CREATIVITY TRAINING EFFECTS UPON CONCEPT MAP COMPLEXITY OF CHILDREN WITH ADHD: AN EXPERIMENTAL STUDY

By

Keetam Alkahtani

B.Sc. Special Education
M.Sc. Clinical Psychology

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University of Glasgow
Faculty of Education
Department of Educational Studies

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ABSTRACT

The rationale for this study was to extend the knowledge about creative thinking among children with attention deficit hyperactivity disorder (ADHD) by investigating the effects of creativity training upon concept mapping complexity. To verify whether *the CoRT Thinking Lessons* can enhance creative ability and improve concept map complexity, a *Pretest-Posttest Control Group Design* was used in this study. Sixty four students who are fourth and fifth graders (age 9-10 years) and classified as having ADHD participated in the investigation. In order to ensure that concept mapping is a familiar technique to all participants, they all were given a training session in concept mapping. Next to that, they were asked to complete a concept map and *Torrance tests of creative thinking* (TTCT) as a pre-test measure. After that, they were assigned to either experimental or control group, each group consisted of thirty two students. The experimental group was given creativity training (20 hours of *CoRT thinking lessons* during ten weeks) and the control group received no creativity training. Finally, all sixty four participants completed a second concept map and the TTCT as a post-test measure.

Data collected from participants were analyzed via *the Pearson product-moment correlation coefficient*, *the t test for two independent samples*, and *the paired-sample t test*. Results of the analysis indicated that participants who received creativity training developed significantly more complex concept maps than those participants who received no such creativity training. Thus, creativity training enhances both concept mapping complexity and creative ability of students with ADHD as measured by the TTCT. Implications for practice include recommendation for teachers to design and establish educational activities and environments in which creative abilities of children with ADHD can be develop.

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CHAPTER ONE

INTRODUCTION

This chapter is organized in the following manner. It begins with the rationale for this study. The purpose and the significance of the study will also be introduced. The chapter ends with a specification of the study questions.

Rationale for the Study

It is inevitable that schools and, indeed, universities, will emphasize the sharing of knowledge and skills which have come from the past. However, the students of today will live their lives in the world of tomorrow where, with incessant change, things may be very different. Thus, people who can use facts, ideas, and materials of the past as a springboard for future developments are needed in any society. One major task in education, therefore, is to produce more minds that focus on the future than those that concentrate on the past (Taylor, 1964). Nonetheless, traditional education has been more successful at educating students to recite the facts of the past than to develop skills and concepts that will enable them to both discover and use knowledge in the future (Blagg, 1991; Marksberry, 1965). Fisher emphasized this issue, in his words:

> there is evidence that traditional teaching methods are efficient in teaching what the Greeks called *tekne*, the 'technical' side of knowing how to do and make things, the basic skills and techniques which need to be introduced and practiced by beginners in any area of learning. But traditional methods are less successful in developing what Greeks called *Phronesis*, that is practical wisdom or intelligence, the higher order thinking which enhances skill to the level of expertise (2003, p.18).

It is clear that, these days, we live in a global environment where information and technology are changing as science expounds new insights nearly everyday. For example, Cropley observed that "the knowledge and skills needed in the future may not even be known at the time a person attends school or university" (2001, p.135). These changes led educators to realize the importance of teaching children skills which they will need as adults, and to become more effective learners. There is no one way to teach these skills, but creativity training has been suggested by many educators and educational leaders as a successful strategy to empower students to understand their abilities, learning style, and to take charge of their own learning.

The movement that promotes creativity training as an essential practice in schools started during the 1950's. Torrance (1963, p. 12-45) has argued that increasing the level of creative thinking is important and he also offered some reasons to reinforce the desire of both teachers and parents to give children a chance to learn and think creatively. These reasons were summarized by Russell and Meikamp (1994, p. 297) as follows:

Creative thinking,

- Helps maintain good mental health and enhances personality development.
- May lead to the acquisition of new knowledge.
- May help in solving daily problems.
- Helps people of present and future generations to survive.

Although amending or adding to Torrance's specifications is possible, denying the value of any of those listed is difficult. In fact, everyone who is interested in creativity (such as education leaders, educators and researchers) has tended to agree on one aspect of creativity which is the tremendous value of teaching creativity for everyone and in every domain.

However, unfortunately, not everyone believes that creativity can be taught (e.g. Alvin Wolf who believes that creativity is an important quality and can be encouraged but not taught, in Fraenkel, 1977). According to Runco (2007) the question of the possibility of teaching creativity and enhancing creative ability may be related to:

> A misunderstanding of human behavior. Virtually 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 experiences that influence that potential. It is very much like exercising. Not everyone will be an outstanding weight-lifter, but everyone can build muscle. The amount of muscle built will depend on genetic potentials and the amount of exercise. Creative talents depend on the same two things … programs and techniques … will very likely increase the likelihood that the individual will behave in a creative fashion (p. 372).

Runco's argument suggests that whilst all people have creativity, some people have more than others. Just as some people can enhance their physical strength through exercise, he argues that creativity can also be increased through techniques and exercise presented in creativity programme (such as CoRT which was used in the present study). If this argument is valid creativity training can, as one would suspect, help individuals to perform more creatively.

The above argument by Runco is in line with other researchers' arguments that creativity is very much a feature of humanity. Perhaps it can be found to some degree in everyone and creative abilities are teachable and measurable in terms of fluency, flexibility, originality, and elaboration (e.g. Amabile, 1983, 1989; Blagg, 1991; Dacey, 1989; Getzels and Jackson, 1962; Guilford, 1967; Parnes, 1963; Sternberg, 1995, 1999, 2000; Torrance, 1962a, 1963, 1972; Torrance and Safter, 1989).

Furthermore, results of experimental studies support this argument. Torrance analyzed 103 experimental studies which used nine different programmes to enhance creative ability and the *Torrance tests of creative thinking* (TTCT) was used to measure the effectiveness of each programme. Torrance concluded from his review of literature that it is possible to teach children how to think creatively (Torrance, 1972, p. 132-133). In addition, results of more recent Meta-analysis studies confirmed that creative abilities can be enhanced by training (e.g. Ma, 2006; Scott *et al*., 2004a, 2004b).

Purpose of the Study

Since every child should have the chance to learn and think creatively and assuming that everyone is creative to some measure and creative abilities can be enhanced, this study explores the question about whether creativity training can improve the creativity of children who have ADHD. More specifically, it is the purpose of the current study to verify whether a creativity training programme (the *CoRT thinking lessons*) can enhance creative ability among children who are classified as having ADHD. Therefore, the researcher hopes that as a consequence of this research children with ADHD will be given access to creativity and talent programmes in their schools if that is in their benefit. In other words, if the findings of the current study are not different from those of previous studies in which a positive effect of creativity training programmes were reported then the creative ability of children who are classified as having ADHD can be enhanced. The enhancement of the creative ability of children with ADHD (presuming that it can be achieved via providing them with creativity and talent programmes which are available in their schools) possibly will result in the development of their learning abilities and skills which might lead them to become independent learners and thinkers who know how to resolve open-ended problems.

The idea of considering creativity among exceptional children (for this study, an exceptional child is the child who is classified in one or more of the following categories: Gifted and talented, behavioural and emotional disorder, autism, ADHD, learning disabilities/difficulties LD, mental retardation, speech and language impairments, hearing impairments, visual impairments, orthopedic impairments, other health impairments) was first presented as a wild idea by Torrance in 1971. In his words:

> I am suggesting that the "creatively handicapped" be adopted as a new category in the field of Special Education of Exceptional Children. I know that it will impress even this sympathetic audience as a wild idea. Actually, the logic for this implication is rather clear. There are many children whose behavior problems stem from the differences their abilities create between them and other children and between them and their teachers. Their learning difficulties from the incompatibility between their abilities and learning preferences on one hand and the teaching methods and system of rewards of the school on the other (Gowan and Torrance, 1971, p.212)

Today and as a result of the *twice-exceptional*[*] (double-exceptionality) movement new categories such as Gifted/LD (that is, a child who is gifted and has learning disabilities/difficulties) add to the special education categories. Mostly, twice-exceptional children are exceptional because they are gifted and they have a disability such as learning disabilities, ADHD, or Asperger's syndrome (Assoulin, 2003; Baum, 1990; Colangelo, 2003; Seeley, 2003; Silverman, 2003; Zentall *et al*., 2001).

While there is no scientific evidence that children with ADHD may have high creative ability, considering any child with ADHD as a twice-exceptional child is increasingly being considered among professionals in the field of ADHD (e.g. Hallowell and Ratey, 1994a, 1994b; Hartmann, 1996, 1997, 2003; Kelly and Ramundo, 1995; Kewley, 2005; Sherman *et al*., 2006; Weiss, 1997). This will be discussed in chapter four in more detail. The purpose of the present study is not to explore the connection between creativity and ADHD or to examine creativity among children with ADHD, but rather to investigate

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[*] More information about twice-exceptional children can be found at *the Twice-exceptional* website: www.2enewsletter.com.

whether a proven creativity programme, specifically *the CoRT thinking lessons*, can help children with ADHD to be more creative. The extent to which it does or does not achieve this goal, it will be argued, will be visible in the complexity of concept maps produced by the students prior to and following creativity training.

Many creativity training programmes are commercially available (e.g. *the Purdue Creativity Program* PCP, *the Productive Thinking Program* PTP, and *the Cognitive Research Trust* CoRT). These programmes include activities to teach cognitive skills that lead to creative thinking. Problem recognition, problem definition, generation of possible solutions, testing solutions, and selection of the best solution are some of the skills that creativity training programmes are designed to teach either in isolation or infused in the curriculum (Gehlbach, 1987; Sternberg *et al*., 2002). Although, the results from analysis of 156 training programmes by Scott *et al*., (2004b) indicated that each programme has some value, it is not the purpose of the present study to establish a new creativity training programme for children with ADHD or their teachers but rather to explore the effect of *the CoRT thinking lessons* (which considered by many researchers as a good creativity training programme, see chapter seven) as an enhancement tool on the creative thinking of children with ADHD who are fourth and fifth graders (age 9-10 years). The full description of *the CoRT thinking lessons* and why the researcher has chosen it are detailed in a later chapter.

It has been argued by many researchers that creativity training programmes which are educational activities designed to increase fluency, flexibility, elaboration, and originality, and are also exercises to bring new, different, and unexpected responses to a situation will improve creative thinking (Amabile, 1983, 1989; Blagg, 1991; Dacey, 1989; Getzels and Jackson, 1962; Guilford, 1967; Parnes, 1963; Sternberg, 1995, 1999, 2000; Torrance, 1962a, 1963, 1972; Torrance and Safter, 1989). Other researchers, such as Mansfield and colleagues, argued that when students scored higher scores on divergent thinking tests (e.g. TCTT) after receiving creativity training might not necessarily reflect real improvement in their creativity. In their words:

> a training program may lead to improved performance on divergent thinking tests, it is not at all clear that this improvement will be reflected in real-life creative accomplishments (1978, p. 517).

However, Mansfield and colleagues concerns in 1978 were not supported by results of recent researches. For example, among young adults Cropley and Cropley found that the training of creativity "was associated with changes in behaviour not only on the test, but in a practical activity also" (2000, p. 207). And among students of all abilities (gifted, LD, and regular education students) Russell and Meikamp affirmed that creativity training did develop students' metacognitive skills. Development of metacognitive skills was evidenced by the complexity of the maps produced by the students in the experimental group who received creativity training (Russell and Meikamp, 1994).

Although Mansfield and colleagues concerns fade in results of recent researches, in the present study the researcher will consider Mansfield and colleagues' concerns that the improvement in creative ability as a result of training programmes might be limited to divergent thinking tests such as TCTT. Therefore, the current researcher will follow Russell and Meikamp (1994) and instead of only using the TTCT, which is a divergent thinking test to evaluate the creativity training, concept mapping which is considered to be a metacognitive strategy and widely used to promote and evaluate metacognitive skills (Novak and Cañas, 2006a, 2006b) will also be used along with TTCT to assess the impact, if any, of creativity training.

Based on an analysis of the literature regarding creativity and concept mapping, the current researcher will argue that concept mapping is related to creativity. This argument is presented on the ground that concept mapping is a creative activity which could be used to foster, reflect, and measure creativity.

Creativity, to Ausubel, is the individual's ability to build hierarchical conceptual structures and to make unique associations across concepts at the higher levels in his/her conceptual structures (as cited in Novak, 1977). Thus, creativity is a very high level of meaningful learning which leads to success in finding new solutions to problems (Novak and Cañas, 2006b). Concept mapping also has been considered as a metacognitive strategy that allows learners to learn in a very highly meaningful fashion (Novak, 1991, 1993; Novak and Cañas, 2006a, 2006b; Novak and Gowin, 1984). Additionally, concept mapping might "open the door to more complex, flexible and creative thought processes" (Hill, 1994, p. 30). Moreover, Novak *et al.*, draw attention to the proposition that, "the greatest creativity may be required to construct a concept map without any supplied words or text, but drawing on an individual’s fund of knowledge for some specific topic” (1983, p. 626). Goldstein (2001) suggested that concept mapping "helps to focus the divergent process and provide structure to the inherently organic nature of the creative process" (p. 33). Otis concluded that, “the strength of the concept mapping process is not increasing the size of the student’s data-base but in increasing its malleability and flexibility” (2001, p. 145). Novak and Cañas highlighted that, "there are two features of concept maps that are important in the facilitation of creative thinking: the hierarchical structure that is represented in a good map and the ability to search for and characterize new cross-links" (2006a, p, 2). Russell and Meikamp (1994) found that students who received creativity training developed significantly more complex concept maps compared to students who did not receive training (p.298). Therefore, based on the evidence in the literature mentioned above, it might be reasonable to say that concept mapping might be related to creativity.

Concept mapping has been considered as a useful teaching and instructional strategy to use with students with various abilities and characteristics. Almost all studies reviewed reported positive results of using concept mapping as a teaching and learning strategy (e.g. Aidman and Egan, 1998; Blair *et al*., 2002; Bulgren *et al*., 1988; Cleland, 1981; Roberts and Joiner, 2007; Sturm and Rankin-Erickson, 2002; Zipprich, 1995). Additionally, it has been affirmed, in many studies, that concept mapping is an effective, valid, and reliable assessment tool (e.g. Bolte, 1999; Liu, 2004; Novak, 1998; Osmundson *et al*., 1999; Reese, 2004; Ruiz-Primo and Shavelson, 1996; Ruiz-Primo *et al*., 1997; Stoddart *et al*., 2000).

Apparently then, concept mapping could be used to measure creativity and since creative ability can be enhanced with appropriate training, how would *the CoRT thinking lessons* affect the complexity of concept map production among children (age 9-10 years) with ADHD? Would the concept maps of the children who receive creativity training be more complex compared to that of children who did not receive training? Thus, in this study, concept mapping will be used as a measurement tool rather than teaching strategy.

Significance of the Study

The significance of the current study can be addressed from seven aspects. First, creativity training, it is argued, is a successful practice to address the needs of both exceptional and regular education students in an inclusion classroom. An unprecedented universal movement toward including exceptional children into the regular classroom resulted from launching *the International Year for Disabled Persons (1981)*[*] and *The UN Decade of Disabled Persons (1983-1993)* by the United Nations in 1976. For the current study, inclusion refers to the full-time placement of students classified as exceptional children into the regular education classroom. Teaching students possessing varying abilities might be a challenge for both regular and special education teachers. However, the process of including exceptional children into the regular classroom accelerated rapidly in the 1990s. This movement is likely to continue to increase as society and teachers' attitudes change to accept inclusion as mutually beneficial for both normal and exceptional children (Forlin, 1996; Junkala and Mooney, 2001; Kasari *et al*., 1999; Monsen and Frederickson, 2004; Stainback *et al*., 1994, 1996; Wetstein-Kroft and Vargo, 1984). Today, as a result of this universal movement toward including exceptional children into the regular classroom, a typical class - of many classrooms around the world - includes two gifted and talented students, five students "who can easily complete all assigned tasks", fifteen average students "who can usually complete assigned tasks with little assistance, six students with learning difficulties who struggle with all tasks and need constant teacher assistance, one student with a learning disability who cannot read but is 'average' in other subject areas, and one slow-learning student who has a mild intellectual disability who generally needs teacher assistance in all subject areas", and one or two students who exhibit behaviour problem (Knight, 1999, p. 3). Moreover, in any classroom "20 per cent of students require special attention, but because they are not categorized as 'disabled', they are not eligible for special education services" (Knight, 1999, p. 3). In short, almost each student in today's classroom brings to the classroom

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[*] More information about *the International Year for Disabled Persons (1981)* can be found at this website: http://www.un.org/esa/socdev/enable/disiydp.htm

his/her unique learning characteristics which are specific to his/her exceptionalities. These unique learning characteristics should be valued by today's school. The idea of enabling "all students to belong within an educational community that validates and values their individuality" by Stainback and colleagues in 1994 (p. 489) is not a new one. According to Fleege (1977) Montessori believed that children need to be treated individually and the impulse to learn comes from inside the child. She also emphasized that children prefer to educate themselves when supplied with the proper conditions. Montessori's aim was to help each child to develop within himself/herself “the foundational habits, attitudes, skills, appreciations, and ideas which are essential for a lifetime of creative learning” (p. 3). Today's school should change to meet the needs of the exceptional children, otherwise, these students will not benefit from the inclusion. Stainback *et al*., argued that:

> Unless fundamental changes occur in regular education, there is little likelihood that students being returned to the mainstream will be any more successful than they were before the advent of special classes (1985, p. 151).

An example of these fundamental changes, which were highlighted by Stainback and colleagues, is adapting and using new teaching strategies. Madden and Slavin (1983) also argued that the base of effective inclusion is the teacher's ability to adapt what they consider as useful teaching strategies to be used with each student in the classroom. In their words inclusion "works when regular classroom teachers are able to adapt instruction for the students in their classrooms, including those with [disability]” (p. 557). Cheminais (2004, p. 40) suggested the following instructions as effective teaching strategies for the inclusive classroom:

- Mind mapping: powerful tool for giving the 'big picture' connecting thinking and supporting memory recall.

- Visualisation: guided visualisations stimulate imagination, support creative writing, mental rehearsal, relaxation, thought control and mood management.
- Music: reduces stress, boosts memory, improves whole-brain thinking and increases learning capacity.
- Multiple intelligences: promote understanding and mastery of learning.
- Thinking skills: open-minded, problem solving, investigating and exploring alternative possibilities, questioning, evaluating, evidence gathering.
- Brain gym, brain breaks: help refocus attention, reinforce concepts in learning, promote receptiveness to whole-brain learning, develop hand-eye coordination.

Russell and Meikamp (1994) also recommended "creativity training as an effective strategy for use in the regular classroom with both regular education students and students designated as learning disabled or mentally gifted" (p. 298). Creativity training might be a successful strategy to enhance students' creative thinking abilities. It was also recommended by many researchers as an appropriate strategy to address the needs of both exceptional and regular education students (e.g. Baum, 1990; Baum and Owen, 1988; DeRoche, 1968a, 1968b; Feldhusen *et al*., 1969; Fleith *et al*., 2002; Fortner, 1986; Jaben, 1983, 1986a, 1986b; Khatena, 1971, 1973; Laughton, 1988; MacDonald *et al*., 1976; Renner and Renner, 1971; Russell and Meikamp, 1994; Stasinos, 1984; Swanson and Hoskyn, 1998). The present study may provide additional evidence that creativity training is an effective strategy to use with children with ADHD. Most children with ADHD are already in mainstream schools (Lerner *et al*., 1995). It is essential to their sense of belonging, that they are valued and can become autonomous learners. Their development and identity as effective learners, therefore, may be enhanced through creativity training.

Second, creativity training, as many educators and researchers suggested, might motivate and help students to become better at resolving open-ended problems (Davis and Rimm, 1998; Torrance, 1963).

Third, creativity enhancement also might increase students' self-concept (that is, self-ideal, self-image, and self-esteem) and self-efficacy which might help students to become independent learners and thinkers (Davis and Rimm, 1998; Fleith *et al*., 2002; Ritchhart, 2004; Taylor and Sarks, 1981; Thorne, 2007).

Fourth, academic achievement might be positively influenced by creativity training (Craft, 2002; Craft *et al*., 1997, Davis and Rimm, 1998; Gowan and Torrance, 1971; Mindham, 2004; Nuss, 1962; Torrance, 1972, 1977; Torrance and Myers, 1970). Creativity training includes activities (e.g. brainstorming, analogies, problem solving, questioning techniques and the like) which help students develop the valuable skills that improve academic performance such as the ability to transfer knowledge from one domain to another (Ritchhart, 2004; Sternberg, 2003; Sternberg and Williams, 1996).

Fifth, behaviour and social skill development also might benefit from creativity training. Creativity training activities such as brainstorming are designed as a group activity which encourages students to work together building social and interpersonal skills. Moreover, most, if not all, creativity training activities are designed to foster cooperation and minimize competition which creates an environment that respects and values individual differences (Nuss, 1962; Ritchhart, 2004; Torrance and Myers, 1970).

Sixth, in general, children between eight and ten are able to use and discover ways of using their creative abilities. Yet, unfortunately, these abilities are thought to decrease between nine and ten (Ligon, 1947; Novak, 1977; Piaget, 1953; Torrance, 1962a) because children between nine and ten are easily discouraged by adult pressure. Unfortunately, most children lose their creativity forever and for only a few creativity returns after the decrease at this stage (Torrance, 1962a). Therefore, the present study will focus on children at this stage of development. Additionally, this stage of development can also be very distressing for the majority of children with ADHD and their parents because problems are likely to occur both at home and schools. For example, children with ADHD experience academic difficulties because of their lack of academic skills such as sitting quietly, listening, and focusing on their assigned tasks which are essential to success in the academic curriculum (Barkley, 2005, 2006b; Flick, 1998). They also experience social rejection because of their poor social skills and tend to develop feeling of low self-esteem about their school and social abilities. Therefore, creativity training could help those children in developing skills that improve their academic performance and social relationships with others. For example, creativity training activities such as brainstorming are designed as a group activity which might encourage students to work together building social and interpersonal skills.

Seventh, based on the literature on creativity (which was reviewed for the present study) it is reasonably fair to consider creativity training as a useful strategy to be used with children. However, much of the research has used creativity training with regular education students, LD, hearing impaired, mental retardation, and behavioural and emotional disordered, but none - to the researcher's knowledge - have been conducted into the effect of creativity training with children who are classified as having ADHD. Therefore, to add variety to this body of research, the present study will examine the effectiveness of creativity training among children with ADHD. Moreover, if this study is not the first to address creativity growth among children with ADHD using an experimental method it will be one of a few. Therefore, the researcher wishes that the information gained from this study will not only add some knowledge to the field but will also lead to further investigation.

Research Questions

The overall aim of the current study is to explore the question about whether the creative ability of children who are classified as having Attention Deficit/Hyperactivity Disorder (ADHD) can be enhanced by creativity training. The other goal of the study is to inform our understanding of the impact of creativity training on the complexity of concept maps among children who are classified as having ADHD. Specifically, the following questions will be investigated:

1. Is there a correlation between the concept mapping ability of students with ADHD and their performance in *the Torrance tests of creative thinking* (TTCT)?
2. Will students classified with ADHD who receive creativity training score higher scores on the TTCT than students with ADHD who not do receive such training?
3. Will students classified with ADHD who receive creativity training score higher scores on the TTCT in the post-test compared with the pre-test?
4. Will students classified with ADHD who receive creativity training produce more complex concept maps than students with ADHD who not do receive such training?
5. Will students classified with ADHD who receive creativity training produce more complex concept maps in the post-test compared with the pre-test?
6. Will students classified with ADHD who do not receive creativity training produce more complex concept maps in the post-test compared with the pre-test?
7. Will students classified with ADHD who receive creativity training score higher proposition's scores compared with the students with ADHD who not do receive such training?
8. Will students classified with ADHD who receive creativity training score higher proposition's scores in the post-test compared with the pre-test?
9. Will students classified with ADHD who do not receive creativity training score higher proposition's scores in the post-test compared with the pre-test?
10. Will students classified with ADHD who receive creativity training score higher hierarchy's scores compared with the students with ADHD who not do receive such training?

11. Will students classified with ADHD who receive creativity training score higher hierarchy’s scores in the post-test compared with the pre-test?
12. Will students classified with ADHD who do not receive creativity training score higher hierarchy’s scores in the post-test compared with the pre-test?
13. Will students classified with ADHD who receive creativity training score higher cross link’s scores compared with the students with ADHD who not do receive such training?
14. Will students classified with ADHD who receive creativity training score higher cross link’s scores in the post-test compared with the pre-test?
15. Will students classified with ADHD who do not receive creativity training score higher cross link’s scores in the post-test compared with the pre-test?
16. Will students classified with ADHD who receive creativity training score higher example’s scores compared with the students with ADHD who not do receive such training?
17. Will students classified with ADHD who receive creativity training score higher example’s scores in the post-test compared with the pre-test?
18. Will students classified with ADHD who do not receive creativity training score higher example’s scores in the post-test compared with the pre-test?

Through the information gained from answering the above questions, the researcher hopes that children with ADHD will benefit from this study through the understanding of their creative thinking. She also wishes to fill a small space in the large gap that exists in our knowledge about creativity among children with ADHD.

CHAPTER TWO

CREATIVITY

Introduction

In this chapter, the literature review on the subject of creativity will be organized in topical sections. This review includes the following related content areas: history and theories of creativity, definition of creativity, characteristics of creative individuals, the developmental stages of creativity, and creativity and education.

History and Theories of Creativity

Many researchers have been occupied with the investigation of the phenomenon of creativity - which has been considered as having mystical or magical characteristics - over the years. The ancient Greek philosophers searched for an understanding of creativity, and recently psychologists, educators and others have continued the quest to understand it (Treffinger *et al*., 2002, p.3).

The early studies in the field of creativity focused on philosophical speculation and anecdotal reports of creative mental functioning. As a topic for psychological and educational research, however, creativity was a neglected subject (Daniels, 1985).

Studies of creativity were rare before 1950, but during the 1950's the field of creativity research changed. In his 1950 parting address as president of *The American Psychological Association* (APA), J. P. Guilford pointed out at the annual meeting that year, only 186 out of 121,000 entries in *Psychological*

Abstracts dealt with creativity. Although, Galton's study of heredity genius attracts empirical researchers to study creativity, Guilford's presidential address introduced the study of creativity to experimental psychology which resulted in the exploration of Osborn's brainstorming exercises in 1963.

Torrance and others helped advance the field further, and during the 1950s and 1960s an impressive amount of research was generated on creativity. Following Guilford's call for more research in the field of creativity, the number of entries in *Psychological Abstracts* on creativity had doubled by 1956, and a number of educational programmes were developed and used which had as their goal the fostering of creative thinking (Barron and Harrington, 1981; Daniels, 1997; Guilford, 1950; Torrance, 1977).

Today, as a result of the interest in creativity as a research topic, creativity is constructed and tackled differently by a large number of theorists. Treffinger (1986) affirmed that there are many ideas that are considered theories of creativity, but there is no single widely accepted theory of creativity.

None of the many theories of creativity provide a clear and widely accepted explanation nor claim they did or could. Therefore, the current researcher will argue that the variety of theories in which creativity is viewed and explained could be considered as an advantage by educators. Today's teachers might find different theories useful at different times (Craft, 2001, 2002; Pope, 2005; Shallcross, 1981; Treffinger, 1986).

Although the current researcher is fully aware that each theory highlights a different aspect of creativity and also offers a different explanation of creativity, as Dacey stated "I doubt whether it makes much sense to argue which of them is right and which is wrong … they remain in such a speculative state that nothing but an endless argument is likely to result" (1989, p. 53). In this section the current researcher will present the main points of these theories, and the educational practices that might arise from them under the following sub-headings:

The self-actualization approach: Researchers who are proponents of this approach perceive a creative product as a result of certain personality characteristics in relation to environments. Creative individuals according to this approach use their talents to become what they are capable of becoming. Therefore, those individuals can be considered as being self-actualized people who are fully functioning, mentally healthy, and forward-growing human beings. Additionally, creativity is developed throughout the individual's life (Davis, 1998; Gutman, 1967; Maslow, 1954, 1967, 1968; May, 1975; Mooney, 1967; Moustakas, 1967; Neill, 1968; Rogers, 1954, 1962; Taylor, 1975; Yamamoto, 1967).

They also recognize creativity as a necessary quality for living and growing in a threatening, complex world. Obviously, theorists of the self-actualization approach considered creativity training as an important and good activity for all mankind. ADHD has been considered as a complex developmental disorder which most of children with ADHD will suffer throughout their lives. Living day to day with ADHD will typically be threatening and complex. Children with ADHD, therefore, should have the chance to be educated and prepared to think and behave creatively when solving daily problems. This can be achieved through creativity training programmes such as CoRT which will be used in the present study.

Maslow, in his hierarchy of needs, considered creativity as being a need for any human being. Figure 2.1 presents Maslow's hierarchy of needs. In this pyramid Maslow divided our needs into two levels. First, the level of "*deficiency*" in which the needs are possible to be satisfied to the level that they are no longer deficient (e.g. hunger can be fulfilled by eating). In contrast, needs in the second level "*being*" are not possible to be satisfied. In fact, the more we feed them the stronger and greater they become which enriches our being (e.g. creativity and morality) (Davis, 1998, p.51).

The current researcher, therefore, argues that one value of this approach in an educational setting is that it suggests that teachers should recognize, understand, and fulfill the child's needs. It is important to understand the child's deficiency and being needs in order to support the child to become what he/she is capable of becoming. Thus, teachers should give their attention to the child's *physiological needs* which are reported on Maslow's hierarchy of needs (e.g. making sure that the classroom temperature is ideal for the child). Here, it might be helpful to note that some teachers might assume that they should only meet the *physiological needs* and that the *self-actualization needs* is the child's responsibility. It might be true that children have more responsibility toward their own self-actualization needs more than their teachers. Yet, children might not be able to accomplish their self-actualization of *being* needs unless all their *deficiency* needs are satisfied fully by their teachers. For example, teachers might meet the child's *esteem need*s (which is *deficiency* need) through encouraging and valuing the child's contribution in the class.

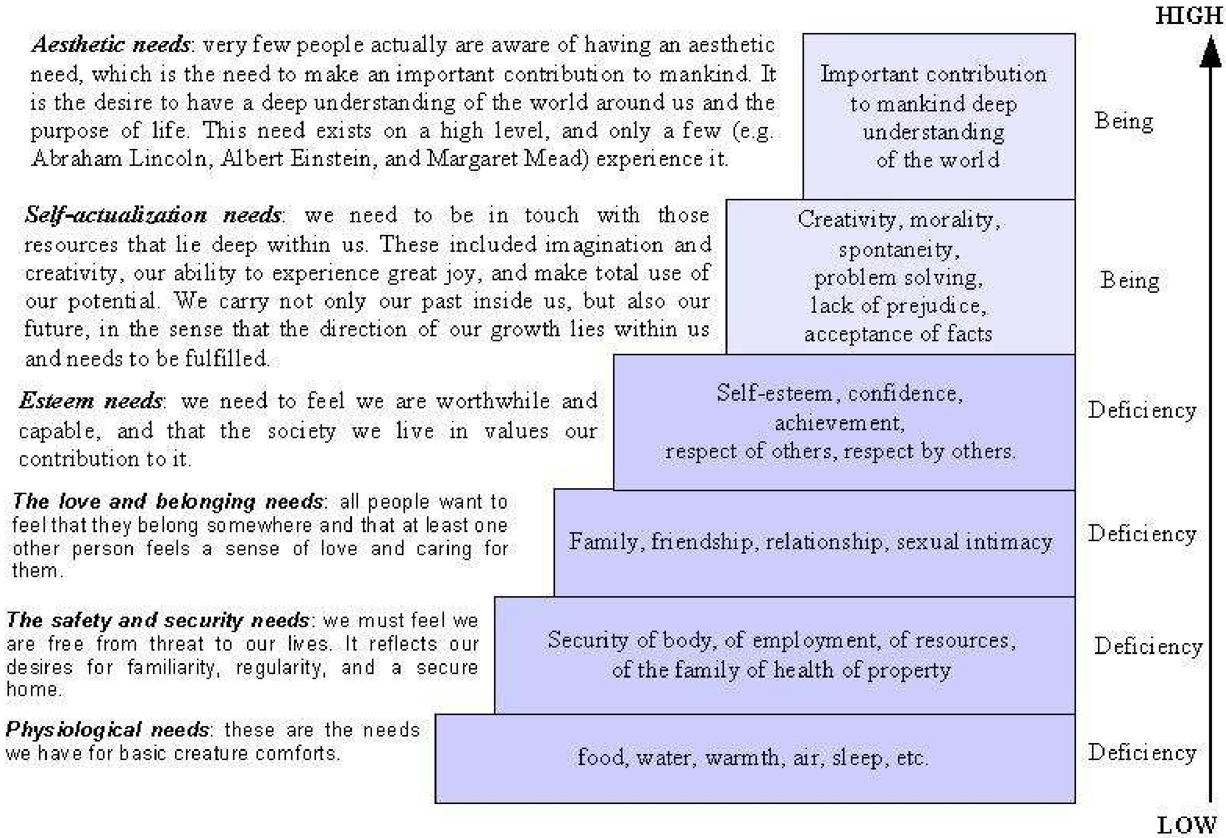

Figure 2.1 Maslow's Hierarchy of Needs
Adapted from: Dacey (1989, p.51)

The psychoanalysis approach: Psychoanalysis is a theory which was created by Freud whose creativity was essential to him, both in his work and his personal life. Freud concluded that creativity as in art results from unconscious conflict becoming conscious through the creative process, but he also admitted that psychoanalysis cannot explain creativity. Freud saw creative productivity as a result of an unconscious conflict between the libido (sex instinct) and the superego (social conscience). He also said that sexual energy is re-channeled into acceptable forms like creative fantasies and products. Fantasy and creative thinking include a regression to a childlike mode of thought, so creativity to Freud is a combining of childhood free playing and substitution for the free play of childhood (Getzels and Jackson, 1962). Kris (1953, 1976) asserted that creativity is in the service of the ego rather than the id as Freud thought.

As a consequence of the Freudian view of creativity being a negative one, some theorists like Eigen (1983, p.40) questioned whether "Freud's thought contains a unified theory of creativity in any proper sense". Unlike Freud who linked creativity to the human unconscious, Eigen affirmed that "awareness of self and other … is the most essential creative act of humankind" (p. 44). However, according to Solomon (1985) others like Jung were stimulated by Freud’s fertile thinking about the unconscious arousal of creativity. Both Freud and Jung placed the wellspring of creativity in the unconscious (Solomon, 1985). But unlike Freud who considered creativity as being due solely to the personal unconscious (which is repressed thoughts, feelings, and memories) of the artist, Jung in 1966 (as stated in Solomon, 1985) instead of the personal unconscious, used the collective unconscious (which is common to all humanity and not repressed) to explain creativity. To Jung, the collective unconscious is a universal storehouse of memories handed down from the past in the form of primordial images called “archetypes” (e.g. mother, wise old woman). Thus Jung's artist transforms material from the collective unconscious to produce an artistic creation (as stated in Solomon, 1985).

It is clear that psychoanalysis theorists backed Torrance's (1963, p. 12-45) argument that increasing the level of creative thinking through creativity training is important to enhance children's personality development and to help them maintain good mental health. Children with ADHD have been characterized as showing low self-esteem and the rate of comorbidity of ADHD with other psychiatric disorders is high (e.g. conduct disorder, CD, 12-50%, anxiety disorder, 22-34%, mood disorder, 30%, and depression, 47.9%) (August *et al*, 1996; Barkley, 2006b; Bender, 1998; Biederman *et al*., 1991; Bird *et al*., 1993; DuPaul and Stoner, 1994; Hinshaw *et al*., 1993; Kuhne *et al*., 1997; Lerner *et al*., 1995; McKinney *et al*., 1993; Riccio and Hynd, 1993; Satterfield *et al*., 1994; Szatmari *et al*., 1989). Therefore, creativity training, as psychoanalysis theorists and Torrance presumed, might enhance the development of the personality of children with ADHD and help them to maintain good mental health.

Based on the psychoanalysis approach the current researcher argues that teachers can foster creativity by helping the child to be more open with his/her personal experience. For example, encouraging the child to express and say what he/she feels through drawing or free writing. This practice might help the child to understand his/her feeling and beliefs, which might, in turn lead him/her to move on from using his/her unconscious conflict as the source of his/her creativity (which is a negative way as Eigen suggested) to be aware of his/her feelings and personal experience and, instead, use them to feed his/her creativity.

The behaviourism approach: This approach focuses on the visible behaviour itself, rather than on the unseen mental events that control the behaviour of a person. This is a different view of creativity because of the different emphasis on the behaviouristic analyses of creative thinking. For example, Skinner (1971) - who argued that there is no such thing as creativity, freedom, or dignity - suggested that all of our behaviour is controlled by those who dispense reinforcements and punishments, therefore we have no freedom.

Traditional behaviourism theory, then, emphasizes the reinforcement “reward” of correct responses and stimulus-stimulus associations. For example, Maltzman (1960) - whose research showed that when new word associations were rewarded the frequency of new word associations increased - argued that we can increase original behaviour simply by rewarding it.

A less traditional behaviourism theory focuses on mental associations which are assumed to be learned on a contiguity basis. For example, the word “carrot” might elicit “rabbit”. According to this behaviouristic view of creativity the person who possesses a large number of verbal and nonverbal mental associations that are available for recombination into creative ideas is a highly creative person and the person who can respond with just a few highly dominant mental associations is a less creative person (Mednick and Andrews, 1967).

In the light of the behaviourism view of creativity, the current researcher believes that teachers can foster creativity by rewarding creative ideas. She also argues that teachers should not use money, tokens, or school grades to reward creativity. The centre of this argument is that it is obvious that these rewards represent examples of extrinsic motivation in which the child's motivation to perform creatively comes from factors which are external or outside. Consequently, when these rewards are removed or lose their meaning to the child (e.g. the child used to have them everyday) the child’s desire to progress stops or decreases.

Instead of that, teachers should employ teaching methods which aid mental associations such as brainstorming (in which the children are encouraged to generate a long list of possible creative solutions to solve a problem) and forcing relationship (in which children are encouraged to produce new thoughts by forming a relationship between two or more things or ideas, where no relationship in reality exists between them). These teaching methods might provide the child with genuine and intrinsic reward by respecting the child's needs, developing his/her creative abilities, and recognizing the importance of these needs and abilities. In a later section entitled "Creativity and Education" further discussion regarding how schools might foster and reward creativity is presented.

The Gestalt approach: This approach which is unencumbered by a commitment to conditioning principles focuses on the internal processes in learning, thinking, memory, and problem solving. According to the Gestalt approach creative thinking is the formation and alteration of Gestalts (mental patterns or forms) and not the mere associations or sum of the associations.

For Gestalt theorists (e.g. Wertheimer, 1982) creativity is a complicated process and not only results from associating ideas in new and different ways. The whole of an idea always amounts to more than merely the sum of its parts. For example, “greater paintings are made up of elements that are interrelated to the point that the whole is greater than the sum of the parts” (Dacey, 1989, p.91). Creativity, therefore, occurs as a result of human beings' innate tendency toward clear, whole understanding of what happens in reality and generalized schemas from past experiences which provides a basis for perceiving problems, retrieving needed information, restructuring the Gestalt, and adding to the general schema (Wertheimer, 1982). Thus, theorists of Gestalt suggest that creativity training is an essential activity to be provided to everyone in order to reach clearer and fuller Gestalt about his/her self and his/her situations.

The major task of creativity, as seen by this approach, involves the ability to break up a problem into parts and then to reorganize them in new meaningful ways. According to the Gestalt approach creativity proceeds in a sequence of stages. These stages were explicated by Wallas (1926) in his widely acknowledged four-stage model. The four stages – which will be detailed in a later section – are: preparation, incubation, illumination, and verification.

The current researcher argues that the Gestalt view of creativity can be valuable in many educational settings. The basis of this argument is that learning is self-emergent and teachers can integrate new information with previous knowledge to help children achieve meaningful understanding which might lead to creativity. The child's desire to seek meaning is innate, and when he/she attempts to make meaning while he/she thinks and solves problems he/she is feeding his/her desire to be a self-emergent and creative learner (Wertheimer, 1982; Wheatly, 1992). This becomes more evident in the results of metacognitive research. According to findings of this research (e.g. Caine and Caine, 1995, 1997; Healey, 1990; Hyrle, 1996) our mind is self-regulating and can allow us to keep track of our own thinking to solve the problem at our hand. We use self-regulation, therefore, as mechanism in which meaning becomes self-emergent.

The current researcher further argues that enhancing self-regulation (which might improve self-emergent learning and thus enhance problem solving and creative thinking abilities) could be achieved via the use of metacognitive tools such as concept mapping. Teachers could use concept mapping to assist them to figure out what the child already knows and then teach from there. By knowing the child's prior knowledge, teachers could tie the new concept -which they wish to teach- to the existing ones. Tying concepts is important to assist the child to activate his/her prior knowledge by seeing relationships within and around concepts. Therefore, concept mapping might lead the child to examine concepts and infer relationships when not explicitly stated. In other words, concept mapping might guide the child to achieve meaningful understanding which according to the Gestalt approach might lead to creativity.

The potential approach: This approach was established by Guilford who with his colleagues used factor analysis to create the *Structure-of-Intellect* (SOI) which is a map of the intellectual human mind. Guilford estimated that there are at least 120 unique intellectual abilities (each is a combination of content, an operation, and a product). This will be detailed in a later section.

