. In addition, it may be also useful for future studies to incorporate organizational performance measures to the set of measures used to assess creative performance. Studies that can provide evidence on how creativity training programs held within organizations helped them to enhance performance indicators related to creativity and innovation (e.g. new projects undertaken, new products launched, new customers acquired, improvements in internal processes or operational effectiveness as a result of new measures applied, etc.), may be more relevant to both practitioners and academia

than laboratory studies limited to measuring creative performance through standard tests and measures designed for laboratory settings.

Further limitations are related to the design of the study. One major limitation in this sense is given by the restriction imposed on the participants to use a single idea generation technique. Further studies should therefore test the effect of training, delivery method and problem realism, for different creative thinking techniques in order to ascertain the extent to which these factors affect their effectiveness. An additional design related limitation – a common limitation of scientific research in social sciences - resides in the difficulty to capture the sole effect of a given variable.

Chapter 8 – References

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Chapter 9 – Appendix

APPENDIX 1: Brainstorming, an idea generation technique

This approach to ideation was developed in 1941 by one of BBDO's advertising executives, Alex Osborn, and was later popularized through his widely distributed book *Applied Imagination* (Osborn, 1953)[3]. Since its introduction brainstorming sessions have been widely used in different organizational settings as a means of problem-solving and idea generation (Kavadias and Sommer, 2007)[4]. Osborn felt frustration regarding employees' lack of creativity in problem solving and idea generation and argued that the general tendency that people have to emphasize judgment and criticism over originality was a major hindrance in achieving high levels of creativity (Mongeau and Morr, 1999)[5]. To overcome such hindrance and break the mental blocks inhibiting creativity, Osborn strongly believed in the need of separating judgmental from creative processes. Creativity is thus encouraged by not allowing ideas to be evaluated or discussed until everyone has run dry (i.e. suspended judgment). As expressed by Osborn himself:

> *When driving for ideas you can go further if you keep your foot off the brake.*
>
> *(Osborn, 1957 cited in Mongeau and Morr, 1999: 15).*

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[3]Osborn, A. F. (1953). Applied imagination: principles and procedures for creative problem-solving. New York: Scribner

[4]Kavadias, S., Sommer, S.C. (2009) The effects of problem structure and team diversity on braisntorming effectiveness, *Management Science,* 55(12): 1899 – 1913.

[5]Mongeau, P.A., Morr, M.C. (1999) Reconsidering brainstorming, *Group Facilitation*, 1(1) 14 – 21.

Suspended judgment is one of the four basic rules brainstorming groups should follow for maximally productive brainstorming sessions. A productive session should also be lively and free-wheeling (second rule). Participants should be therefore encouraged towards the carefree expression of ideas. Any and all ideas are considered legitimate and often the craziest and outlandish ideas are the most fertile as such ideas often inspire people to have more radical ideas and so spur more creative brainstorming (Baumgartner, 2001:11)[6]. The main objective is to create an atmosphere of enthusiasm and originality where many ideas are generated (Rietzschel, Nijstad and Stroebe, 2006)[7].

Focusing on the quantity of ideas generated and not on their quality is a third guideline for effective brainstorming sessions. The rationale behind this is quite straightforward as put by Baumgartner (2001:3):

> [I]deas inspire more ideas. Creative ideas inspire more creative ideas. People build on each other's ideas. The result is a rich list of ideas some of which are obvious, some of which are so crazy they could never be implemented and some of which are real gems that could lead to new products, new services, or new ways of doing business.

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[6]Baumgartner, L. M. (2001). An update on transformational learning theory. In S. B. Merriam (Ed.), The new update on adult learning theory (pp. 15-24). New Directions for Adult and Continuing Education, No. 89. San Francisco, CA: Jossey-Bass.
[7]Rietzschel, E. F., Nijstad, B. A., & Stroebe, W. (2006). Productivity is not enough: A comparison of interactive and nominal brainstorming groups on idea generation and selection. Journal of Experimental Social Psychology, 42, 244−251

The fourth rule established for effective brainstorming sessions encourages leapfrogging. This means that any idea generated during the session could be used as a means of jumping forward to other ideas. This in fact is the usual dynamic during a properly run brainstorming session. One person shares an idea, another person reacts to it, another person reacts to the reaction and so on. In addition to contributing their own ideas, participants are thus encouraged to "suggest how ideas of others can be turned into better ideas; or how two or more ideas can be joined into still another idea" (Osborn 1957:84, cited by Mongeau and Morr, 1999:15).