SOI which is also known as the "factorial theory" is considered one of the most influential contemporary theories of creativity (Dacey, 1989). The potential theory opens the door to measure creativity. For example, based on this theory, Torrance in 1966 created *the Torrance tests of creative thinking* (TTCT) which is a measure of creative abilities.

Guilford (1984) identified flexibility, fluency, elaboration and originality as creative abilities. Guilford also identified the cognitive processes of these abilities as essential to creativity. He assumed, that the “mental operation of divergent production is a key process in creative thinking” (1984, p.1). Moreover, Guilford suggested that the creative process occurs at the same time as an assistant feature of primary abilities. The primary abilities – fluency, flexibility, originality, and elaboration – will be detailed in a later section.

According to the potential approach when someone is equipped with a set of cognitive traits or potentials (flexibility, fluency, elaboration and originality) he/she should be a creative person. Thus the abilities to be flexible, fluent, elaborate and original are some of the characteristics of the creative person.

The other assumption of this approach is that creative abilities are different factors in different groups of people. Therefore creative abilities are not the same in different fields of creative endeavour. That is, inventors, writers, artists, and composers “may have some same factors in common, but there is much room for variation in patterns of abilities” (Guilford, 1950, p.451). More importantly, Guilford also anticipated that these abilities vary between and within individuals. This suggests that creativity is an ability that everyone has and it might be enhanced via creativity training. The potential theory of creativity may perhaps give an explanation why some individuals with autism who have a great ability to play a piece of Mozart the way a professional does cannot compose a piece of music. It may also explain why Van Gogh whose IQ was below average reflected great imagination in his painting. Creative ability among children with ADHD is the focal point on the present study. More specifically, this study will investigate the effects of creativity training on fluency, flexibility, originality, and elaboration which were identified by Guilford and Torrance as creative abilities.

Regarding the educational practices arising from the potential approach to creativity, the current researcher argues that teachers could, and should, measure the child's abilities. Measuring the child's abilities via standard tests (which were mainly developed to measure the abilities that Guilford expected in his theory *Structure-of-Intellect*, SOI, such as TTCT) help teachers to generate an accurate understanding of the child's abilities and style of learning. Thus, the purpose of these tests and the results obtained from them should not be used only to help the child to achieve an academic excellence. Instead, teachers' main objective from measuring the child's abilities should be to develop study materials and teaching styles which suit the child and which enhance his/her abilities and learning skills.

The Right-left brain approach: The central point of this approach is the special function of brain hemispheres. Hemispheres are the two halves which make up the brain (the left brain and the right brain) and a thick cable of nerves (the corpus collosum) connects the two halves. Each hemisphere takes control over the opposite side of the body. For example, the left hemisphere deals with the information from the right eye and vice versa. According to this approach certain modes of consciousness and skills are associated with hemispheric specialization. For example, the left hemisphere deals with the following modes and skills (Symbols, phonics, language, verbal, logical, abstract, and linear processes) and the right hemisphere deals with (feelings and emotions, spatial relationships, visualization, intuitive, nonverbal, random, and holistic processes).

The other assumption of this approach is that because of superior creativity-related functions such as spatial relationships and holistic processes a special emphasis is given to the right hemisphere during the creative thinking process. However, this approach asserts that originality and valuableness - two qualities of creativity - occur in opposite sides of the brain. In short, the left hemisphere has a dominant role over valuableness and the right hemisphere has a dominant role over originality. Moreover, to maximize the creative processes, both hemispheres' functions are needed. (Bakan, 1969; Herrmann, 1981; Kats, 1983; Kinsbourne, 1972; Martindale *et al.*, 1984; Reynolds and Torrance, 1978; Torrance, 1982; Torrance and Rokenstein, 1987; Vitale, 1994; Wertheimer, 1982).

Obviously, the right-left brain approach observes creativity as a result of particular functions of brain hemispheres. In other words, creativity is achieved by using both hemispheres. Thus, this approach suggests that teachers might develop and utilize teaching strategies (e.g. concept mapping) which might aid their students in making use of both hemispheres and be more creative. Concept mapping represent modes and skills of both hemispheres. For example, through creating a concept map the child uses symbols, language, and his/her logical thinking to connect concepts. These are modes and skills of the left hemisphere. The process of creating a concept map also described as visualization, random, and holistic processes which are modes and skills of the right hemisphere.

The current researcher, based on the above theories of creativity, argues that creativity is a multidimensional quality whose origin and definition are more easily understand by the general public. For example, music and art would be considered by most people as having some feature of creativity. Unfortunately, for the purposes of psychological and educational research it is definitely far more difficult to establish a clear answer or to agree on the origin of creativity. For example, Freud admitted that psychoanalysis cannot explain creativity, and Piaget asserted that "the origin of creativity, to me, remains a mystery and it is not explicable" (Piaget, 1981, p.222).

Definition of Creativity

The lack of a broad agreement on a unified theory of creativity, as mentioned earlier, results in different definitions of creativity. Taylor (1964, 1995) and Torrance (1977) hypothesized that any human activity may be looked at from four angles: the person who performs it, the thing which is done, the process of activity itself and the conditions which affect the above three divisions.

Taylor and Torrance's hypothesis seems to stand up well. They argued that the creative product can be observed as a production of the creative process, which is affected by creative abilities and other characteristics of a person. Similarly, the creative product is affected by environmental conditions, which also affect people and creative processes. Based on this argument Moony (1963/1999) defined creativity under the four Ps which he introduced as following:

- Creative Person.
- Creative Product.

- Creative Process.
- Creative Press (environment).

Here, it is worth mentioning that in the current study, the researcher adopted Torrance's definition of creativity which entails all four Ps as they are not mutually exclusive. This will be discussed more fully towards the end of this section.

Creative Person: The primary focus of creative person definitions is the characteristics of highly creative people. Creative personality characteristics have been described in the literature as intelligent, imaginative, original, curious, artistic, energetic, risk-taking, and open-minded (Barron, 1969; Barron and Welsh, 1952; Barron and Harrington, 1981; Hussain and Kumar, 1991; MacKinnon, 1962; Taylor, 1995; Torrance, 1962a, 1967a, 1977, 2004; Weiss, 1997; Welsh, 1975). These characteristics will be discussed further in the section entitled characteristics of creative individuals.

Taylor asserted that "all persons have some degree of potential to be creative in one or more ways" (1964, p.8). Additionally, Lowenfeld (1960) argued that there are two types of creativity, the actual creativity (which is already developed and functioning) and potential creativity which includes the total creative potential (developed and undeveloped) of an individual. Daniels (1997) backed Lowenfeld, and further argued that creativity is a set of both abilities and traits. If Lowenfeld and Daniels' argument is applicable to all people, whether or not they have a disability, then the current researcher argues that children with ADHD might have creative potential which could be developed by creativity training, and therefore should not be excluded from having the opportunity to develop their potential of being creative personnel. In addition, the main object of creativity training programmes which have been put forward to nurture creativity (such as *the CoRT thinking lessons* which are used in the present study) is to enhance creative traits and abilities which might develop a creative personality.

Creative Process: While the primary focus of all creative process definitions is the skills involved in creative thinking, there are many different views of the creative process. Wallas suggested that in the creative process there are four stages:

- Stage of *preparation*: the subject begins to gather information about the problem to be solved and attempts some solutions. This stage is characterized by a state of trial-and-error in learning. Therefore, the subject is advised to learn as much as possible about the problem area.

- Stage of *incubation*: where the solution exists but is not clear. The subject must not intentionally work on the problem. Instead it is allowed to sink into the unconscious.

- Stage of *illumination*: here, the subject suddenly experiences insight into the problem when a new solution, idea, or relationship emerges. In other words, the subject attempts to reformulate his/her ideas or to formulate new ones. The subject is more active and more conscious work is needed in this stage.

- Stage of *verification*: the subject tries and checks the solution. In this final stage some modification may also occur to ideas reached in the previous stages (Wallas, 1926).

In some situations, the above stages may appear in a different order, or combined into two or three stages. They also do not occur regularly (see Dacey, 1989; Davis, 1997; Davis and Rimm, 1998; Taylor, 1964; Wallas, 1926). For example, sometimes the subject's knowledge of the problem area allows him/her to pass over the first stage (*preparation*) and move on to the next stage (*incubation*) or even to the third stage.

Here the current researcher will argue that the four-stage model of creativity and the process of creating a concept map are similar. The first similarity is that in *preparation* (the first stage) the learner begins recalling personal experiences and investigating in all different directions to gather information about the problem to be solved. Likewise, the first step of mapping a concept map is to define the topic or the focus question that addresses the problem, issues, or knowledge domain the learner wishes to map. The object of defining the focus question of interest is to list all concepts associated with the focus question. Since the goal from this procedure is to generate the largest possible list, the learner should not worry about redundancy, relative importance, or relationships at this point.

Another similarity is that in the stage of *incubation* (the second stage) the solution exists but is not clear. Therefore, the learner must not intentionally work on the problem. Instead, he/she should be allowed to sink into the unconscious. Similarly, in the step of rank ordering the concept, which is quite a difficult step on the process of creating a concept map, the learner is advised to relax and reflect on his/her focus question which might lead him/her to modification of the focus question.

A further similarity is that at the stage of *illumination* (the third stage) the learner experiences insight into the problem when a new solution, idea, or relationship emerges. Thus, he/she attempts to reformulate his/her ideas or to formulate new ones. In a similar way, the process of creating cross-links between concepts in different sections of the map often help the learner to see new and creative relationships in the knowledge domain.

Finally, in the stage of *verification* (the fourth stage) the learner tests, tries and checks the solution he/she created. Since this stage is the final one, the learner may well make some modification to his/her ideas which he/she reached in the previous stages. In the same way, in order to map a good concept map the learner should rework the structure of his/her map to represent his/her collective understanding of the interrelationships and connections among groupings, which may include adding, subtracting, or changing superordinate concepts, thus, he/she may need to review his/her concept map as he/she gains new knowledge or new insights.

Although the current researcher is fully aware that the above association which she made between the stages of the creativity process (as suggested by Wallas in 1926) and the process of creating a concept map (as suggested by Novak in 1998) is a generalized statement, it may be possible to conclude that concept mapping allows the learner to view and represent problems in an effective way which might help him/her in understanding the problems and finding suitable and creative solutions to solve problems. Therefore, the present study argues that if the learner is taught to behave creatively (through a proper creativity training programme such as CoRT which fosters higher cognitive processes) his/her ability to map a complex concept map might be improved.

The current researcher is also fully aware that the intellectual abilities of the child, his/her own way of thinking, and other factors related to his/her personal characteristics, attitude to learning, and environmental influences may affect one or more of the creative process stages. For example, in the first stage, *preparation*, if a child with ADHD is faced with failure to reach a solution or other difficulties which cause him/her tension and suffering, he/she may choose to stop looking for a solution. Therefore, it is necessary to motivate the child with ADHD to continue his/her work in this stage by providing him/her with some clues and by removing the fear of failing the right answer. This can be accomplished through open-ended activities which have no right or wrong answers.

Guilford highlighted the intellectual aspects of creativity with his model *Structure-of-Intellect* (SOI). Guilford and his assistants used factor analysis to create the SOI which is a map of the intellectual of the human mind. Guilford, as mentioned previously, estimated that there are at least 120 unique intellectual abilities which each is a combination of content, an operation, and a product. More importantly, Guilford also anticipated that these abilities vary between and within individuals. Figure 2.2 presents the SOI.

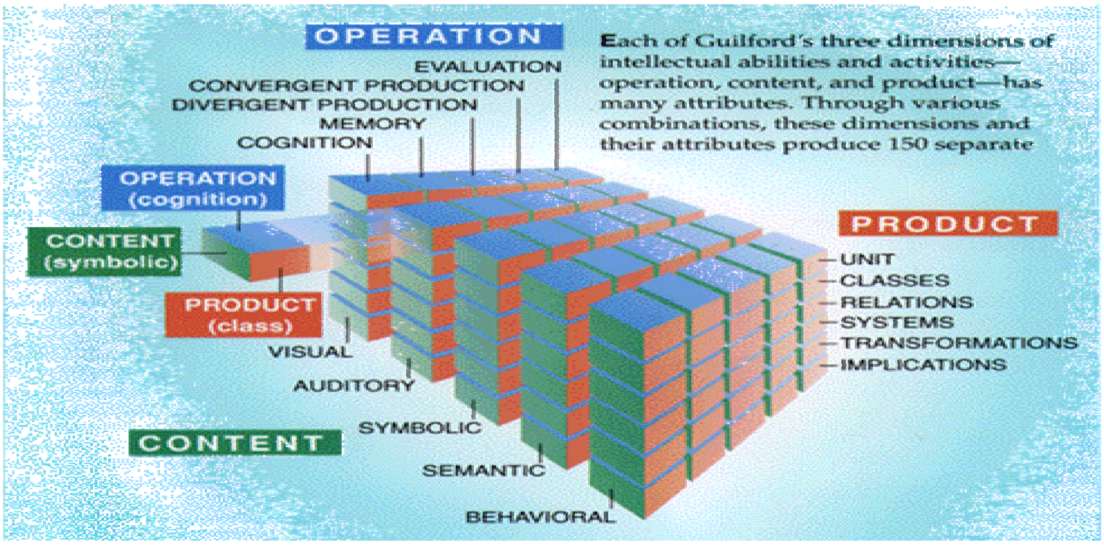

Figure 2.2 the Structure of Intellect
Adapted from: *Educational Psychology: Theory and Practice* *

Contents which mean "in which field does the mind work?" can be divided into four kinds (figural - visual and auditory - content, symbolic content, semantic content, and behavioural content). Operations which indicate "what does the mind do?" can be divided into five groups (cognitive thinking operations, memory operations, convergent thinking operations, evaluative thinking operations, and divergent thinking operations). Products which explain "what does the mind use? Or how does the mind act with content?" can be divided

* For more information see: http://www.abacon.com/slavin/index.html

into six kinds (units production, classes production, relations production, systems production, transformations production, and implications production). In other words, Guilford supposed that any action of an operation (e.g. divergent thinking) with a content (e.g. symbolic) by a product (e.g. units) will lead to a certain ability (e.g. the ability of divergent symbolic units). Therefore, the expected abilities from Guilford's map of the intellect of the human mind are 4 contents x 5 operations x 6 products = 120 abilities. This number may increase if the branches of those abilities are considered.

Guilford separated those abilities into two categories: *convergent thinking* (which can be defined as that thinking which requires one correct solution to one problem and which is probed by traditional intelligence tests), and *divergent thinking* (which requires many correct solutions to the one problem and is measured by the richness and excellence of ideas as in creativity tests).

According to Guilford's map there are 24 subsidiary abilities concerned with creativity. However, only 23 were discovered. The ability of "divergent figural units" is an expected ability (Bachelor and Michael, 1991; Dacey, 1989; Guilford, 1959, 1984, 1988; Guilford and Hoepfner, 1965, 1966; Hendricks *et al.*, 1969; Michael, 2003).

On the bases of Guilford's work, Torrance classified creative abilities into four basic abilities: fluency, flexibility, originality and elaboration.

Fluency is the individual's ability to produce a large number of responses, ideas or solutions to a problem. *Flexibility* is the individual's ability to produce not only a large number of responses, ideas or solutions to a problem, but also a variety of responses, ideas or solutions to a problem. In other words, fluency is assessed quantitatively by the number of the responses and flexibility is assessed qualitatively by the number of categories into which those responses can be divided.

Originality is the individual's ability to produce something new, rare, unprecedented, or different from the obvious. Originality is assessed by the weight of originality which may be defined by the degree of publicity or rarity of response among individuals' answers. Therefore, a widespread response is given a low rating, while a rare response is given a high rating and considered an original response. In other words, originality is assessed based on the statistical infrequency.

Elaboration is the individual's ability to give more details about the object and view it from many angles. Therefore, this ability is measured quantitatively by the number of new details added to the original idea.

The above abilities were the basis on which Torrance created the TTCT. The TTCT is the most widely used measure of creativity. Description of TTCT and why the researcher has chosen it are detailed in a later chapter (Cramond *et al.*, 2005; Dacey, 1989; Davis, 1997; Kim, 2006a, 2006b; Torrance, 1962a, 1962b, 1965; Zarnegar *et al.*, 1988).

There, it might be worth mentioning that Guilford developed his theory during the *Cold War* and the *Space Race* between the Soviet Union and the United States of America. In this era the American education goal moved "from “life adjustment” education in the 1930s to academic excellence to beat the Russians in the 1950s and 1960s" (Novak, 1977, p.28). As a result most of the tests developed to measure the abilities that Guilford expected in his theory were used to assess students' abilities in order to achieve an academic excellence. However, today – as in the current study – most of these tests (e.g. TTCT) are used by many researcher and educators to measure the improvement in the students' abilities which might result from a specific training programme such as the *CoRT thinking lessons*.

Creative Product: The primary focus of creative product definitions is the creative product which is the outcome of the creative process. The products of creativity can include ideas, acts, or products that change or transform an existing domain into a new one. The creative product must meet the following criteria: First, it must be original, new or substantially different from anything. A product, however, may be considered original and new by some people but not by others. Boden (1994) suggested that there are two categories of creativity. The first one is psychological which he called (P-creativity), and the second is historical (H-creativity). Boden stated that,

> an idea is P-creative if the person in whose mind it arises could not have had it before; it does not matter how many times other people have already had the same idea. By contrast, an idea is H-creative if it is P-creative and no-one else has ever had it before (1994, p. 5)

By Boden’s definition all H-creative ideas are P-creative too. Second, a creative product should be correct, meaningful, appealing or useful for achieving a goal or solving a certain problem. Third, a creative product should be possible to assess and/or distinguished by a certain charm (for a comprehensive review see Amabile, 1989; Boden, 1994; Butcher, 1968; Csikzentmahalyi, 1990, 1996; Daniels, 1997; Freeman *et al*., 1971; Mar’i, 1976; Okuda *et al*., 1991; Taylor, 1960, 1964, 1975, 1995).

Creative Press (environment): Creativity does not occur in a vacuum. The creative press of the environment is the space in which creativity takes place. The environment includes the people, their attitudes, culture, and the physical space. Although the definitions of creativity are not generally based solely on environmental creativity, the importance of the environment is commonly noted. (e.g. Amabile, 1989; Baer and Kaufman, 2005; Csikzentmahalyi, 1990, 1996; 1997; Daniels, 1997; Davis, 1997; Fabun, 1968; Freeman *et al*., 1971; Getzels and Jackson, 1962; Guilford, 1959; Holland, 1961; Kemple and Nissenberg, 2000; MacKinnon, 1962 ,1975; Mar'i, 1976; Parsons, 1971; Stein, 1953, 1968; Taylor and Barron, 1963; Torrance, 1977; Torrance and Goff, 1989; Treffinger *et al*., 2002).

The current researcher concludes, based on the above review of literature, that there are probably as many varied definitions of creativity as there are people who want to be creative because creativity might mean different things to different people at different times. It is also sufficient to say that there are many definitions of creativity, yet, there is no one definition universally accepted (Treffinger *et al*., 2002). On this basis Mayer stated that developing a clearer definition is a "challenge for the next 50 years of creativity research" (1999, p.459). For now, the current researcher will adopt Torrance's definition for the present study. Torrance (1963) defined creativity as:

> The process of sensing problems or gaps in information, forming ideas, or hypotheses, testing and modifying these hypotheses, and communicating the results. This process may lead to any one of many kinds of products verbal and nonverbal, concrete and abstract. (p.4)

The current researcher has chosen to adopt Torrance's definition because in this definition Torrance entails all four Ps as they are not mutually exclusive. In fact, Torrance related all four aspects of creativity (person, process, product, and press) which might aid our understanding of the whole concept of creativity. Furthermore, for research purposes Torrance (1993) declared that the reasons he chose a process focus of creativity are that he could then "ask what kind of person one must be in order to engage in the process successfully, what kinds of environments will facilitate it, and what kinds of products will result from successful operation of the processes" (p. 233). Thus, creativity as defined by Torrance involved a stepwise process with sensing the problem, forming hypotheses, testing the hypotheses, and describing the results (Davis, 1998).

Since Torrance's definition is adopted by the researcher and the TTCT was used to measure creativity, in the present study the researcher defines creativity as "what the figural TTCT *thinking creatively with pictures* measures".

Characteristics of Creative Individuals

As stated at the previous section, creativity can be viewed as a human trait which all individuals possess. Therefore, the differences are in the degree (Taylor, 1964).

Much research has been compiled to describe the characteristics of creative individuals and have presented many general forms of the creative personality (Amabile, 1989; Baer and Kaufman, 2005; Barron, 1969; Barron and Welsh, 1952; Csikzentmahalyi, 1996; Daniels, 1997; Davis, 1997, 1998; Golann, 1963; Kneller, 1965).

Using the existing literature, Davis gleaned a list of characteristics of the creative individuals. He listed the following twelve characteristics of creative individuals: aware of their own creativeness, original, independent, risk taking, energetic, curious, sense of humour, attracted to complexity of novelty, artistic, open-minded, needs for privacy, alone time, and perceptive. See Davis (1998) for a detailed description of the twelve characteristics.

Characteristics of creative individuals, based on the literature reviewed in this regard, can be divided into:

- *Positive characteristics* (e.g. aware of creativeness, imaginative and original, independent, self-starting, risk-taking, energetic, attracted to novelty and complexity, curious, humorous, artistic, tolerant of disorder, open-minded, perceptive intuitive, and spontaneous).

- *Negative characteristics* (e.g. nonaccepting of or questions laws and rules, rebellious, cares little about cultural courtesies and standards, often doesn't like to join the crowd, argumentative, stubborn , feels others are wrong or out of step, resistant to authority, demanding, does not care about what others think, assertive, uncooperative, may not do well in groups, capricious, absentminded, spends time day dreaming, forgetful, careless, sloppy with details, egocentric, moody, sensitive, temperamental, impatient, impulsive, and overactive physically or mentally). (Csikzentmahalyi, 1996; Daniels, 1997; Davis, 1997, 1998; Torrance, 2004; Weiss, 1997).

In conclusion, there are many listings of characteristics of the creative individual, most of which are similar, and not all of which will apply to all creative individuals. Neither, it must be acknowledged, does the existence of the above characteristics necessarily guarantee the existence of creativity. Thus, children with ADHD who demonstrate similar characteristics (mainly the negative characteristics) do not necessarily have high creative ability. The similarity between characteristics of creativity and the symptoms of ADHD is developed further in chapter four.

The Developmental Stages of Creativity

Cognitive development varies from one human to another and is influenced by a large number of biological, social, and cultural factors (Runco, 2007). However, cognitive researchers (e.g. Ausuablel, Ligon, and Piaget) established several theories to explain the existence and development of various intellectual activities and characteristics. Today, there are many cognitive theories in which the nature and processes of change are described. However, the origins of most, if not all, cognitive theories is the work of Piaget (Ginsburg and Opper, 1988). Additionally, Piaget's cognitive development stages are characterized by being widely influential.

According to these theories creativity growth depends on the development of abilities which were thought to be involved in creative thinking such as imagination, abstraction, and logical thinking.

The developmental stages of creativity will be presented in this section. In presenting this information the current researcher will refer to Piaget's stages in the development of children’s cognitive structure in 1953. The current researcher will also adopt Torrance’s method of using different educational levels (the preschool, elementary school, and high school periods). A third emphasis in this section relates to Torrance's treatment of Ligon. In his summary of Ligon’s (1940) extensive project "*Their future is now: The growth and development of Christian personality"* Torrance (1962a, p. 85-102) focused on the characteristics which he thought to be related to creative growth as follows:

Preschool Years: The stages of development during the preschool years embody children from birth to the age of six. According to Piaget during this period the infant develops his/her sensorimotor thinking. In general the infant relies on innate reflexes and uses trial and error learning to learn simple skills. The infant can reach the permanence phase (that is, represent objects and events mentally) at the end of age two.

An infant of this stage is egocentric. He/she understands the world from his/her own perspective and finds difficulty in understanding alternative views held by other people. An important characteristic of this stage is dealing with language which entails using and understanding symbolic shapes: letters, words and numbers. Language allows the infant to communicate with other people in his/her environment.

The ability of imagination develops and expresses itself between the ages of four to six in two aspects: interest in telling and hearing stories (especially imaginative stories) and using imagination in playing (e.g. playing with a stick as a horse and the like). The child starts to search curiously for “truth and right” even in areas that may be embarrassing to adults. Ligon affirmed that the search for truth should never be inhibited by shame or guilt. Children’s questions at this stage can be rewarded by simple but direct and honest answers and sharing the child’s discovery of new things and helping him/her in his/her search for truth by exploring the meanings of words.

A hallmark of a child who is under the age of two at this stage of development is his/her ability of manipulating the environment and objects physically to satisfy his/her curiosity. Therefore, simple games, large building blocks, dolls, and encouraging the child’s desire to explore are some ways of supporting creative growth at this age.

Creative growth at the age of two can be nurtured by providing the child with toys like blocks or a ball of clay which could stimulate more imagination. At the age of four creativity and confidence can be built up through arts and word games. (Ligon, 1947; Novak, 1977; Torrance, 1962a; Piaget, 1953).

Elementary Years: According to Piaget, the stage of concrete operations is attained during the primary school period. Stages of development during the elementary school years include children from six to the age of twelve.

Curiosity continues to develop at this stage if not restricted by adults. Children at this stage enjoy learning unless school experiences are unrewarding. Children can learn adult-imposed rules. They also can and do create rules to guide their own behaviour and protect the rights of others. They also love creating characters and making others guesses who they are. At the age of six to eight, creativity can be developed through role-playing lessons, stories, discussions, and characters personifying moral principles (Ligon, 1947; Novak, 1977; Torrance, 1962a; Piaget, 1953).

The child between eight and ten is able to use and discover ways of using his/her creative abilities. The child's ability to ask critical questions also increases. The child might worry about what he/she can and cannot do as a result of his/her awareness of differing from others. Although at this stage children should be helped to realize the impossibility of being good at every thing, they should be provided with support when the task they do is difficult.

Lowry (as cited in Torrance 1962a, p.95) described the developmental vision of nine-year-olds as the worst possible visual organization. Lowry also reported that the majority at this age depart from “ideal” or theoretical vision. Furthermore, Lowry asserted that the nine-year-old child will practice endlessly with little improvement when provided with vision training or rehabilitation. Therefore, Lowry suggested that training or therapy should be delayed six months to a year.

Although the focus of the intervention which will be used in the present study is nurturing creativity (through the use of *the CoRT thinking lessons*), complexity of the concept map (which might need a good visual organization to map) will also be used to assess the impact of creativity training on the child's creative ability. Therefore, it is worth mentioning that in the current study along with the concept mapping technique, the TTCT will also be used to avoid the possibility of poor visual organization reported on Lowry's study.

The child between ten and twelve is able to read and think for long periods. Therefore, it is a great age for helping the child to read, think, persist in difficult tasks, and challenge him/her to learn things because they are difficult (Ligon, 1947; Novak, 1977; Torrance, 1962a; Piaget, 1953).

As a result of the Minnesota studies Torrance (1968, 1962a, 1967a) arrived at a general pattern for the development curve of most of the creative-thinking abilities. From the curve Torrance concluded that these abilities reached their highest points in grades three, six, eleven, and first year of high school. Growths of these abilities decreased in grades four, eight, and twelve. According to Torrance (1962a) the Minnesota studies results come into line with that of Kirkpatrick (1900), Colvin and Meyer (1906), Simpson (1922), Mearns (1931), Vernon (1948), Lally and LaBrant (1951), Wilt (1959), and Barkan (1960).

Torrance presented some explanations for the declines which occurred at some grades, especially at fourth and seventh grades, he states that:

- These declines could be explained by pressures met at each new stage or each new transitional state in education, whereby a temporary decline in performance results from a period of shock.
- They may be explained by accompanying physiological changes which occur at certain ages, as around age nine, according to Lowry.
- According to the theory of Harry Sullivan (1953), the skills acquired during the transition period that usually occurs between third and fourth grade are accompanied with a group of social development aspects, causing pressures toward socialization. By this time, strong dependence upon consensual validation develops, and unusual ideas are ridiculed and condemned. This creates a tendency to reduce the freedom and excitement of communication, especially of original ideas. (1962a, p. 94-95).

Torrance (1962a) drew attention to the possibility of being misled by using the age-level characteristics to look for an average behaviour. He also asserted the importance of looking for a range of possible abilities and stimulating children toward their maximum. Barkan in 1960 (as cited in Torrance 1962a) observed that fourth grade children were easily discouraged by adult pressure. Furthermore, Wilt in 1959 (as cited in Torrance 1962a) maintained that only a few children would be able to retrieve their creativity after a decrease in grade four. Others will lose their creativity forever and will only be able to retrieve some of their creativity. It might be worthy of note that the participants in the present study were chosen from fourth and fifth graders because of the decrease in creative ability which possibly will occur between nine and ten.

High School Years: According to Piaget, the stage of formal operations is attained during the high school period. Stages of development during the high school years include children from twelve to the age of eighteen.

The age of twelve to fourteen is the age of adventure both socially and emotionally. Abstract thought characterizes this stage. A twelve-to-fourteen year-old youth is capable of thinking without the necessity of the object of thinking to be present. Creativity can be developed through planning specific short-range goals, and by giving the youth practice and experience in making decisions and using creative solutions.

A fourteen to sixteen year old youth can focus his/her imaginative activity on a future career. Creativity can be developed by helping the young person in evaluating his/her abilities realistically to choose a career in which he/she can achieve success.

Intellectual developments express itself in social behaviour between the ages of sixteen to eighteen. The young person can harness his/her emotional energy creatively. Although adults should avoid competing with the young person, the young person must be treated as a fellow learner. Creativity and confidence can be built up through helping the young person to find creative ways to assimilate his/her beliefs, and to practice his/her social skills (Ligon, 1947; Piaget, 1953; Torrance, 1962a).

To conclude, the development of creativity is influenced by other developmental processes such as imagination and attention (Runco, 1996, 2007). Moreover, we should concentrate on how far rather than how fast, and also we should and could accelerate children's growth and progress through each stage as Piaget suggested in 1953. Here, it must be acknowledged that in 1969 Piaget and Inhelder wrote a book in which they attempt to dispel misinterpretations of Piaget' theory. They asserted that: (1) The age at which the stages transpire is vary considerably both within and among cultures; (2) Although the course of an individual's development is continuous, an individual may demonstrate many forms of behaviour intermediary between two adjacent stages; (3) *Vertical decalage* (which describe across-stage gap) is the process in which the individual is not always in the same stage of development with regard to different content areas; (4) *Horizontal decalage* (which describes within-stage gaps) is the process in which an individual in a certain advanced stage may not always be able to apply this mode of thinking to wider range of content areas.

There have been many criticisms of Piaget theory of childhood cognitive development, most notably, psychologists debate whether children actually go through the four stages in the way that Piaget proposed, and further that not all children reach the formal operation stage (Bourne *et al.*, 1979; Flavell, 1971, 1976; McShanc, 1991; Novak, 1977; Sutherland, 1992). However, Gardner (1982, 1993) asserted that Piaget's theory corrected the mistaken notion of considering the child as a "little adult" who perhaps knew less than an adult but reasoned in the same way an adult do. In his words:

> Piaget provided the most crucial information that we have about what children know, how they come to their knowledge, what they are likely to be able to learn, and what is completely beyond their grasp at various stages of development (Gardner, 1982, p.7).

The current researcher has chosen to address the developmental stages of creativity because it is an essential consideration for each adult who interacts with children. An understanding of the developmental stage helps parents and teachers to understand what the child needs in each stage and how to meet these needs. Torrance asserted that:

> teachers who know most about the age-level characteristics of the students whom they teach do a better job of teaching, establish better relationships with children, and enjoy their teaching more than do their less informed colleagues (1962a, p.84).

The current researcher, therefore, argues that understanding the creative growth at every development stage is necessary to reward creative behaviour successfully at each stage. For example, creative abilities decrease between the age of nine and ten because children at this stage of development are easily discouraged by adult pressure. Yet, they are able to use and discover ways for using their creative abilities. Creative behaviour at this stage can be rewarded by providing the child with some support when the task he/she is doing difficult, and helping the child to overcome the worry about what he/she can and cannot do by realizing that it is impossible to be good at every thing. Teaching those children through open-ended activities which have no right or wrong answers probably will remove the fear of failing that "one" right answer. It is more likely that creativity among children with ADHD (who generally have low self-esteem feelings about their abilities) at this stage of development will decrease and those children might lose their creativity forever. The present study will apply to a sample of children with ADHD who are fourth and fifth graders because of the possible decrease of creative ability between the age of nine and ten.

Creativity and Education

Half a century ago, in his presidential address to *the American Psychological Association* (APA) Guilford asked "Why is there so little apparent correlation between education and creative productiveness?" (1950, p. 444). Bloom also projected that by the end of the 20th century, and perhaps even earlier, humanity would find itself facing up to a rapidly changing and unpredictable future (as cited in Torrance, 1965). Moreover, Torrance (1967b) who cautioned the impossibility of foreseeing or envisioning particular problems which would be paramount in the next few decades, asserted that the only thing which appeared to be certain was that the existing ways of viewing life and solving problems would not be sufficient for the future. Therefore, it is imperative that individuals be prepared to accept the creative challenge. In 1967b Torrance stated:

> thing are changing so rapidly that we can no longer survive, if we insist on thinking and living in static terms....We can not afford to return to the old ways.... We must accept the creative challenge (p.330).

de Bono (1991) backed Torrance's argument that since all human beings are innately creative, but not all are able to express their creativity, those not able to express their creativity may lack the opportunity or their environment may not facilitate creative growth as it should do (Torrance, 1965). de Bono also asserted that in many countries there is a pressing need to teach creative thinking skills. In his words:

> I have worked in 45 different countries with all manner of ideologies and cultures (Protestant, Catholic, Marxist, Islamic, Buddhist, ect.). In all of them there is a great need to teach creative thinking skills for the following reasons:
>
> - The provision of life skills is necessary so that individuals can operate in an increasingly complex world: making choices, solving problems, taking initiatives.
> - In highly competitive industrial societies (and also in developing societies), there is a great need to increase the skills of "operacy". Operacy is the skill of doing. It is a bad mistake to assume that knowing is enough.
> - In addition to operacy at a general work level, education must provide the entrepreneurs, organizers and leaders that society requires. Such people need a great fluency in thinking skills: in the skills of wisdom and not just cleverness.
> - In any democracy where individuals have to make choices and assessments, a lack of thinking skills means politics by slogan.
> - If we do not teach thinking skills, then the only intellectual activity open to the intellectually energetic is to be "against everything" because this requires the least thinking skills. That leads to a society that can only progress through disruption and opposition. (1991, p.5).

Ausubel and Robinson (1969) exposed the nature of rote and meaningful learning. Furthermore, they argued that creativity should indicate a level of synthesis which was based on meaningful learning. Additionally, they clarified the relationship between application, problem solving, and creativity as present in figure 2.3.

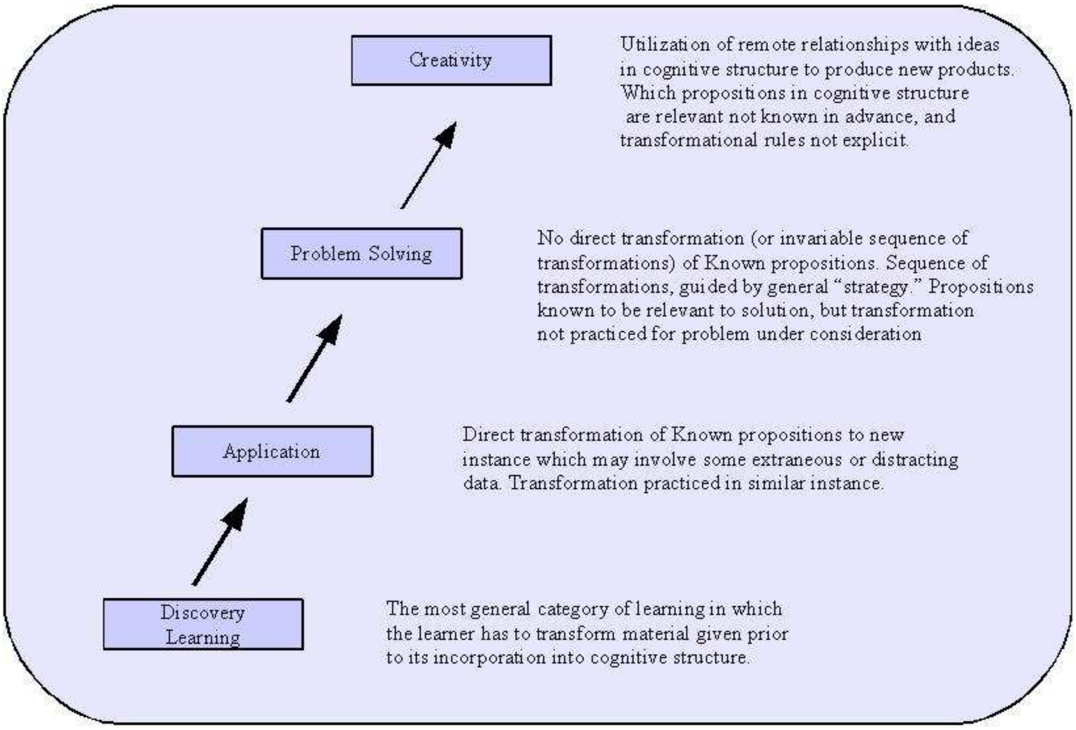

Figure 2.3 Relationship Between Application, Problem Solving, and Creativity
Adapted from: Ausubel and Robinson (1969, p.72)

It is the school's responsibility to provide students with an environment that develops creative abilities and thinking skills. Therefore, the current researcher argues that since children do need knowledge and skills in order to be able to express their creative potential, it is then teachers' responsibility to provide an adequate base of knowledge and skills for their students. The foundation of this argument is that children cannot develop creative abilities and thinking skills without the basic knowledge and skills of a particular domain, because knowledge and skills are a prerequisite for creativity (Kats and Chard, 1989). For example, most preschool children cannot think of using clothes hangers and table knives in many ways (flexibility) or in an unusual way (originality) because they are not allowed to use these items, therefore, they have little or no knowledge and skill in the use of clothes hangers and table knives (Moran *et al*., 1983). The above finding of Moran and colleagues study also supports de

Bono's notion that one bad practice of most today's schools is assuming knowing is enough. Instead he emphasized that leaning through doing (or as he named it operacy) is highly important skill to every child to learn and then to obtain knowledge (1991, p.5).

Many theorist and educators have argued that the classroom environment plays an important role on enhancing and flourishing creativity (e.g. Bassett, 2004; Daniels, 1997; Davis and Rimm, 1998; Saracho, 2002; Sternberg and Lubart, 1993; Sternberg and Williams, 1996; Torrance, 1965). They based their argument on the fact that, to flourish, creativity needs a learning environment that provides freedom and encourages students to think in a "noncritical, nonevaluative, and receptive atmosphere where fresh and even wild ideas are safely proposed” (Davis and Rimm, 1998, p. 201). Therefore, teachers should and could value the student's creative contribution to the learning process by encouraging and helping their students to realize that the classroom is full of creative ideas, and that each student plays a valuable role in the teaching process (Davis and Rimm, 1998; Mildrun, 2000; Sternberg, 2000).

A creative teacher who possesses and teaches with a great sense of humour, and more importantly develops personal relationships with his/her students and understands the individual needs of each one of them, will focus on enhancing his/her students' creativity. Through establishing creative student-teacher relationships, the teacher can provide his/her students with instructions, techniques, or teaching methods which enhance creativity (Sternberg, 2000; Sternberg and Williams, 1996; Torrance and Goff, 1989).

Furthermore, teachers should not only have a positive attitude and value the student’s individuality and creativity, they should and could teach their student to value, develop, and strength their creativity. Today, there are many creative techniques and programmes (e.g. CoRT which used in the present study) which strengthen creative abilities (fluency, flexibility, elaboration and originality). Therefore, these techniques should be implemented and practised in the classroom as well as positive creative thinking traits such as playfulness, humour, risk-taking, and curiosity which should be rewarded and encouraged by the teacher (Davis and Rimm, 1998; Torrance and Goff, 1989).

The current researcher argues that since there are many techniques and programmes put forward to enhance creative abilities, and since most of creativity programmes are highly structured (e.g. CoRT), teachers should be capable of implementing these techniques and programmes in their class easily. Additionally, in every school in the Kingdom of Saudi Arabia there is at least one creativity training programme run by a special education teacher who specializes in the field of gifted and talented. Thus the availability of highly prepared and trained teachers who specializes in the field of gifted and talented could and should make use of creativity programmes accessible to every child in the school by offering their support to the class teachers when needed.

The current researcher believes that children should not be rushed when practising creative exercises. Instead they should be provided with the time and space for quiet reflection and thinking (Daniels, 1997; Torrance and Goff, 1989). She also believes that practise and persistence are necessary ingredients of a successful creativity enhancement programme, thus creativity enhancement will take time. Yet, the benefits from enhancing creativity far outweigh the costs.

There it must be acknowledged that there are many instructions, techniques, and teaching methods which have been suggested to develop and strengthen creative abilities, but the main ones as follow:

Attribute Listing: Created in 1954 by Crawford. In this technique students are asked to enumerate and limit the characteristics of an object to the basic then the students begin to make a series of changes to each characteristic, without any restriction of their freedom.