The process of a traditional brainstorming session is summarized in Figure A1.1. As it can be observed, the process is quite straightforward. Brain-stormers, either in group or individually, are expected to generate as many solutions as possible to a pre-established problem or issue. The purpose of the session is to "make the mind deliver" and hence the focus is on the quantity of ideas that can be generated within a determined time frame and not on their feasibility or effectiveness.

Figure A1.1. The process of brainstorming
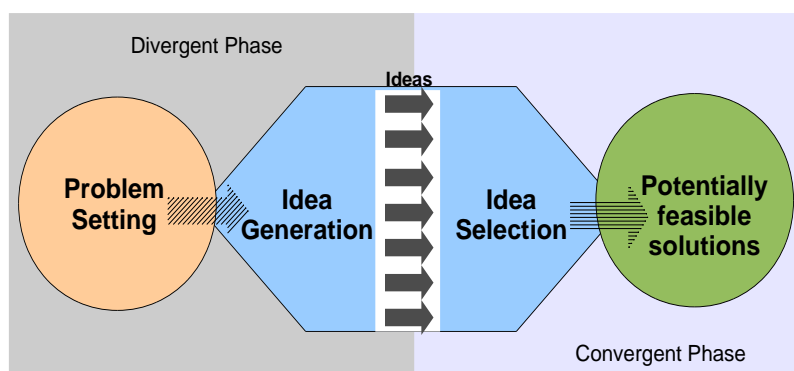
Source: Self devised

A moderator or facilitator leads the session motivating the participants, recording the ideas as they are generated and making sure that the four basic rules are respected during the whole meeting. Criticism is ruled out and free-wheeling is encouraged so that any idea, no matter how crazy, apparently impracticable or irrelevant it may be, must be heard and be written down. Combinations and improvements of ideas proposed by others are also welcomed. The end result of the session should be a list of ideas that are further reviewed and evaluated to determine their utility and practicability according to pre-established evaluation criteria (Baumgartner, 2001[8]).

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[8]Baumgartner, J. (2001) *The Complete Guide to Managing Traditional Brainstorming Events,* Bwiti, Belgium. Available online at http://www.jpb.com/creative/brainstorming.pdf

APPENDIX 2: Experiential Learning

As indicated in Puccio et al. (2006:19)[9] "the study of creativity is an applied science". Although apparently many breakthrough innovations occur through a spark of genius − the *eureka!* moment − creativity involves sustained practice and hands-on experience. Thomas Edison's proverbial saying (published in the September 1932 edition of *Harper's Monthly Magazine)* that "genius is one per cent inspiration, ninety-nine per cent perspiration" also illustrates the intimate relationship between the quality and novelty of creative work and the amount of time put into acquiring the skills and abilities needed for the task.

The way in which people learn and acquire creative skills and abilities may also affect the end result of their creative work. Puccio, Wheeler and Casandro (2004)[10] suggest that trainees with different cognitive styles react differently to different creative thinking techniques. However, most of previous research examining the impact of training on creativity is focused on traditional training methods (such as workshops, courses and seminaries in which participants are trained to apply creativity enhancing methods and techniques) and has neglected the effect of more applied methods of training may have on the creative outcome. Experiential learning (hereafter *ELT*) is one such applied

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[9]Puccio, G.J., Firestien, R.L., Coyle, C., Masucci, C. (2006) A review of the effectiveness of CPS training: A focus on workplace issues. *Creativity and Innovation Management* 15(1): 19 – 33.
[10]Puccio, G. J., Wheeler, R. A., Cassandro, V. J. (2004) Reactions to creative problem solving training: Does cognitive style make a difference, Journal of Creative Behavior, 38: 192 – 216.

method of learning and teaching, particularly suited to educate entire teams (Adams, Kayes and Kolb, 2005)[11].