Check-List: Created in 1957 by Osborn. This technique depends on posing a group of questions including a wide range of information (e.g. new uses, change, adaptation, magnifying, minimizing, modification, re-arrangement, and relating). Each question requires a specific change in an object, thing, or idea.

Morphological Analysis: Created in 1957 by Zwicky. This technique involves three steps: first the problem is analyzed into its main elements, then those elements are collected into general categories, and finally those categories related in all possible ways. This technique combines characteristics of both attribute listing and the check-lists techniques.

Forced Relationship: Created in 1961 by Gordon. The aim of this technique is to produce new thoughts by forming a relationship between two or more things or ideas, where no relationship in reality exists between them.

Brainstorming: Created in 1963 by Osborn. This technique was constructed for use with groups of six to twelve students, but it may also be used with individuals. This technique aimed to generate a long list of possible creative problem solving solutions by following these three rules:

- Elimination of any evaluation or critique of responses while ideas are being generated.
- Encouragement of richness and abundance of ideas and acceptance of all responses.
- Problems posed for solving in this way are usually broad problems.

Synectics: Created in 1961 by Gordon. This technique is a complex one which is founded on a principle with two parts: making the strange familiar; and the familiar strange. The first part includes an analytic process. The second part means perceiving a common object in a way in which it is not usually seen by using a variety of mechanisms based on analogy.

Open-ended Activities: This teaching method is used to remove the fear of failing that "one" right answer. Open-ended activities which have no right or wrong answers provide for multiple possibilities and risk taking that lead to creativity (Hertzog, 1997, 1998).

Questioning Technique: This technique is vital to encouraging and responding to intellectual and creative curiosity. Questioning technique encourages independent thought and creativity. Therefore, teachers and students ability to develop effective questioning techniques leads to a deeper creative thinking (Healey, 1990; Hertzog, 1997). According to Gardner (2000) "the purpose of education is not to provide ultimate answers, but to enhance one's sense of understanding without dashing one's sense of mystery and wonder" (p. 185). Vail asserted that "by engaging students only in a quest for the correct answer rather than for the interesting question, we condemn them to live inside other men's discoveries" (as cited in Healey, 1990, p. 259).

Drawing: This technique is used to aid students' abilities of visual thinking by clarifying the visual images. It also helps students to manipulate, record, and store the visual images. Teachers should provide students with materials and opportunities to interact visually with ideas (Adams, 1986; Brookes, 1996; Tate, 2003).

Most, if not all, the above teaching methods and techniques were developed and considered to be useful and practical tools in aiding creative abilities such as elaboration, fluency, flexibility, and originality. However, some of these methods are more useful than others in supporting a particular ability. For example, check-list technique may impede the ability of fluency because the pre-set questions in this technique limit the spontaneity of responses which needs freedom. Yet, the check-list technique also promotes flexibility because the focus of this method is on creating new ideas within the existing categories in the list. Additionally, some of these methods and techniques are combinations of previous methods. For example, the morphological analysis technique created by Zwicky is based on the attribute listing and check-lists techniques. More importantly, in view of the fact that a greater advantage can be achieved by using all the above teaching methods and techniques, the following models have been developed:

- Talents Unlimited (TU).
- Creative Problem Solving (CPS).
- Future Problem Solving (FPS).
- Cognitive Research Trust (CoRT).
- Schoolwide Enrichment Model (SEM).
- Purdue Creativity Program (PCP).
- Productive Thinking Program (PTP)

For more details about the above teaching methods, techniques, and models see (Adams, 1986; Brookes, 1996; Chance, 1986; Cropley, 1992, 2001; Daniels, 1997; Davis, 1998; Davis and Rimm, 1998; de Bono, 1986; Gardner, 2000; Healey, 1990; Hennessey, 1997; Hertzog, 1997, 1998; Mcpherson, 1964; Osborn, 1963; Renzulli and Reis, 1997; Ritchhart, 2004; Raudsepp and Hough, 1977; Schlichter, 1997; Schlichter and Palmer, 1993; Stein, 1968; Sternberg, 1999, 2001, 2003; Tate, 2003; Tomlinson, 1999, 2001).

Conclusion

While creativity studies began in the last third of the nineteenth century, the real interest in this phenomenon emerged approximately in the 1950s as a response to Guilford's call for more research. Today, as a result of the extensive research, creativity is construed and tackled differently by a large number of theorists. Even though each of the many theories of creativity views and tries to explain the many dimensions of creativity, unfortunately, to this date, there is no single widely accepted theory of creativity which results in different definitions of creativity. However, theorists have looked at creativity and defined it mainly from four angles which are known as the four Ps. First, the *person* who performs creatively. Second, the *product* which should be original, elegant and possible to assess. Third, the *process* of an activity which might lead to a creative product. Fourth, the *press* which is the environmental conditions in which creativity might accrue. In the current study the researcher will adopt Torrance's definition because this definition relates all the four aspects of creativity (person, process, product, and press) as they are not mutually exclusive. Torrance's definition also allows the researcher to "ask what kind of person one must be in order to engage in the process successfully, what kinds of environments will facilitate it, and what kinds of products will result from successful operation of the processes" (Torrance, 1993, p. 233). This holistic approach to define creativity might aid our understanding of the whole concept of creativity. Given that the current researcher adopted Torrance's definition of creativity and due to the use of the TTCT (which Torrance designed on the base of his definition of creativity) in the present study, creativity is defined as "what the figural TTCT *Thinking creatively with pictures* measures".

The characteristics of creative individuals were also examined in this review. Characteristics of creative individuals can be divided into positive characteristics (e.g. curious, imaginative and original) and negative characteristics (e.g. uncooperative, egocentric, and moody). However, not all of these characteristics will apply to all creative individuals, and the existence of these characteristics do not necessarily guarantee the existence of creativity. Some of these characteristics are also features of ADHD, therefore, it is not necessary that children with ADHD who exhibit similar characteristics (mainly the negative characteristics) will have high creative ability. This issue will be discussed further in the chapter entitled Creativity and ADHD.

The review also looked at the developmental stages of creativity. According to the literature, growth of creative abilities decreases in grades fourth, eighth, and twelfth because children at this stage of development are easily discouraged by adult pressure. Moreover, only a few children would be able to retrieve their creativity after this decrease. Others will lose their creativity forever and will only be able to retrieve some of their creativity. Therefore, it is more likely that creativity among children with ADHD (who generally have low self-esteem feelings about their abilities) at this stage of development will decrease and those children might lose their creativity forever. The present study will apply to a sample of children with ADHD who are fourth and fifth graders because of the possible decrease of creative ability between the ages of nine and ten. Creativity training might help those children in developing and nourishing their creative thinking abilities. Creativity training could also help those children in developing skills that improve their academic performance and social relationships with others. For example, creativity training activities such as brainstorming are designed as a group activity which encourages students to work together building social and interpersonal skills.

In regard to creativity and education, today's teachers can nurture creativity by providing their students with an adequate knowledge through meaningful learning instead of rote learning. Knowledge and thinking skills are essential to nurture creativity and allow students to express their creative potential. Of even greater importance for the current study is that the literature is consistent in suggesting that all people are creative to some extent and that creativity can be taught by training programmes such as the *CoRT thinking lessons* which will be used in this study to enhance creativity among children with ADHD. Literature regarding ADHD is the focus of the next chapter.

CHAPTER THREE

ADHD

Introduction

In this chapter, the literature review about ADHD will be organized in topical sections. This review includes the following related content areas: a brief history of ADHD, symptoms and definition of ADHD, developmental stages of ADHD, etiology of ADHD, treatment of ADHD, assessment and diagnosis of ADHD, and ADHD and education.

A Brief History of ADHD

One of the most common myths and misconceptions about ADHD is that this disorder is a relatively new one (Richard, 2000; Schwean *et al*., 1993). In fact, in 1902, Still wrote an article in which he described the common characteristics of ADHD. Moreover, throughout the past decades ADHD was described by a variety of terms such as postencephalitic behaviour disorder (PBD), brain damage syndrome (BDS), minimal brain dysfunction (MBD), hyperkinetic reaction of childhood (HRC), attention deficit disorder (ADD), and the most current term which is attention deficit hyperactivity disorder (ADHD) (Barkley, 2005, 2006a; Goldstein and Goldstein, 1990; Lerner *et al*., 1995; Richard, 2000; Schwean *et al*., 1993; Weiss and Hechtman, 1993).

Weiss and Hechtman (1993, p.7) pointed out that ADHD has intrigued researchers throughout history. In their words,

> It has been estimated that between 1957 and 1960 thirty-one articles were published in the scientific literature on the hyperactive child syndrome. Between 1960 and 1975 there were over 2000 articles, and from 1977 to 1980 (a period of 3 years) 700 articles were published. Within the past 20

> years, this condition has clearly become the most-researched and best-known of the childhood behaviour disorders.

However, Cooper and Ideus (2002) asserted that "unfortunately, to date, some of the popular debate about [ADHD] has generated far more heat than light" (p. vii).

In 1917 and 1918 the term postencephalitic behaviour disorder (PBD) was used to describe children who survived encephalitic (that is, a brain infection outbreak during the World War I). Therefore, the disorder was linked to the central nervous system (CNS) (Barkley, 2006a; Goldstein and Goldstein, 1990; Weiss and Hechtman, 1993).

Brain damaged syndrome (BDS) was used in the early 1940s to describe the child who displayed a pattern of inattentive, restless and over aroused behaviour (Barkley, 2006a; Berko *et al*., 1970; Birch, 1964).

From the late 1940s to the early 1960s it was popular to use the term minimal brain dysfunction (MBD). However, because of the lack of clear descriptions for accurate diagnosis, the concept of MBD was not recommended for use in 1965 (Barkley, 2006a; Clements, 1971).

Hyperkinetic reaction of childhood (HRC) was another term established by *the American Psychiatric Association* (APA) in the second edition of *the Diagnostic and statistical Manual of Mental Disorders* (DSM-II) in 1968. HRC was defined as an environmental problem rather than a biological disorder. Unfortunately, because of the lack of a scientific explanation of the child's behaviour, the mother or the environment in which the child was raised was to blame (Barkley, 2006a; Copeland, 1995; Lerner *et al*., 1995; Weiss and Hechtman, 1993).

In 1980 "With the focus shifting to attentional problems rather than activity problems, the term ADD was established" (Lerner *et al*., 1995, p.26) in the third edition of *the Diagnostic and Statistical Manual of Mental Disorders* (DSM-III, APA, 1980). See table 3.1 for full diagnostic description of ADD in DSM-III.

Table 3.1 ***Diagnostic and statistical manual of mental disorders*** **(3rd Edition) DSM-111 criteria for ADHD***

Diagnostic Criteria for Attention Deficit Disorder with Hyperactivity
The child displays, for his or her mental and chronological age, signs of developmentally inappropriate inattention, impulsivity, and hyperactivity. The signs must be reported by adults in the child's environment, such as parents and teachers. Because the symptoms are typically variable, they may not be observed directly by the clinician. When the reports of teachers and parents conflict, primary consideration should be given to the teacher reports because greater familiarity with age-appropriate norms. Symptoms typically worsen in situations that require self-application, as in the classroom. Signs of the disorder may be absent when the child is in a new or a one-to-one situation. The number of symptoms specified is for children between the ages of eight and ten, the peak age range for referral. In younger children, more severe forms of the symptoms and a greater number of symptoms are usually present. The opposite is true for older children. A. *Inattention*. At least three of the following: 1. often fails to finish things he or she starts. 2. often doesn't seem to listen. 3. easily distracted. 4. has difficulty concentrating on schoolwork or other tasks requiring sustained attention. 5. has difficulty sticking to a play activity. B. *Impulsivity*. At least three of the following: 1. often acts before thinking. 2. shifts excessively from one activity to another. 3. has difficulty organizing work (this not due to cognitive impairment). 4. needs a lot of supervision. 5. has difficulty awaiting turn in games or group situations. C. *Hyperactivity*. At least two of the following:

* Adapted from *Diagnostic and statistical manual of mental disorders*, DSM-III (1980)

1. runs about or climbs on things excessively. 2. has difficulty sitting still or fidgets excessively. 3. has difficulty staying seated. 4. moves about excessively during sleep. 5. is always "on the go" or acts as if "driven by a motor" D. Onset before the age of seven. E. Duration of at least six months. F. Not due to Schizophrenia, Affective Disorder, or Severe or Profound Mental Retardation.
Diagnostic Criteria for Attention Deficit Disorder without Hyperactivity
The criteria for this disorder are the same as those for Attention Deficit Disorder with Hyperactivity except that the individual never had signs of hyperactivity (Criterion C).
Diagnostic Criteria for Attention Deficit Disorder, Residual Type
A. The individual once met the criteria for Attention Deficit Disorder with Hyperactivity. This information may come from the individual or from others, such as family members. B. Signs of hyperactivity are no longer present, but other signs of the illness have persisted to the present without periods of remission, as evidenced by signs of both attentional deficits and impulsivity (e.g., difficulty organizing work and completing tasks, difficulty concentrating, being easily distracted, making sudden decisions without thought of the consequences). C. The symptoms of inattention and impulsivity result in some impairment in social or occupational functioning. D. Not due to Schizophrenia, Affective Disorder, Severe or Profound Mental Retardation, or Schizotypal or Borderline Personality Disorders.

In 1987 with the publication of the revised third edition of *the Diagnostic and Statistical Manual of Mental Disorders* (DSM-III-R, APA, 1987) the term changed again, "this edition recommended the term Attention-Deficit Hyperactivity Disorder (ADHD), to reflect recent research showing that thought distractibility was primary in this disorder, hyperactivity was also an important factor" (Lerner *et al.*, 1995, p.27). See table 3.2 for full diagnostic description of ADHD in DSM-III-R.

Table 3.2 ***Diagnostic and statistical manual of mental disorders*** **(3rd Edition-Revised) DSM-111-R criteria for ADHD***

Diagnostic Criteria for Attention-Deficit Hyperactivity Disorder (ADHD)
Note: Consider a criterion met only if the behavior is considerably more frequent than that of most people of the same mental age. A. A disturbance of at least six months during which at least eight of the following are present: 1. often fidgets with hands or feet or squirms in seat (in adolescents, may be limited to subjective feelings of restlessness). 2. has difficulty remaining seated when required to do so. 3. is easily distracted by extraneous stimuli. 4. has difficulty awaiting turn in games or group situations. 5. often blurts out answers to questions before they have been completed. 6. has difficulty following through on instructions from others (not due to oppositional behavior or failure of comprehension), e.g. fails to finish chores. 7. has difficulty sustaining in tasks or play activities. 8. often shifts from one uncompleted activity to another. 9. has difficulty playing quietly. 10. often talks excessively. 11. often interrupts or intrudes on others, e.g., butts into other children's games. 12. often does not listen to what is being said to him or her. 13. often loses things necessary for tasks or activities at school or at home (e.g., toys, pencils, books, assignments). 14. often engages in physically dangerous activities without considering possible consequences (not for the purpose of thrill-seeking), e.g., runs into street without looking. **Not:** the above items are listed in descending order of discriminating power based on data from a national field trial of the DSM-III-R criteria for Disruptive Behavior Disorders. B. Onset before the age of seven. C. Does not meet the criteria for a pervasive Developmental Disorder.
Criteria for severity of Attention-deficit Hyperactivity Disorder
Mild: Few, if any, symptoms in excess of those required to make the diagnosis and only minimal or no impairment in school and social functioning.

* Adapted from *Diagnostic and statistical manual of mental disorders*, DSM-III-R (1987)

Moderate: Symptoms or functional impairment intermediate between "mild" and "severe".

Severe: Many symptoms in excess of those required to make a diagnosis and significant and pervasive impairment in functioning at home and school and with peers.

In the fourth edition of *the Diagnostic and statistical Manuals of Mental Disorders* (DSM-IV, APA, 1994) the diagnostic criteria for ADHD was modified. According to Barkley (2006a, p.35) this edition "reintroduced criteria for the diagnosis of a purely inattentive form of ADHD, similar to ADD-H in DSM-III". Barkley (2006a, p.35) also asserted that in this edition,

> the diagnostic criteria … require evidence of symptoms' pervasiveness across settings, as well as the demonstration of impairment in a major domain of life functioning (home, school, work). Based on a much larger field trial than any of their predecessors, the DSM-IV criteria for ADHD are the most empirically based in the history of this disorder.

The fourth edition and its text revision (DSM-IV-TR, APA, 2000) which remained essentially the same is - to this date - the last and the current method of diagnosing children and adults with ADHD. See table 3.3 for full diagnostic description of ADHD in DSM-IV and DSM-IV-TR.

Table 3.3 ***Diagnostic and statistical manual of mental disorders*** **(4th Edition-Revised) DSM-1V + DSM-1V –TR criteria for ADHD** *

Diagnostic Criteria for Attention-Deficit Hyperactivity Disorder (ADHD)
A. Either (1) or (2): (1) Six (or more) of the following symptoms of inattention have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level: ***Inattention*** (a) Often fails to give close attention to details or makes careless mistakes in schoolwork, work or other activities.

* Adapted from *Diagnostic and statistical manual of mental disorders*, DSM-IV (1994) + DSM-IV-TR (2000)

(b) Often has difficulty sustaining attention in tasks or play activities.
(c) Often dose not seem to listen when spoken to directly.
(d) Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (no due to oppositional behavior or failure to understand instructions).
(e) Often has difficulty organizing tasks and activities.
(f) Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework).
(g) Often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools).
(h) Is often easily distracted by extraneous stimuli.
(i) Is often forgetful in daily activities.

(2) Six (or more) of the following symptoms of hyperactivity-impulsivity have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

Hyperactivity

(a) Often fidgets with hands or feet or squirms in seat.
(b) Often leaves seat in classroom or in other situations in which remaining seated is expected.
(c) Often runs about or climbs excessively in situation in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness).
(d) Often has difficulty playing or engaging in leisure activities quietly.
(e) Is often “on the go” or often acts as if “driven by a motor”.
(f) Often talks excessively.

Impulsivity

(g) Often blurts out answers before questions have been completed.
(h) Often has difficulty awaiting turn.
(i) Often interrupts or intrudes on others (e.g., butts into conversations or games).

B. Some hyperactive-impulsive or inattention symptoms that caused impairment were present before age 7 years.
C. Some impairment from the symptoms is present in two or more settings (e.g., at school or work and at home).
D. There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning.
E. The symptoms do not occur exclusively during the course of a Pervasive Developmental Disorder, Schizophrenia, or other Psychotic Disorder and

are not better accounted for by another disorder (e.g., Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder).
***Code* based on type**
314.01 Attention-Deficit/Hyperactivity Disorder, Combined Type: if both Criteria A1 and A2 are met for the past 6 months. *314.00 Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type*: if Criteria A1 is met but Criteria A2 is not met for the past 6 months. *314.01 Attention-Deficit/Hyperactivity Disorder, Predominantly Hyperactive-Impulsive Type*: if Criteria A2 is met but Criteria A1 is not met for the past 6 months. **Coding note**: For individual (especially adolescents and adults) who currently have symptoms that no longer meet full criteria, "In Partial Remission" should be specified.

Because the first diagnostic criteria for ADHD were established in the United State of America (USA), it was mistakenly considered as a disorder which only existed in the USA. However, in 2000 ADHD was

> recognized as a universal disorder, with an ever-growing international acceptance of both its existence and its status as a chronic disabling condition, for which combinations of medications and psychosocial treatments and accommodations may offer the most effective approach (Barkley, 2006a, p. 40).

In 2002, more than 80 of the world's leading scientists specializing in this disorder signed *the International Consensus Statement on ADHD* (Barkley, 2006a, p. 38). Barkley also asserted that:

> This means that there is no longer going to be an Italian view of ADHD or a U.S. view, but an international view, founded on the most recent scientific advances as they become available on the Internet (2006a, p. 38).

Symptoms and Definition of ADHD

The symptoms that characterize ADHD are present in everyone to some degree. However, "the diagnosis of ADHD is not bases on the mere presence of these symptoms, but on their severity and duration, and the extent to which they interfere with everyday life" (Hallowell and Ratey, 1994a, p.6). The three primary characteristics of ADHD as follows:

Inattention: Attention is a multidimensional concept and a complex field of investigation. Therefore, there is no adequate definition for attentional skills (Hale and Lewis, 1979; Mostovsky, 1970; Posner and Snyder, 1975). The term attention is used by many as a homogeneous skill. However, there are statistically weak correlations between various tests of attention which suggest that there are distinct and different aspects of attentional skills (Goldstein and Goldstein, 1990; Gordon and McClure, 1983; Taylor, 1980). Goldstein and Goldstein (1990) outlined the following types of attentional skills:

- Divided attention (the ability to complete two simultaneous tasks, such as listening to the teacher and taking notes).
- Focused attention (the child who has problems with this type is often preoccupied with other activities instead of the task assigned by the teacher or parent).
- Selective attention (the child who has problems with this type is easily distracted by extraneous events such as minor noises in the classroom).
- Sustained attention (the child who has problems with this type will be unable to remain on a task for a sufficient amount of time to complete the task).
- Vigilance attention (the ability of readiness to respond such as listening to the next spelling word).

Although researchers and clinicians have been criticized for characterizing children with ADHD as experiencing generic attention deficit problems with most if not all types mentioned above, these problems have been reported by parents and teachers in terms such as "Doesn't seem to listen," "Fails to finish assigned tasks," "Daydreams," "Often loses things," "Can't concentrate," "Easily distracted," "Can't work independently," "Shifts from one activity to another," and "Confused or seems to be in a fog" (Barkley, 2005, 2006b;

Barkley *et al*., 1990a, 1990b; Fischer *et al*., 1990; Flick, 1998 Goldstein and Goldstein, 1990; Hughes and Cooper, 2007; Stewart *et al*., 1966).

Children with ADHD have great difficulty with sustained and vigilant attention in situations that require the child to attend to boring, uninteresting, and repetitive tasks such as seatwork in the classroom, homework, or household chores (Hooks *et al*., 1994; Milich *et al*., 1982; Zentall, 1985).

Impulsivity: Impulsiveness, like inattentiveness, is multidimensional in nature. Moreover, impulsivity may also refer to poor attentional skills. For example, the child who responds before directions have been completed and before he/she has an opportunity to assess fully the demands of the situation, he/she may behave impulsively because of difficulties he/she has in the sustained attention ability (Barkley, 2006b; Brown and Quay, 1977; Gordon, 1979; Milich and Kramer, 1985; Rapport *et al*., 1986).

Children with ADHD have difficulty weighing the consequences of their actions before acting. Flick (1998, p. 3) asserted that,

> although they may be aware of right and wrong and may be able to cite a rule of the home or classroom, they often "think after the act." By this time, it's too late - they've already "done it" and are "in trouble" again.

Children with ADHD do not reasonably consider the consequences of their past behaviour. Therefore, they often do not appear to learn from their experiences. Children with ADHD have difficulties in working toward longer-term goals, waiting in line, taking turns, and they may carelessly damage or destroy others' property. Therefore, it is not surprising that children with ADHD are often not popular among their peers. Accidental proneness and injuries are often higher among children with ADHD because of their impulsive behaviour. (Barkley, 2005, 2006b; Flick, 1998; Hughes and Cooper, 2007).

Hyperactivity: Not all children with ADHD are excessively active. DSM-IV (APA, 1994) and its text revision DSM-IV-TR (APA, 2000) which remained essentially the same contain three subtypes of ADHD. Individuals who are diagnosed with *Predominantly Inattentive Type* do not exhibit signs of hyperactivity. But, unfortunately, the individuals who are diagnosed with other types do.

The above may explain why some researchers (e.g. Firestone and Martin, 1979; Sandberg *et al*., 1978 and Shaffer *et al*., 1974) found that hyperactivity does not distinguish children with ADHD from other clinic-referred groups of children. Moreover, Taylor suggested that it may be the pervasiveness (that is, presence of the syndrome in all situations) of hyperactivity across settings such as at home and at school that separates children with ADHD from other diagnostic categories (Taylor, 1986).

According to Barkley (2006b) hyperactivity is what best distinguishes children with ADHD from both other clinical conditions and normal children. Barkley also pointed out that analyzing behavioural rating lists shows that the items of restlessness cluster on a factor comprising primarily poor attention. It also shows that other types of overactivity cluster on a factor constituting impulsive or disinhibited behaviour. Douglas and Peters (1979) hypothesized that hyperactivity may develop as a result of the core symptoms of ADHD which are inattention and impulsivity. In short, they considered hyperactivity as a reflection of inattention and impulsivity (Douglas, 1985; Douglas and Peters, 1979). However, "some mothers of children with ADD/ADHD have noted that hyperactivity was often present even before birth" (Flick, 1998, p.4).

Hyperactiveness, like inattentiveness and impulsiveness, is a failure of self-control. Therefore, the symptom of hyperactivity can be clearly recognized in those structured settings which require some self-control such as the classroom (Barkley, 2005, 2006b; Flick, 1998; Hughes and Cooper, 2007). In the classroom students with ADHD are frequently out of their seat, playing with their materials, talking without permission, and generally seeming to not pay attention to the instructional activities. Moreover, they are often described by their parents and teachers as “Always on the go,” “Climbs on everything,” and “Never stops talking.” (Barkley, 2005, 2006b; Barkley *et al*., 1990b; Flick, 1998; Goldstein and Goldstein, 1990; Hughes and Cooper, 2007; Stewart *et al*., 1966).

Besides the above difficulties with inattention, impulsivity, and hyperactivity children with ADHD are more likely to have difficulties in the following areas:

Intellectual development: Children with ADHD, usually, score lower scores than children without ADHD on various indicators of cognitive ability. They score on average 7 to 15 points below both normal children and their own siblings on standardized measures of intelligence (Barkley, 2006c). However, the range of cognitive functioning of children with ADHD is normally distributed, that is, some children with ADHD falling below average and some falling above average and in gifted range (DuPaul and Stoner, 1994; Kaplan *et al*., 2000).

Academic difficulties: Although some children with ADHD have coexisting learning disabilities, the academic problems experienced by children with ADHD are not the result of coexisting learning disabilities (Zentall, 1993). More than 80% of children with ADHD have some type of learning or achievement problems such as grade retention and/or underachievement (Frick and Lahey, 1991; Semrud-Clikeman *et al*., 1992). According to DuPaul and Stoner ADHD characteristics might interfere with learning and academic achievement. For example, inattention resulted in not understanding directions, "poor test performance; deficient study skills; disorganized notebooks, desks, and written reports; and lack of attention to teacher lectures and/or group discussions" (1994, p.4).

Adaptive functioning: Children with ADHD often have impaired adaptive functioning which is "the skills that are necessary to take care of oneself and get along with others" (Harrison and Robinson, 1995, p.819).

Speech and language: Children with ADHD often have speech and language problems, but they do not have "serious or generalized language delays" (Barkley, 2006c, p. 101). They have some specific speech and language difficulties. For example, their speech is often poorly organized and inefficient. However, the comorbidity of speech and language disorders and ADHD is strong. Therefore, children with ADHD should be routinely screened for speech and language disorders (Baker and Cantwell, 1987, 1992; Cantwell *et al*., 1981; Cohen *et al*., 1989).

Motor difficulties: Children with ADHD have poor motor coordination which may result in behaviour that is termed "clumsy". They also have difficulty with fine motor skills such as handwriting (Barkley, 2006c; Selikowitz, 1995).

Social impairments: Children with ADHD often experience difficulty with social relationships, especially in establishing and maintaining satisfactory peer relationships. Moreover, 30% to 60% of them may exhibit antisocial behaviours (Barkley, 2006c; DuPaul and Stoner, 1994; Hinshaw, 1992; Johnsto *et al*., 1985; Landau and Moore, 1991).

Emotional characteristics: Children with ADHD have poor self-regulation and low self-esteem. They are often more negative and emotional in their interactions with other. Terms like “irritable”, “hostile” and “excitable” are often used to describe children with ADHD (Barkley, 2006c).

Today, there are many strategies and techniques which designed to aid teachers in helping children with ADHD to cope with and overcome symptoms of ADHD which mentioned above, these strategies and techniques will be discussed in a later section entitled ADHD and Education.

Definition of ADHD

Barkley, who is a respected authority in the field of ADHD, offered the following definition of ADHD:

> Attention-Deficit Hyperactivity Disorder is a developmental disorder characterized by developmentally inappropriate degrees of inattention, overactivity, and impulsivity. These often arise in early childhood; are relatively chronic in nature; and are not readily accounted for on the basis of gross neurological, sensory, language, or motor impairment, mental retardation, or severe emotional disturbance. These difficulties are typically associated with deficits in rule-governed behaviour and in maintaining a consistent pattern of work performance over time (Barkley, 2006a, p.47).

It might be worth mentioning that the current researcher has chosen Barkley's definition to refer to because it reflects most, if not all, the above symptoms of ADHD. Moreover, the participants of the present study were diagnosed based on the DSM-IV diagnostic criteria for ADHD, and Barkley's definition falls in line with these criteria.

Developmental Stages of ADHD

ADHD, currently, is considered as a developmental disorder. In each developmental stage the problems presented by individuals with ADHD is somewhat homogeneous, but in some areas each individual's presentation will be unique (Barkley, 2006a, 2006f).

Infants: An infant with ADHD may have a very high activity level even before birth. He/she may have a very different pattern of crying. Infants with ADHD tended to cry much of the time and for a longer period of time compared to normal or other clinical control groups of children. In the first months of life an infant with ADHD either has a similar sleep pattern to premature infants - which is excessive sleeping - or has sleep difficulties which result in brief periods of quiet and deep sleep.

Compared to normal or other clinical control groups of children, infants with ADHD have low birth weight, smaller head circumference (at birth and at 12 months of age), delayed motor development, speech and language problems, and short time spans of responding to objects.

The above qualities affect ADHD infants' ability to accommodate and meet the environment’s expectations. For example, the infant who cries much of the time and has motor difficulties may also have feeding difficulties and poor nutrition because of the poor sucking and crying during feeding.

Additionally, it also affects the mother-infant relationships and cognitive development. For example, instead of being free to interact with the mother and the environment an infant with ADHD cries most of the time. (Cunningham and Barkley, 1979; Dumas and Wahler, 1985; Barkley, 2006a;

Barkley *et al*., 1990a; Campbell, 1990; Carey, 1970; Flick, 1998; Hartsough and Lambert, 1985; Moffitt, 1990; Nichols and Chen, 1981; Palfrey *et al*, 1985; Ross and Ross, 1982; Terestman, 1980; Thomas and Chess, 1977; Weiss and Hechtman, 1979, 1993; Wolff, 1969).

Preschool: In this stage, besides continued poor sleep and low tolerance for frustration, preschoolers with ADHD begin to exhibit greater inattention and overactivity (Barkley, 2005, 2006a; Flick, 1998). By the age of four up to 40% of preschoolers with ADHD can have significant problems with inattention to a degree that their teachers and parents had strong concerns (Palfrey *et al*., 1985). However, the majority of these concerns fade within three to six months. Moreover, only 48% of the children who are given a clinical diagnosis of ADHD will have this same diagnosis by later childhood or early adolescence (Campbell, 1990; Palfrey *et al*., 1985). Therefore, based on these results, some researchers suggest that significant inattention and overactivity at the preschool stage is not indicative of a persistent pattern of ADHD into later childhood or adolescence (Campbell, 1990; Palfrey *et al*., 1985). However, about 10% of those children with parent and teacher concerns about inattention and overactivity can be expected to develop behaviour problems and low academic achievement which result in the need for special educational services by second grade (Barkley, 2005, 2006a; Palfrey *et al*, 1985).

Barkley (2006a) suggested that the duration of six months for symptoms of ADHD recommended by DSM-IV is inadequate for preschoolers. Instead, he recommended duration of twelve months when making predictions about the stability of ADHD behavioural patterns in preschool-age children.

Children with ADHD at this stage may tend to have accidental injuries because of their overactive, inattentive, impulsive, and fearless pattern of behaviour.

They may also have speech and language problems (Barkley, 2005, 2006a; Campbell, 1990).

In preschool or day care settings, preschoolers with ADHD are often characterized as being out of their seats, wandering the classroom inappropriately, vocally noisy and talkative, disrupting the play activities of other children, and excessively demanding during peer interactions (Campbell *et al*., 1977, 1978; Schleifer *et al*., 1975). Therefore, it is very often that these children are asked to leave the preschool or day care provision. However, if the child is intellectually bright or not aggressive he/she may have few or no difficulties with the demands of a typical day care or preschool programme (Barkley, 2005; Flick, 1998).

Middle childhood: At this stage youngsters with ADHD enter school. Thus their behaviour pattern is more likely to become worse. In any school setting children are mostly expected to sit quietly, listen, obey instructions, and interact pleasantly with other children. Unfortunately, most students with ADHD lack these behaviours and skills which are essential to success in an academic curriculum. It is a very distressing period for students with ADHD and their parents because problems are likely to occur both at home and schools (Barkley, 2005; Flick, 1998).

According to Barkley (2006c) 20% to 25% of students with ADHD are likely to have a reading disorder. Additionally, they need formal special educational assistance because of their academic difficulties and 30% to 45% will be receiving it by the end of sixth grade.

Most students with ADHD find difficulties in accepting household chores and responsibilities. They also need more supervision and assistance from the parents to accomplish daily chores and self-care activities such as bathing and dressing. Their siblings may express some jealousy because of the attention which children with ADHD required and get from their parents (Barkley, 2005).

Barkley (2006c) pointed out that children with ADHD can experience social rejection because of their poor social skills. Moreover, Ross and Ross (1982) asserted that even when children with ADHD display an appropriate behaviour towards others they mostly will experience social rejection from their peers.

Although it is not surprising that most students with ADHD tend to develop low self-esteem feelings about their school and social abilities, some students with ADHD have unrealistically positive images of themselves or have limited self-awareness which can be observed in their tendency to blame their parents, teacher, or peers when faced with difficulties instead of being realistic when weighing up what caused the problem (Barkley, 2005, 2006b).

According to Barkley social conflicts and problems are well established at this stage of development. In his words:

> Between 7 and 10 years of age, at least 30% - 50% are likely to develop symptoms of conduct disorder and antisocial behaviour, such as lying, petty thievery, and resistance to the authority. Twenty-five percent or more may have problems with fighting with other children. Those who have not developed some other psychiatric, academic, or social disorder by this time are in the minority, and it is these children who are likely to have the best adolescent outcomes, experiencing problems primarily with academic performance and eventual attainment (2005, p.94).

Adolescence: According to follow-up research studies over the past decades it is at this stage the primary characteristics of ADHD will decrease. Many students with ADHD, however, will continue to experience significant difficulties through adolescence and into adulthood (Brown and Borden, 1986; Klein and Mannuzza, 1991; Milich and Loney, 1979; Richard, 2000; Schwean *et al*., 1993; Thorley, 1984; Weiss and Hechtman, 1993).

Barkley *et al*., (1990b) conducted an eight year detailed follow-up study of a group of ADHD children and normal children. The results are consistent with other adolescent outcome studies (e.g. Ackerman *et al*., 1977; Goldstein and Goldstein, 1990; Loney *et al*., 1981; Mendelson *et al*., 1971) and assert that students with ADHD are more likely to exhibit the core of ADHD symptoms which are hyperactivity, inattention, and impulsivity. Students with ADHD also have marked difficulties at school. For instance, 80% have a history of failures in one or more basic academic subject, 30% have been suspended from school at least once, and 35% quit school before completion (Ackerman *et al*., 1977; Barkley 2005, 2006f; Barkley *et al*., 1990b, 1991; Flick, 1998; Loney *et al*., 1981).

At this stage of development, unfortunately, poor self-concept, low self-esteem, and poor self-confidence are common among students with ADHD. They also may have anxiety or depression. Moreover, they tend to find social acceptance in bonding with other teenagers who have similar problems which may result in involvement in risk-taking behaviour such as antisocial behaviour or use of alcohol or other addictive substances (Barkley, 2005, 2006f; Farrington *et al*., 1990; Flick, 1998; Huesmann *et al*., 1984).

Adulthood: At this stage of development, continuation of the core of ADHD symptoms is highly expected among individuals with ADHD. According to Barkley,

> only 10-20% of children with ADHD reach adulthood free of any psychiatric diagnosis, functioning well, and without significant symptoms of their disorder. The rest continue having many of the same problems they

> had as children and then as teenagers, and dealing with those problems for so long can take a tragic toll (2005, p.95).

Mannuzza *et al*., (1991) found that 43% of young adults with a history of ADHD still manifested a full syndrome of ADHD symptoms, 32% met the diagnostic criteria for antisocial personality disorder, and 10% were involved in substance abuse. Mannuzza *et al*. suggested that, other than antisocial problems and substance abuse, individuals with ADHD are not at risk of developing any disorder. However, elsewhere (e.g. Barkley, 2005, 2006f; Biederman *et al*., 1987, 1991; Weiss and Hechtman, 1993) it has been shown that individuals with ADHD are at greater risks of internalizing work, friendships, marital and vocational problems. Moreover, these problems are significantly associated with some factors such as the emotional climate of the home (e.g. the mental health of family members), emotional stability (e.g. level of aggression), intelligence, hyperactivity, and relationships with adults. For example, individuals with ADHD are dismissed from jobs are more likely to have been so for reasons related to hyperactivity, antisocial behaviours and their relationships with adults.

To conclude, although the studies mentioned above have confirmed that the symptoms of ADHD may change somewhat as the child develops and most children do not "outgrow" ADHD some asserted that the early symptoms of ADHD are transient problems of young children which the child will "outgrow" by adolescence (Duncan *et al*., 2007; Shaw *et al*., 2007).

The current researcher has chosen to address the developmental stages of ADHD because these stages are highly important in identifying children with ADHD. If parents and teachers were not aware of how a similar problem or behaviour will present differently at different maturational stages or if they ignore the signs of ADHD the result will be the loss of valuable treatment time for the child. Cohen and colleagues (1981) estimated that at least 60% to 70% of children who are later diagnosed with ADHD could have been identified during the preschool years. Moreover, from both the developmental stages of creativity and ADHD it is reasonably fair to consider children aged 9 to 10 as vulnerable, therefore the present study is applied to a sample of these children.

Etiology of ADHD

There are a number of explanations offered for how and why ADHD can arise. These claims can be compiled under the following headings:

Genetic factors: Results of studies aimed at examining the heritability of ADHD reported that this disorder appears to be highly hereditary. For example, 15-20% of mothers and 20-30% of fathers of children with ADHD have or may have had ADHD in the past (Alberts-Corush *et al*., 1986; Barkley, 2006e; Singer *et al*., 1981). Additionally, 26% of the siblings of children with ADHD also have this disorder (Barkley, 2006e). Moreover, twin studies estimated 30-33% of dizygotic twins and 50-51% of monozygtic twins have ADHD (Cunningham and Barkley, 1978; Gillis *et al*., 1992; Goodman and Stevenson, 1989; Lopez, 1965; Willerman, 1973). However, to date, genetic research has failed to identify genes which may cause ADHD (Barkley, 2006e, Fine, 2001).

Family functioning and poor parenting: ADHD has been linked with family functioning and poor parenting skills (Anastopoulos *et al*., 1992; Barkley *et al*., 1985; Biederman *et al*., 1987, 1990; Cunningham and Barkley, 1979; Cunningham *et al*., 1988; Edwards *et al*., 1995; Fischer *et al*., 1990; Frick *et al*., 1991; Ingersoll, 1998; Lahey *et al*., 1988; Lensch, 2000; Lilienfeld and Waldman, 1990; Mash and Johnston, 1983; Moffitt, 1990; Morrison, 1980;

Singer *et al*., 1981; Stewart *et al*., 1980; Tarver-Behring *et al*., 1985; Webster-Stratton and Eyberg, 1982). It was reported that families of children with ADHD are more socially isolated compared to the families of children without ADHD. Moreover, 54% of parents of children with ADHD are separated or divorced, whereas 15% of parents of children without ADHD are separated or divorced. Additionally, stress and feelings of parental incompetence were higher among parents of children with ADHD compared to parents of children without ADHD (Barkley, 2005, 2006d, 2006e).

However, according to Green and Chee “the child with ADHD has a biological condition which is influenced by the actions of parents but not caused by poor parenting” (1998, p.255). Additionally, most families which have a child with a mental health disorder reported similar problems to those reported by families of children with ADHD. Therefore, it is not clear wither ADHD is caused by family functioning and poor parenting skills or these problems are reflection of the difficulty of having a child with ADHD (Barkley, 2006d, 2006e).

FAS and Smoking: Fetal Alcohol Syndrome (FAS) refers to mothers who drink alcohol during pregnancy and whose drinking has a detrimental effect on their unborn child. FAS considered as one of the leading known preventable cause of mental and physical birth defects. FAS also has been linked to ADHD (Clarren, 2000). Individuals with ADHD - as adolescents and young adults - are more likely to smoke and drink than those who are not diagnosed as having ADHD (Cherkes-julkowski *et al*., 1997). However, this correlation does not prove that smoking or drinking during pregnancy cause ADHD. Instead, it could support the genetic link between parents and children with ADHD (Barkley, 2006e).

Plumbism, also known as lead poisoning: This is a condition of severe intoxication which might result from ingestion, inhalation, or skin absorption of lead. Blondis and Chisolm (2000) - based on a review of studies on the correlation between lead toxicity (plumbism) and ADHD - asserted that although a few studies reported some correlation, it is not known whether or not plumbism could cause ADHD.

Sugar and food allergies: It was claimed that sugar, artificial flavourings, and Allergic Tension Fatigue Syndrome (ATFS) could cause ADHD. These claims lead Feingold to present his diet[*] as a non-drug treatment for children with ADHD. However, even though the media gave attention to these claims, scientific studies did not support it (Armstrong, 1995, Barkley, 2006e; Ingersoll, 1998; Rapp, 1991).

Fluorescent lighting and television: It was also claimed that cool-white fluorescent lighting and too much television-watching could be the causes of ADHD. These claims also generated media attention, but again scientific studies did not support it (Barkley, 2006e).

Neurological factors: Research has suggested that there is a connection between ADHD and neurological factors (see Barkley, 2006e, p. 202-238). The trends in neurological research (which view the brain as a neurologicals organ) can be mainly contained under three models: neuroanatomical, neurchemical, and neurophysiological. Studies in the *neuroanatomical model* involve two areas: the frontal region of the cortex, and subcortical structures (e.g. the thalamus, basal ganglia, hypothalamus, and reticular activating system). Most of the work in both avenues of inquiry reported positive results.

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[*] More information about Feingold diet is available on the *Feingold Association of the United States* (FAUS) website: http://www.feingold.org/

The similarity between the symptoms of the frontal lobe dysfunction and ADHD has been highlighted by many researchers (see Barkley, 2006e; Castellanos *et al*., 2001, 2002; Hendren *et al*., 2000). Furthermore, the assumption of the involvement of the frontal lobe in ADHD (e.g. development delay in myelination of the prefrontal area) is also reported in many studies (Castellanos *et al*., 2001, 2002; Chelune *et al*., 1986; Gualtieri and Hicks, 1985; Hendren *et al*., 2000; Hynd *et al*., 1990, 1991; Mattes, 1980).

Zametkin and colleagues (1990) questioned the notion that individuals with ADHD suffered from underarousal in the frontal area of the brain and that ADHD was caused by an overactive brain. This study was the first in which a brain mapping technique called the Positron Emission Tomographic (PET) scan was used to measure the rate at which glucose -associated with cognitive activity- was metabolized in the brains of adults with and without ADHD. Results of this study show reduced whole brain glucose utilization in the frontal region among adults with ADHD - when performing mental tasks involving attention, concentration, and inhibition of movement - compared to normal adults (Zametkin *et al*., 1990). Results from other studies which used PET scan are inconsistent (for a comprehensive review see Barkley, 2006e and Riccio *et al*., 1993). Yet, in general, results of PET scan studies "suggest some reduced activation in the insular and hippocampal regions and greater activation in the right anterior cingulated during decision-make tasks" (Barkley, 2006e, p. 237).

In regard to studies in the *neurchemical model*, the focus was on neurochemicals (e.g. the catecholamines dopamine and norepinephrine) which are essential to attention, motivation, and motor inhibition (Barkley, 2006e; Clark *et al*., 1987a, 1987b; Zametkin and Rapport, 1987). Researchers who are proponents of this model consider the symptoms of ADHD as a result of an imbalance in the production of dopamine or norepinephrine which leads to the reticular activating system (Barkley, 2006e; Medford and Potter, 1989). This hypothesis is backed by the distribution of dopamine and norepinephrine in brain regions implicated in ADHD (Barkley, 2006e, p. 237). This hypothesis is also supported by the successful treatment of the symptoms of ADHD by the use of medication (e.g. stimulant drugs such as methylphenidate which is commercially known as Ritalin® and Ritalin-SR®) (see Barkley, 2006e; Hunt *et al.*, 1985; Pelham *et al.*, 1990; Riccio *et al.*, 1993). However, for 20-30% of children with ADHD there is either no positive response or even a negative response to the medication which means their ADHD might not be caused by an imbalance in the production of dopamine or norepinephrine as the neurochemical model suggested (Barkley, 2005; DuPaul *et al.*, 1991; Flick, 1998).

The *neurophysiological model* considers the symptoms of ADHD as a result of deficiency in executive function (specifically in inhibitory control) and suggests the following: 1) Loops are formed from ascending/arousal and descending/inhibitory fibers. 2) Frontal lobes, basal ganglia, and thalamus are connected by loops. 3) A system which is responsible for selectively activating or inhibiting our brain structure is formed by both brain structures and loops. Therefore, one can presume that any disorder in the ascending pathway would decrease our state of arousal, and any interference in the descending pathway would enhance our ability to attend selectively or concentrate (Barkley, 2006e; Goldstein and Goldstein, 1990, Riccio *et al.*, 1993). According to Barkley studies in which neurophysiological tests of frontal lobe functions were used "have often found deficits on tests believed to assess executive functioning. The executive functions are known to be mediated by the prefrontal cortex and its networks with the basal ganglia and cerebellum, suggesting that these regions may play a prime role in ADHD" (Barkley, 2006e, p. 237)

Here, it might be worth mentioning that the assumption that our behaviour is controlled by neurological mechanisms has dominated most neurological studies (including the above three models) in ADHD over the past two decades. In other words, individuals with ADHD are deviating from standard behaviour because of the neurological dysfunction (Barkley, 2006e). Shaw and colleagues (2007) supported this assumption. They found that the brain development of children with ADHD did not differ from normal children but rather was delayed. This landmark study might present an explanation of the finding reported in many follow-up research studies in which the primary characteristics of ADHD decreased by adolescence. In other words, the symptoms of ADHD (inattention, impulsivity, and hyperactivity) will decrease when the neurological dysfunction –which cause the symptoms of ADHD– is decreased and brain development is completed. Therefore, results from Shaw and colleagues' study support the hypothesis that the early symptoms of ADHD are transient problems of young children which the child will "outgrow" by adolescence.

To conclude, there are more than 30 different explications of the possible cause of the symptoms of ADHD. Some researchers (e.g. Fine, 2001) hoped that in the near future with the advance of technology, scientists "will be able to use brain scans and brain imaging to diagnose children with ADHD" (Fine, 2001, p.27). However, to date, it is not known what actually causes ADHD. The lack of definitive diagnostic laboratory tests for ADHD (e.g. X-rays, blood and urine tests) results in questioning the existence of ADHD (Armstrong, 1995; Furman, 2008; Goodman and Poillion, 1992; Richard, 2000). Here, it must be acknowledged that neither the cause of other childhood disorders such as autism and LD is known, nor a definitive diagnostic laboratory tests is available to verify their existence. Therefore, the causes and diagnosis of ADHD and other childhood disorders (e.g. autism) are debatable.

The current researcher fully understands that the etiology of ADHD does not inform our understanding and practice as educators directly, yet it widens our understanding of what might cause ADHD. Additionally, the etiology of ADHD is an important issue because aetiological beliefs affect attitudes towards both the diagnosis and treatment options which an individual with ADHD could have. For example, a person who believes that ADHD has an organic origin such as neurological or genetic causes, usually will support the use of medication as a proper treatment for ADHD. In reverse, a person who believes that a non-organic origin such as family functioning and poor parenting skills can cause ADHD, usually will recommend a parents' training programme as a proper treatment for ADHD. More importantly, any diagnosis and assessment team should consider and address all the factors which could cause ADHD to achieve more accurate diagnosis and an efficient treatment for individuals with ADHD (Accardo and Blondis, 2000a; Armstrong, 1995; Barkley, 2006e; Calhoum *et al.*, 1997; O'Shea, 2000).

Treatment of ADHD

While - as mentioned above - the etiology of ADHD is unknown, many suggestions were put forward to treat it. These suggestions also can be compiled under the following headings:

Medications: Treating ADHD by the use of medication is not a new method. Bradley, in 1937, used a stimulant drug with hyperactive children which helped those children to develop better work habits and become more interested in school projects (Barkley, 2006a; Ingersoll, 1998; Moghadam, 1988; Schachar, 1986).

Stimulant medication which is now, usually, a physician's first choice for treatment of ADHD became available commercially in 1957 as Dexedrine® (dextroamphetamine), Ritalin® and Ritalin-SR® (methylphenidate), Cylert® (magnesium pemoline), and Adderall® (a combination of amphetamine and dextroamphetamine). Tricyclic antidepressant, which is available commercially as Tofranil® (imipramin) and is the second choice, can be used when the child does not respond positively to stimulants. The final choice is to use other medications (such as antihypertensive, anticonvulsant, and antipsychotic) when the child does not respond positively to stimulants or antidepressants, or could have comorbid disorders (Accardo and Blondis, 2000b; Barkley, 2005; Connor, 2006a, 2006b; DuPaul, *et al*., 1991, Flick, 1998; Ingersoll, 1998; Spencer, 2006).

DuPaul and colleagues (1991) reported that behavioural, academic, and social functioning did improve with using stimulant medication in about 50-95% of children with ADHD. However, it is not clear if using the medication will lead to long-term improvements. Additionally, some children may be seen to respond positively on some measures of learning and/or behaviour, but not respond or respond negatively on other measures. Furthermore, for 20-30% of children with ADHD there is either no positive response or even a negative response to the medication. This suggests that medication is not a suitable treatment for every child with ADHD (Barkley, 2005; DuPaul *et al*., 1991; Flick, 1998).

Psychotherapy: Treating ADHD by the use of psychotherapy interventions is also not a new method. According to Barkley (2006a) behavioural modification techniques were used in 1917 and met with some success. Additionally, in 1947, the work of Strauss, Werner and Lehtenen led to the introduction of the minimal stimulation classroom. In this classroom the room is undecorated, windows are frosted, and teachers wear drab colours (Goldstein and Goldstein, 1990; Schachar, 1986). This approach has been developed, and today the term psychotherapy includes "a wide variety of methods and techniques aimed at helping people make changes in their attitudes, emotions, and behaviour patterns" (Ingersoll, 1998, p.105). Behaviour modification (such as points programmes, tokens economy systems, and time-outs) and cognitive-behavioural interventions (such as self-monitoring, self-reinforcements, and self-instruction) are, perhaps, the most well known types of psychotherapy interventions (Ashman and Conway, 1989; Batsche and Knoff, 1994; Dawson, 1995; DuPaul and Eckert, 1997; Flick, 1998; Fiore *et al*., 1993; Ingersoll, 1998; Pfiffiner *et al*., 2006; Purdie *et al*., 2002).

Although psychotherapy interventions are not as effective as medications in reducing the core symptoms of ADHD, it can benefit children in reducing activity level, increasing time on task, and improving academic performance (Ashman and Conway, 1989; DuPaul and Eckert, 1998; Flick, 1998; Fiore *et al*., 1993; Ingersoll, 1998; Pfiffiner *et al*., 2006; Purdie *et al*., 2002).

Parent training: Parents training and/or counselling is an appropriate method to help the parents in dealing with their personal difficulties (such as guilt, frustration, sadness, stress, and marital strain) which may develop as a result of the difficulties they face as parents of a child with ADHD. In addition, training in using different techniques – which parents' training and/or counselling programmes offer – help parents manage their children's behaviour (Anastopoulos *et al*., 1992, 2006; Flick, 1998; Purdie *et al*., 2002).

Although using parents' training and/or counselling programmes may not enhance the academic performance of children with ADHD, it may make positive changes in child behaviour and in parental and family functioning (Anastopoulos *et al*., 2006; Flick, 1998; Pfiffiner *et al*., 2006).

To conclude, today, throughout the medical community it is considered that medication is the most effective treatment for ADHD. Although numbers of studies (e.g. Accardo and Blondis, 2000b; CHADD, 1997, 2000; Green and Chee, 1998) affirmed the safety of using medication to treat children with ADHD, there are, however, some researchers who support the medicine-free treatment (e.g. Bratter, 2007; Breggin and Cohen, 2000).

Those who are not in favour of using medication to treat children with ADHD argue that the statement that medication is safe and effective for treatment of children with ADHD is a fabrication of the medical companies which financially sponsor many of these studies. They further argue that some of theses medications (e.g. Tofranil®) used to treat depression patients are not developed to treat children with ADHD specifically. Another argument against the use of medications is the short-term negative effects (e.g. headaches, stomach problems, and insomnia). Furthermore, the long-term effects are unknown (Bratter, 2007; Breggin and Cohen, 2000).

In this regard, the current researcher argues that the decision to medicate the child should not be made by medical or school boards alone but rather in conjunction with the parents of the child with ADHD. This decision should be based on the seriousness of the ADHD condition. Parents should not be forced to make this decision. Today, in the kingdom of Saudi Arabia there are some parents who decided to treat their children with medication because it is the only way to obtain an additional support from the SEPS (*Special Education*

Programming and Services) for their children. Unfortunately, SEPS support mainly focuses on ADHD as a health problem. Therefore, SEPS support is of limited educational help to the child and his/her teacher. It mostly ensures that the child will take his/her medication at the correct times. For example, if the child is on Ritalin® (duration of effects is 3-4 hours) the teacher should make sure that the child takes his/her medication before academic classes.

The current researcher also argues that medication should not be used as the only treatment for ADHD, but rather should be considered as a part of a multi-dimensional treatment programme for children with ADHD. Therefore, if parents decide to use the medication, they should also consider using psychotherapy interventions and parent training alongside it to take advantage of each treatment. Using psychotherapy interventions and parent training might also help to minimize medication dosage. Additionally, medication does not cure ADHD. When the medication stops, the symptoms of ADHD (inattention, impulsivity, and hyperactivity) come back. Therefore, it might be wise to use psychological treatments which might help the child to understand his/her condition and learn some techniques (e.g. self-monitoring) to manage the symptoms of ADHD (Barkley, 2005; DuPaul and Stoner, 1994; Flick, 1998; Lensch, 2000; Schwean *et al*., 1993).

Since the *Department of Special Education* at *King Saud University* started (in the academic year 2008/2009) to prepare and qualify special education teachers in the field of ADHD to work with children with ADHD, the current researcher expects that the children with ADHD will be able to obtain an appropriate treatment plan which will probably include all the above treatments. She also hopes within the next three years, SEPS support for children with ADHD will change and be more helpful for children with ADHD, their parents, and regular teachers who teach children with ADHD.

The treatment plan should be based on the diagnosis and assessment of the child which will be discussed in the next section. However, because the process of diagnosing and assessing ADHD usually takes a long time (according to DSM-IV-TR should be no less than six month), an appropriate treatment could be implemented before diagnosis is completed (Barkley, 2005, 2006b; Lensch, 2000).

Assessment and Diagnosis of ADHD

According to *the American Psychiatric Association* (APA, 2000) with an estimated prevalence rate of 3-7% among school-age children, ADHD is one of the most commonly diagnosed psychiatric disorders of childhood. Additionally, in 2004 *the American Academy of Pediatrics* reported that 6-9% of school students are affected by this disorder. ADHD exists in all social classes, in every ethnic group and in every country. Studies done in different countries have produced these figures for prevalence: Brazil, 5-6%; Canada, 5-14%; China, 6-9%; Germany, 4%; India 5-29%; Japan, 7-8%; New Zealand, 2-7%; and the United Kingdom, 3-5% (Barkley, 2005, 2006b; Hughes and Cooper, 2007; Szatmari *et al*., 1989).

In the Kingdom of Saudi Arabia – where the present study was conducted – the prevalence rate of ADHD is 12.6–16.7% (Abdur-Rahim *et al*., 1996; Al-Hamed, 2002) which is quite a high prevalence rate compared to the rate of the above countries. However, it is not higher than those revealed by some studies in other countries, in particular in the United State of America (USA). For example, Carlson and colleagues (1997) reported that 18.9% of school-age children have ADHD. Additionally, others reported a similar prevalence rate. For example, Wolraich and colleagues (1996) reported that 16% of school-age children in the USA have ADHD. In the KSA most of children with ADHD were diagnosed by American professionals who work in the KSA or by Saudis professionals who mostly taught and trained on the USA. Thus, the similarity in the prevalence rate of ADHD between the USA and KSA might be clarified on this ground.

ADHD is a complex developmental disorder, therefore the process of diagnosis and assessment of this disorder should reflect that (Barkley, 2006b). The purpose of diagnosis and assessment of ADHD

> should not be restricted to answering the question of whether or not the student has ADHD. Rather, assessment should be linked to an ongoing evaluation of the student's needs, development of appropriate interventions, and measurement of the success of these interventions (Burcham and DeMers, 1995, p. 213).

This approach emphasises the importance of using multiple methods of assessment (e.g. physical or medical exam, standardized tests, interviews, and behaviour rating scales) and multiple sources of information (e.g. parents, teachers, and the child) over multiple settings (e.g. home, classroom, and playground). The current researcher believes that the multiple method of assessment is probably the best practice to diagnose and assess ADHD because of the following reasons:

- There is no single diagnostic test which can diagnose ADHD.
- To understand the perspectives of those who interact with the child being referred such as the parents and teachers.
- To assess varying abilities, skills, and behaviours and document the child's strengths and weaknesses for treatment planning, in short, the child's strengths can be used to help ameliorate the problems.
- To address the goal of designing and monitoring effective intervention.
- To determine the pervasiveness of the ADHD symptoms and to address other possible causes for the symptoms.
- To assess for any comorbid conditions and to rule out other possible explanations for the problem behaviour.
- It is a multidisciplinary approach which allows and values the effort of professionals from different disciplines, therefore, not only a physician

can diagnose and assess ADHD, but psychiatrics, psychologists, and teachers could and should.

Assessment techniques and instruments can be categorized as following:

- Behaviour rating scales.
- Interviews and observations.
- Continuous Performance Tests (e.g. *the test of variables of Attention*, TOVA).
- Intelligence and academic tests.
- School records.
- Physical or medical exams.

(Barkley, 2005, 2006b; Barkley and Edwards, 2006; Douglas, 1983; Dowdy *et al*., 1997; DuPaul and Stoner, 1994; Fowler, 1990; Gordon *et al.,* 2006; Guyer, 2000; Hagin and Deson, 2000; Hinshaw *et al*., 1995; Hughes and Cooper, 2007; Landau and Burcham, 1995; Montague *et al*., 1994; Nadeau, 1995; Reid *et al*., 1994; Schwean *et al*., 1993; Szatmari *et al*., 1989).

Although some believe that children are being over-diagnosed with ADHD, Gordon and Asher (1994) asserted that ADHD was first identified in the early 1990s and since the percentage of population with ADHD has not varied. Most researchers agree that ADHD affects 3-5% of school-aged children (APA, 1994). It is worth mentioning that the rate of comorbidity of ADHD with other psychiatric disorder as reported in the literature is as follows:

- Oppositional Defiant Disorder (ODD) (32-60%).
- Conduct Disorder (CD) (12-50%).
- Anxiety disorder (22-34%).
- Mood disorder (30%).
- Depression (47.9%).
- Learning disabilities (9 -63%).
- Language disorders (10-59%)

(August *et al*, 1996; Barkley, 2006b; Bender, 1998; Biederman *et al*., 1991; Bird *et al*., 1993; DuPaul and Stoner, 1994; Hinshaw *et al*., 1993; Kuhne *et al*., 1997; Lerner *et al*., 1995; McKinney *et al*., 1993; Riccio and Hynd, 1993; Satterfield *et al*., 1994; Szatmari *et al*., 1989).

ADHD and Education

The launching of *the UN Decade of Disabled Persons (1983-1993)* by the United Nations in 1976 made this era of including exceptional children into the regular classroom a period of challenge for both regular and special education teachers. Today, around the world, society and teachers' attitudes are changing to accept inclusion as mutually beneficial for both normal and exceptional children (Forlin, 1996; Junkala and Mooney, 2001; Kasari *et al*., 1999; Monsen and Frederickson, 2004; Stainback and Stainback, 1996; Stainback *et al*., 1985, 1994).

Today's teachers, in any classroom around the world, have to deal with children who are categorized as being physically, mentally, learning, and emotionally disabled. Additionally, there are around 20% of any classroom students who are not classified as disabled, yet they need special attention from their teacher (Knight, 1999, 3). Therefore, an average class teacher should expect and be prepared to have and teach one or two students with special needs. Because the prevalence rate of LD and ADHD is high, those one or two students with special needs, as one would expect, will be children with LD or ADHD. The prevalence rate of students with special needs varies from one disability to another. The prevalence rate of some disabilities such as hearing impairments and visual impairments are small compared to others disabilities such as LD or ADHD. For example, deafness is present in 5-12 per 10,000 children. In addition, ADHD is one of the most commonly diagnosed psychiatric disorders of childhood with an estimated prevalence rate of 3-7% among school-age children. This means that teachers should expect and be prepared to have and teach one or two students with ADHD or LD. They also should expect that they may seldom encounter a hearing or visually impaired child. More importantly, it has been argued that most of the students with ADHD should and could be served properly in the regular class by the class teacher. Regular teachers who are trained and educated to recognize and meet the needs of children with ADHD can serve up to half (about 50%) of those children within regular education by appropriate adjustments, modifications and accommodation in the regular classroom. Additionally, around 35% of children with ADHD might need special education services, but they also can be served within regular education by a collaborative team of regular and special educators who work together to serve the child. The rest of children with ADHD (which are only 15% and usually may have coexisting disabilities) will need to be served by the special education teacher in the resource room for part of the day. Yet, they should and could take advantage from remaining in the regular classroom with class teacher for most of the day (AAP, 2004; Fowler, 1990; Goldstein and Goldstein, 1990; Hughes and Cooper, 2007; Lerner *et al*., 1995; Stevens, 2000).

From the above, it would appear to be imperative that regular teachers should be offered the opportunity to learn about ADHD and how to teach children with ADHD. Teachers' knowledge about ADHD and attitudes toward children with ADHD are two key issues in teaching and serving children with ADHD within regular education.

Teachers' knowledge and attitudes about ADHD is the first and most crucial step in getting a child with ADHD identified. According to Jerome and colleagues (1994, p. 563) teachers are frequently involved in both the assessment and treatment process of children with ADHD. Jerome and colleagues (1994, 1998) reported that teachers with special education certification or who had specific training in ADHD scored higher on *the Knowledge about Attention Deficit Disorder Questionnaire* (KADD-Q) than those with less education or who had little training. Similarly Piccolo-Torsky and Waishwell (1998, p. 36) used the KADD-Q and reported that 90% of the regular teachers desired more training and the majority had recently taught at least six ADHD children. West and colleagues (2005) found that the total scores of parents of children with ADHD on the KADD-Q were significantly higher than the total scores of teachers. Thus, teachers had less knowledge about ADHD and could benefit from learning more about this disorder to meet their students' needs. The KADD-Q was also used by Sciutto and colleagues who found a significant correlation between teacher confidence teaching children with ADHD and his/her knowledge about ADHD. More importantly, they reported that the number of ADHD children taught and years of teaching experience are positively correlated with the regular teacher's knowledge of ADHD (2000, p. 120).

There is a strong relationship between teacher confidence in teaching children with ADHD and their attitude and knowledge about ADHD. However, most regular teachers do not have proper knowledge about ADHD to either identify or serve children with ADHD. Therefore, teachers should be provided with workshops and special training courses to develop more understanding of ADHD and learn some successful educational strategies in handling children with ADHD from experts in the field of ADHD such as psychologists, special education teachers, and teachers who are expert in any changing methodologies (Brook *et al*., 2000, p. 250).

Regular teachers can utilize these educational strategies in: (1) *content* (that is, the changes in the information the student is required to learn upon); (2) *delivery of instruction* (that is, the instruction dealing with the delivery of information such as using peer tutoring and increased waiting time after asking a question); (3) *materials* (this involves using alternative learning tools such as outlining and concept mapping); (4) and *assignments* (this involves changes in the class-work, homework, projects or tests such as shortening assignments and/or allowing the student more time to complete them). These educational strategies are aimed at helping children with ADHD to cope with and overcome the primary traits of ADHD which are inattention, impulsivity, and hyperactivity (Barkley, 2005; Dowdy *et al*., 1997; DuPaul and Eckert, 1998; Goldstein and Goldstein, 1990; Lerner *et al*., 1995). Some of the educational strategies that have been found to be successful with children with ADHD are reviewed under the following sub-headings:

Environmental strategy: This strategy - which is the first suggestion for any teacher who wishes to enhance his/her effectiveness in teaching children with ADHD - involves making changes in the design of the classroom. It is preferable to locate the child with ADHD in the centre of the front row where the teacher, usually directs his/her attention and can observe and monitor the child's behaviour easily. Classmates who sit next to the child with ADHD should also be considered. Therefore, the child with ADHD should be surrounding with peers who show a high rate of on-task behaviour and are well behaved. The child with ADHD might take advantage from his/her classmate as peer models or peer tutors.

It is also highly recommended to provide a physical space in the classroom. Teachers should create a "movement path" in which activity is permitted. The "movement path" (which is an area in the back of the classroom where the child can walk) is very useful with young children who are hyper and have lots of impulsive energy, but teachers should make sure that this strategy will not distract the other children. Teachers should also create a designated quiet place such as a study carrel (which is a desk that comes with its own walls) as a workspace for children with ADHD. Although any child with ADHD could and should work most of the time at his/her own desks in the way other children do, it may be practical to have multiple study carrels in another part of the classroom. To eliminate any stigma which might attach to using the study carrels, the teacher can call it "Quiet Study Area" and permit other children to use it. The study carrels (which are away from windows and the door) are considered as a place that is reasonably free from distraction. Also in this place background music (which has been effectively implemented for reducing the distraction from the child's own thoughts) can be used. Additionally, study carrels may successfully provide the child with ADHD a break from class-work and allow him/her to move legitimately from one place to the other. The teacher could make a prearrangement with the child such as using a hand signal which allows the child the use of the study carrel. It is also highly important that teachers use the study carrel to provide the child with ADHD additional practise in both academic and social skills, thus, materials and activities used in the study carrel should be enjoyable. However, teachers must ensure that the child with ADHD is still part of the class, but gets some privacy sometimes. For example, the teacher should not allow the use of the study carrel during frontal lessons or class discussions. It is also unacceptable that the teacher allows the student to use the study carrel everyday and/or every class. Instead, the teacher should encourage the child with ADHD to only use the study carrel when he/she needs quietness to concentrate on his/her independent class-work. Table 3.4 presents an example of how the designated quiet place can be sometimes inadequately applied by the teacher.

Table 3.4 Example of an Inadequate Use of the Designated Quiet Place

Attention Deficit through the Eyes of a Child,
By Alan Brown, age 15*

My teacher wanted to make me concentrate better, so one day she put my desk in the far corner separated from the rest of the class. A few days had passed. I still wasn't finishing my work on

> time, but I was trying to do the work correctly. The teacher didn't care; it wasn't finished. She then put a refrigerator box around my desk so I couldn't see anyone in class. I could hear as other kids in class would make fun of me. It really hurt; I was ashamed of myself and made at my teacher. I couldn't tell my Mom because I might get in trouble. I hated school, didn't like my teacher, and started not liking myself. Imagine a nine-year-old going through this day after day.
>
> ∗Adapted from Barkley, 2005, p.229.

Using the above creative and useful ways in setting up the classroom will, usually, result in increasing positive interactions between the child with ADHD and other children, increasing on-task behaviour, and decreasing noisiness and disruptions (Barkley, 2005; Cooper and Ideus, 1996, 2002; Daly, 2005; Gordon and Asher, 1994; Hughes and Cooper, 2007; Lerner *et al*., 1995).

Understanding and categorizing the child's behaviour strategy: Some teachers might choose not to address the problems of the child with ADHD with the principal, special education teacher, or the school psychologist because they might think that will be seen as teaching failures (Daly, 2005; Gordon and Asher, 1994). Thus, regular teachers will benefit from learning and understanding the hierarchy of behaviours. Daly (2005, p.52) presented the hierarchy of behaviours as follows: "*On-Task*" (which is the first level of the behaviour hierarchy) means that the child follows directions quickly and quietly. He/she also stays on-task and does not disrupt others. "*Off-Task*" (which is the second level of the behaviour hierarchy) means that the child is mostly not engaged in the assignment which the rest of the children in the class are doing. The third level of the behaviour hierarchy is "*Disruptive*" which means that the child is not only off-task, he/she is also driving other children to be off-task. The final and highest level is "*Aggressive*" which means that the child is either showing aggressive expressions such as clenched fists or acting physically such as hitting other children.

Familiarity with the above hierarchy of behaviours will provide the teacher with some self-confidence to address the child's problems. For example, when the teacher says "I can't handle this child, he/she is out of control" the teacher himself and others maybe think that he/she is a bad teacher who does not know how to control children. More importantly, using the hierarchy of behaviours - instead of vague statements which do not identify the child's problem - will help the teacher in discussing and diagnosing the child's difficulty with other professionals which probably will result in choosing a strategy to help the child (Daly, 2005; Gordon and Asher, 1994).

Strategy of establishing roles for others: The aim of this strategy is to encourage the regular teacher to involve his/her assistant and/or other children in the class in helping the child with ADHD. Accordingly, the class teacher should provide them with a guideline in which their responsibilities toward the child with ADHD are specified, table 3.5 provides an example.

Table 3.5 Sample Timetable for Teaching Assistant's Supervision of Child with ADHD∗

Time	***Task***	***Interaction***
8:45 AM	Arrival	Greeting, review of morning schedule.
9:00-9:30 AM	Group discussion	Monitoring behavior (praise for on-task, ignore for off-task).
10:00-10:30 AM	Independent work	Monitoring behavior (praise for on-task, ignore for off-task).
12:15 BM	Lunch	Review lunch rules and consequences.
1:30-2:10 BM	Cooperative learning	Verbal rules, give verbal prompts and praise.
3:00 BM	Departure	Check homework materials.

∗Adapted from Gordon and Asher, 1994, p. 89.

According to Gordon and Asher (1994, P. 88) in the USA "most teachers do not have an assistant", so they presented a simple version of this method. They suggested that the teacher who does not have an assistant asks other children to help as assistants. Basically, the teacher identifies a peer as "study buddy" who would help the child with ADHD in completing his/her class-work as an assistant teacher would. The child with ADHD should also check the work of his/her "study buddy". These reversed roles will keep both of them on an equal footing. The other area that the child with ADHD may need some help with is the social behaviour, so the teacher should also identify a peer as a "social buddy" who would help the child with ADHD in observing and practising the positive behaviours of his/her "social buddy" in the cafeteria or the playground. For example, if the "social buddy" greets the child with ADHD and reviews the morning schedule with him/her, it is very likely that the negative behaviours by the child with ADHD toward other children to obtain their attention will reduce. Additionally, having a "study buddy" and "social buddy" might encourage telephone contact between the child with ADHD and his/her buddies which possibly will result in social interaction (Gordon and Asher, 1994, p. 88).

Gordon and Asher (1994, p. 88) also suggested "using other students as peer teachers" as a successful strategy to be used to help children with ADHD. Peer tutoring is a teaching method that encourages students to learn from each other. Thus, the student who "teaches" offers his/her help to another student who is usually his/her classmate (DuPaul and Stoner, 1994; Lerner *et al.*, 1995). Table 3.6 describes the process of this method.

Table 3.6 Description of the Process of Peer Tutoring

Process of Peer Tutoring*
The tutor and tutee are seated separate, adjacent desks during tutorial sessions. The tutor is provided with a "script" of academic material (e.g., ten math problems) related to the current content of instruction in the classroom. Items are dictated to the tutee one at a time form the script. The tutee then responds orally to the presented item, using a blank piece of paper when necessary (e.g., to work out math problem). Two points are awarded by the tutor for each correct, initial response. Alternatively, the tutor provides the correct answer when errors are made and offers the tutee the opportunity to practice the correct response. The tutee is eligible to earn one point after practicing the correct response three times. No points are awarded if the student is unable to answer correctly three times. The item list is presented as many times as possible for 10 minutes. The two students then switch roles with tutor now receiving instruction from the tutee for 10 minutes.
*Adapted from DuPaul and Stoner, 1994, p. 181.

According to Lerner and colleague "peer tutoring is simple to implement, it requires little time and effort from teachers, it is a practical way to meet the special academic needs of a few children in a class, and students like it" (1995, p.115). However, it is highly important that teachers ensure that he/she provides his/her students with proper training in using this method before implementing it. Proper training - which includes "brief didactic descriptions of behaviors to be trained (e.g., how to present academic material to the tutee), modeling of the behaviours by the teacher and selected students, followed by structured rehearsal of the tutoring techniques by the entire class" - can be covered in three or four (20 minutes for each session) training sessions (DuPaul and Stoner, 1994, p.180). Since teaching something to others is one of the best ways to learn it, the student who is the tutor will take advantage of this method. Yet, the child with ADHD as a tutee will greatly benefit from having immediate feedback from his/her tutors, and observing and practising the positive academic and nonacademic behaviours of their peer tutors which possibly will result in building social relationships with his/her tutors (DuPaul and Stoner, 1994; Lerner *et al*., 1995).

Strategy of establishing classroom rules: Since rules communicate expectations, the aim of this strategy is to aid the class teacher in helping his/her students by establishing clear instruction which explain what the child needs to do, and how, in order to succeed. Additionally, by allowing children to participate in creating the classroom rules they will have more commitment to adherence to the rules which will result in behaving themselves. Yet, the teacher also should apply and enforce the classroom rules consistently otherwise the children will not take these rules seriously (Daly, 2005; Goldstein and Goldstein, 1990; Gordon and Asher, 1994; Rammundo, 2000).

The teacher might take advantage of the classroom rules by using these rules as cues when he/she responds to the child's behaviour. For example, when the child violates one of the classroom rules, the teacher could ask him/her the following question: What happened? What did she/he do wrong? Why is what happened wrong? What rule did she/he just break? How will this be fixed? What he/she should have done differently and what he/she will choose to do next time? (Daly, 2005).

Another important use of the classroom rules is to teach children the meaning of fairness and equality. Rules help children to realize that they will be treated equally and their teacher will not indiscriminately apply the consequences. Yet, children should also know that it is fair to treat some of the children in the classroom in a different way because those children have special needs. For example, "not every student uses glasses to see the board, but those who need them are always permitted - rather, urged and reminded - to wear them" (Rammundo, 2000, p.141). Similarly, children with ADHD are also permitted to use the study carrel to do the class-work because they need quietness to concentrate on their class-work (Cooper and Ideus, 1996, 2002; Daly, 2005; Goldstein and Goldstein, 1990; Gordon and Asher, 1994; Rammundo, 2000). Table 3.7 presents the main principles of developing the classroom rules.

Table 3.7 The Main Principles of Developing the Classroom Rules

Principles of Rule Development*

The following principles of rule development should be observed:

- The number of rules should be kept to a minimum, perhaps no more than three or four for the young child and perhaps five or six for the adolescent.
- The wording should be simple but specific (e.g. "Use indoor voice" rather than "Respect others").
- Rules should be stated positively whenever possible. Rules convey information, and a negative rule (e.g. "Do not hit") communicates what *not* to do but does not convey what to do. The admonishment "Don't think of pink elephants" usually results in that very thought. In the same way, stating rules negatively may actually encourage the negative behavior. Moreover, a long list of "Do nots" generally results in unpleasant feelings.
- Rules should be situation specific. For example, it may be appropriate to raise one's hand to speak in class during a test, but other times it may be appropriate to speak without raising one's hand. The classroom teacher may need to make these subtle differences explicit for the child with ADHD.
- Rules should be publicly posted. It is not a good idea to have children rely on memory or, even worse, repeat rules over and over again. Write out the rules for a given situation (e.g. playground rules, rules for lining up) and display them prominently. Doing so facilitates compliance.

*Adapted from Gordon and Asher, 1994, P. 90.

Cooperative learning strategy: The aim of this strategy is to increase children's cooperation rather than competition. Thus, children will learn from each other by working together on a task which will eliminate competition among them. Unlike competitive, cooperative learning promotes and encourages children to learn and to develop both positive attitudes and stronger relationships with their classmates who have special learning needs such children with ADHD (Learner *et al*., 1995; Putnam, 1993).

According to Learner and colleagues (1995, p. 114) teachers can use the following steps for structuring cooperative learning in the regular classroom:

- Clearly specify the objectives for the lesson.
- Selectively group the students.
- Clearly explain the learning activity to the students.
- Monitor for the effectiveness of the learning groups.
- Intervene to assist groups with the task as needed.
- Evaluate the students' achievements.
- Encourage the students to discuss how well they collaborated.

Teachers should know that cooperation takes time and hard work to implement, and if one or more of the above steps of cooperative learning was not fulfilled it may well turn to a traditional groups rather than cooperative learning groups (Putnam, 1993). Table 3.8 presents the differences between cooperative learning groups and traditional groups.

Table 3.8 Differences between Cooperative Learning Groups and Traditional Groups ∗

Cooperative learning groups	Traditional learning groups
Positive interdependence.	No positive interdependence.
Individual accountability.	No individual accountability.
Cooperative skills taught directly.	No cooperative skills instruction
Shared leadership.	Appointed leader.
Responsibility for success of all group members.	Responsibility for one's own contribution.
Teacher observation and feedback.	Teacher withdraws from groups.
Equal opportunity for success.	Uniform standard for success.
Groups review process and set goals for future.	No review or goal setting.

∗Adapted from Putnam, 1993, p. 21.

For example, the step of - clearly specify the objectives for the lesson - will lead the teacher to detail the criteria for achieving the objectives of the lesson which will result in both positive interdependence and individual accountability. Positive interdependence which is according to Putnam (1993, p. 17) the essence of cooperative learning based on the children's ability to work together and coordinate in order to achieve the group objective/s. Consequently, the teacher should develop this ability by (a) specifying a mutual objective/s for the whole group; (b) using resource interdependence by encouraging children to divide and/or share materials, resources, and information among them; (c) rewarding interdependence behaviour by awarding all the group members upon completion of the mutual objective/s; (d) specifying role interdependence by assigning different roles to children which will reflect and encourage individual accountability. Teachers should clarify that each child has two duties in helping his/her group to achieve the objective/s of the lesson. These duties are learning the material of the lesson, and contributing to his/her group by making good participation and relationship with others. Thus, children are rewarded as a group based on their success on the mutual objective/s, but tested individually based on the specific objective/s which the teacher specified to each child. This procedure of learning and assessment will promote equal opportunity for success by giving every child in the class the chance to contribute to the accomplishment of his/her group and to improve his/her self and ability. Thus, the teacher could and should individualize the criteria for learning and achievement based on the child abilities and unique needs.

Additionally, the teacher should give the second step - selectively group the students - high consideration. According to Putnam (1993, p. 19) the rule is to create heterogeneous groups (which include children of various cognitive abilities, a mixture of social and behavioural skills and level, etc.). However, sometimes it is appropriate that the teacher assign children into "homogeneous groups based on mutual interests (e.g. a group dedicated to writing about a particular topic such as salmon fishing or herb gardening), for instruction in specific skills in a subject area (e.g. multiplying fractions in mathematics), or for other specific purposes." It is also highly important that the child with ADHD is assigned to a group in which his/her study and/or social buddies are also members.

Teaching style and the teacher's teaching ability are essential issues to implement the above educational strategies productively. Golstein and Golstein highlighted some teaching styles which create difficulty to both the teacher and the child with ADHD in the classroom. In their words:

> The hypercritical, fault-finding, threatening teacher will be frustrated by the ADHD child's inability to change quickly. The autocratic teacher, who may be intolerant and rigid in providing directions, will experience difficulty with the ADHD child's frequent inability to follow those directions. The aloof, distant, condescending teacher stiff or formal in relationships with students or unable to view students as children, will experience difficulty with the ADHD child differences. The restricted, rigid teacher, able to recognize only the need for academic accomplishments, focusing only on the very good or very bad and impatient with students who do not fit expectations, will have difficulty with the ADHD child. The hopeless, pessimistic, unhappy teacher with a tendency to categorically view all misbehavior and unfinished work as the result of willful disregard will not develop a good relationship with the ADHD child. Finally, impulsive, short-tempered, disorganized teacher will also experience difficulty caused by the similarity in their behavior with that of the typical ADHD child (1990, p. 326).

The teacher should understand that having a child with ADHD in his/her classroom will help him/her to develop his/her skills as a teacher and that other children will also benefit from the new teaching skills that the teacher develops in implementing the above educational strategies in the classroom. If the teacher unable to improve his/her teaching abilities and/or change his/her teaching style to meet the needs of the child with ADHD, it is preferable that this teacher seek to place the child with ADHD with another teacher. Parents of the child with ADHD should also ask to move their child to effective teacher (AAP, 2004; Golstein and Golstein, 1990).

An effective teacher is described by Golstein and Golstein as a teacher who will:

> Focus on academic goals; carefully select instructional goals and materials; structure and plan learning activities; involve students in the learning process; closely monitor student progress; and provide frequent feedback concerning progress and accomplishments. Effective teacher develop the ability to organize and maintain the classroom learning environment in order to maximize time spent engaged in productive activities and minimize time lost during transition periods or for disruptions that require disciplinary action. In regards to classroom discipline with inattentive students, effective teacher develop a workable set of rules in the classroom; respond consistently and quickly to inappropriate behavior; structure classroom activities in an effort to minimize disruption; and respond to; but do not become angry or insult, the disruptive student. The effective classroom teacher for the ADHD student must also be well organized, an efficient time manager, flexible and able to handle multiple task demands. That teacher must set realistic goals for the ADHD students and find ways of helping the student achieve those goals. The effective teacher for an ADHD student must be able to maintain an ongoing awareness of the entire classroom's activities, even when focusing one-on-one with ADHD student. Such a teacher is a democratic, responsive and understanding. The kindly, optimistic, friendly teacher will be better able to accept and meet the needs of the ADHD students (1990, p. 325).