Experiential learning is, as defined by Kolb (1984:41)[12] "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience". Experiential learning is therefore an active form of learning. It is based upon a constructivist approach to learning according to which students, rather than being passive receptors of information, are active learners, constructing their own knowledge, rather than observing the demonstrative behavior of a teacher. Such learning may involve experiments, field observations, field trips, focused imaging, games, model building, role plays, simulations, surveys, and synectics.

Cognitive and humanistic research were among the first research fields to point more and more towards the importance of experience in learning. For example, Säljö (1979)[13] created the following hierarchy of student views of learning.

1. *Learning brings about increase in knowledge. (knowing a lot)*

2. *Learning is memorizing. (storing information for easy recall)*

3. *Learning is about developing skills and methods, and acquiring facts that can be used as necessary.*

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[11]Adams, A.B., Kayes, C., Kolb, D.A. (2005) Experiential learning in teams, *Simulation & Gaming*, 36(3): 330 – 354.

[12]Kolb, D.A. (1984) Experiential Learning: Experience as a source of learning and development. Prentice-Hall, Englewood Cliffs, NJ.

[13]Säljö, R. (1979) Learning in the Learner's Perspective: 1: some commonplace misconceptions, *Reports from the Institute of Education,* University of Gothenburg, 76.

4. *Learning is about making sense of information, extracting meaning and relating information to everyday life.*

5. *Learning is about understanding the world through reinterpreting knowledge.*

During the 1980's the *Experiential Learning Theory* (ELT) was formulated and gained prominence in education research (Kolb, Boyatzis and Mainemelis, 1999)[14]. Some researchers spoke of learning as a cycle that begins with experience, continues with reflection and later leads to action, which itself becomes a concrete experience for reflection. Kolb (1984) further refined the concept of reflection by dividing it into two separate learning activities, perceiving and processing. He thus added another stage, called "Abstract Conceptualization." Whereas in the Critical Reflection stage we ask questions about the experience in terms of previous experiences, in the Abstract Conceptualization stage, we try to find the answers. We make generalizations, draw conclusions and form hypotheses about the experience. The Action phase, in light of his interpretation, then becomes a phase of Active Experimentation, where we try the hypotheses out. Figure A2.1 presents a graphical representation of Kolb's (1984) model.

According to the theory of experiential learning, learning is a process through which knowledge is generated, knowledge which in turn transforms our experience. Thus, there is a close relationship between creativity and experiential learning. Following

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[14]Kolb, D.A., Boyatzis, R.E., Mainemelis, C. (1999) Experiential learning theory: Previous research and new directions. In Sternberg, R.J. & Zhang, L.F. (Eds.) *Perspectives on Cognitive Learning and Thinking Styles.* Lawrence Erlbaum, NJ.

DeWulf and Baillie (1999)[15] three of the characteristics that define creative behavior and attitudes, are enhanced by experiential learning: (1) the ability to transform ideas and visualize them, either holistically, spatially or metamorphically. Flexibility, fluency and adaptability are thus three dimensions necessary and important to successfully transform ideas (McKim, 1980)[16]; (2) the effective use of memory—being able to use previous experiences and knowledge gained from them to make new connections and associations of concepts – and, (3) convergent and divergent thinking: convergent thinking focuses on the existence of a single correct answer, while divergent thinking relies on the existence of multiple solutions, all of them viable ones.

Figure A2.1. The experiential learning cycle and basic learning styles
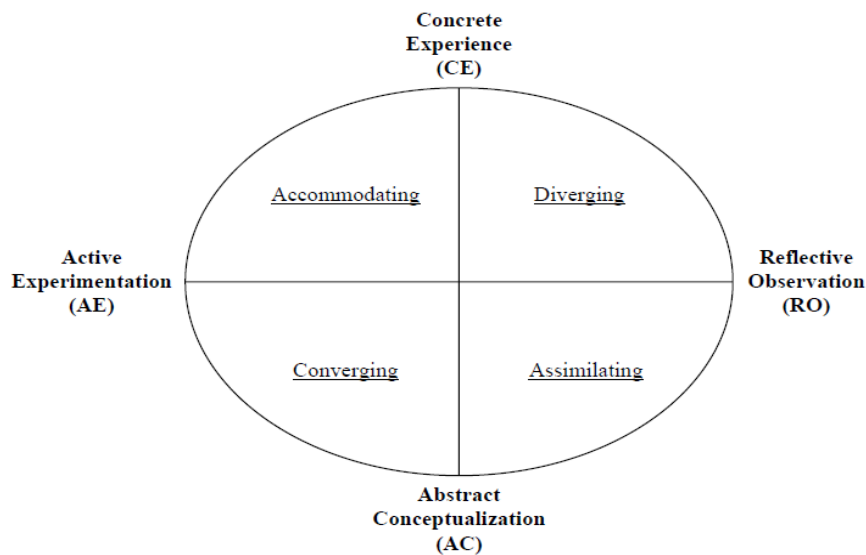
Source: Kolb et al., (1999:39)