From the above description of the characteristics that an effective teacher possesses he/she is also an effective team member who knows how to work with others. The regular teacher's ability to work and collaborate on an interdisciplinary team will result in great collaboration between him/her and the other team members which should greatly benefit the child with ADHD. These characteristics will also help regular teachers to learn more about ADHD, and behaviour management techniques. That, in turn, will assist the regular teacher to move from being a technician - who applies certain techniques without understanding the concepts underlying them and/or the child's motivation for certain behaviours - to a professional who could and should understand the nature of ADHD, choose an appropriate technique based on adequate analyzes of the child's problem, and evaluate the usefulness of the technique (Cooper, 2005; Gordon and Asher, 1994; Lerner *et al.*, 1995).

The researcher - who is herself an ADHD sufferer - considers ADHD as a neurological disorder and is not trying to imply that curriculum changes and/or educational strategies could be the solution for children with ADHD, but it could help those children to learn - which is a basic right for every child - more effectively.

Even though, as highlighted earlier, the vast majority (about 85%) of children with ADHD are able to learn successfully within the regular classroom, some of those children (about 15% who are usually have coexisting disabilities) need and benefit from special education services. These services will be discussed in the next section.

ADHD and Special Education

Hallahan and Kauffman stated that "there have always been exceptional children, but there have not always been special education services to answer their needs" (1978, p. 12). They also considered Jean Itard (a French physician who successfully educated a 12 years old boy who had been found, in the forests of France, roaming naked and wild) "as the person to whom most historians trace the beginning of special education as we know it today" (1978, p. 15). In 1866, Edouard Seguin (who was Itard's student and immigrated to the USA) published his book *Idiocy and its treatment by the physiological method* in which he "described in detail his interpretation and elaboration of Itard's methods and also provided much of the foundation for the work of Maria Montessori" (Hallahan and Kauffman, 1978, p. 15). In 1824, Samuel

Gridley Howe (who was a physician and teacher of the deaf-blind) succeed in teaching a deaf-blind child called Laura Bridgman (Hallahan and Kauffman, 1978, p. 15).

From the above it is clear that the field of special education is not a new discipline. In fact, teaching methods and instructions used by today's special education educators to teach exceptional children are based on several psychological theories of learning (Ashman and Conway, 1989; Hallahan and Kauffman, 1978; Lerner *et al*., 1995; Kirk *et al*., 2000; Kneedler, *et al*., 1984). For example, the concept of readiness - which is a fundamental principle in the field of special education - is both based on and supported by developmental psychology theorists such as Piaget and Montessori. Lerner and colleagues defined readiness as "the state of maturational development that is needed before a desired skill can be successfully learned" (1995, p.130). Thus, a special education teacher should design an individualized educational plan which will both develop and fit with the child's natural development (Hallahan and Kauffman, 1978; Lerner *et al*., 1995; Kirk *et al*., 2000). Additionally, psychotherapy interventions are derived from behavioural psychology and/or cognitive psychology (Ashman and Conway, 1989; Barkley, 2005; Dawson, 1995; DuPaul and Eckert, 1997; DuPaul and Stoner, 1994; Fiore *et al*., 1993; Flick, 1998; Goldstein and Goldstein, 1990; Ingersoll, 1998; Lerner *et al*., 1995; Pfiffiner *et al*., 2006; Purdie *et al*., 2002).

The term *special education* means specially designed instruction which meets the unique needs of an exceptional child. Special materials, teaching techniques, equipment, and/or facilities may be required. For example, visually impaired children may require reading materials in large print or Braille. Hearing-impaired children may require hearing aids and/or instruction in manual communication. Children with physical disabilities may need wheelchairs, ramps, and a variety of equipment available only in a special medical facility. Gifted children may require access to working professionals and their environs. Special education also includes related services the exceptional child may need, such as special transportation, physical and occupational therapy, medical treatment, audiology and speech pathology, psychological assessment, social service, and counselling. The special education and related services must be specified in the child's individualized education programme (Hallahan and Kauffman, 1978, p. 4; Lerner *et al.*, 1995, p. 125).

Exceptional children are those who require special education and related services if they are to realize their full human potential. They require special education because they are markedly different from most children in one or more of the following ways: they are mentally retarded, gifted, learning disabled, emotionally disturbed, physically disabled, or have disordered speech or language, impaired hearing, or impaired sight (Hallahan and Kauffman, 1978, p. 4; Heward and Orlansky, 1980, p.3; Kirk *et al.*, 2000, p. 2). ADHD - according to DuPaul and Stoner, Kirk and colleagues - is one of the recent categories which have been added to the categories of exceptional children (DuPaul and Stoner, 1994, p. 88; Kirk *et al.*, 2000, p. 5).

Most, if not all, teaching methods and instructions used by today's special education educators to teach children with ADHD are either utilized and/or well known to the regular teachers (Barkley, 2005; Cooper and Ideus, 1996, 2002; DuPaul and Stoner, 1994; Gordon and Asher, 1994; Hughes and Cooper, 2007; Lerner *et al.*, 1995). Lerner and colleagues (1995, p. 128) used the term "*clinical teaching*" to differ special education from regular teaching. Clinical teaching is a cycle of phases in the following order (assessment, planning, implementation, evaluation, and modification). In the first stage all the information obtained from the multiple methods of assessment (in which, as noted previously, different assessment techniques and instruments are used) will be reviewed by the special education teacher in order to analyse the child's specific attentional, learning, and behaviour problems. Then, based on this analysis the special education teacher will plan and design a special teaching program for the child. After that, is implementation of the teaching plan. Next to that is evaluation which will lead to modification (which is the last stage) of the assessment (which is the first stage) thus, a new planning and a continuing cycle of clinical teaching (Lerner *et al*., 1995, p. 128). Figure 3.1 presents the clinical teaching cycle.

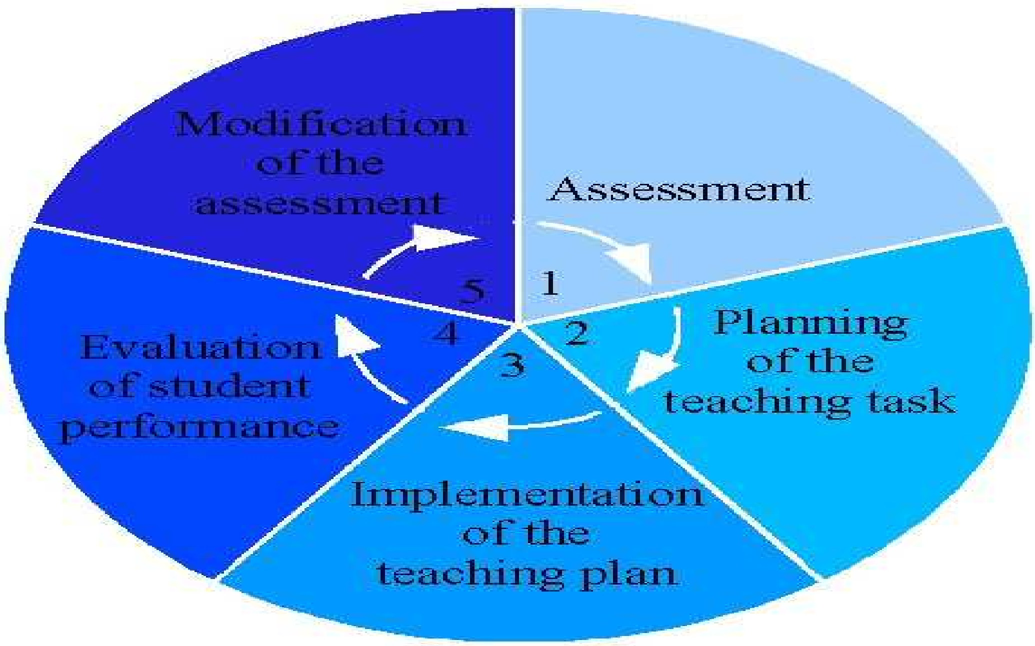

Figure 3.1 The Clinical Teaching Cycle
Adapted from: Lerner *et al*. (1995, p.129)

Lerner and colleagues also described clinical teaching as unique in the following ways:

- It requires flexibility and continual decision making.
- It is planned for an individual student.

- It can be accomplished in a variety of placements (1995, p. 128).

The child with ADHD is served by the special education teacher in the resource room for only part of the day and should remain in the regular classroom most of the school day. Therefore, both the special education teacher and the class teacher should work together if the clinical teaching is to be successful. Table 3.9 presents a description of roles that they might play.

Table 3.9 Inclusion Team Roles: Division of Labor∗

General Education	***Special Education***
Present the regular curriculum with awareness of individual differences.	Provide individual instruction for students as needed.
Provide a setting of acceptance in the classroom; focus on student similarities.	Model effectiveness instruction for exceptional children for teachers and aids.
Maintain classroom standards of behavior and a structured routine that stresses fair treatment for all.	Oversee responsibilities for paraprofessional who work with children.
Promote social interaction between children with disabilities and other students.	Develop plan for coping with special behavior problems related to exceptionality.
Be responsible for general class performance on accountability measures.	Be accountable for IEP goals, paperwork, and concurrence with legal requirements.

∗Adapted from Kirk *et al*., 2000, p. 64.

Conclusion

ADHD, currently, is considered as one of the most commonly diagnosed psychiatric disorders of childhood. Most researchers agree that ADHD affects 3-5% of school-aged children (APA, 1994, 2000; Gordon and Asher, 1994). Inattention, impulsivity, and hyperactivity are the three primary characteristics of ADHD.

The developmental stages of ADHD were addressed in this chapter. These stages are highly important to each adult who interacts with children.

Awareness of how a similar problem or behaviour will present differently at different maturational stage will help greatly to identify and treat this disorder during an early age.

Although, to date, it is not known what actually causes ADHD, most of the claims which put forward to explain from what ADHD can result were also outlined in this chapter.

Today, there are different suggestions to treat ADHD (e.g. medication, psychotherapy, and parent training) and sometimes it is of considerable importance to take advantage of each treatment.

In regard to the process of diagnosis and assessment of ADHD, it is important to use multiple methods of assessment (e.g. physical or medical exam, standardized tests, interviews, and behaviour rating scales) and multiple sources of information (e.g. parents, teachers, and the child) over multiple settings (e.g. home, classroom, and playground). This approach reflects the complexity of this disorder.

The literature is consistent with the possibility of teaching most students with ADHD in the regular class by the class teacher in suggesting that trained and educated teachers should and could recognize and meet the needs of children with ADHD by appropriate adjustments, modifications and accommodation in the regular classroom. Since some students with ADHD might need special educational services, the last section in this chapter was devoted to ADHD and special education. The next chapter looks at the connection between creativity and ADHD.

CHAPTER FOUR

CREATIVITY AND ADHD

Based on the previous review of literature on creativity and ADHD it is clear that the two concepts are very complex. The relationship between creativity and ADHD has been evaluated by a limited number of empirical studies.

Solanto and Wender (1989) hypothesized that the use of methylphenidate (that is a psycho-stimulant medication which is commercially known as Ritalin® and Ritalin-SR®) would have a deleterious effect on tasks of divergent thinking among children with ADHD. They found that methylphenidate did not significantly affect the performance of children with ADHD on a measure of creativity. Actually the numbers of responses given by some children on the creativity measure increased when they were taking the medication. Funk and colleagues (1993) also hypothesized that the use of methylphenidate would result in a decrease in nonverbal creativity. The results of Funk *et al.*'s study were similar to that of Solanto and Wender in 1989, in which methylphenidate did not significantly affect the performance of children with ADHD on a measure of creativity (Funk *et al.*, 1993). More importantly, both studies reported that the creative thinking performance of children with ADHD using a measure of creativity was not significantly different from that of children without ADHD. On average, the scores of children without ADHD in the TTCT were higher than the scores of children with ADHD but not significantly different.

Barkley asserted that there is a need for more research on creativity in ADHD and that the small number of studies available are "plagued, as is the field of creativity research itself, by problems in the very definition of creativity"

(2006c, p. 147). However, in two studies, Barkley and colleagues found that young adults with ADHD are not different from normal young adults in normal control groups on measures of creativity (Barkley *et al*., 1996, 2001).

Healey and Rucklidge (2005) also confirmed that ADHD is not associated with high creative ability. Using the TTCT, they found that children aged 10 to 12 and diagnosed with ADHD appeared to be no more creative than children without the diagnosis.

Shaw and Brown (1990) tested 16 children who had both ADHD and high IQ. They found that those children had high figural creativity. In a second study in 1991, Shaw and Brown also reported that children who had ADHD and a high IQ had higher figural creativity compared to children who had a high IQ and were not classified as having ADHD.

Using the results of the two previous studies Shaw (1992) concluded that children who are highly intelligent (score a high IQ score) and have ADHD probably have higher creativity compared to children without ADHD.

Simeonova and colleagues found that children with ADHD who are offspring of bipolar parents scored higher scores on *the BWAS* (*the Barron–Welsh Art Scale*) compared to healthy control children. They suggested that children with ADHD may have a high creative ability (Simeonova *et al*., 2005).

The inconsistent results from above studies lead some academics and clinical professionals to establish a much firmer link between creativity and ADHD outside the scientific literature. This purported link between creativity and ADHD was based on the observation of patients they have witnessed in their practice. For example, Hallowell and Ratey (1994a, 1994b) noted specific criteria which adults with ADHD exhibit in their behaviours. They identified twenty criteria, one of which is:

> Often creative, intuitive, highly intelligent. Not a symptom, but a trait deserving of mention. Adults with ADD often have unusually creative minds. In the midst of their disorganization and distractibility, they show flashes of brilliance (1994a, p.74).

Kelly and Ramundo mentioned similarities between ADHD and creativity. They stated that:

> We mentioned creativity in our discussion of an ADDer's specialized brain. It's possible to determine exactly what's responsible for creativity. Distractibility doesn't cause creativity but it does play a part in the vast array of disjointed thoughts and ideas that come together in imaginative thinking. Although each of us has an individual profile of abilities and disabilities, many of us share the gift of creativity (1995, p.385).

Weiss contended that "people with ADD have a lot of creativity" (1997, p.6), and also compared the positive and negative characteristics of ADHD and creativity. In her words:

> The bottom line is that people who are creative often have many ADD attributes. That is not at all to say that creative people would necessarily be diagnosed as ADD. But they certainly share much in common with people who are ADD (p.58).

Hartmann (1996, 1997, and 2003) believed that ADHD is a trait of personality. For that reason, people do not *have* ADHD but rather they *are* ADHD. He stated that:

> ADD is not always a disorder-but instead maybe a trait of personality and metabolism; that ADD comes from a specific evolutionary need in the history of humankind; that ADD can actually be an advantage (depending on circumstances); and that, through an understanding of the mechanism which led to ADD's presence in our gene pool, we can recreate our schools and workplaces to not only accommodate ADD individuals, but to allow them to again become the powers behind cultural, political, and scientific change which they have so often historically represented (1997, p.2).

Although, Hartmann's work is non-scientific - as mentioned earlier - some educators adapted Hartmann's idea of Hunter/Farmer and put it in practice. For example, Cooper and Ideus (1996, p.56) and Cooper and O'Regan (2001, p.56) developed some possible positive reframing for common classroom problems which they summarize in tabular form as follows:

Negative	*Positive*
Being out of seat too frequently.	Energetic and lively.
Deviating from what the rest of the class is supposed to be doing.	Independent, inquisitive, and individualistic.
Talking out of turn or calling out.	Keen/impatient to contribute.
Being aggressive towards classmate.	Sensitive, emotional, and passionate.
Losing and forgetting equipment.	Thoughtful, absorbed in own ideas and unmaterialistic.
Handing in homework late or not at all.	Perfectionist, unable to get started because of high standards.
Handing in incomplete or sloppy work.	Signs of effort in spite of difficulties.

Kewley (2005) asserted that students with ADHD have positive attributes and the role of their parents and teachers should be turning these positive characteristics to the student's advantage by using a proper treatment. Moreover, adults with ADHD

> tend to think across boundaries and devise new ways of doing things. Because they get bored easily, they tend not to stay with any one thing for very long. They are able to switch their attention from one thing to another, and often have many things on the go at one time. They tend to see things not noticed by others, and they are generally fairly intuitive (Kewley, 2005, p.80).

However, unfortunately, all of the above claims which have been created outside the scientific literature failed to cite references with evidence to support their claims.

Cramond (1994b) conducted a study to look over the incidence of creativity among individuals with ADHD and the incidence of ADHD among highly creative individuals. The sample of the study consisted of 34 ADHD and 76 highly creative students who registered on a *Torrance Creative Scholars*

Program, aged 6-15 years. Cramond found that 32% of the students with ADHD scored high enough on the TTCT to have qualified for *Torrance Creative Scholars Program*, and 26% of the highly creative students scored high enough on measure of ADHD to have been diagnosed with ADHD. More importantly, Cramond drew attention to the overlapping of characteristics of creativity and symptoms of ADHD which may lead to misdiagnosis of a creative child as having ADHD. In her words:

> The most serious implication of the overlap of ADHD and creative behaviors is that a creative child receives unwarranted diagnosis of ADHD. There are several concerns about labelling a child with Attention Deficit Hyperactivity Disorder: the ramifications of diagnosing a bright, creative child with ADHD may be dire (Cramond, 1994b, p.12).

Moreover, a review of the literature on symptoms of ADHD and characteristics of creativity by Cramond (1994a, 1994b, and 1995) brought to light the similarity between the two. Table 4.1 presents a summary of the comparison of behavioural characteristics of creativity and ADHD by Cramond.

Table 4.1 Comparison of Behavioural Characteristics of Creativity and ADHD

Comparison of Behavioral Characteristics of creativity and ADHD*		
Attention and interests	Creativity	▪ Broad range of interests. ▪ Tendency to play with ideas.
	ADHD	▪ Often fails to finish things. ▪ Frequently shifts activities. ▪ Easily distracted.
Concentration and imagination	Creativity	▪ Hypomanic: thinks and acts at great speed ▪ Daydreams. ▪ Preoccupation, good imagination
	ADHD	▪ Often does not seem to listen. ▪ Daydreams ▪ Difficulty concentrating

* Adapted from Cramond (1994, 1995).

Organization	Creativity	▪ Tolerance for ambiguity ▪ Finds order in chaos.
	ADHD	▪ Difficulty organizing work. ▪ Often loses things necessary for tasks.
Independence	Creativity	▪ Freedom of spirit that rejects limits imposed by others.
	ADHD	▪ Needs a lot of supervision.
Energy and Activity	Creativity	▪ Radiate vitality. ▪ High energy level
	ADHD	▪ Excessive running and climbing. ▪ Excessive fidgeting, difficulty stat, motor restlessness, always on the go.
Risk Taking	Creativity	▪ Willing to take chances, risk taking.
	ADHD	▪ Often engages in physically dangerous activities without considering possible consequences.
Impulsivity	Creativity	▪ Impulsive.
	ADHD	▪ Often acts before thinking. ▪ Frequently calls out in class, difficulty waiting turn.
Sociability	Creativity	▪ Unconventional behaviour. ▪ Emotionally independent-preferring solitary to group activities.
	ADHD	▪ Negative social interactions. ▪ Solitary play.
Self Talk	Creativity	▪ More self talk during problem solving.
	ADHD	▪ Talking during tasks.
Emotionality	Creativity	▪ Experiencing deep emotions. ▪ Emotional instability.
	ADHD	▪ Mood changes quickly and drastically. ▪ Difficult temperament.

Although individuals with ADHD and creative individuals may have some similar behavioural characteristics, to date, the exact nature of the relationship, if any, between ADHD and creativity is not known.

The researcher argues that individuals with ADHD and creative individuals may have similar behaviour but the cause, character, and the reason behind the behaviour are different. For example, both children with ADHD and creative children shift from one activity to another, but a creative child moves to another activity because the first task was boring or too easy to him/her. Additionally, a creative child has a wide range of interests to shift to and usually he/she will get back to the first activity and do it properly and in an unusual way. In contrast, a child with ADHD probably will shift to another activity because the first task was too difficult or because he/she cannot focus on the task and usually he/she will complain loudly, avoid, or not get back to the first activity once he/she leaves it. It might be worthwhile to mention that the current researcher (who is a qualified special education teacher and clinical psychologist, and has ADHD) bases her argument on her own personal experience and knowledge because of the lack of scientific evidence regarding the relationship, if any, between ADHD and creativity.

Based on analyzing Cramond's studies, the current researcher also believes that the percentage of twice-exceptional children who are both gifted and have ADHD might be high. It might be higher than the percentage of other twice-exceptional children (e.g. Gifted/LD, that is, children who are both gifted and have learning disability). This might be due to the overlap between ADHD and creativity which might also explain why some academics and clinical professionals (e.g. Hallowell and Ratey, 1994a, 1994b; Hartmann, 1996, 1997, 2003; Kelly and Ramundo, 1995; and Weiss, 1997) assume that creativity is a significant feature of ADHD. Although they did not back their assumption with scientific evidence, they based it on their observation of patients they witnessed in their practice.

According to Cramond's studies there are 32% of children with ADHD who might be considered as creative children (based on their performance on the TTCT) which means 68% of children with ADHD did not perform creatively on the TTCT. Additionally, there are 26% of children registered on the *Torrance Creative Scholars Program* who were classified as gifted and talented and might be considered as having ADHD (based on their performance on measure of ADHD) which means 74% of the gifted and talented children did not exhibit a sign of ADHD. Therefore, the current researcher argues that it is imperative for professionals (such as physicians, psychiatrics, psychologists, and teachers) who diagnose and assess children with ADHD to consider both the percentage of twice-exceptional children who are creative and have ADHD which might be high, and the overlap of ADHD and creative behaviours reported by Cramond (1994a, 1994b, 1995). This possibly will result in more accurate diagnoses which clarify whether the child is a bright and creative child who sometimes behaves with ADHD-like behaviour, a twice-exceptional child who is a creative child and has ADHD at the same time, or a child who only has ADHD. The accuracy of diagnosing children with special needs is highly important. It helps to create and design an efficient individualized educational plan (IEP) in which the child's needs are addressed accurately. Additionally, those children who are both gifted and have ADHD (twice-exceptional) should not be excluded from creativity training because of their disability (having ADHD).

The above comparison between ADHD and creativity might raise the argument whether creativity training is a suitable practice to be used with children with ADHD. Although the assumption that creativity training may cause more problems for children with ADHD reflects poor understanding of both concepts (ADHD and creativity) it should be addressed for one important reason, teachers' knowledge about creativity and ADHD. Teachers do not have proper knowledge about ADHD (see Jerome *et al*., 1994, 1998; Sciutto *et al*., 2000; Torsky and Waishwell, 1998), and they also do not have proper knowledge about creativity (see Davis and Rimm, 1998; Sternberg, 2003; Treffinger *et al*., 2002; Pope, 2005). Central to this argument is the discussion of whether raising the creativity of children with ADHD will result in raising more problems for them. For example, risk taking is a feature of both creativity and ADHD. Consequently, creativity training might increase the frequency of risk taking which might include unwanted behaviour such as engagement in physically dangerous activities without considering possible consequences.

The current researcher disagrees with the above argument. She also believes that the fear of raising more problems because of raising creativity is unjustified, basically because the objective of creativity training is not to encourage, but rather, to reform the negative behavioural characteristics of creativity. It is very well known - to everyone who works in the field of creativity - that creativity training programmes are design to help children to:

- Explore and understand their personality, individuality, and ability.
- Reform the qualities within themselves that they think are negative and might prevent them from building and understanding their relationships with others.
- Develop and nourish the qualities within themselves that they think are positive and helpful to them to achieve a successful and happier life.

Therefore, creativity training might help children with ADHD by enhancing their understanding of themselves which probably will lead them to strengthen and nourish the positive qualities that they were born with, and to reform the negative aspects of having ADHD. For example, children with ADHD have attention difficulty, they have a short attention span and cannot focus on the material presented in the class. Instead, they daydream. Creativity training might help the child to transform this difficulty or problem (daydreaming) into a strength (having a creative imagination). A special education teacher who specializes in the field of gifted and talented will help the child to:

- Recognize and understand his/her difficulty or negative quality (daydreaming) as part of his/her personality and individuality.
- Reform this negative quality (daydreaming) to a wonderful use of imagination that enhances creative ability by: 1) training the child to daydream purposefully for an hour or a half hour a day, and then to write in his/her personal notebook what he/she wondered and daydreamed about. 2) helping the child to specify and schedule time for daydreaming. 3) helping the child to focus on the material presented in the class, and if he/she is tempted to daydream, he/she should write down what he/she wishes to daydream about in his/her personal notebook in order to daydream about it during his/her scheduled time for daydreaming. 4) encouraging the child to make use of his/her daydreaming by using what he/she wrote in his/her personal notebook as ideas for his/her school projects, drawing class, and creative writing class.

Furthermore, thinking and creativity training programmes help children to learn and implement techniques and skills that are essential to every aspect of their lives. For example, lesson two (*Consider All Factors*, CAF) from CoRT[*] (which is used in the current study) teaches children to "think more effectively about a situation by looking as widely as possible at all the factors involved in

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[*] This description is adapted from de Bono’s CoRT thinking lessons (1998) and also available at de Bono's website: http://www.edwarddebono.com/Default.php

that situation before coming up with an idea. Otherwise, they tend to think only about the first factors that come to mind". Lesson four (*Consequence and Sequel*, C&S) is based on the assumption that "any action has either an immediate, short, medium or long term consequence. In some circumstances, action has all these consequences, therefore a thinker needs to be aware of these possibilities". This lesson, then, is to help students to forecast the possible consequences of a decision or action over time. Impulsivity is a hallmark of children with ADHD and they do need to consider the consequence of their behaviours. Thus, these lessons might help them to overcome this difficulty. See appendix E for full description of CoRT lessons. Lastly, creativity training includes activities (e.g. brainstorming, analogies, creative problems solving, and questioning techniques) which might help students develop the valuable skills that improve academic performance such as the ability to transfer knowledge from one domain to another (see Ritchhart, 2004; Sternberg, 2003; Sternberg and Williams, 1996).

CHAPTER FIVE

CONCEPT MAPPING

Introduction

In this chapter, the origins of concept mapping will be discussed. The purposes and applications of concept mapping (learning, teaching and instructional tools, cognitive/mind tools, and assessment tools) will also be covered.

The Origins of Concept Mapping

In the early 1970s Joseph Novak and his colleagues at Cornell University presented concept mapping as a tool to represent knowledge structures. Concept mapping is based on Ausubel's Assimilation Theory. According to Novak (1977, p. 76) Ausubel's theory of structuring knowledge which focused on prior knowledge and meaning as key factors in learning is based on the following key concepts or processes:

- *Subsumption*: "new information often is relatable to and subsumable under more general, more inclusive concepts". Thus, it is the process of integration of the new information into the relevant existing knowledge (Novak and Gowin, 1984, p.97).

- *Progressive differentiation*: "meaningful learning is a continuous process wherein new concepts gain greater meaning as new relationships (propositional links) are acquired" (Novak and Gowin, 1984, p.99). Thus, as meaningful learning progresses the meaning of a concept increases and become clearer.

- *Superordinate learning*: A more general new concept relates to the meaning of two or more related and less inclusive ideas (Novak and Gowin, 1984).

- *Integrative reconciliation*: The learner "recognizes new relationships (linkages) between related sets of concepts or propositions" (Novak and Gowin, 1984, P.103). Since the new relationships are formed between various previously isolated concepts or ideas, it is likely that the new learning breaks the isolation of concepts, displaces misconceptions, and opens explanation of similarities and differences between related concepts or ideas (Ausubel, 1968; Ausubel *et al*., 1978; Novak, 1977; 1990a; Novak and Gowin, 1984; Wandersee, 1990).

A concept is a regularity in objects e.g. "dog" or events e.g. "rain" designated by a label. Concept maps are visual representations of concepts and the meaningful relationships that exist among or between related concepts in the form of propositions. Thus, concept maps are a form of knowledge representation (Mintzes *et al*., 2001; Novak, 1990a, 1998; Plotnic, 1997). A concept map consists of:

- *Nodes*: to enclose concepts labels, so, each concept is enclosed in a box, circles, oval, or other shapes.

- *Linking lines*: to connect the nodes that are related. The links between the nodes can be one-way or two-way directional, but the linking line/s must have arrows on either single or double-headed to point out the relationship expressed by the linking word/s.

- *Linking word/s*: a word or phrase provides meaning to linkages by describing the relationship between two connected nodes.

- *Labelled lines*: a labelled line is a linking line with a linking word/s on it.

- *Propositions*: a proposition is a meaningful statement consisting of two or more nodes connected with labelled line/s.

- *Structure*: nodes and labelled lines must be organized in a hierarchal manner by placing the key/s concept and the broadest, general, most inclusive concepts at the top of the concept map and more specific detailed concepts below, near the bottom of the concept map. Thus more inclusive concepts subsume more specific concepts and a concept map can be read from top to bottom.

- *Cross-links*: to show interrelationships among the nodes on different branches of the hierarchy.

- *Examples*: to clarify the meaning of a given concept. They are specific examples of events or objects and do not represent concepts. Therefore,

> unlike concepts, examples are not enclosed in a box, circles, oval, or other shapes (Anderson and Huang, 1989; Bolte, 1999; Dabbagh, 2001; Gavrilova *et al*., 1999; Mintzes *et al*., 2001; Novak, 1990a, 1990b, 1993, 1998; Novak and Cañas, 2006a, 2006b; Novak and Gowin, 1984; Novak *et al*., 1983).

Given that concept mapping is a technique for visualizing concepts and propositions, it possibly will provide a schematic summary of learning that has occurred after a learning task has been completed (Novak and Gowin, 1984; Novak, 1998). More importantly, a concept map will reflect an individual's knowledge structure in a given topic, subject, domain or area under discussion. Since a concept map represents how an individual cognitively organizes information, there are no two concepts maps exactly the same. Additionally, as the individual's knowledge and understanding develops over time, his/her concept map will also change over time (Dabbagh, 2001). Figure 5.1 shows a sample concept map about concept maps, and Figure 5.2 shows a concept map showing key concepts in concept mapping.

The phrase *concept maps* has been used interchangeably with mind maps, knowledge maps, graphic/visual organizers, and semantic webs (Anderson-Inman and Ditson, 1999; Clayton and Nordstrom, 1987; Novak, 1990a). However, Cañas *et al*., (2003) distinguished concept maps from other mapping systems such as knowledge maps, mind maps, cognitive maps, and semantic networks by

> their theoretical basis in Ausubel's Assimilation Learning theory and constructivist epistemology, their semi-hierarchical organization, the use of unconstrained and meaningful linking phrases, and the way concepts are defined (p.13).

An elaboration of these distinguishing characteristics can be found in appendix C.

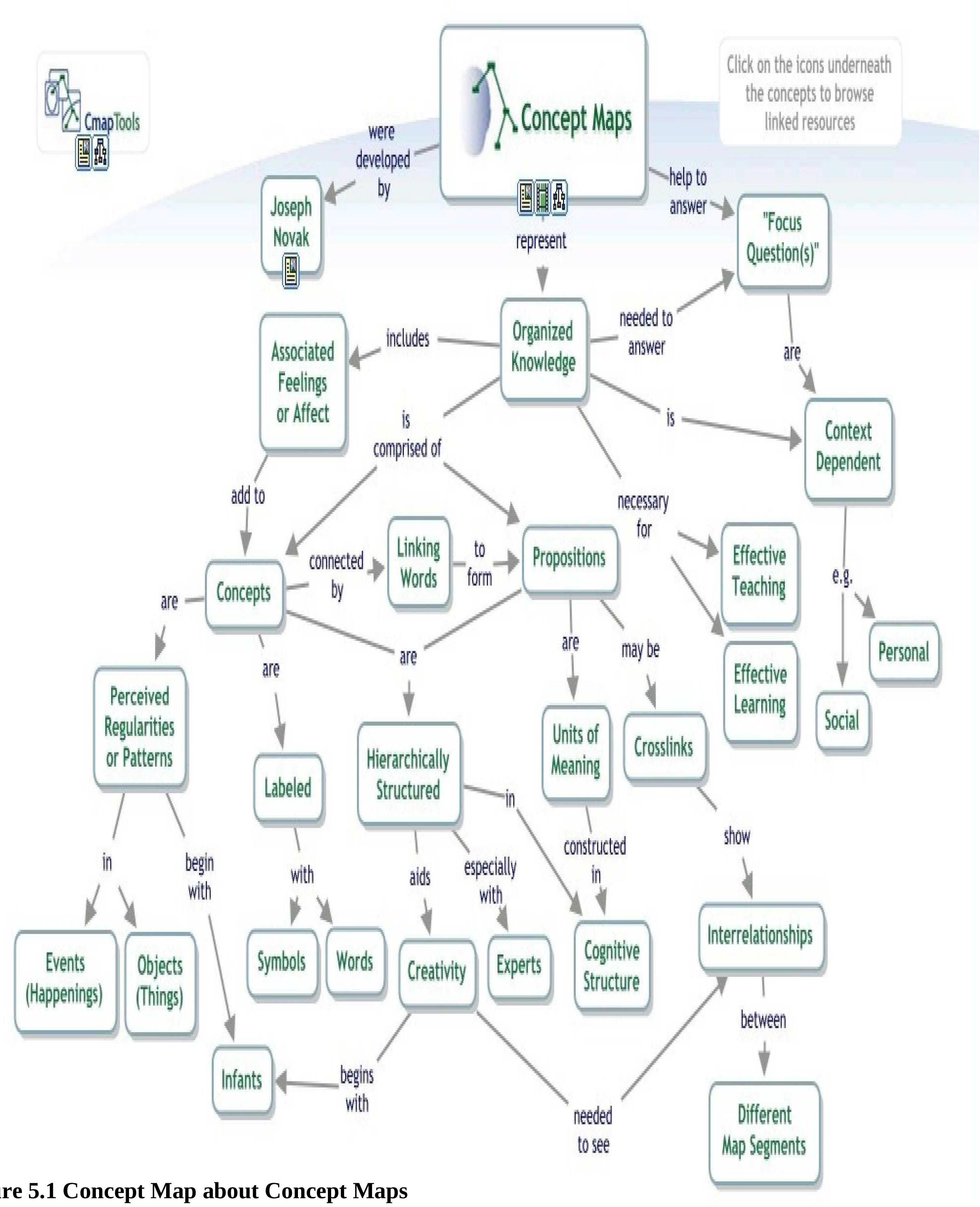


Figure 5.1 Concept Map about Concept Maps
Adapted from: Institute for Human and Machine Cognition.
http://ihmc.us/

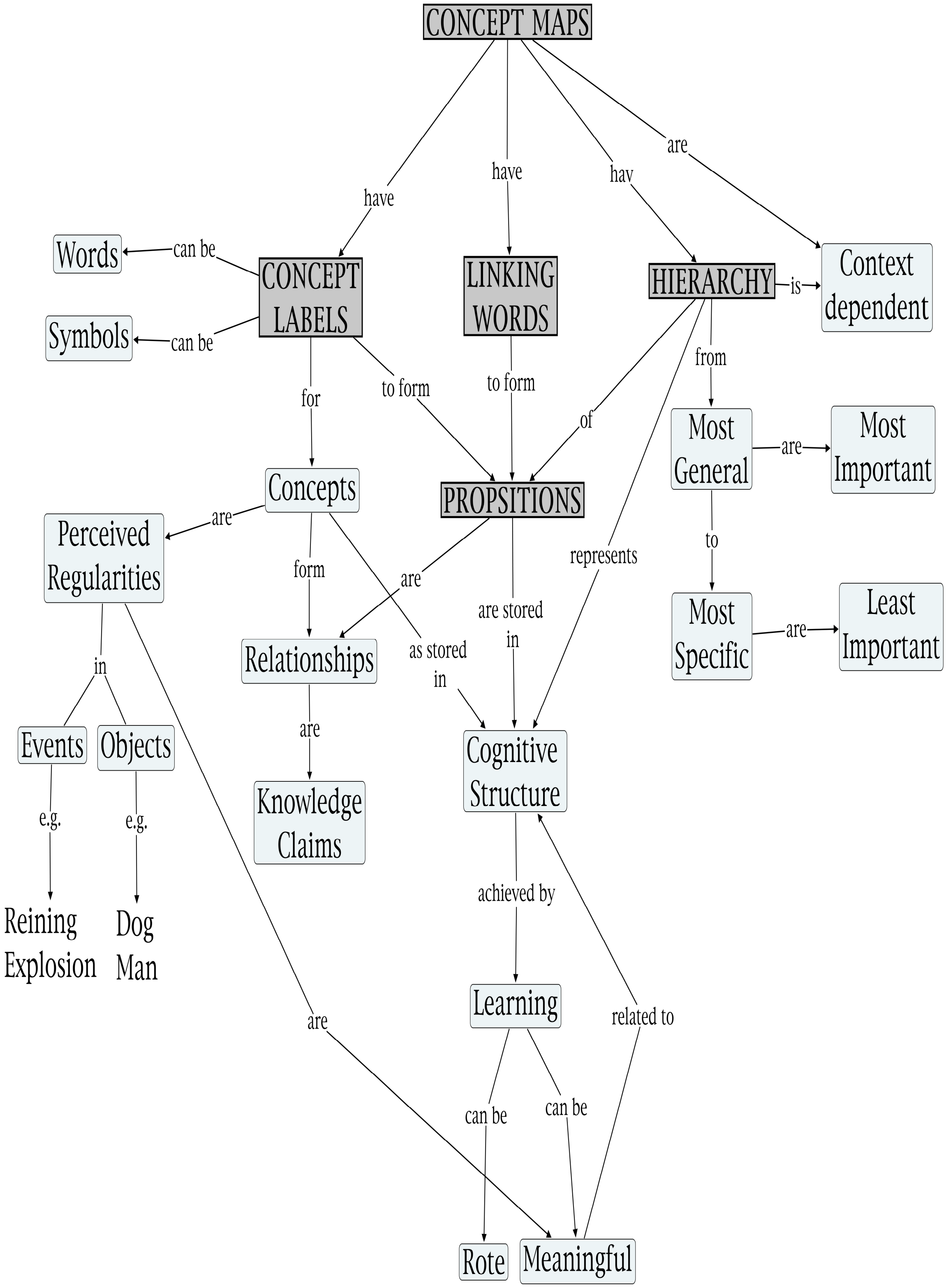


Figure 5.2 Concept Map Showing Key Concepts in Concept Mapping
Adapted from: Novak (1991, p.49)

Purposes and Applications of Concept Mapping

Concept mapping could be used for several purposes such as brainstorming, taking notes, designing a complicated structure, and negotiating complex ideas (Plotnic, 1997). For an educational intention, concept mapping is widely used in a variety of educational settings such as science teaching, teacher education, programme evaluation and planning, evaluation of understanding and conceptual change, and diagnosing misunderstanding (Aidman and Egan, 1998). The main applications of concept mapping in educational contexts are briefly discussed in the following subsections:

Learning, Teaching and Instructional Tools

It is more likely that children who find memorisation easy will choose to learn by rote memorization with little interaction with previous knowledge. On the other hand, children who find memorisation difficult will choose to learn through meaningful integration of new concepts into previously existing cognitive structures. Some might argue that children have no choice over their learning, simply because schools' curriculum and teaching methods used by teachers might force them to learn by rote memorization. In school contexts, therefore, this argument is obviously applicable to most children. However, there are some children who were born with great memory and auditory capacity (see Guilford's model of *the Structure of Intellect*, SOI, in chapter two). Those children are more comfortable with learning by rote memorization because their learning style makes processing information meaningfully (through integration of new concepts into previously existing cognitive structures) difficult.

The current researcher does not advocate universal rote learning, rather she argues that just as some children find memorizing difficult there are other children who find memorizing easy and might choose to learn by rote memorization. For those children, therefore, teachers should consider two things. First is the child's ability. The current researcher, although she has been unable to locate any brain research or empirical study to prove it, believes that memorizing some pieces of good writing (e.g. narrative and poetic) might help children to improve their listening and language abilities. Children with great memory and auditory capacity might benefit from enhancing their natural abilities in many ways such as through theatre performance of narrative and poetic texts. However, the current researcher also believes that in schools the time allocated for practising and celebrating the rhythms of literature should be little and also limited to homework, in order that it does not consume much of the classroom time. Second and more importantly, teachers should assist children who have great memory and auditory capacity to understand that learning a new concept by memorizing the concept's definition is representational learning, and that the child should makes further efforts to learn the concept meaningfully by relating the concepts and propositions of the definition to relevant and prior knowledge which already exists in his/her cognitive structure.

Teachers are able to encourage, help, and lead all their students to choose powerful and meaningful learning approaches by using teaching strategies which can empower students to take charge of their own learning in a highly meaningful fashion (Ausubel, 1968; Novak and Gowin, 1984; Novak, 1998). In this section the current researcher argues that concept mapping is an appropriate strategy to teach children how to learn meaningfully. As argued in Ausubel's theory, meaningful learning is individual and requires association of newly learned concepts with what the learner already knows. Concept mapping focuses on the individual student's discovery of meaning (Ausubel *et al*., 1978; Boxtel *et al*. 2002; Cliburn, 1990; Tergan, 2004). More specifically, in creating a concept map, children are able to structure concepts using their perspective rather than someone else's. They draw their map upon their relevant prior knowledge (Novak and Gowan, 1984).

Concept mapping, via illustrative language labels used to construct concept and propositional relationships, can help children to recognize information which they have understood previously. It might also help them to identify recognizable gaps in their understanding of a particular domain of knowledge (Hyrle, 1996; Novak and Gowin, 1984; Novak and Heinze-Fry, 1990; Roth and Bowen, 1993). Additionally, concepts in a concept map are structured hierarchically which reflects the hierarchical and progressive nature of knowledge as illustrated in Ausobel's theory. Therefore, concept mapping helps students organize their cognitive frameworks into more powerful and integrated patterns which might lead to consistent, hierarchical, and coherent knowledge structures (Gavrilova *et al*., 1999; Novak, 1998).