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[15]Dewulf, S., Baillie, C. (1999) *CASE: Creativity in Art, Science and Engineering. How to foster creativity*, Department for Education and Employment, UK.
[16]McKim, R.H. (1980) *Thinking Visually: A strategy manual for problem-solving.*Lifetime Learning Publications, Belmont, California

Creativity and experiential learning are therefore related. Corbett (2005)[17] provides a conceptualization of how, the opportunity recognition process in entrepreneurship, which is nothing else than creativity, relates to and might beneficiate from experiential learning. Departing from Lumpkin, Hill and Shrader's (2004)[18], model of entrepreneurial opportunity discovery, Corbett shows how the learning modes of experiential learning fit to Lumpkin's et al. (2004) model. As it can be observed in Figure A2.2 which provides representation of Corbett's (2005) model, the opportunity recognition process is conceptualized by entrepreneurship research as being comprised by two main phases: (1) the discovery of the opportunity (all that need to happen until the moment one is conscious that they have identified a potential business opportunity) and, (2) the formation of the opportunity (during which the idea is evaluated and ways to implemented are searched for).

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[17]Corbett, A.C. (2005) Experiential learning within the process of opportunity identification and exploitation, Entrepreneurship Theory and Practice, 29(4): 473 – 491.
[18]Lumpkin, G. T., Hills, G. E., Shrader, R. C. (2004) Opportunity recognition. In Harold L. Welsch, (Ed.), Entrepreneurship: The Road Ahead, pp. 73-90. London: Routledge.

Figure A2.2. Creativity-Based Experiential Learning Model of Opportunity Recognition
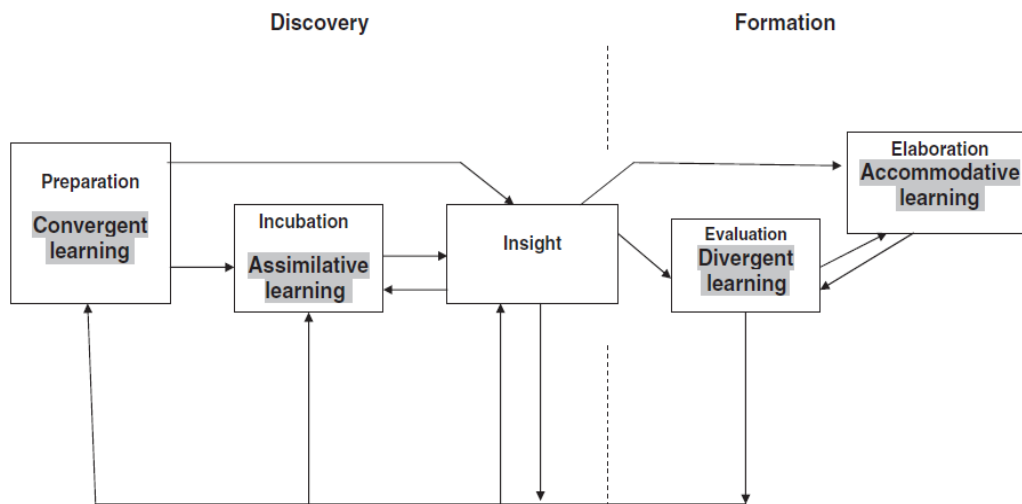
Source: Corbett (2005: 483)

These two phases are linked by an inflection point called "insight" (or the *eureka!* moment). It is the specific moment when one becomes conscious that they found a new thing to do, a new product or service to provide, that has value and solves an existing problem or fulfils an existing need. This point of the model is the one that resembles the most with the ideation phase in CPS in that the end result of this process is also the obtention of new ideas (although not necessarily feasible ones). Corbett (2005) fits experiential learning modes to the different steps of the opportunity recognition model, suggesting an intimate resemblance and relationship between one form of creativity (entrepreneurial opportunity recognition) and experiential learning.

Creativity involves continuous learning and experiential learning is a continuous process. In fact, one of the stumbling blocks of effectively implementing experiential learning in mainstream education is the fact that it often involves a long-term program. Creativity also involves abstracting the lessons of each experience (Biggs, 1999)[19] and involves making hypotheses, reflecting, generating ideas continuously. In other words, creativity is an ongoing process, one that departs from knowledge gained through past experiences (Biggs, 1999), very similar to the process of experiential learning.

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[19]Biggs, J.B. (1999) Teaching for Quality Learning at University. Buckingham: Society for Research in Higher Education & Open University Press.

APPENDIX 3: Creative thinking techniques provided to participants

Morphological Analysis

Morphological Analysis or *General Morphological Analysis* is a method developed and by Fritz Zwicky, the astrophysicist who discovered dark matter. Departing from the works of G.W. Leibnitz (1646 – 1716), Zwicky proposed in 1942 his own method for exploring all the possible solutions to a multi-dimensional, non-quantified complex problem (Zwicky, 1967[20], 1969[21]). The aim of Zwicky's method is twofold: (1) to expand search space for a problem's solutions and (2) to make sure that potential novel solutions are not overlooked during the innovation/creation process (Svaransky, 2000)[22].

Table 7.1 Morphological Analysis Matrix for a new lamp

Power Supply	Bulb Type	Light Intensity	Size	Style	Finish
Battery	Halogen	Low	Very large	Modern	Black
Mains	Bulb	Medium	Large	Antique	White
Solar	Daylight	High	Medium	Roman	Metallic
Generator	Colour	Variable	Small	Art Nouveau	Terracotta
Crank			Handheld	Industrial	Enamel
Gas				Ethnic	Natural
Oil					Fabric

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[20]Zwicky, F., Wilson A. (eds.) (1967) New Methods of Thought and Procedure: Contributions to the Symposium on Methodologies. Berlin: Springer.
[21]Zwicky, F. (1969) Discovery, Invention, Research - Through the Morphological Approach, Toronto: The Macmillian Company.
[22]Svaransky, S.D. (2000) Engineering of Creativity: Introduction to Triz Methodology of Inventive Problem Solving, Taylor and Francis Group.

It is a combinatorial technique consisting in breaking down a problem or concept into its essential elements or basic structures. With such features or attributes a matrix is built. Then all the possible combinations are made among the different elements on the matrix, until new ideas emerge. Thus, in its most basic form, the morphological analysis is simply a technique to generate ideas using a matrix. Table A3.1-1 provides an example of such a matrix. The matrix in the figure was created for the hypothetical case of a company looking to design a new lamp. The matrix (also called "Zwicky box") is created by listing the different properties of the lamp (e.g. power supply, bulb type, size, style, material, etc.) in columns and the different variations of the same property in rows. Once the matrix is built, new combinations can be identified by mixing the different attributes in new ways (e.g. a hand held solar powered lamp with daylight bulb).

Analogical reasoning

Used as creative problem-solving tool, this technique involves transferring information or meaning from one particular subject to another particular subject, by establishing relationships between two or more concepts related to the problem. The problem to be solved may be represented by an analogy which is further developed. For example, to investigate the spread of rumours, you can use the analogy of a snowball that slides down a slope. As the snowball rolls down the slope, it increases in volume (as a rumour

spreads, it also increases its distribution). In addition to the ball increases in size, it must roll over snow.

Bionics

Bionic idea generation technique involves generating new ideas or solutions to problems departing from the observation of natural phenomena. Basically it deals with the application of natural "inventions" to the problem by imitating the way in which nature itself solves certain problems.