Concept mapping is a method that may also aid in facilitating active learning. The process of creating a concept map might allow all children to participate and to make use of their prior knowledge (Gold and Coaffee, 1998). Irvine argued that "concept mapping not only facilitates meaningful learning, but makes the learners into active processors of information rather than passive listeners" (1995, p. 1178). Horton and colleagues further argued that concept mapping, as an instructional strategy, can be used to actively engage children in learning activities. The above argument was supported by findings of meta-analysis findings. These findings revealed that concept mapping as an instructional tool significantly improved children's achievement and attitudes (Horton *et al*., 1993).

Concept maps by teachers can be used to help children to understand what is being taught. Likewise, concept maps by children help teachers understand what is being learned. Moreover, teacher-made and student-made concept maps can be used to exchange their views on a particular topic being studied, to discuss meanings, and to point out any misconceptions (Anderson-Inman and Ditson, 1999; Novak and Gowin, 1984).

As a study strategy, concept mapping can be “a valuable learning technique that helps children to visually organize their understanding of the subject” (Aidman and Egan, 1998, p.277). Concept mapping might assist children in translating ideas from a text into a visual representation which displays whole relationships of content ideas. Thus, concept mapping can help children to understand how a text is organized (Guastello *et al*., 2000; Novak and Gowin, 1984; Kirschner and Gerjets, 2006).

As a planning tool, concept maps can be used as an effective tool by both students and teachers. Students can use concept maps as a study aid in organizing thoughts, planning time, planning research papers, group writing projects, and examining their understanding of a content area under study. Similarly, teachers can use concept mapping to organize curriculum plans, create lesson plans, and adapt instructions to student’s needs by assessing concept maps made by students (Anderson-Inman, *et al*., 1998; Dabbagh, 2001; Zipprich, 1995).

In concept mapping technique information is displayed with categories related to a core concept and the relations between concepts represented hierarchically and visually. By using concept mapping students might use prior knowledge and experiences to increase or expand their knowledge through vocabulary development and discussion. Therefore, concept mapping has been recommended as a useful technique to advance vocabulary development and reading comprehension (see Cleland, 1981; Clewell and Haidemos, 1983; Heimlich and Pitelman, 1986; Johnson and Pearson, 1984; Schwab and Coble, 1985; Sinatra *et al.*, 1984, 1985).

Writing is frightening for most students either because their lack of knowledge about their subject makes idea generation difficult or because when they write they cannot get their ideas together and concept mapping can help ease and overcome this barrier (Lin *et al*, 2004; Novak and Gowin, 1984; Scardamalia and Bereiter, 1986). Concept mapping, it has been argued, assists students to “map out” their ideas. Concept mapping also might aid students in constructing sentences and paragraphs by simplifying information and recognizing important relationships between concepts and paragraphs in the text (Avery *et al.*, 1996; Margerum-Leys, 1999; Pehrsson and Denner, 1998). Chiangmai (1998) found that writing through concept mapping did enhance students' achievement compared to writing through a traditional method.

Empirical research on the effects of using concept mapping (e.g. Aidman and Egan, 1998; Anderson-Inman *et al.*, 1998; Avery *et al.*, 1996; Bakken *et al.*, 1997; Blair *et al.*, 2002; Boyle and Weishaar, 1997; Bulgren *et al.*, 1988; Chiangmai, 1998; Clayton and Nordstrom, 1987; Cleland, 1981; Clements-Davis and Ley, 1991; Clewell and Haidemos, 1983; Dabbagh, 2001; Dimino *et al.*, 1990; Gallego *et al.*, 1989; Gardill and Jitendra, 1999; Gavrilova *et al.*, 1999; Guastello *et al.*, 2000; Gurney *et al.*, 1990; Heimlich and Pitelman, 1986; Idol and Croll, 1987; Margerum-Leys, 1999; Montague and Bos, 1986; Morin and Miller, 1998; Newby *et al.*, 1989; Novak, 1990a 1990b, 1991, 1993, 1998; Novak and Gowin, 1984; Pehrsson and Denner, 1998; Plotnic, 1997; Reyes *et al.*, 1989; Roberts and Joiner, 2007; Scandlon *et al.*, 1996; Scardamalia and Bereiter, 1986; Schwab and Coble, 1985; Sinatra *et al.*, 1984, 1985; Sturm and Rankin-Erickson, 2002; Zipprich, 1995) found that students with various characteristics (e.g. learning disability, mental retardation, and low achievement) who were taught through concept mapping strategies learn significantly better than students taught through traditional methods. It is worth mentioning that only a small percentage of students with learning disabilities experience difficulty with visuospatial functioning (Kirk *et al*., 2000). From the evidence in the literature in this section, therefore, it would appear that concept mapping may be an appropriate tool for supporting and enhancing the teaching, learning and instruction of learners with ADHD. The relationship between concept mapping and learners with ADHD is developed further in the next section.

Cognitive/Mind Tools

Enhancing the cognitive powers of individuals during thinking, problem solving, and learning is the purpose of using a cognitive/mind tool (Gavrilova *et al*., 1999). Concept mapping, according to Novak and Gowin, was "developed specifically to tap into a learner's cognitive structure and to externalize for both the learner and the teacher to see what the learner already knows" (1984, p 40). Jonassen and Grabowski declared that concept maps explain how prior knowledge is interrelated. They also called the relationships between ideas in a knowledge domain the structural knowledge. In addition, Jonassen and Grabowski asserted that visual representations of concept maps allow learners to gain an overview of a domain of knowledge (as cited in Plotnic, 1997). Concept mapping is considered a problem-solving tool which can help learners to generate alternative solutions and options (Plotnic, 1997; Okebukola, 1992).

There are many different cognitive theories (e.g. information processing theory, schema theory, connectionist models of thinking, and non-linear dynamic models), but the main purpose of each of them is to give an explanation of how a human mind works cognitively. Here the current researcher will argue that the common main features of these theories which support the use of concept mapping as a cognitive tool are as follows:

Attention: The first principle in any cognitive theory is that in order to learn students must attend to the relevant information (Driscoll, 1994). The procedure of creating a concept map pulls children towards building connections (links) among concepts. Subsequently they are required to pay attention to every concept they wish to map which, one could assume, helps them to focus on the relevant information (Novak and Cañas, 2006a). If it is the case that concept mapping helps children to pay attention and focus on the relevant information, then the current researcher anticipates that a child with ADHD who usually has great difficulty with sustained and vigilant attention (Hooks *et al*., 1994; Milich *et al*., 1982; Zentall, 1985) might benefit from using concept mapping to improve his/her attention ability.

Schemas: A schema is a data or knowledge structure for representing the general concepts stored in the memory. There are different types of schema or knowledge representations (e.g. declarative knowledge, procedural knowledge, and structural knowledge). Declarative knowledge (knowing what) involves knowledge that student can talk about. Procedural knowledge (knowing how) involves knowledge that student can do such as crossing a street (Dillon, 1986; McNamara, 1994; Phye 1997; Rummelhart, 1980; Rummelhart and Norman, 1978). According to Dabbagh (2001) concept mapping assists students in producing structural knowledge (knowing why) which helps them think in meaningful way by enhancing the relationship between declarative knowledge and procedural knowledge. The current researcher argues that concept mapping might represent schemas by placing propositions (a proposition is the smallest unit of knowledge that can be expressed as words, and in concept mapping is used to judge the validity of the relationship between two concepts) in relation to other propositions thus forming networks. Additionally, representing schemas in the form of maps allows the schema to be uncovered. Therefore, children may be able to see a clearer picture of their thinking (Ruiz-Primo, 2000).

Although the learning styles of children with ADHD may vary, most of them prefer visual learning (Barkley, 2006b; Brown and Quay, 1977; Gordon, 1979; Milich and Kramer, 1985; Rapport *et al.*, 1986). The current researcher, therefore, proposes that a child with ADHD might understand and capture the concepts more readily through concept maps which present information visually.

Meaningful encoding: Organizing information into chunks and units help students makes a meaningful encoding (Gagne, 1962; Grossberg, 1980; Tulving and Thompson, 1973). Through mapping a concept map students create chunks and units which help them store information in the long-term memory (Armbruster and Anderson, 1981; Novak and Cañas, 2006a). Since the vast majority of children with ADHD are characterized as experiencing high levels of impulsivity due to their poor sustained attention ability (Barkley, 2006b; Brown and Quay, 1977; Gordon, 1979; Milich and Kramer, 1985; Rapport *et al.*, 1986), the current researcher anticipates that a child with ADHD might benefit from using concept mapping to take more control over his/her impulsivity by spending some time thinking how to create groups and sub-groups of related concepts in a concept map. This might help children with

ADHD to encode information meaningfully which might in turn lead to better and more meaningful learning.

Retention and retrieval of information: Retrieval of an item from memory is based on activating its internal representation. Therefore, the activation of a neural node passes through the links to other nodes in the network. As long as the node is the focus of activation the node is a source of activation. Distance in the network and shifting focus decay the activation of the node. Concepts associated with many other concepts or which have more meaningful understandings are more active and are retrieved faster than other concepts (Pressley and McCormick, 1995). The current researcher argues that children (including those with ADHD) who use concept mapping techniques might develop an efficient activation and a better recall of information from long-term memory. The ground of this argument is that a concept map is a network of concepts which are cross-linked, and also organized and connected hierarchically. This should allow children to see relations among concepts, ideas, and categories which might assist them in activating their prior knowledge (Novak and Heinze-Fry, 1990; Pressley and McCormick, 1995; Sturm and Rankin-Erickson, 2002). Activating the child's prior knowledge through concept mapping techniques should make understanding and retrieving information much easier and more efficient.

Patterning and paralleling: The human brain, it has been argued, seeks to make sense by perceiving and generating patterns (meaningful organization and categorization of information) and resists having isolated, meaningless pieces of information imposed upon it (Bruer, 1993; Caine and Caine, 1997; Glieck, 1987; Newell and Simon, 1972; Numela and Rosengren, 1988; McClelland and Rumelhart, 1986; sylwester, 1995). The human brain has also been likened to a parallel processor which can accommodate schema from many different memories at the same time. According to Caine and Caine (1995) this principle can be put into practice through thematic teaching. This implies that every experience contains within it the seeds of many, and possibly all, disciplines. One obvious way this notion might be helpful to teachers is to encourage them to teach their students through thematic teaching. Thematic teaching might assist children in relating all the information taught in the classroom (Caine and Caine, 1995). Concept mapping may be a valuable method of achieving thematic teaching as children could relate and connect all the information and ideas learned in different subject areas in a concept map.

Holistic: Learning can also be conceptualised as a collective, holistic understanding of ideas and how the whole relates to the parts (Glieck, 1987). Hyrle assumed that concept mapping is “one way to describe how a system functions and when innovative thinking in one part of the system has an effect on the total system” (1996, p. xi). Hyrle's assumption seems to stand up well. Concept mapping might assist children in developing holistic understanding through placing more general concepts at the top and more specific ones at the lower levels of a concept map. Thus, information is displayed hierarchically and visually which might aid holistic understanding of the core concept via its relations with other concepts.

Chaos: Learning, it has been argued, in humans changes over time in a nonlinear dynamic manner to accommodate new ideas (Glieck, 1987; Guess and Sailor, 1993; sylwester, 1995). If the argument that our learning is the outcome and reflection of our mind's journey from chaos to equilibrium is valid and applicable to everyone (including children with ADHD and highly creative children who have been characterised by the ability of finding order in chaos, see chapter four), then the current researcher argues that concept mapping might aid our mind's journey. The process of creating a concept map requires children to connect different aspects of theme and find relationships between concepts in different sections of the map. Thus, concept mapping might provide children with feedback and help them to develop understanding in the knowledge domain through renewed meaning of concepts.

Based on the above, one might conclude that the use of concept mapping as a cognitive tool is supported by cognitive theories. Additionally, results of experimental studies also supported the efficiency of using concept mapping as an appropriate cognitive strategy. For example, Jonassen and colleagues affirmed that concept mapping facilitates the development of representation of domain knowledge. They stated that higher order thinking depends on well-organized, domain-specific knowledge and concept mapping is predictive of different forms of higher order thinking, such as problem solving and reasoning. Concept mapping also can help transfer these skills to a set of similar problems (Jonassen *et al*., 1997). Okebukola (1992) concluded that the students engaged in concept mapping were better able to solve biology problems. In a study of three experiments, Derbentseva and colleagues (2007) found that concept maps also improved dynamic thinking.

A key theoretical hypothesis underlying the present study is that creativity training programmes (e.g. *CoRT*) might promote metacognition and higher order thinking skills, and since concept mapping has been considered as a cognitive tool, then concept maps following creativity training should reflect the improvement, if any, in the children's metacognition through the complexity of their concept maps. Apparently then, in the present study, it will be valid to use concept mapping as a measurement tool. This will be discussed in the next section.

Assessment Tools

Concept mapping has been seen as an externalized representation of the learner's knowledge (Anderson-Inman *et al*., 1998; Anderson-Inman and Zeitz, 1993, 1994; Dabbagh, 2001; Plotnic, 1997). Concept maps, therefore, may be considered as one valuable assessment and diagnostic tool. Teachers may be able to use concept mapping to evaluate students' understanding. They also may be able to use concept mapping to diagnose any misconception that their students may have on the topic or unit the students have learned or are engaged in (Anderson-Inman *et al*., 1998; Anderson-Inman and Zeitz, 1993, 1994; Dabbagh, 2001; Plotnic, 1997).

A significant correlation between students' performance on concept mapping and on conventional tests, such as multiple-choice evaluations was affirmed by Stoddart and colleagues in their review of the literature on concept mapping (Stoddart *et al*., 2000).

Furthermore Ruiz-Primo and colleagues asserted that concept mapping do not only evaluate most of the aspects of learning that conventional tests assess but also measure other aspects of learning which may well be difficult to measure by conventional tests. For example, declarative knowledge can be measured by a multiple-choice test but structural knowledge is far too complex to be assessed in the way declarative knowledge is measured (Ruiz-Primo, 2000, 2004; Ruiz-Primo *et al*., 1997).

Markham and colleagues emphasized the validity of using concept mapping technique as a research and evaluation tool. They stated that:

> concept map offers an opportunity to significantly broaden the range of evaluation practices in current use, which may well be the most important

> single step [teachers] can take to encourage meaningful learning" (1994, p.100).

However, Novak and colleagues reported low correlations between students' scores on concept maps and on conventional tests such as scholastic aptitude tests and final course grades (Novak *et al*., 1983). In this regard, Markham and colleagues explained that the low correlations reported in the study of Novak and colleagues might be due to the difference between knowledge acquired through rote and meaningful learning modes and the lack of most conventional tests to differentiate between the two forms (Markham *et al*., 1994, p.92). A further consideration of the result given by Novak and colleagues is presented below.

Based on his experimental study, Otis (2001) divided 546 maps of students in the medical school into "good" maps which had clear layers with many valid links and "poor" maps which had simple layers with few valid links. He then compared the scores of concept maps with the students' final course scores. Otis found that 75% of these maps were good and created by students who were average in their academic performance. More importantly the other 25% which were poor maps were created by students who either scored high or low in the final course exam. Otis explained that a concept map is a personal creation by the student and an outside reader may misunderstand the map. Thus, "the strength of [a]concept map is not what is transferred to paper but the amount of information the selected nodes spark in the mind of the students" (p.142). Therefore, students who scored high scores on the final course exam used their "poor" maps as a set of keys to help them open their memory and activate a large body of both knowledge and understanding (Otis, 2001). This explanation by Otis may also possibly clarify the low correlations reported in the study of Novak and colleagues between concept maps scores and most of the conventional tests (which usually measured the child's declarative knowledge obtained through rote learning) scores.

Although a number of studies have supported the reliability and validity of using concept mapping as an assessment tool, most of these studies also affirmed that further research is required. More importantly, these studies used a variety of methods of scoring and different styles of concept mapping techniques such as construct a map or fill in a map (Akkaya *et al*., 2005; Bolte, 1999; Cañas *et al*., 2003; Chung *et al*., 2006; Clariana *et al*., 2006; Conlon, 2006; Gouli *et al*., 2004; Gul and Boman, 2006; Liu, 2004; Liu and Hinchey, 1996; Liu *et al*., 2005; Osmundson *et al*. 1999; Ozdemir, 2005; Rice *et al*., 1998; Ruiz-Primo, 2000; Ruiz-Primo and Shavelson, 1996; Ruiz-Primo *et al*., 1997; 2001a; 2001b; Shavelson *et al*., 1993; Thomson, 1997; Walker and King, 2002; West *et al*., 2000, 2002; Yin *et al*., 2004, 2005). The current researcher, therefore, believes that concept mapping might assist teachers in assessing the level of the understanding and learning of their students. Teachers can use concept mapping to measure some of the same aspects of learning that conventional tests assess. They also can use concept mapping to measure other aspects of learning which conventional tests might fail to evaluate.

In the present study concept mapping was selected as a measurement tool to assess changes in metacognition for two reasons: first, due to the promising findings in a previous study by Russell and Meikamp (1994) in which they affirmed that creativity training did develop students' metacognitive skills and that the developing of metacognitive skills was evidenced by the complexity of the maps produced by the students in the experimental group compared to the maps produced by students who did not receive creativity training (p.298). Second and more important, as argued previously in chapter one, concept mapping might reflect the enrichment in children's creativity which might result from creativity training. Concept mapping has been seen by some researchers (e.g. Goldstein, 2001; Hill, 1994; Russell and Meikamp, 1994; Novak and Cañas, 2006a, 2006b; Novak *et al.*, 1983; and Otis, 2001) as a creative activity which could foster, reflect, and measure creativity. The current researcher, therefore, hypothesizes that children who will be given creativity training might create more complex concept maps through integrating information related to a key concept and concepts in different sections of the map.

Conclusion

From the moment Novak presented the concept mapping technique, it has been an interesting research topic for researchers from nearly every discipline (such as political science, business, medicine, nursing, biology, physics, mathematics, statistics, engineering, computing, psychology, art, and education). For example, in 1991 the *Journal of Research in Science Teaching* devoted a special issue to concept mapping, and the *Journal of Interactive Learning Research* also reflected researchers' attention to this technique as a research topic by publishing a special double issue on concept mapping in 1997. Unfortunately, to date, the field of creativity and ADHD has received very little attention from concept map researchers. However, many researchers have confirmed that the concept mapping technique, whether on paper or computer, with small group or whole class situations, is beneficial in both learning and teaching. It is also useful to students irrespective of whether they have learning problems or not.

CHAPTER SIX

REFLECTION ON CREATIVITY, ADHD, AND CONCEPT MAPPING

In this chapter there is a reflection on the literature presented previously about creativity, ADHD, and concept mapping. The assertion that research on creativity among children with ADHD is slight and is a justifiable area for the present study will also be highlighted.

In order to locate the greatest number of related studies to the present study, the researcher conducted a computer search using the following computerized data bases:

- *Australian Education Index* (AEI) http://www.dialogatsite.com/webcd/AtSiteExt.dll?Submit
- *British Education Index* (BEI) http://www.dialogatsite.com/webcd/AtSiteExt.dll?Submit
- *Educational Resources Information Center* (ERIC) http://www.eric.ed.gov/
- *ProQuest Dissertations & Theses* (PQDT) http://proquest.umi.com/pqdweb?RQT=306&TS=1203095169&clientId=29134

By the use of the key word/s "*concept mapping*", "*creativity*", and "*ADHD*", the search yielded these results which summarized in a tabular form as follows:

Table 6.1 Literature's Data Sources

Key word/s	***AEI***	***BEI***	***ERIC***	***PQDT***
Creativity	979	691	10348	6687
ADHD	162	44	1561	1817
Concept mapping	232	218	1165	356
Creativity, ADHD	0	0	13	0
Creativity, Concept mapping	0	0	16	13
ADHD, Concept mapping	0	0	0	1
Creativity, ADHD, Concept mapping	0	0	0	0

From data presented in Table 6.1 it might be reasonable to say that these concepts (creativity, concept mapping, and ADHD) were researched intensively, yet, the area of creativity among individuals with ADHD is greatly lacking in research. Additionally, concept mapping technique is rarely used as a research topic in both creativity and ADHD. The aim of the present study is to investigate the effects of creativity training (*the CoRT thinking lessons*) upon the creative ability of students classified with ADHD as measured by the ability to develop complex concept maps. These three concepts (creativity, concept mapping and ADHD) which this study considers are very complex and never explored together before. To the researcher's knowledge, there is no academic work done to investigate the effects of using creativity training on creative ability of children with ADHD through concept mapping technique. Therefore, in the following discussion the researcher will put these concepts together when it is possible and appropriate.

Creativity, as mentioned in chapter two, has been tackled and recognized differently by a large number of theorists through a diversity of research methodologies. Despite differences they all conclude, unsurprisingly, that creativity is an important quality for everyone to have. They also considered creativity training as a good activity, and that children might benefit from developing their creative thinking skills.

In regard to creativity among children with ADHD, some researchers and professionals in the field of ADHD reported that children with ADHD might have creative personalities. One obvious explanation of this is that ADHD and creative behaviours may overlap. In other words, there are some characteristics (such as risk-taking, energetic, attracted to novelty and complexity, argumentative, resistant to authority, demanding, uncooperative, may not do well in groups, spends time day dreaming, forgetful, careless, sloppy with details, egocentric, moody, sensitive, temperamental, impatient, impulsive, and overactive physically or mentally) which are common characteristics of creative children and also a hallmark of children with ADHD. The current researcher (as mentioned in chapter four) believes that children with ADHD and creative children may behave similarly but the cause, character, and the reason behind the behaviour might be different. The researcher also believes that not all of the above characteristics will apply to all children with ADHD nor to all creative children. Thus, the existence of the above characteristics does not necessarily guarantee the existence of ADHD or creativity.

Since children with ADHD have common characteristics with creative children and creativity training programmes are designed to help children to understand their personality, then creativity training might help children with ADHD to understand their negative qualities (e.g. daydreaming, sensitivity, and impulsivity) as part of their character and individuality. This might help children with ADHD to reform and modify these negative qualities in a more acceptable form to their environment. Creativity training, in that case, might help children with ADHD to achieve more successful and happier relationships with their parents, teachers, and friends.

The above characteristics might create more daily problems for children with ADHD. Since one important objective of any creativity training programme is to teach children the skill of generating more creative solutions to solve everyday problems, one may suggest that creativity training might help children with ADHD in solving daily problems, and that they should have the chance to be educated and prepared to think and behave creatively.

Concept mapping has been related to creativity (in the sense that concept mapping is an activity which could foster, reflect, and measure creativity). Creative behaviour might result from generalizing schemas from the individual's past experiences which provide a basis for perceiving problems, retrieving needed information, restructuring the Gestalt, and adding to the general schema. In a similar way, mapping a concept map - which focuses on the individual's discovery of meaning - requires the association of newly learned concepts with what the learner already knows. Thus, in creating a concept map, an individual structures concepts using his/her perspective rather than someone else’s. He/she draws his/her map upon his/her relevant prior knowledge. The process of creating a concept map empowers the learner to take charge of his/her own learning. The individual's personal awareness of how much control he/she has over his/her own learning may increase the individual's awareness of internal control and lead to deeper levels of cognitive engagement which can lead to creative behaviour.

Since concept mapping has been seen as an externalized representation of the learner’s knowledge (see Anderson-Inman *et al.*, 1998; Anderson-Inman and Zeitz, 1993, 1994; Dabbagh, 2001; Plotnic, 1997). It can be considered as a valuable assessment and diagnostic tool to assess changes in metacognition. Thus, concept mapping can be also considered as a suitable instrument for measuring creativity.

Gender differences in the above three concepts (creativity, ADHD, and concept mapping) will be presented in the next paragraphs. The current researcher has chosen to discuss the gender differences to present a general picture of these concepts. The current researcher is not trying to imply that females or children with ADHD are disadvantaged. In fact, she believes that every one (female/male, with/without ADHD) could enhance his/her creative abilities and should have the chance to do so.

In regard to the gender differences in creativity, many studies have arrived at very different results. Nevertheless, most creativity researchers have found no differences between the scores of males and females on creativity tests. In 1965 Torrance reported that, whether on verbal or non-verbal creativity measures, he did not find significant gender differences. Michel and Dudek (1991) also used TTCT and arrived at very similar results to that of Torrance. Results of a more recent study confirmed that no significant relationship was found between gender and creativity (Matud *et al.*, 2007). Baer (2007) reviewed more than 80 studies and found that more than half of these studies reported no difference, two-thirds of the others reported that females scored higher than males on creativity tests and one-third reported that males scored higher than females on creativity tests. More importantly, in respect to the benefit from creativity training - which the present study addresses - meta-analysis studies (e.g. Ma, 2006; Mansfield *et al.*, 1978; Scott *et al.*, 2004a, 2004b; Torrance, 1972) reported that creative abilities of both gender can be enhanced by training.

In 1902, Still observed that the majority of children with ADHD were boys. He also believed that this did not happen by chance. Today, most ADHD researchers have found (with ratios of 3:1- 6:1) ADHD is more frequently diagnosed in boys which led some to believe that ADHD is found primarily in boys (Barkley, 2006b; Batsche and Knoff, 1994; Newcorn *et al.*, 2001; Quinn and Nadeau, 2000). Thus, it is more likely that girls will not both be identified and/or treated. The *American Academy of Pediatrics* (AAP, 2004) highlighted this issue as follows:

> The fact that many more boys than girls are diagnosed with ADHD - at a ratio of approximately 3:1 - has led to the mistaken belief among many parents and teachers that ADHD is a "boys" disorder that rarely occurs in girls. This belief, along with the fact that girls are more likely to have inattentive-type ADHD that tends to be overlooked entirely or does not attract attention until the child is older, means that girls are less likely to be referred for evaluation and to receive the treatment they need. Even when diagnosis and treatment have been obtained, girls with ADHD are further disadvantaged by the fact that most ADHD research to date has focused on boys, and little is known about potential differences between the genders in the development to the condition over time or response to medication and other forms of treatment. (p.13)

Although the main symptoms of ADHD in females are similar to those in males, Nolan and colleagues (2001) found that comparing to males with ADHD, females with ADHD tended to be diagnosed with inattentive subtype. Additionally, Newcorn and colleagues (2001) reported that females with ADHD, in general, were less impaired than males with ADHD.

Given that most of the research on ADHD has focused on boys - as stated previously - Quinn and Nadeau affirmed that further research is needed regarding gender differences and ADHD. In their words:

> Although we have come along way in the last decade toward a better understanding of girls and women with ADHD, there remains much to do and many avenues yet unexplored. Two issues requiring immediate attention are the establishment of diagnostic criteria for girls and women with ADD without hyperactivity, leading to better incidence figures. In order to accurately assess incidence, rating scales will need to examine gender selection bias. Scales that focus on hyperactivity/impulsivity or externalizing behaviors will miss the majority of girls but especially those with ADD without hyperactivity. The development of self-rating scales for girls is critical to more accurate diagnosis and incidence reporting.... Girls with ADHD also have low self-esteem and poor peer relations. These conditions combined with impulsivity place girls at risk for unprotected sex and teen pregnancy. Does this also lead to an increase in sexually transmitted diseases in girls and women with ADHD? Are they at grater risk for suicide and suicide attempts? Are girls and women with ADD or ADHD presenting with eating disorders? How do poor social skills impact on girls and women with ADHD? Do women with ADHD have a higher incidence of divorce? Many questions seeking answers. Many women and girls seeking our knowledge,

> understanding, and help. What can we do to assist them in their quest for a better life? (2000, p. 224).

In their Meta-analysis study Horton *et al.* (1993, p. 107) failed to answer "whether concept mapping as an instructional tool had different effects for male and female students" because most studies did not address gender. Horton and colleagues find only one study by Jegedel *et al*. (1989) in which they affirmed that, among 51 Nigerian students, concept mapping reduce students' anxiety towards the learning of biology, but males demonstrated better achievement than females. However, Okebukola (1992) reported mixed results for gender in the use of concept mapping as a problem solving skill in science, but the females who get training on using concept mapping outperformed those in the control group.

On the basis of the above discussion on gender differences, it is evident from the literature that the benefits from concept mapping strategy or creativity training are not related to the child's gender. Thus, the current researcher suggests that every child should have the opportunity to develop and nourish his/her learning skills and creative thinking abilities.

To conclude, the literature is consistent about the importance of creativity to every individual and every community. The literature also affirmed that all people are creative to some extent and that creativity can be measured as well as taught. Furthermore, the literature highlights the importance of creativity training for everyone, and that creativity training may enhance creative thinking and behaviour.

Lastly, from reviewing the literature, it is sufficient to say that creativity among children with ADHD is an area sorely lacking in research. Therefore, filling a small space in the large gap that exists in knowledge of creativity among children with ADHD is a major aim of the present study. More importantly, the researcher hopes that information gained from this study will benefit children with ADHD through the understanding of their creative thinking. Thus, the purpose of the present study is to explore whether creativity training (*the CoRT thinking lessons*) can increase the complexity in concept mapping produced by children with ADHD who are fourth and fifth graders. The following chapter introduces the procedures followed in conducting this study.

CHAPTER SEVEN

METHODOLOGY

Introduction

The aim of this study is to explore the effects of creativity training upon concept mapping performance of children designated as having ADHD. This chapter outlines the procedures adopted to achieve this aim. The chapter begins with a description of the participants of the study, and the method of participant selection. Next the experimental design will be discussed, followed by a description of the procedures of data collection. The chapter concludes with a discussion of the instrumentations used in this study.

Participants

Sixty four girls ranging in age from 9 to 10 years were sampled from twenty four public primary schools located in Riyadh, capital of the Kingdom of Saudi Arabia. In the Kingdom - for a cultural reason - females are separated in their education from males, therefore it was difficult to include boys. All participants in this study were fourth and fifth grade students who were identified as having ADHD, having been diagnosed according to DSM-IV-RT criteria as expressed in Table 3.3 (see chapter three). The participants were of Saudi descent and came primarily from middle socioeconomic backgrounds.

The study required approval of the Ethics Committee at the *University of Glasgow*, Glasgow, Scotland; and the *Center of Care for Talented Female Students* (CCTFS), Riyadh, KSA. The director of the CCTFS offered her support to carry out this study in their schools by distributing a memo to all of the creativity and talent teachers in all of the primary schools in Riyadh city.

The memo introduced the study and requested teachers' cooperation pertaining to the study. Further, she approved the holding of meetings in the CCTFS.

Creativity and talent teachers who hold bachelor degrees in Special Education in the field of Creativity and Talent, and had taught the creativity class for at least two years, and who had the desire to participate in this research were asked to attend a meeting with the researcher. During the meeting, the researcher explained the purpose and procedure of the study to the teachers and gave them the opportunity to ask questions about the study. At the time of the meeting, teachers were asked to sign the consent form (a sample of the consent form attached in appendix F) and provided the researcher with their school details such as school name, principal name, and the address. The total number of creativity and talent teachers who participated was twenty four.

Participants were selected by the class teachers. Using the information provided by creativity and talent teachers, the researcher communicated with the class teachers through the principals who contacted the class teachers to inquire about fourth and fifth grade students (who had been diagnosed with ADHD) to participate in the study. The class teachers provided names of the students to the principal, who in turn contacted the parents. Students' names and addresses were released to the researcher once the principal received verbal permission from their parents. Both the class teachers and the researcher wrote a letter to the students' parents inviting them to a meeting with the class teacher, creativity and talent teachers, and the researcher wherein the purpose and procedure of this study were explained and the opportunity to ask questions about it was given to the students' parents.

At the time of the meeting, the parents were requested to read and sign an informed consent form. One copy of the consent form was retained by the investigator and one copy was given to the parent (a sample of the consent form is attached in appendix G).

Following the parents' meeting, the class teachers organized a meeting for the creativity and talent teachers and the researcher meeting with the students who had been obtained parental consent to participate in the study. The purpose and procedure of this study was explained and the opportunity to ask questions about it was given to the students. They also were asked to read a child's consent form and then were requested to sign it (a sample of the consent form is attached in appendix H). It is worth noting that the researcher did her very best to ensure that participants were treated with integrity and every effort was made to preserve their anonymity. Participants were also informed that they could contact the researcher, if they had any concerns or questions about the study, at any time in the future.

Obviously, the larger the sample the more likely the participants' scores on the measured variables will be representative of the population scores (Gall *et al*., 2003). However, in experimental research the rule of thumb is that there should be at least 15 participants in each group to be compared (Gall *et al*., 2003; Sheskin, 2000). The present study involved 32 participants in the experimental group and 32 participants in the control group. While this can be considered as a statistically reliable sample size for the population of the study (Gall *et al*., 2003; Sheskin, 2000), such a sample size does restrict the use of inferential statistics. However, the percentage of children with ADHD is small compared to other children of the same age, most researchers agree that ADHD affects 3-5% of school-aged children (APA, 1994). This and other variable restrictions (e.g. time and teacher's busy schedule which impressed some of them to not participate in this study) made any increase in the sample size impossible.

Experimental Design

In order to investigate the effects of creativity training upon the complexity of concept mapping among children with ADHD, a *Pretest-Posttest Control Group Design* was utilized in the investigation (Gall *et al*., 2003). Since the *Pretest-Posttest Control Group Design* involved an experimental group and a control group which both undertook the same pre-test and post-test measure, this design is an acceptable method to achieve this study's objective and ascertain whether creativity training has an effect on the concept map complexity. In using the *Pretest-Posttest Control Group Design* the following steps were followed:

- Non-random assignment of research participants to the experimental and the control group (see appendix I for the distribution of the participants across the participating schools).
- Administration of a pre-test (19 concepts from a 465 words text to map and the figural TTCT *Thinking creatively with pictures, A*) to both groups.
- Administration of treatment (creativity training) to the experimental group.
- Administration of a post-test (19 concepts from a 465 words text to map and the figural TTCT *Thinking creatively with pictures, B*) to both groups (Gall *et al*., 2003). Table 7.1 presents the experimental design.

Table 7.1 The Experimental Design

Group	Instruction to Concept Map	Pre-test Concept Map	Pre-test TTCT	Creativity Training	Post-test Concept Map	Post-test TTCT
Control Group	Yes	Yes	Yes	No	Yes	Yes
Experimental Group	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable in this study is the concept mapping performance which was measured by the hierarchical complexity of concept relationship produced by participants when asked to map a concept.

The independent variable in this study is the creativity training. Therefore, the experimental group received 20 hours of creativity training (*the CoRT thinking lessons*) which occurred over a period of 20 sessions during ten weeks (two hours each week). All the creativity training sessions were offered by the creativity and talent teachers and held on Mondays and Wednesdays in the resources-room at the school. In each of these sessions, creativity training included fluency, flexibility, originality, and elaboration.

Procedure for Data Collection

The following procedures were used to collect data:

- Permission was granted for this study by the Ministry of Education, *Center of Care for Talented Female Students* in Riyadh, Kingdom of Saudi Arabia (see appendix J for the permission document).
- All the creativity and talent teachers participating in this study were asked to attend a two-day workshop in concept mapping technique (four hours each day) which was presented by the investigator (see appendix C for the workshop details).
- To ensure familiarity with concept mapping technique, all students participating in this study were introduced to this technique by receiving instruction on how to develop a concept map in an initial 30 minute session. This session was presented by creativity and talent teachers - based on the training received from the investigator - and 16 concepts from a text of 610 words used to practice concept mapping technique (see appendix A).
- All students participating in this study were asked to construct a concept map using 19 concepts from a 470 words text as a pre-test (see appendix B).

- All students participating in this study were asked to complete the figural TTCT *Thinking creatively with pictures, A,* as a pre-test.
- Concept maps and completed test booklets (of the figural TTCT *Thinking creatively with pictures, A*) by the students participating in this study were sent by the creativity and talent teachers to the Assessment Unit at *the Center of Care for Talented Female Students* in Riyadh in order to be marked by professional psychologists which might reduce the threats of *the Rosenthal effect*.
- In order to ensure that each participant has an equal chance at being selected for the treatment (the creativity training) and to reduce the chance that other confounding variables which might interfere with the evaluation of the treatment, students participating in this study were assigned to either experimental or control group based on the figural TTCT (*Thinking creatively with pictures, A*) scores as follows:
    - A. Instead of names, the students used assigned numbers to put on the concept maps and the test booklet to ensure confidentiality.
    - B. The figural TTCT (*Thinking creatively with pictures, A*) test booklets were ranked from 1 to 64 (1 for the highest mark and 64 for the lowest one).
    - C. Prime numbers (e.g. 1,3,5,..... 63) were selected to be the control group, and even numbers (e.g. 2,4,6,..... 64) were selected to be the experimental group.
- Homogeneity of variance was measured. The mean scores and the standard deviation were contrasted. The results revealed that the control group and the experimental group were equal in both creative ability (measured by the TTCT scores) and concept mapping ability (measured by concept map scores). Table 7.2 presents the number of participants, mean scores, and standard deviation achieved by the students in each group on the figural TTCT (*Thinking creatively with pictures, A*).

Table 7.2 Descriptive Statistics for the TTCT

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Control Group	32	70.5	13.3	0.478	62	0.635
Experimental Group	32	68.9	13.4			

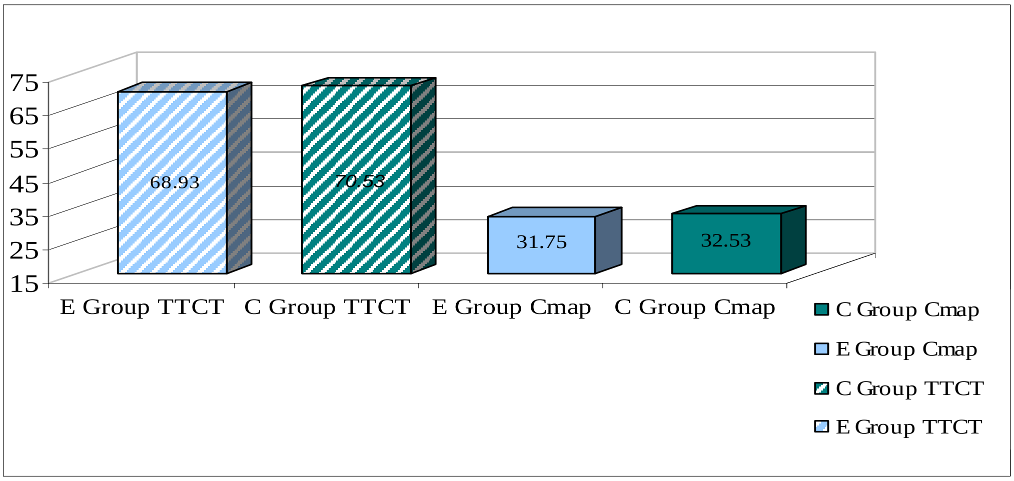
Table 7.3 presents the number of participants, mean scores achieved by the students in each group on concept mapping.

Table 7.3 Concept Mapping Descriptive Statistics

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Control Group	32	32.5	17.7	0.181	62	0.857
Experimental Group	32	31.7	16.8			

Figure 7.1 presents the mean scores achieved by the students in each group on the figural TTCT *Thinking creatively with pictures, A* and concept mapping.

Figure 7.1 Sample Characteristics



- The experimental group was given training on creativity (*the CoRT thinking lessons* for ten weeks) while the control group received no treatment (training).

- All students participating in this study were asked to complete the figural TTCT (*Thinking creatively with Pictures*, *B*) as a post-test.
- All students participating in this study were asked to construct a concept map using 19 concepts from a 470 words text as a post-test.

Instrumentations of the Study

Instrumentations in this study included the concept mapping technique, creativity training (*the CoRT thinking lessons*), and *the Torrance tests of creative thinking* (TTCT).

Concept mapping technique[*]

In order to create criterion maps for this study, the researcher chose two texts. The first one entitled *Life in a pack* (see appendix A), was about wolves' way of living in a pack, and was used as training material for the concept mapping technique. The second one (which was used as pre-test and post-test in this study) entitled *Looking after the egg* and was about Emperor Penguins' way of looking after the egg (see appendix B). Then the researcher scheduled a two-hour meeting with three experts in the field of creativity. All three were experienced trainers. Each trainer had more than five years experience of training and running workshops in using concept mapping technique.

During the meeting, from the texts, the focus questions were identified and the key concepts were selected. Both the experts and the researcher, using the key concepts, constructed the criterion maps to answer the focus questions (see appendixes A and B). Then, the criterion maps were scored by the experts and the researcher. Each map was given a total point score based upon the assigned criteria presented in appendix D.

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[*] More information about concept mapping available at the *Institute for Human and Machine* http://www.ihmc.us/*Cognition* website:

Quantitative assessment for concept maps has been used extensively in research (Novak, 1990a, 1990b, 1998). Novak and Gowin (1984) developed scoring keys for concept maps awarding points for correct linkage or relationship for each level of hierarchy shown, and for each cross link showing a correct relationship between two concepts in different levels of the hierarchy. Quantitative assessment for concept maps in this study followed Novak's (1984) scoring keys (see the scored protocol in appendix D).