Empathy

Empathic problem solving consists in putting oneself in other's place and reconsiders the problem from that person's point of view. Imagination is required to apply this technique given it involves representing or acting as a client, an object, an element, a situation that needs a solution. For example, if you are an entrepreneur that needs to know what will be the reaction of people to the launch of a new product, an energy drink. Applying empathy would imply to put you in the place of the energy drink and imagine one observing the potential consumers passing by and choosing the drink over competing choices.
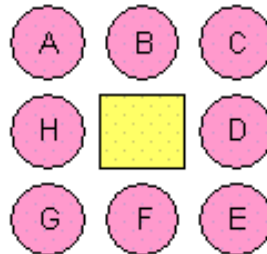
The Lotus Blossom

In addition to encouraging creative thinking the lotus blossom technique is also used to develop analytical thinking. Originally developed by Yasuo Matsumara, director of Clover Management Research in Chiba city, Japan, and popularized by Michael Michalko in his famous book *Thinkertoys* (Michalko, 1991)[23], is a cognitive-analytical tool that provides a visual means to record the relationship between a central concept and related sub concepts. The procedure followed when applying the Lotus Blossom consists of the following steps (Michalko, 1991):

➢ Write the main problem in a rectangle in the centre of the diagram.

➢ Write the significant themes, components or dimensions of your subject in the surrounding circles labeled A to H surrounding the central theme (see Figure A.3.1. below). List The optimal number of themes for a manageable diagram is between six and eight. If you have more than eight, make additional diagrams. Ask questions like: What are my specific objectives? What are the constants in my problem? If my subject were a book, what would the chapter headings be? What are the dimensions of my problem?

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[23]Michalko, M. (1991) Thinkertoys. A handbook of business creativity, Ten Speed Press, Berkeley, California.

Figure 7.1. An example of Lotus Blossom diagram

➢ Use the ideas written in the circles as the central themes for the surrounding lotus blossom petals or boxes. Thus, the idea or application you wrote in Circle A would become the central theme for the lower middle box A. It now becomes the basis for generating eight new ideas or applications (see Figure A.3.2.).

➢ Continue the process until the lotus blossom diagram is completed.

Figure 7.2. The extended Lotus Blossom diagram
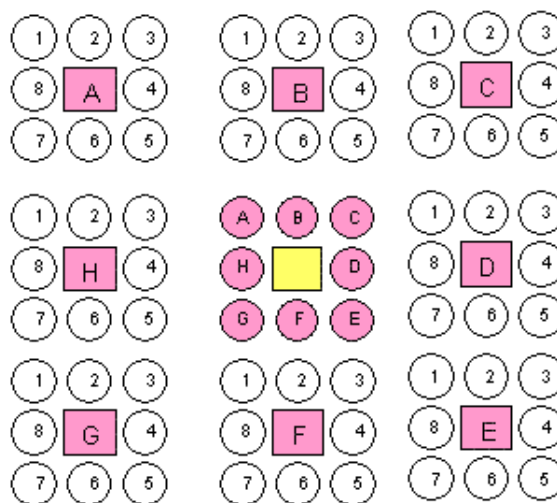
The 5 Whys

The 5 Whys is a question-asking technique used to explore the cause-and-effect relationships underlying a particular problem. The primary goal of the technique is to determine the root cause of a defect or problem. The Random Word is the simplest technique employed to stimulate new ideas. It consists of randomly picking a word and use that word to think about a new idea or new solution to the given problem. By getting a random word and thinking how it can be used to solve the problem you are practically guaranteed to attack the problem from a different direction from than you would normally.

SCAMPER

Scamper is a general-purpose checklist with idea-spurring questions. Scamper departs from the assumption that everything new is in fact a modification of something that already exists. For example when using this technique to improve the selling process the following questions could be asked:

  ➢ S (Substitute): "What can I substitute in my selling process?"

  ➢ C (Combine): "How can I combine selling with other activities?"

  ➢ A (Adapt): "What can I adapt or copy from someone else's selling process?"

  ➢ M (Magnify): "What can I magnify or put more emphasis on when selling?"

- ➤ P (Put to Other Uses): "How can I put my selling to other uses?"

- ➤ E (Eliminate): "What can I eliminate or simplify in my selling process?"

- ➤ R (Rearrange): "How can I change, reorder or reverse the way I sell?"

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