In order to establish inter-rater reliability for the scoring procedure, independent raters were asked to score the criterion map in entirety. A reliability measure was computed by calculating the percentage of agreement correlating the two independent rater's scores - who were blind to the purpose of the study - with that of the investigator's score. The scores of the two independent raters were calculated for reliability by adding the totals together and dividing by two. This number was divided by the total number obtained by the investigator with resulting number indicating the percentage of correlation (Borg and Gall, 1983). The inter-rater reliability was 0.92.

Additionally, three experienced psychologists (each with more than three years experience of scoring concept maps) were asked to score six different concept maps - selected at random - applying the given criteria (see appendix D). Using *the average measure intraclass correlation* in the Statistical Package for the Social Sciences, SPSS (MacLennon, 1993) the inter-rater reliability was 0.81.

Creativity training (the CoRT thinking lessons)*

In this study, *the CoRT thinking lessons* (de Bono, 1998) was employed as the creativity training. Edward de Bono is the principal developer of the CoRT

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* More information about *the CoRT* available at de Bono's website: http://www.edwarddebono.com/Default.php

which established at Cambridge, England. CoRT is an abbreviation derived from Cognitive Research Trust, and was first published in 1973. The differences between individuals thinking styles and considering thinking as skills (which can be taught and improved) were the basis on which de Bono designed the CoRT. In addition, the assumption of the CoRT is that poor thinking is caused by deficiency in perception. Thus, thinking programmes should focus on developing perceptual skills which are, usually, neglected by schools (Chance, 1986; de Bono, 1983, 1986; Ritchie and Edwards, 1996). In *the CoRT thinking lessons* de Bono meets his own criteria of the method of teaching thinking which he suggested in (1991, p.7) as follows:

- The method must be simple, practical and capable of being used by a large number of teachers.
- The method must be robust so that when passed from trainer to trainee and teacher to student it will remain intact.
- The "parallel design" method uses a design in which any part on its own is usable and useful even if the other parts are forgotten or misunderstood. This is in contrast to "hierarchical design", in which the whole structure must be remembered or the parts are useless.
- The method must refer specifically to "real life situations. It is not enough to hope that this transfer will occur.
- The method must go beyond "reactive thinking" analysis and information sorting to reach the operacy skills required in real life. This involves an emphasis on perceptual thinking (how we see the world around us).
- The method must be applicable to students of ages and abilities, with teachers of varying aptitude, with different cultures, ideologies and background.
- The students must enjoy the thinking lessons.

After more than 30 years of widespread use, today, the CoRT is considered as a global instrument which has been widely in use with different cultures, situations, ages, and abilities. The CoRT has been used in Australia, Brazil, Canada, France, India, Ireland, Israel, Italy, Japan, Jordan, Kingdom of Saudi Arabia, Malaysia, Malta, New Zealand, Philippines, Russia, Singapore, South Africa, UK, USA, United Arab Emirates, and Venezuela. Arabic is one of a number of languages in which the CoRT is available in. The CoRT consisted of sixty lessons divided into six sections, in each of the sections there are ten lessons containing teacher's notes and student's notes.

The CoRT thinking lessons can be used with different ages and abilities. According to Chance (1986), the CoRT “most often is used with children between the ages of nine and twelve” (p.21), and “the IQs of students who have taken the course have ranged from about 80 to 140” (p.22).

Although the main goal of the *CoRT thinking lessons* is to improve perceptual thinking skills by using tools such as PMI (which is an abbreviation of Plus, Minus, Interesting), CAF (Consider All Factors), and FIP (First Important Priorities) analytical thinking is also covered as in lesson 12 (Chance, 1986, p.11).

The successful method in using the CoRT is to teach thinking as a basic skill in practical, simple, clear, focused and serious fashion. Therefore, practice in the use of perceptual thinking skills tools on real life problems through group and class discussion is necessary. Individual work and homework projects are also recommended. Although *CoRT thinking lessons* are designed for the direct teaching of thinking as a basic skill, once the CoRT thinking skills were learned by the students, it can be infused through school curriculum. In teaching *the CoRT thinking lessons* it must begin with CoRT-1 (Breadth) and the rest of lessons can be taught in any sequence. One fast-paced lesson per week for two years is recommended to teach the complete set of 60 lessons (Chance, 1986; de Bono, 1983, 1986, 1998).

In the present study, the research followed Ritchie and Edwards in using five lessons each from the CoRT-4 (creativity) and CoRT-6 (Action) because of their potential to enhance creative thinking and the positive results revealed in Ritchie and Edwards's study in 1996. A brief description of the entire *CoRT* *thinking lessons* and the creativity training sessions used in this study are presented in appendix E.

According to Chance (1986, p.11) the benefits of using *the CoRT thinking lessons* are that "students become more flexible, are likely to see more sides to an issue, more alternatives to a problem". In addition, in her review, Dingli (2001) summarized 26 studies - most of these studies unpublished papers and theses - carried out on the impact of using *the CoRT thinking lessons* on thinking skills. In the 26 studies creative thinking improved as result of using the CoRT, and participants in most studies have received no more than ten lessons of the CoRT. The following features and benefits of *the CoRT thinking lessons* listed by de Bono (1983, p.117) and Ritchie and Edwards (1996, p.61):

- The CoRT lessons provide a framework where the emphasis is placed directly on thinking.
- Pupils are encouraged to think, and are given credit for their thinking.
- Pupils get opportunities to think in groups, in order to put their ideas across to interact with the ideas of others.
- CoRT offers a selection of specific and deliberate thinking skills.
- Pupils are encouraged to view thinking as a skill that can be learned and practiced, pupils can practice and see their improvement.
- The improvement is in confidence, focus, fluency, and application.
- Pupils feel in control of their thinking, rather than drifting in a sea of emotion and confusion
- CoRT is the learning of specific thinking tools that can be transferred to other situations.

Formal training is not requirement to teach the *CoRT thinking lessons*. According to de Bono "many teachers have succeeded without special training [because] the materials themselves are highly structured, and the teacher's manuals are very detailed [and] it is the quality of the teacher, not training in the use of a program, that counts most in teaching thinking" (as cited in Chance, 1986, p. 22). However, in the current study the creativity training sessions were taught by trained creativity and talent teachers.

In the discussion of CoRT teaching there are difficulties to be considered. These difficulties include lesson structure, object to tool labels, and some students find tools obvious (Chance, 1986; Edwards, 1991; Ritchie and Edwards, 1996).

With regard to the first difficulty de Bono conceded monotony (all of the lessons follow essentially the same plan) as a problem, but he also asserted that tight lesson structure (2-4 minutes are allocated for discussion, individual work, or practice on a particular tool) helps students to focus their attention on the tool in each lesson rather than the problem or associated content (Chance, 1986; de Bono, 1986; Edwards, 1991; Ritchie and Edwards, 1996). The participants in the present study are children with ADHD, therefore the researcher sees the tight lesson structure as an advantage.

Although some object to using acronym as a label to identify specific tools such as PMI (Plus, Minus, Interesting) because it is difficult to use and remember them, de Bono asserted that the object of this tool is to direct attention. In addition, he affirmed that they are simple and easily learned and used. However, de Bono conceded that it is possible to teach a lesson without reference to the label (Chance, 1986; de Bono, 1986; Edwards, 1991; Ritchie and Edwards, 1996). In his evaluation of the CoRT, Chance stated that:

> Some students may complain that they already know the things the program teaches. De Bono admits that most students know how to use the thinking tools in CoRT, but he insists that students have not learned to use them. Over and over again de Bono argues that learning to think is not so much a matter of learning new procedures, but of forming the habit of using those procedures. It is because of this that “obvious things are far more difficult to teach than anything else” (1986, p.24)

de Bono concluded that using the *CoRT thinking lessons* might "increase the number and diversity of ideas as well as help the individual establish goals, set priorities, improve interactions with others, and incorporate feeling into thinking" (1986, p. 33). Thus, the researcher hoped that the participants' ability to integrate information related to a key concept will increase as a result of the creativity training and therefore they will produce more complex concept map.

The Torrance Tests of Creative Thinking (TTCT)*

Torrance and his colleagues created *the Torrance tests of creative thinking* (TTCT) to identify gifted and creative individuals. It was a result of nine years of Torrance' and his colleagues work on the nature of creative behaviour and its assessment. The research edition of *the Torrance tests of creative thinking* (TTCT) which is a multiple-task paper-and-pencil measure of creative abilities was published in 1966.

In 1967 Hoepfner described the research edition of TTCT as "an early attempt to measure an area of individual differences about which much more needs to be learned, and as such, is designed to be used for research purposes, and not for counseling or guiding the lives of people" (p.191).

Today, *the Scholastic Testing Service, Inc*. (STS) holds the copyright for the TTCT which is the most widely used test for testing creative abilities and has been used in more than 2,000 studies (Kim, 2006a, 2006b; Thomas *et al*., 2002, Torrance, 1998).

The claim that all individuals possess some degree of creative thinking was the basis on which Torrance designed the TTCT. Torrance also believed that not all those who possess high creative ability will behave creatively. He clarified that in order to behave in a creative fashion an individual must have the necessary skills (that is, the thinking skills such as critical thinking), creative

* for more information about the TTCT see *the Scholastic Testing Service, Inc*. website: www.ststesting.com

abilities (that is, fluency, flexibility, originality, and elaboration) and must be motivated (Torrance, 1998). According to *the TTCT Norms-Technical Manual* Torrance uses the term creative thinking ability to refer "to that constellation of generalized mental abilities that is commonly presumed to be brought into play in creative achievement. Many educators and psychologists would prefer to call these abilities divergent thinking, productive thinking, inventive thinking, or imagination (1998, p.38).

The TTCT is in heavy use in more than 35 countries including the Kingdom of Saudi Arabia where the present study was conducted. It is also available in Arabic and other 32 languages (Kim, 2006a, 2006b; Thomas *et al.*, 2002). There are two versions of the TTCT. The first one is the verbal TTCT (*Thinking creatively with words*), and the second is the figural TTCT (*Thinking creatively with pictures*). Both are available in two equivalent forms, A and B (Torrance, 1998; Torrance *et al*., 1992).

The verbal TTCT (*Thinking creatively with words*) is appropriate for subjects from first grade through graduate school and can be administered in 45 minutes. This test provides subjects with the opportunity to release creativity through six word-based exercises and the assessor to assess the following mental characteristics: fluency, flexibility and originality (Torrance 1998; Torrance *et al*., 1992).

The figural TTCT (*Thinking creatively with pictures*) is appropriate for subjects from kindergarten through graduate school and can be administered in 30 minutes. This test provides subjects with the opportunity to release creativity through drawing and the assessor to assess the following mental characteristics: fluency, flexibility, originality, elaboration, abstractness of titles, and resistance to premature closure. It also assesses thirteen additional creative strengths which are: emotional expressiveness, storytelling articulateness, movement or action, expressiveness of titles, synthesis of incomplete figures, synthesis of lines or circles, unusual visualization, internal visualization, extending or breaking boundaries, humor, richness of imagery, colorfulness of imagery and fantasy (Torrance 1998; Torrance *et al.*, 1992).

In the present study both forms A and B of the figural TTCT (*Thinking creatively with pictures*, Torrance, 2006a) were used. Each of these forms consists of three subtests which are designed to tap a different aspect of creative functioning. Each subtest is an activity which requires subjects to think of a picture no one else will draw and to keep building upon each new idea to create an interesting picture or exciting story. When the subjects are finished drawing, they were asked to make up a clever and unusual title for each of the pictures. Therefore, the subjects must have a pencil or crayon in order to draw pictures (Torrance, 2006b).

In the first activity, Picture Construction, in both forms A and B, the subjects are asked to look at the curved shape and think of a picture or an object of which this shape is a part. Then they are asked to think of a picture no one else will think of (Torrance, 2006b, p.4).

The second activity, Picture Completion, in both forms A and B, consists of 10 separate boxes which hold incomplete figures. The subject is asked to add lines to the incomplete figures and to sketch some interesting objects or pictures, again, trying to draw pictures no one else will (Torrance, 2006b, p.5).

The third activity, Parallel Lines in form A or Circles in form B, consists of 36 Parallel Lines/circles. The subject is asked to make objects or pictures from the Parallel Lines/circles. The Parallel Lines/circles have to be the main part of whatever is drawn and the subject is asked to draw pictures that no one else will think of (Torrance, 2006b, p.5).

All three subtests are timed activities. In each subtest the participant has 10 minutes to complete the activity after instructions are read. The TTCT directions manual recommends that the examiner creates the expectation that the activities will be enjoyable and fun to present a game-like atmosphere because all three subtests require the subjects to relax and have fun with the activities (Torrance, 2006b, p.2).

The participants' test booklets in the present study were scored by four experienced scorers of five years employed at *the Assessment Unit*, *the Center of Care for Talented Female Students* in Riyadh. Test booklets were scored based upon the latest streamlined scoring guide (Torrance *et. al*., 1992) as follows:

- Fluency score is the number of ideas a person expresses through interpretable responses that use the stimulus in a meaningful manner. The essence of the idea may be expressed through the title, but the stimuli must still be used. Abstract designs without meaningful titles are not counted (Torrance *et al*., 1992, p.6).
- Originality score is based on the statistical infrequency and unusualness of the response (Torrance *et al.*, 1992, p.8).
- Abstractness of Titles score represents the ability to produce good titles which involves the thinking processes of synthesis and organization. At the highest level, there is the ability to capture the essence of the information involved, to know what is important. Such a title enables the viewer to see the picture more deeply and richly (Torrance *et al*., 1992, p.11).
- Elaboration score is based on the number of each pertinent detail (idea, piece of information, etc.) added to the original stimulus figure, its boundaries, and/or its surrounding space. However, the basic response itself must be meaningful before Elaboration has any worth or can be scored (Torrance *et al.*, 1992, p.12).
- Resistance to Premature Closure score is based on the person's ability to keep open and delay closure long enough to make the mental leap that

makes possible original ideas. Less creative persons tend to leap to conclusions prematurely without considering the available information. In responding to the second activity (which is the only activity scored for Resistance to Premature Closure)such people close the incomplete figures immediately with straight or curved lines, cutting the chances of more powerful, original images (Torrance *et al.*, 1992, p.14).

- The checklist of creative strengths score represents the following: emotional expressiveness, storytelling articulateness, movement or action, expressiveness of titles, synthesis of incomplete figures, synthesis of lines or circles, unusual visualization, internal visualization, extending or breaking boundaries, humor, richness of imagery, colorfulness of imagery and fantasy (Torrance *et al.*, 1992, p.16).
- Creative index score is the total score of the five abilities (Fluency, Originality, Abstractness of Titles, Elaboration, and Resistance to Premature Closure) plus the checklist of creative strengths (Torrance *et al.*, 1992, p.40).

In scoring the TTCT scorers' judgment is involved in the scoring process, but the streamlined scoring guide (1992) is very clear, detailed, and provides the scorer with examples. Therefore, a scorer with basic training can score the TTCT as well as an experienced scorer. According to the streamlined scoring guide (1992) the reliability coefficients of scoring between a scorer in training and an experienced scorer ranged from 0.86 to 0.99 with an average of 0.95.

In his review of the TTCT, Treffinger (1985) reported that test-retest reliabilities in several studies of the TTCT have ranged from 0.50 to 0.93. He also reported that validities of the TTCT have been significantly correlated with creative achievement criteria. For example, individuals who scored higher on the TTCT eventually obtained more unusual occupations and followed more creative lifestyle.

For research and group assessments, Swartz (1988) considered the TTCT reasonably reliable as far as evaluating changes within the group over a period of several weeks as in the present study.

Another report on the 40-year follow-up of the TTCT by Cramond *et al*. (2005) concluded that the TTCT have shown a significant reliability and validity in assessing creativity.

A recent review by Kim (2006a) highlighted and affirmed the reliability, validity and effectiveness of using the TTCT in assessing creativity and encouraging everyday life creativity.

According to Cramond (1994c, p.70) and (Kim, 2006a, p.4) Torrance's five purposes for using the TTCT are:

- To promote understanding of the human mind, its functioning and development.
- To assist in the development of individualized instruction.
- To provide additional information for remedial and psychotherapeutic programs
- To assess the differential effects of educational materials, programs, curriculums, procedures, and so on.
- To point out potentialities that might otherwise go unnoticed, especially in children from culturally diverse and lower socioeconomic backgrounds.

Although, some educators (e.g. Baer, 1994a, 1994b) object to using creativity tests (the TTCT is not an exception) to decide which students fit for gifted and talented programmes, others (e.g. Cramond, 1994c; Cropley, 2000; Davis, 1997; Davis and Rimm, 1998; Kim, 2006a; Plucker, 1999; Runco, 2007) do support using creativity tests as a part of multidimensional assessment when assessing creativity. However, to date - to the researcher's knowledge - in regards to using creativity tests in the context of research and group assessment as in the present study none objection has been made.

The researcher chose to use the figural TTCT (*Thinking creatively with pictures*) because of its usefulness in research and evaluation applications (as mentioned previously) and more importantly because the TTCT is one of the better tests for assessing creativity as stated by its reviewers (Cramond *et al*., 2005; Kim, 2006a; Plucker, 1999; Treffinger, 1985; Swartz, 1988). It was also chosen because it is a proper tool to be used with children who have ADHD since the time needed to complete each activity is 10 minutes.

Conclusion

The main purpose of this study was to investigate the effects of creativity training upon the complexity of concept mapping among children with ADHD. In order to determine whether the use of *the CoRT thinking lessons* as creativity training can be effective in developing creative ability of children with ADHD *the Pretest-Posttest Control Group Design* has been selected. This design involved an experimental group and a control group. Both groups were administered the same pre-test. Therefore, all the participants in this study were asked to construct a concept map using 19 concepts from a 470 words text. They also were asked to complete the figural TTCT (*Thinking creatively with pictures, A*) as a pre-test. Following that, only the experimental group received 20 hours of creativity training (*the CoRT thinking lessons*) which occurred over a period of 20 sessions during ten weeks. Finally, both groups were administered the same post-test. Therefore, for a second time, all the participants in this study were asked to construct a concept map using 19 concepts from a 470 words text. They also were asked to complete the figural TTCT (*Thinking creatively with pictures, B*) as a post-test.

In this study there is a possibility that *the effect of pretesting* might result from using the same text and concepts twice (for pre-testing and post-testing). However, by using two forms of the TTCT which Torrance designed for pre-testing and post-testing (the figural TTCT *Thinking creatively with pictures, A,* as a pre-test and the figural TTCT *Thinking creatively with pictures, B,* as a prost-test) it is reasonable to say that *the effect of pretesting* in this study was relatively small.

Everyone who participated in this study (creativity and talent teachers, class teachers, parents’ of children, and children with ADHD) are aware of the purpose and procedure of this study and were requested to read and sign an informed consent which give an explanation of this study. Consequently, both *the Hawthorne effect* and *the Rosenthal effect* were unavoidable. However, in order to minimize the threats of *the Hawthorne effect* (that is, the change or improvement of participants' behaviours might due to their knowledge that they are being studied) all the participants were informed that this study is not expected to be of direct benefit to them, but the knowledge gained may be of benefit to other people. Additionally, to reduce the intimidation of *the Rosenthal effect* (which also known as *the teacher-expectancy effect* is the fear that the participants in the experimental group might perform better than the participants in the controlled group simply because they are expected to do so. Or that if a teacher informed that a particular student is a bright child, the teacher may behave in a fashion that encourages and facilitates the child's needs and success) all the concept maps and test booklets were marked by professional psychologists at the CCTFS who were independent, trained, and uninformed of which students were in the experimental group and which were in the controlled group.

Instrumentations in this study which included the concept mapping technique, creativity training (*the CoRT thinking lessons*), and *the Torrance tests of creative thinking* (TTCT) were also detailed in this chapter. The following chapter introduces the results from this investigation.

CHAPTER EIGHT

ANALYSIS AND RESULT

Introduction

Data analysis and accompanying results from the investigation are presented in this chapter. In order to summarize data findings, results are detailed via tables and graphs as visual representations of the analyzed data.

Data Analysis

Descriptive statistics which included group means and standard deviation to check for normality and variability was the first step in analyzing data to help decide whether parametric or non-parametric statistics were appropriate. Group distributions were normal and both were equal in standard deviation. The descriptive statistics showed reasonable normality which permitted the use of parametric statistics.

The second step in analyzing data was utilizing appropriate statistical procedures. Therefore, the following methods were utilized to analyze the data obtained from the pre-test and the post-test. *The Pearson product-moment correlation coefficient* was done to detect the relationship between the creative ability and the ability of concept mapping (Sheskin, 2000). This statistical test is an appropriate statistical procedure because it is used with integer data (e.g. examination marks) to assess the linear association between two variables and assume a normal distribution (Sheskin, 2000).

The t test for two independent samples was done to compare the mean of the experimental group with the mean of the control group. This statistical test is an appropriate statistical procedure because it is used to compare two independent samples (Sheskin, 2000).

The paired-sample t test was done to compare the pre-test mean with the post-test mean. This statistical test is an appropriate statistical procedure because it is used to compare paired data (Sheskin, 2000).

Since the researcher was not only examining the difference in mean, but also an improvement throughout the distribution, a two-tailed test was done. Equal variance was not assumed. Therefore, *Levene's Test for Equality of Variances* was ignored. This process of testing without assuming equal variance is a more vigorous measure and reduces the possibility of a Type I error. SPSS-13 (Pallant, 2005) was used for all data analyses.

Alpha Level

Because of the exploratory nature of this study and in order to identify potential significance 0.05 was selected as the alpha levels.

Null Hypotheses Findings

The following are the null hypotheses results. Null hypotheses are based on and a direct reflection of the research questions. Therefore, findings are arranged in the order of research questions and pertaining null hypotheses. The outcomes are reported with statements of results and tables.

Research Question 1

Is there a correlation between the concept mapping ability of students with ADHD and their performance in *the Torrance tests of creative thinking* (TTCT)?

***H_o1*: (*H_o: ρ=0*)** there is not a statistically significant correlation between the TTCT scores and the scores of concept maps produced by students with ADHD.

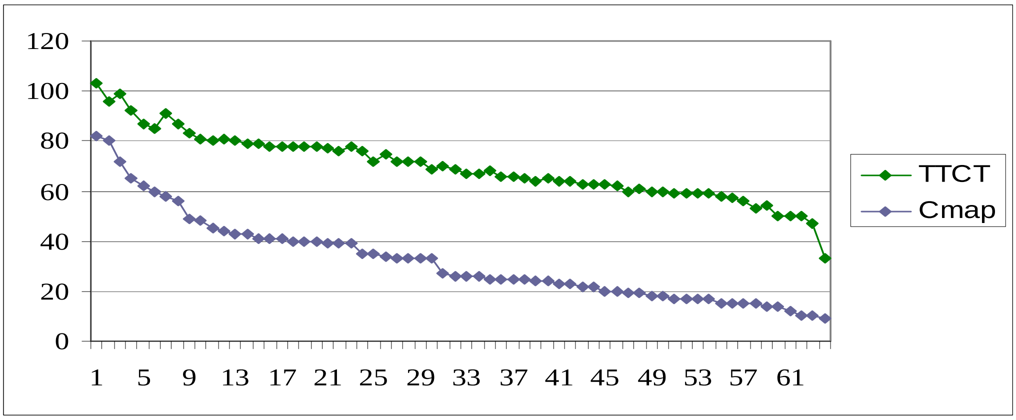
Statistical analysis was conducted to calculate Pearson's correlation coefficient for the relationship between students' scores on the concept map and their scores in the TTCT. A strong positive correlation was found (r=0.961, P<0.0001), indicating a significant relationship at the 0.01 level between the pre-test' scores on the concept map and on the TTCT. In addition, a strong positive correlation was found (r=0.878, P<0.0001) indicating a significant relationship at the 0.01 level between the post-test' scores on the concept map and on the TTCT. Therefore, the null hypothesis was rejected.

Table 8.1 and figures 8.1 and 8.2 present a visual summary of this result.

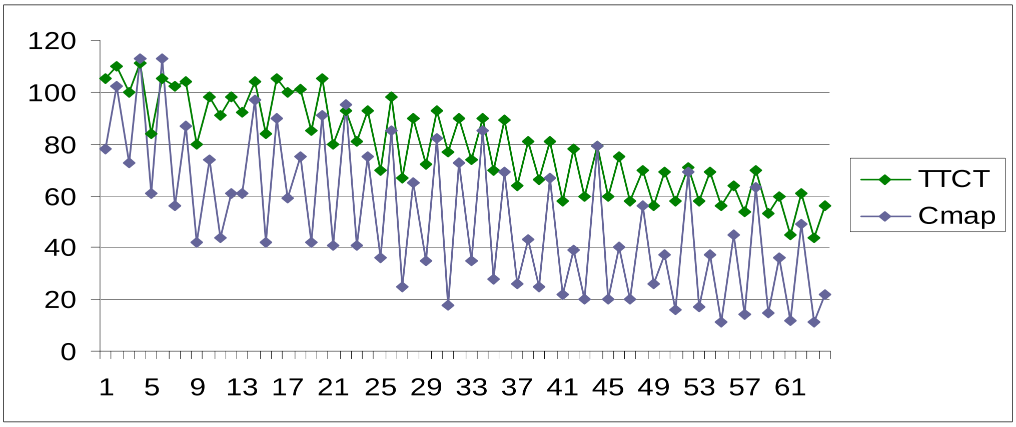
Table 8.1 The Number of Participants, Mean, Standard Deviation and *r* Value of TTCT and Concept Mapping on the Pre-test and Post-test.

		N	Mean	Standard Deviation	*r*	Significance (2-tailed)
Pre-test	TTCT	64	69.73	13.26	0.961	0.000
	Concept Mapping	64	32.14	17.17		
Post-test	TTCT	64	79.14	17.93	0.878	0.000
	Concept Mapping	64	51.34	27.77		

Figures 8.1 The Correlation between the TTCT and Concept Mapping Scores on the pre-test



Figures 8.2 The Correlation between the TTCT and Concept Mapping Scores on the Post-test



Research Question 2

Will students classified with ADHD who receive creativity training score higher scores on the TTCT than students with ADHD who not do receive such training?

***H_o2*: (H_o: $\mu_1=\mu_2$)** there is not a statistically significant difference between the scores of students in the experimental group who received creativity training and the control group who did not receive creativity training on the TTCT.

This hypothesis looked at the effect of the creativity training on creativity as measured by post-test scores, by determining if there was a difference in post-test scores between the experimental and control group on the TTCT. To quantify this effect, the post-test scores of the experimental group who received creativity training were compared with the post-test scores of the control group who did not receive creativity training using *the t test for two independent samples.*

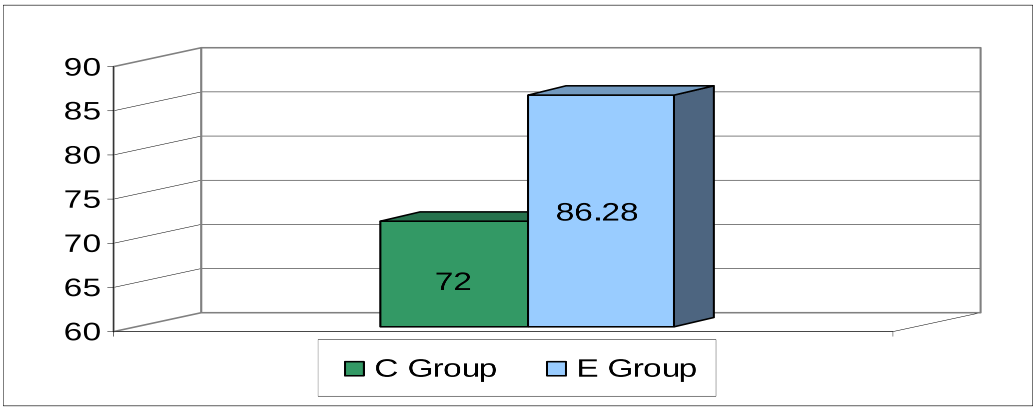
The results indicated that the post-test scores for the two groups were significantly different (t=3.450, P=0.001), indicating that the experimental group displayed significantly higher post-test scores at the 0.01 level compared to the control group after the creativity training. Results of the analysis are summarized in table 8.2. Based on these results, the null hypothesis was rejected. Therefore, it was concluded that the improvement of the experimental group was significantly higher than that of the control group.

Table 8.2 Comparison between the Post-test Results of the Experimental and the Control Group on the TTCT

	N	**Mean**	**Standard Deviation**	***t***	***df***	**Significance (2-tailed)**
Control Group	32	72.00	16.97	3.450	62	0.001
Experimental Group	32	86.28	16.13			

Figure 8.3 presents a visual summary of the experimental and the control group post-test results on the TTCT.

Figure 8.3 The Post-test Results of the Experimental and the Control Group on the TTCT



Research Question 3

Will students classified with ADHD who receive creativity training score higher scores on the TTCT in the post-test compared with the pre-test?

***H_o3*: (*H_o*: μ_1=μ_2)** there is not a statistically significant difference between the scores of students in the experimental group who received creativity training at the post-test and the pre-test on the TTCT.

This hypothesis looked at the effect of the creativity training on creativity as measured by post-test scores, by determining if there was a difference between the pre-test and the post-test scores on the TTCT. To quantify this effect, the pre-test scores of the experimental group who received creativity training were compared with the post-test using *the paired-sample t test.*

The results indicated that the two scores were significantly different (t=17.78, P=0.0001), indicating that the experimental group displayed significantly higher post-test scores at the 0.01 level compared to the pre-test after the creativity training. Results of the analysis are summarized in table 8.3. Based on these results, the null hypothesis was rejected. Therefore, it was concluded

that the experimental group performance in the TTCT on the post-test was significantly higher than on the pre-test.

Table 8.3 Comparison between the Results of the Pre-test and the Post-test of the Experimental Group on the TTCT

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Pre-test	32	68.93	13.35	17.78	31	0.000
Post-test	32	86.28	16.13			

Research Question 4

Will students classified with ADHD who do not receive creativity training score higher scores on the TTCT in the post-test compared with the pre-test?

$\boldsymbol{H_o4}$**:** $\boldsymbol{(H_o: \mu_1 = \mu_2)}$ there is not a statistically significant difference between scores of students in the control group who did not receive creativity training at the post-test and the pre-test on the TTCT.

This hypothesis predicts that the post-test scores of the control group who did not receive creativity training should not outscore the pre-test scores. To quantify this prediction, the pre-test scores were compared with the post-test scores using *the paired-sample t test.*

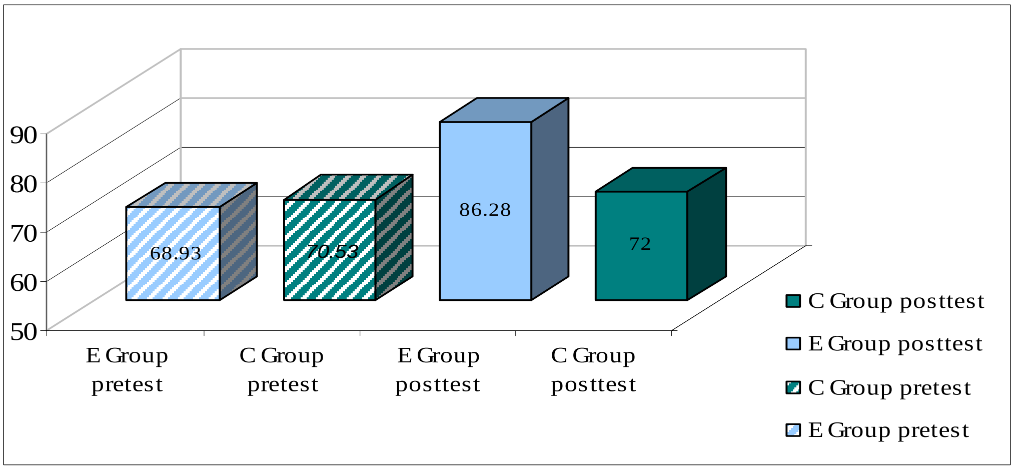
The results indicated that the two scores were significantly not different (t=1.305, P=0.187), indicating that the control group displayed in the post-test similar scores to that on the pre-test. Results of the analysis are summarized in table 8.4. Based on these results, the null hypothesis was accepted. Therefore, it was concluded that the control group performance in the TTCT on the post-test was not different than on the pre-test.

Table 8.4 Comparison between the Results of the Pre-test and the Post-test of the Control Group on the TTCT

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Pre-test	32	70.53	13.34	1.305	31	0.187
Post-test	32	72.00	16.97			

Figure 8.4 presents a visual summary of the results of the pre-test and the post-test of the experimental and the control group on the TTCT.

Figure 8.4 The Results of the Pre-test and the Post-test of the Experimental and the Control Group on the TTCT



Research Question 5

Will students classified with ADHD who receive creativity training produce more complex concept maps than students with ADHD who not do receive such training?

***H_o5*: (*H_o*: *μ_1=μ_2*)** there is not a statistically significant difference between the post-test scores on concept maps (the total scores) of students in the experimental group who received creativity training and the control group who did not receive creativity training.

This hypothesis looked at the effect of the creativity training on the complexity of the concept map as measured by post-test scores by determining if there was a difference in post-test scores between the experimental and control groups on the concept map. To quantify this effect, the post-test scores of the experimental group who received creativity training were compared with the post-test scores of the control group who did not receive creativity training using *the t test for two independent samples.*

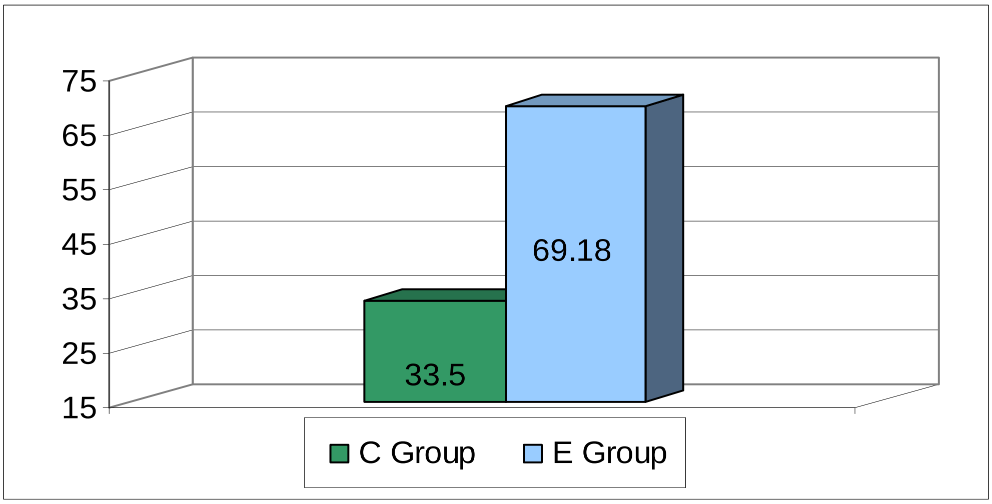
The results indicated that the post-test scores for the two groups were significantly different (t=6.690, P=0.0001), indicating that the experimental group displayed significantly higher post-test scores at the 0.01 level compared to the control group after the creativity training. Results of the analysis are summarized in table 8.5. Based on these results, the null hypothesis was rejected. Therefore, it was concluded that the improvement of the experimental group was significantly higher than that of the control group.

Table 8.5 Comparison between the Results of the Experimental and the Control Group on the Concept Mapping

	N	**Mean**	**Standard Deviation**	***t***	***df***	**Significance (2-tailed)**
Control Group	32	33.50	18.52	6.690	62	0.000
Experimental Group	32	69.18	23.82			

Figure 8.5 presents a visual summary of the experimental and the control group results on the concept mapping.

Figure 8.5 The Post-test Results of the Experimental and the Control Group on the Concept Mapping



Research Question 6

Will students classified with ADHD who receive creativity training produce more complex concept maps in the post-test compared with the pre-test?

***H_o6*: (*H_o: μ_1=μ_2*)** there is not a statistically significant difference between the pretest and the posttest scores on concept maps (the total scores) of students in the experimental group who received creativity training.

This hypothesis looked at the effect of the creativity training on complexity of the concept map as measured by post-test scores, by determining if there was a difference between the pre-test and the post-test scores on the concept map. To quantify this effect, the pre-test scores of the experimental group who received creativity training were compared with the post-test using *the paired-sample t test.*

The results indicated that the two scores were significantly different (t=14.632, P=0.0001), indicating that the experimental group displayed significantly higher post-test scores at the 0.01 level compared to the pre-test after the creativity training. Results of the analysis are summarized in Table 8.6. Based on these results, the null hypothesis was rejected. Therefore, it was concluded that the experimental group performance in the concept map on the post-test was significantly higher than on the pre-test.

Table 8.6 Comparison between the Results of the Pre-test and the Post-test of the Experimental Group on the Concept Mapping

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Pre-test	32	31.75	16.88	14.632	31	0.000
Post-test	32	69.18	23.82			

Research Question 7

Will students classified with ADHD who do not receive creativity training produce more complex concept maps in the post-test compared with the pre-test?

***H_o7*: (H_o: $\mu_1 = \mu_2$)** there is not a statistically significant difference between the pre-test and the post-test scores on concept maps (the total scores) of students in the control group who did not receive creativity training.

This hypothesis predicts that the post-test scores of the control group who did not receive creativity training should not outscore the pre-test scores. To quantify this prediction, the pre-test scores were compared with the post-test scores using *the paired-sample t test.*

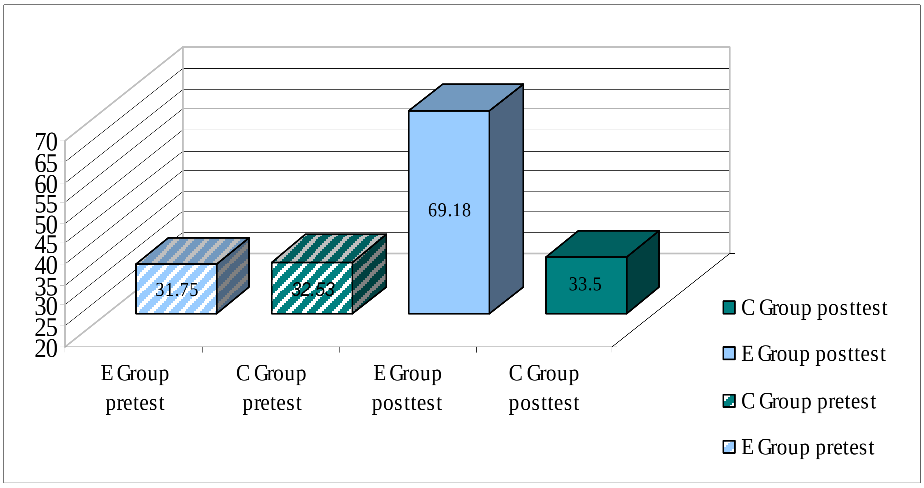
The results indicated that the two scores were significantly not different (t=0.948, P=0.350), indicating that the control group displayed in the post-test similar scores to that on the pre-test. Results of the analysis are summarized in table 8.7. Based on these results, the null hypothesis was accepted. Therefore, it was concluded that the control group performance in the concept map on the post-test was not different from the performance on the pre-test.

Table 8.7 Comparison between the Results of the Pre-test and the Post-test of the Control Group on the Concept Mapping

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Pre-test	32	32.53	17.71	0.948	31	0.350
Post-test	32	33.50	18.52			

Figure 8.6 presents a visual summary of the results of the pre-test and the post-test of the experimental and the control group on the concept mapping.

Figure 8.6 The Results of the Pre-test and the Post-test of the Experimental and the Control Group on the Concept Mapping



Research Question 8

Will students classified with ADHD who receive creativity training score higher proposition's scores compared with the students with ADHD who not do receive such training?

***H_o8*: (*H_o*: $\mu_1=\mu_2$)** there is not a statistically significant difference between the post-test scores on concept maps (the proposition's scores) of students in the experimental group who received creativity training and the control group who did not receive creativity training.

This hypothesis looked at the effect of the creativity training on the proposition's scores as measured by post-test scores, by determining if there was a difference in post-test scores between the experimental and control group in proposition's scores. To quantify this effect, the post-test scores of the experimental group who received creativity training were compared with the post-test scores of the control group who did not receive creativity training using *the t test for two independent samples.*

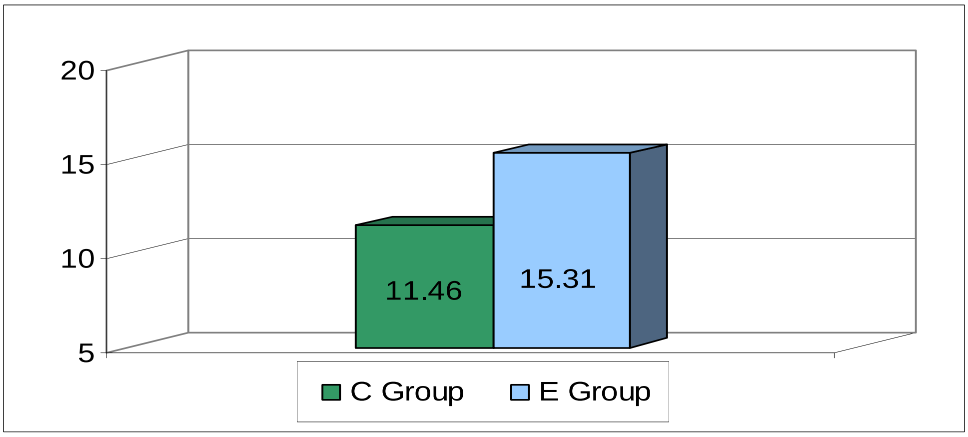
The results indicated that the post-test scores for the two groups were significantly different (t=4.038, P=0.0001), indicating that the experimental group displayed significantly higher post-test scores at the 0.01 level compared to the control group after the creativity training. Results of the analysis are summarized in table 8.8. Based on these results, the null hypothesis was rejected. Therefore, it was concluded that the proposition's scores achieved by the experimental group were significantly higher than that of the control group.

Table 8.8 Comparison between the Results of the Proposition's Scores Achieved by the Experimental and the Control Group

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Control Group	32	11.46	4.40	4.038	62	0.000
Experimental Group	32	15.31	3.09			

Figure 8.7 presents a visual summary of the proposition's scores achieved by the experimental and the control group.

Figure 8.7 The Proposition's Scores Achieved by the Experimental and the Control Group on the Post-test



Research Question 9

Will students classified with ADHD who receive creativity training score higher proposition's scores in the post-test compared with the pre-test?

***H_o9*: (*H_o*: μ_1=μ_2)** there is not a statistically significant difference between the pre-test and the post-test scores on concept maps (the proposition's scores) of students in the experimental group who received creativity training.

This hypothesis looked at the effect of the creativity training on the proposition's scores as measured by post-test scores, by determining if there was a difference between the pre-test and the post-test scores on the proposition's scores. To quantify this effect, the pre-test scores of the experimental group who received creativity training were compared with the post-test using *the paired-sample t test.*

The results indicated that the two scores were significantly different (t=13.759, P=0.0001), indicating that the experimental group displayed significantly higher post-test scores at the 0.01 level compared to the pre-test after the creativity training. Results of the analysis are summarized in table 8.9. Based on these results, the null hypothesis was rejected. Therefore, it was concluded that the experimental group scores in the proposition's scores on the post-test were significantly higher than on the pre-test.

Table 8.9 Comparison between the Results of the Proposition's Scores Achieved by the Experimental Group in the Pre-test and the post-test

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Pre-test	32	11.59	3.60	13.759	31	0.000
Post-test	32	15.31	3.09			

Research Question 10

Will students classified with ADHD who do not receive creativity training score higher proposition's scores in the post-test compared with the pre-test?

***H_o10*: (*H_o: μ_1=μ_2*)** there is not a statistically significant difference between the pre-test and the post-test scores on concept maps (the proposition's scores) of students in the control group who did not receive creativity training.

This hypothesis predicts that the post-test scores of the control group who did not receive creativity training should not outscore the pre-test scores. To quantify this prediction, the pre-test scores were compared with the post-test scores using *the paired-sample t test.*

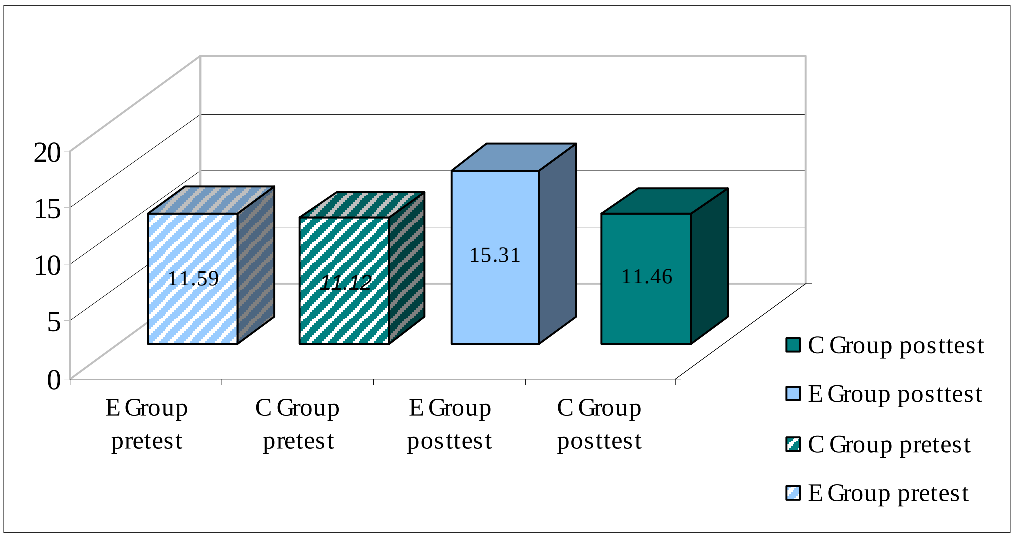
The results indicated that the two scores were significantly not different (t=0.992, P=0.329), indicating that the control group displayed in the post-test similar scores to that on the pre-test. Results of the analysis are summarized in table 8.10. Based on these results, the null hypothesis was accepted. Therefore, it was concluded that the proposition's scores of the control group on the post-test were not different than on the pre-test.

Table 8.10 Comparison between the Results of the Proposition's Scores Achieved by the Control Group in the Pre-test and the post-test

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Pre-test	32	11.12	4.03	.9920	31	0.329
Post-test	32	11.46	4.40			

Figure 8.8 presents a visual summary of the proposition's scores achieved by the experimental and the control group in the pre-test and the post-test.

Figure 8.8 The Proposition's Scores Achieved by the Experimental and the Control Group in the Pre-test and the Post-test.



Research Question 11

Will students classified with ADHD who receive creativity training score higher hierarchy's scores compared with the students with ADHD who not do receive such training?

***H_o11*: (*H_o*: $\mu_1=\mu_2$)** there is not a statistically significant difference between the post-test scores on concept maps (the hierarchy's scores) of students in the experimental group who received creativity training and the control group who did not receive creativity training.

This hypothesis looked at the effect of the creativity training on the hierarchy's scores as measured by post-test scores, by determining if there was a difference in post-test scores between the experimental and control group in hierarchy's scores. To quantify this effect, the post-test scores of the experimental group who received creativity training were compared with the post-test scores of the control group who did not receive creativity training using *the t test for two independent samples.*

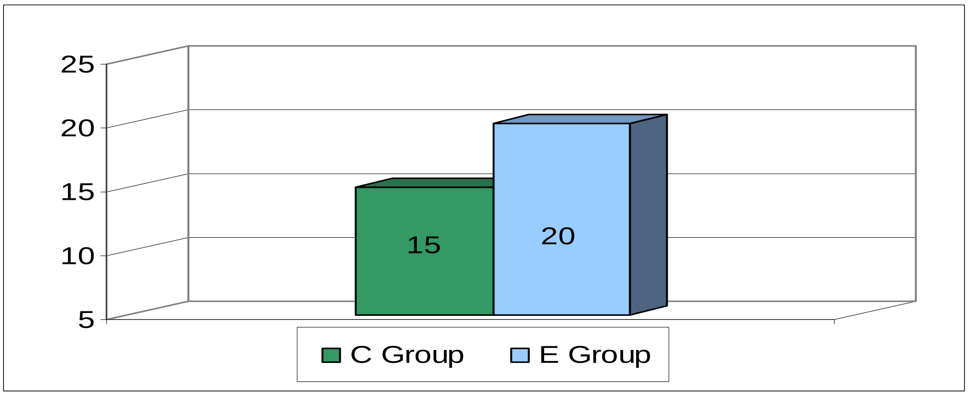
The results indicated that the post-test scores for the two groups were significantly different (t=3.150, P=0.003), indicating that the experimental group displayed significantly higher post-test scores at the 0.01 level compared to the control group after the creativity training. Results of the analysis are summarized in table 8.11. Based on these results, the null hypothesis was rejected. Therefore, it was concluded that the hierarchy's scores achieved by the experimental group were significantly higher than that of the control group.

Table 8.11 Comparison between the Results of the Hierarchy's Scores Achieved by the Experimental and the Control Group

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Control Group	32	15.00	6.35	3.150	62	0.003
Experimental Group	32	20.00	6.35			

Figure 8.9 presents a visual summary of the hierarchy's scores achieved by the experimental and the control group.

Figure 8.9 The Hierarchy's Scores Achieved by the Experimental and the Control Group on the Post-test.



Research Question 12

Will students classified with ADHD who receive creativity training score higher hierarchy's scores in the post-test compared with the pre-test?

***H_o12*: (*H_o*: *$\mu_1=\mu_2$*)** there is not a statistically significant difference between the pre-test and the post-test scores on concept maps (the hierarchy's scores) of students in the experimental group who received creativity training.

This hypothesis looked at the effect of the creativity training on the hierarchy's scores as measured by post-test scores, by determining if there was a difference between the pre-test and the post-test scores on the hierarchy's scores. To quantify this effect, the pre-test scores of the experimental group who received creativity training were compared with the post-test using *the paired-sample t test.*

The results indicated that the two scores were significantly different (t=7.924, P=0.0001), indicating that the experimental group displayed significantly higher post-test scores at the 0.01 level compared to the pre-test after the creativity training. Results of the analysis are summarized in table 8.12. Based on these results, the null hypothesis was rejected. Therefore, it was concluded that the experimental group scores in the hierarchy's scores on the post-test were significantly higher than on the pre-test.

Table 8.12 Comparison between the Results of the Hierarchy's Scores Achieved by the Experimental Group in the Pre-test and the Post-test.

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Pre-test	32	13.90	7.15	7.924	31	0.000
Post-test	32	20.00	6.35			

Research Question 13

Will students classified with ADHD who do not receive creativity training score higher hierarchy's scores in the post-test compared with the pre-test?

$\boldsymbol{H_o 13}$: **($\boldsymbol{H_o: \mu_1=\mu_2}$)** there is not a statistically significant difference between the pre-test and the post-test scores on concept maps (the hierarchy's scores) of students in the control group who did not receive creativity training.

This hypothesis predicts that the post-test scores of the control group who did not receive creativity training should not outscore the pre-test scores. To quantify this prediction, the pre-test scores were compared with the post-test scores using *the paired-sample t test.*

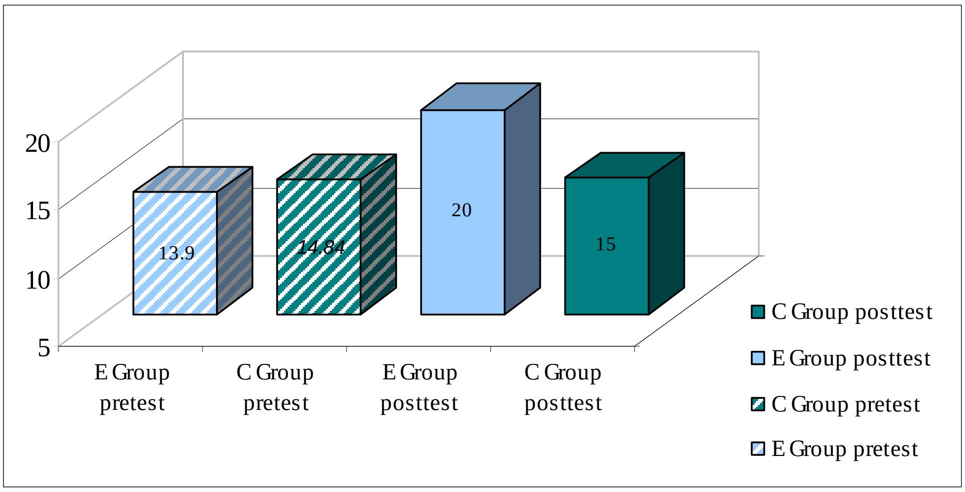
The results indicated that the two scores were significantly not different (t=0.329 P=0.745), indicating that the control group displayed in the post-test similar scores to that on the pre-test. Results of the analysis are summarized in table 8.13. Based on these results, the null hypothesis was accepted. Therefore, it was concluded that the hierarchy's scores of the control group on the post-test was not different than on the pre-test.

Table 8.13 Comparison between the Results of the Hierarchy's Scores Achieved by the Control Group in the Pre-test and the post-test.

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Pre-test	32	14.84	6.53	.3290	31	0.745
Post-test	32	15.00	6.35			

Figure 8.10 presents a visual summary of the hierarchy's scores achieved by the experimental and the control group in the pre-test and the post-test.

Figure 8.10 The Hierarchy's Scores Achieved by the Experimental and the Control Group in the Pre-test and the Posttest.



Research Question 14

Will students classified with ADHD who receive creativity training score higher cross link's scores compared with the students with ADHD who not do receive such training?

***H_o14*: (*H_o*: *μ_1=μ_2*)** there is not a statistically significant difference between the post-test scores on concept maps (the cross link's scores) of students in the experimental group who received creativity training and the control group who did not receive creativity training.

This hypothesis looked at the effect of the creativity training on the cross link's scores as measured by post-test scores, by determining if there was a difference in post-test scores between the experimental and control group in cross link's scores. To quantify this effect, the post-test scores of the experimental group who received creativity training were compared with the post-test scores of the control group who did not receive creativity training using *the t test for two independent samples.*

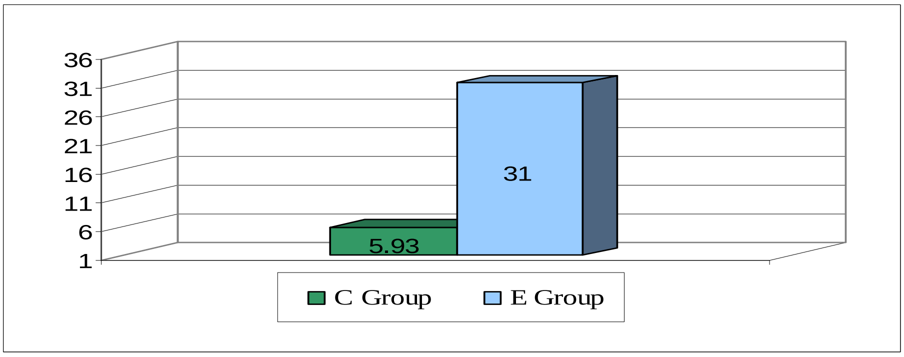
The results indicated that the post-test scores for the two groups were significantly different (t=8.073, P=0.0001), indicating that the experimental group displayed significantly higher post-test scores at the 0.01 level compared to the control group after the creativity training. Results of the analysis are summarized in table 8.14. Based on these results, the null hypothesis was rejected. Therefore, it was concluded that the cross link's scores achieved by the experimental group were significantly higher than that of the control group.

Table 8.14 Comparison between the Results of the Cross Link's Scores Achieved by the Experimental and the Control Group.

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Control Group	32	5.93	8.74	8.073	62	0.000
Experimental Group	32	31.00	15.68			

Figure 8.11 presents a visual summary of the cross link's scores achieved by the experimental and the control group.

Figure 8.11 The Cross Link's Scores Achieved by the Experimental and the Control Group on the Post-test.



Research Question 15

Will students classified with ADHD who receive creativity training score higher cross link's scores in the post-test compared with the pre-test?

***H_o15*: (*H_o: μ_1=μ_2*)** there is not a statistically significant difference between the pre-test and the post-test scores on concept maps (the cross link's scores) of students in the experimental group who received creativity training.

This hypothesis looked at the effect of the creativity training on the cross link's scores as measured by post-test scores, by determining if there was a difference between the pre-test and the post-test scores on the cross link's scores. To quantify this effect, the pre-test scores of the experimental group who received creativity training were compared with the post-test using *the paired-sample t test*.

The results indicated that the two scores were significantly different (t=12.257, P=0.0001), indicating that the experimental group displayed significantly higher post-test scores at the 0.01 level compared to the pre-test after the creativity training. Results of the analysis are summarized in table 8.15. Based on these results, the null hypothesis was rejected. Therefore, it was concluded

that the experimental group scores in the cross link's scores on the posttest were significantly higher than on the pre-test.

Table 8.15 Comparison between the Results of the Cross Link's Scores Achieved by the Experimental Group in the Pre-test and the Post-test.

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Pre-test	32	5.31	7.61	12.257	31	0.000
Post-test	32	31.56	15.68			

Research Question 16

Will students classified with ADHD who do not receive creativity training score higher cross link's scores in the post-test compared with the pre-test?

$\boldsymbol{H_o16}$**:** $\boldsymbol{(H_o: \mu_1=\mu_2)}$ there is not a statistically significant difference between the pre-test and the post-test scores on concept maps (the cross link's scores) of students in the control group who did not receive creativity training.

This hypothesis predicts that the post-test scores of the control group who did not receive creativity training should not outscore the pre-test scores. To quantify this prediction, the pre-test scores were compared with the post-test scores using *the paired-sample t test.*

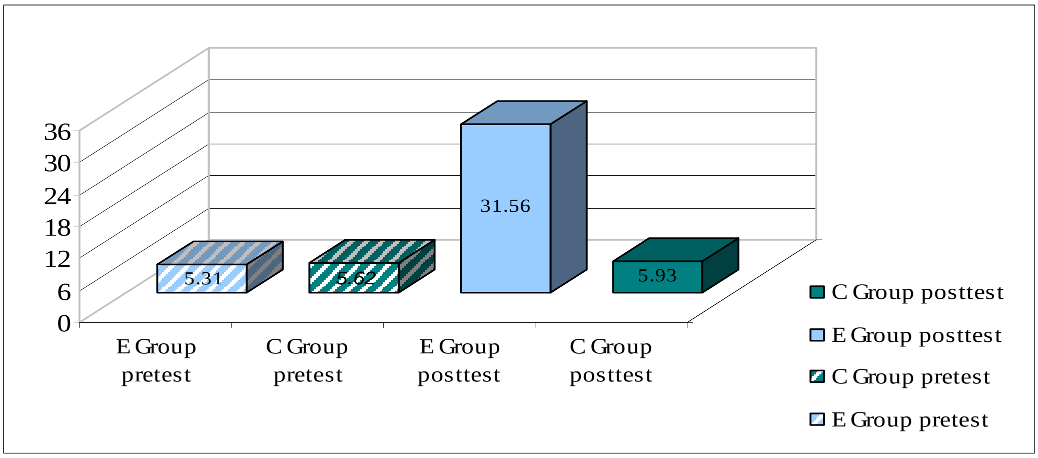
The results indicated that the two scores were significantly not different (t=0.571 P=0.572), indicating that the control group displayed in the post-test similar scores to that on the pre-test. Results of the analysis are summarized in table 8.16. Based on these results, the null hypothesis was accepted. Therefore, it was concluded that the cross link's scores of the control group on the post-test was not different than on the pre-test.

Table 8.16 Comparison between the Results of the Cross Link's Scores Achieved by the Control Group in the Pre-test and the Post-test.

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Pre-test	32	5.62	8.40	.5710	31	0.572
Post-test	32	5.93	8.74			

Figure 8.12 presents a visual summary of the cross link's scores achieved by the experimental and the control group in the pre-test and the post-test.

Figure 8.12 The Cross Link's Scores Achieved by the Experimental and the Control Group in the Pre-test and the Post-test.



Research Question 17

Will students classified with ADHD who receive creativity training score higher example's scores compared with the students with ADHD who not do receive such training?

***H_o17*: (H_o: μ_1=μ_2)** there is not a statistically significant difference between the post-test scores on concept maps (the example's scores) of students in the experimental group who received creativity training and the control group who did not receive creativity training.

This hypothesis looked at the effect of the creativity training on the example's scores as measured by post-test scores, by determining if there was a difference in post-test scores between the experimental and control group in example's scores. To quantify this effect, the post-test scores of the experimental group who received creativity training were compared with the post-test scores of the control group who did not receive creativity training using *the t test for two independent samples.*

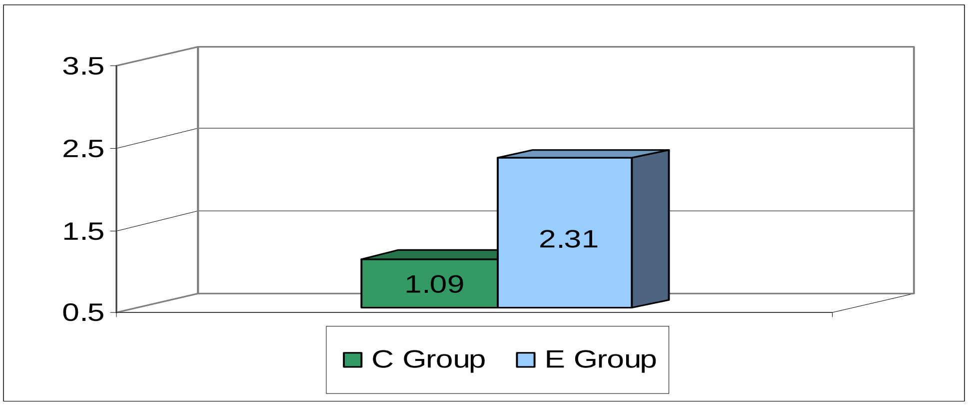
The results indicated that the post-test scores for the two groups were significantly different (t=5.148, P=0.0001), indicating that the experimental group displayed significantly higher post-test scores at the 0.01 level compared to the control group after the creativity training. Results of the analysis are summarized in table 8.17. Based on these results, the null hypothesis was rejected. Therefore, it was concluded that the example's scores achieved by the experimental group were significantly higher than that of the control group.

Table 8.17 Comparison between the Results of the Example's Scores Achieved by the Experimental and the Control Group.

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Control Group	32	1.09	1.14	5.148	62	0.000
Experimental Group	32	2.31	0.69			

Figure 8.13 presents a visual summary of the example's scores achieved by the experimental and the control group.

Figure 8.13 The Example's Scores Achieved by the Experimental and the Control Group on the Post-test.



Research Question 18

Will students classified with ADHD who receive creativity training score higher example's scores in the post-test compared with the pre-test?

***H_o18*: (*H_o: $\mu_1=\mu_2$*)** there is not a statistically significant difference between the pre-test and the post-test scores on concept maps (the example's scores) of students in the experimental group who received creativity training.

This hypothesis looked at the effect of the creativity training on the example's scores as measured by post-test scores, by determining if there was a difference between the pre-test and the post-test scores on the example's scores. To quantify this effect, the pre-test scores of the experimental group who received creativity training were compared with the post-test using *the paired-sample t test*.

The results indicated that the two scores were significantly different (t=7.072, P=0.0001), indicating that the experimental group displayed significantly higher post-test scores at the 0.01 level compared to the pre-test after the creativity training. Results of the analysis are summarized in table 8.18. Based on these results, the null hypothesis was rejected. Therefore, it was concluded

that the experimental group scores in the example's scores on the post-test were significantly higher than on the pre-test.

Table 8.18 Comparison between the Results of the Example's Scores Achieved by the Experimental Group in the Pre-test and the Post-test.

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Pre-test	32	0.937	0.981	7.072	31	0.000
Post-test	32	2.312	0.692			

Research Question 19

Will students classified with ADHD who do not receive creativity training score higher example's scores in the post-test compared with the pre-test?

***H_o19*: (H_o: μ_1=μ_2)** there is not a statistically significant difference between the pre-test and the post-test scores on concept maps (the example's scores) of students in the control group who did not receive creativity training.

This hypothesis predicts that the post-test scores of the control group who did not receive creativity training should not outscore the pre-test scores. To quantify this prediction, the pre-test scores were compared with the post-test scores using *the paired-sample t test.*

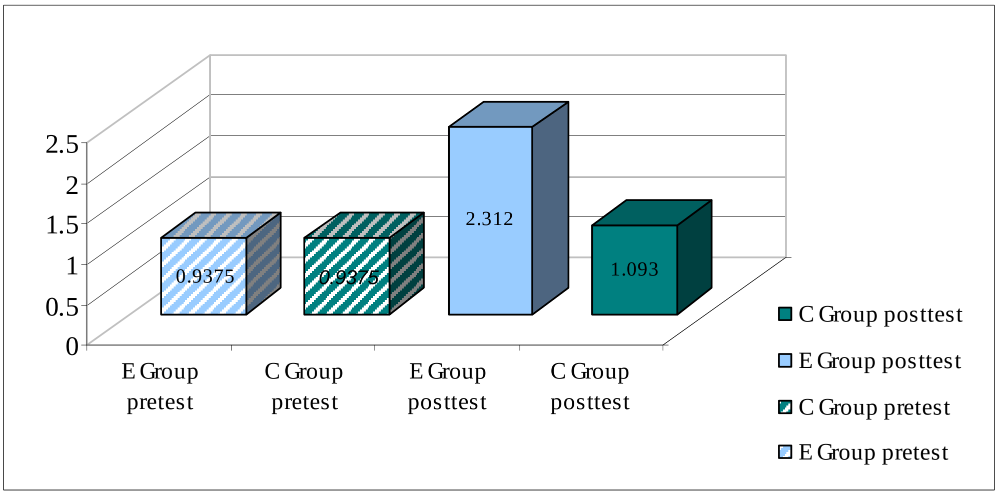
The results indicated that the two scores were significantly not different (t=1.717, P=0.096), indicating that the control group displayed in the post-test similar scores to that on the pre-test. Results of the analysis are summarized in table 8.19. Based on these results, the null hypothesis was accepted. Therefore, it was concluded that the example's scores of the control group on the post-test was not different than on the pre-test.

Table 8.19 Comparison between the Results of the Example's Scores Achieved by the Control Group in the Pre-test and the Post-test.

	N	Mean	Standard Deviation	*t*	*df*	Significance (2-tailed)
Pre-test	32	0.937	1.134	1.717	31	0.096
Post-test	32	1.093	1.146			

Figure 8.14 presents a visual summary of the example's scores achieved by the experimental and the control group in the pre-test and the post-test.

Figure 8.14 The Example's Scores Achieved by the Experimental and the Control Group in the Pre-test and the Post-test.



Conclusion

The analysis and results of the data from the investigation were detailed in this chapter. Findings of this study showed a strong positive correlation between the students' scores on the concept map and on the TTCT in both the pre-test and the post-test. It also indicated students who received creativity training scored higher scores on the TTCT and developed more complex concept maps than students who received no such creativity training.

The results of this study will be discussed in the next chapter, and recommendations for practice and future research will also be presented.

CHAPTER NINE

DISCUSSION OF FINDINGS, RECOMMENDATIONS, FUTURE RESEARCH, AND CONCLUSION

Introduction

This chapter will review the purpose, methodology, and findings of this investigation. Following the review, discussion of these findings will be provided, and delimitations as well as limitations will be presented. Finally recommendations for practice and further research will be suggested, and conclusion will also be offered.

Review of Investigation

Living in a global environment where information and technology are changing as science expounds new insights nearly everyday led educators to realize the importance of teaching children skills which they will need as adults, and to become more effective learners. Most, if not all, of today's educators have agreed on both the tremendous value of creativity and the possibility of teaching and enhancing creative ability (Runco, 2007).

Even though, to date, researchers and leaders in the field of creativity failed to agree on one theory to clarify the concept of creativity and to reach an agreement on how to define and assess the ability of creativity, they acknowledged that everyone is creative to some measure and it is possible to teach and enhance creative ability.

Since all human beings are innately creative and able to develop creative abilities and thinking skills, many teaching programmes (e.g. *the Creative Problem Solving CPS*, *the Purdue Creative Thinking Program PCTP*, and *the*

CoRT thinking lessons) which aimed to develop and strengthen creative abilities have been established and used with both students with and without learning problems. Additionally, as creativity training is a helpful strategy to enhance students' creative thinking abilities, many researchers recommended creativity training as an appropriate strategy to address the needs of today's schools which include students possessing varying abilities as a result of the movement toward including exceptional children into the regular classroom. It is likely that this universal movement by the United Nations - which started in 1976 and accelerated rapidly in the 1990s - will continue to increase as society and teachers’ attitudes change to accept inclusion as mutually beneficial for both normal and exceptional children (Baum, 1990; Baum and Owen, 1988; DeRoche, 1968a, 1968b; Feldhusen *et al*., 1969; Fleith *et al*., 2002; Fortner, 1986; Jaben, 1983, 1986a, 1986b; Khatena, 1971, 1973; Laughton, 1988; MacDonald *et al*., 1976; Renner and Renner, 1971; Russell and Meikamp, 1994; Stasinos, 1984; Swanson and Hoskyn, 1998).

Creativity, to Ausubel, is the individual ability to build hierarchical conceptual structure and to make unique associations across concepts at the higher levels in his/her conceptual structures (as cited in Novak, 1977). Thus, creativity is a very high level of meaningful learning which leads to the success in finding new solutions to problems (Novak and Cañas, 2006b).

Concept mapping also has been considered as a metacognitive strategy which allows learners to learn in a very highly meaningful fashion (Novak, 1991, 1993; Novak and Gowin, 1984; Novak and Cañas, 2006a, 2006b). Additionally, concept mapping does "open the door to more complex, flexible and creative thought processes" (Hill, 1994, p. 30). Moreover, Novak *et al*. stated that "the greatest creativity may be required to construct a concept map without any supplied words or text, but drawing on an individual’s fund of knowledge for some specific topic" (1983, p. 626). Goldstein (2001) asserted that concept mapping "help to focus the divergent process and provide structure to the inherently organic nature of the creative process" (p. 33). Otis concluded that "the strength of the concept mapping process is not increasing the size of the student's data-base but in increasing its malleability and flexibility" (2001, p. 145). Novak and Cañas affirmed that "there are two features of concept maps that are important in the facilitation of creative thinking: the hierarchical structure that is represented in a good map and the ability to search for and characterize new cross-links" (2006a, p, 2). Russell and Meikamp (1994) found that students who received creativity training developed significantly more complex concept maps compared to students who did not receive training (p. 298). It might then be reasonable to say that concept mapping is related to creativity.

Previous studies have suggested and considered concept mapping as a useful, valid, and reliable tool to assess and teach students with various ability and characteristics (Bolte, 1999; Liu, 2004; Novak, 1998; Osmundson *et al*., 1999; Reese, 2004; Ruiz-Primo and Shavelson, 1996; Ruiz-Primo *et al*., 1997; Stoddart *et al*., 2000). In the present study concept mapping which is believed to be a metacognitive strategy and widely used to promote and evaluate metacognitive skills (Novak and Cañas, 2006a, 2006b) was used along with TTCT which is a divergent thinking test to evaluate the creativity training. Additionally, concept mapping was selected as an assessment tool due to the promising findings in a previous study by Russell and Meikamp (1994) in which they affirmed that creativity training did develop students' metacognitive skills and that developing of metacognitive skills was evidenced by the complexity of the maps produced by the students in the experimental group.

If everyone is creative to some measure and creative abilities can be enhanced with appropriate training, would *the CoRT thinking lessons* improve creativity of children who have ADHD? And if concept mapping could be used to measure creativity, would *the CoRT thinking lessons* have an effect on the complexity of concept map production among children with ADHD? Would the concept maps of the children who receive creativity training be more complex compared to that of children who did not receive training? The purpose of the present study was to investigate the effects of creativity training (*the CoRT thinking lessons*) upon students classified with ADHD as measured by the ability to develop complex concept maps.

Although, results of previous studies have suggested that the use of creativity training did increase the students' creative ability, much of these studies have used creativity training with regular education students, LD, hearing impaired, mental retardation, and behavioural and emotional disordered, but none - to the researcher's knowledge - has been carried into effect creativity training with children with ADHD. For that reason, in the present study it was hypothesized participants receiving creativity training would not score significantly higher scores on the TTCT, nor would they produce more complex concept maps than those participants not receiving such creativity training on the post-test. Specifically, the research questions of the present study have been defined as follows:

1. Is there a correlation between the concept mapping ability of students with ADHD and their performance in *the Torrance tests of creative thinking* (TTCT)?
2. Will students classified with ADHD who receive creativity training score higher scores on the TTCT than students with ADHD who not do receive such training?
3. Will students classified with ADHD who receive creativity training score higher scores on the TTCT in the post-test compared with the pre-test?

4. Will students classified with ADHD who do not receive creativity training score higher scores on the TTCT in the post-test compared with the pre-test?
5. Will students classified with ADHD who receive creativity training produce more complex concept maps than students with ADHD who not do receive such training?
6. Will students classified with ADHD who receive creativity training produce more complex concept maps in the post-test compared with the pre-test?
7. Will students classified with ADHD who do not receive creativity training produce more complex concept maps in the post-test compared with the pre-test?
8. Will students classified with ADHD who receive creativity training score higher proposition’s scores compared with the students with ADHD who not do receive such training?
9. Will students classified with ADHD who receive creativity training score higher proposition’s scores in the post-test compared with the pre-test?
10. Will students classified with ADHD who do not receive creativity training score higher proposition’s scores in the post-test compared with the pre-test?
11. Will students classified with ADHD who receive creativity training score higher hierarchy’s scores compared with the students with ADHD who not do receive such training?
12. Will students classified with ADHD who receive creativity training score higher hierarchy’s scores in the post-test compared with the pre-test?
13. Will students classified with ADHD who do not receive creativity training score higher hierarchy’s scores in the post-test compared with the pre-test?
14. Will students classified with ADHD who receive creativity training score higher cross link’s scores compared with the students with ADHD who not do receive such training?
15. Will students classified with ADHD who receive creativity training score higher cross link’s scores in the post-test compared with the pre-test?
16. Will students classified with ADHD who do not receive creativity training score higher cross link’s scores in the post-test compared with the pre-test?
17. Will students classified with ADHD who receive creativity training score higher example’s scores compared with the students with ADHD who not do receive such training?
18. Will students classified with ADHD who receive creativity training score higher example’s scores in the post-test compared with the pre-test?
19. Will students classified with ADHD who do not receive creativity training score higher example’s scores in the post-test compared with the pre-test?

To verify whether *the CoRT thinking lessons* can enhance creative ability and improve concept map complexity a *Pretest-Posttest Control Group Design* was used in this study. Sixty four students who are fourth and fifth graders and classified as having ADHD participated in the investigation. In order to ensure that concept mapping is a familiar technique to all participants, they all were given a training session in concept mapping. Next to that, they were asked to complete a concept map and the TTCT as a pre-test measure. After that, they were non-randomly assigned to either experimental or control group, each group consisted of thirty two students. The experimental group was given creativity training (20 hours of *the CoRT thinking lessons* during ten weeks) and the control group received no creativity training. Finally, all sixty four participants completed a second concept map and the TTCT as a post-test measure.

Data collected from participants were analyzed via *the Pearson product-moment correlation coefficient*, *the t test for two independent samples*, and *the paired-sample t test*. Results of the analysis indicated that participants who received creativity training developed significantly more complex concept maps than those participants who received no such creativity training. Thus, creativity training enhances both concept mapping complexity and creative ability of students with ADHD.

Discussion of Findings

Data analysis of the present study revealed a statistically significant difference between the scores of the experimental group (which received creativity training) and the scores of the control group (which did not receive such training) in the post-tests. Since both groups were equivalent before beginning the training (*the CoRT thinking lessons*) but significantly different after the creativity training, it is reasonable to conclude that the students' scores in the experimental group did increase on the post-tests as a result of the implementation of creativity training. Thus, the overall findings of this study value and support providing children with ADHD with creativity training.

Reviewing of the literature pertaining to the impact of creativity training on the enhancement of creative ability indicated that the results of the present study added to a growing body of research that validated the role of nurturing creativity through creativity training as an opportunity for increasing creative ability. The literature review also recommends creativity training as a successful practice to address the needs of students of varying abilities (Baum, 1990; Baum and Owen, 1988; DeRoche, 1968a, 1968b; Feldhusen *et al*., 1969; Fleith *et al*., 2002; Fortner, 1986; Golovin, 1993; Jaben, 1983, 1986a, 1986b; Khatena, 1971, 1973; Laughton, 1988; MacDonald *et al*., 1976; Moran *et al*., 1983; Renner and Renner, 1971; Russell and Meikamp, 1994; Schack, 1993; Stasinos, 1984; Sternberg, 2003; Swanson and Hoskyn, 1998).

Results of both previous studies and the present study are supported by many theorists (e.g. Davis, 1998; de Bono, 1978, 1986; Gordon, 1961; Guilford, 1967; Renzulli and Dai, 2001; Renzulli and Reis, 1997; Runco, 2007; Schilchter, 1997; Sternberg, 2003; Torrance, 1962a, 1962b, 1963, 1965, 1967a, 1967b, 1977, 1993) who theorized that creativity can be taught and students do learn techniques which help them to enhance their creativity.

Russell and Meikamp (1994) concluded that creativity training assisted students of varying abilities in developing metacognitive skills. They based their conclusion on the complexity of the maps produced by the students who were provided with creativity training. Results of the present study are in line with that by Russell and Meikamp (1994), showing that students who received creativity training produced more complex maps and outperformed those who did not receive creativity training.

Additionally, results of the present study also added to previous studies that found *the CoRT thinking lessons* to be beneficial in promoting metacognition and higher order thinking skills such as analysis, synthesis, and evaluation. In teaching *the CoRT thinking lessons* brainstorming, analogies, problem solving, questioning techniques and open-ended activities were used. Consequently, creativity training did benefit students who received it by enhancing their creative abilities (such as fluency, flexibility, originality, and elaboration) which result in their scores on the post-test in which they produced creative products on the TTCT and created more complex concept maps by integrating information related to a key concept. Maps of the students in the experimental group (which received creativity training) point to a deep learning and understanding which resulted from the change in their learning strategies. The maps constructed by those students reflected changes in their conceptual understanding which was evidenced by a higher number of concepts, a higher quality of hierarchial organization of concepts, and a higher number of cross-links. They used different thinking skills and learning strategies to read, understand, and map the story. For example, lessons five (AGO) assisted students to understand why the Emperor Penguin will lay the egg on her feet, and what the intention was behind leaving the egg with the male.

Promoting metacognition and higher order thinking skills is an important key to facilitate both meaningful learning (which is long term learning) and success in school. Thus, even though creativity training may take some time and requires some effort from both students and teachers, the benefits to them far outweigh the costs. Today, in the Kingdom of Saudi Arabia, the availability of highly prepared teachers who work with gifted children in every school could and should make use of creativity programmes available to every child in the school by offering their support to the class teachers.

Although de Bono asserted that formal training is not required to use *the CoRT thinking lessons*, the high results of the experimental group (which received creativity training) on the post-tests might also have been due to the effort made by their teachers who are qualified creativity and talent teachers', who have the expertise of utilizing *the CoRT thinking lessons*, and have taught creativity as a serious matter, yet, in a fun and enjoyable way. However, the availability of creativity programmes (which are highly structure, planned, and flexible such as *the CoRT thinking lessons*) should make implementing creativity training in the classroom by the class teacher with some help from the creativity and talent teacher easier and successful.

Another finding is that there is a relationship between the TTCT scores and concept map performance. This finding indicates that those students who created better concept maps also score better scores in the TTCT. This high correlations found (in both the pre-test and post-test) between concept mapping and TTCT supports Novak and Gowin (1984) and Novak's (1998) proposal that concept maps can be used to aid creativity. They argue that the process of creating a concept map is an activity that encourage and develop creativity. In their words:

> Undoubtedly, we may develop new concept relationships in the process of drawing concept maps, especially if we seek actively to construct propositional relationships between concepts that were not previously recognized as related: Students and teachers constructing concept maps often remark that they recognize new relationships and hence new meanings (or at least meanings they did not consciously hold before making the map). (Novak and Gowin, 1984 p. 17).

The current researcher believes that Novak and Gowin's argument seems to stand up well. In fact, the current researcher has chosen to use concept mapping to measure changes in metacognition (following creativity training) because she believes that, as argued in chapter one, concept mapping is related to creativity. Concept mapping has been seen as an externalized representation of the learner's knowledge (see Anderson-Inman *et al*., 1998; Anderson-Inman and Zeitz, 1993, 1994; Dabbagh, 2001; Plotnic, 1997, Novak 1998; Novak and Gowin, 1984, Novak and Cañas, 2006a, 2006b). Concept mapping, therefore, might help children to develop more personal awareness of themselves as learners and their own knowledge. This awareness might lead to deeper levels of cognitive engagement which can result in a creative way of thinking and creative behaviour.

Additionally, this finding (high correlations between the TTCT scores and concept map scores in both the pre-test and post-test) might be explained under Ausubel's theory. To Ausubel, building hierarchical conceptual structures, and making unique associations across concepts at the higher levels in the conceptual structure is a creative behaviour (as cited in Novak, 1977). Therefore, it can be argued that the correlation between concept map scores and TTCT scores may be explained by the parallels between creativity as seen by Ausubel and concept mapping procedure.

It might also be explained by the comparison between concept mapping procedure and brainstorming proposed by Plotnic who stated that "as one puts ideas down on paper without criticism, the ideas become clearer and the mind becomes free to receive new ideas. These new ideas may be linked to ideas already on the paper, and they may also trigger new associations leading to new ideas" (1997, p. 3). However, the sample of the present study is very small and further investigation to explore the connection between creativity and concept mapping using a large sample with wide range of age and varying abilities is very much needed. If this finding (high correlations between the TTCT scores and concept map scores in both the pre-test and post-test) is confirmed in further studies, then concept mapping can be used to measure creativity instead of creativity tests (e.g. TTCT) which are expensive and must be applied and scored by professional psychologist.

Delimitations and Limitations

Delimitations suggest how the study will be narrowed in scope by providing descriptions of the population to which generalizations accurately may be made (Creswell, 1994; Locke *et al*., 1993). People, places, and times are the three major threats to external validity, thus, delimitations may affect the external validity of a study (Creswell, 1994; Locke *et al*., 1993).

In the present study, the researcher identified three delimitations which may well affect the applicability and generalization the results of this study to other settings and populations.

First, this study was delimited by its restriction to explore the effect of *the CoRT thinking lessons* as an enhancement tool on the creative thinking of children with ADHD who are fourth and fifth graders. Enhancement of creativity in this study was measured by both the TTCT and concept map complexity. Although during this investigation all of the participants were taking prescribed medication for their treatment of their ADHD, this study did not address the use of prescribed medication for the treatment of ADHD nor address gender differences. Therefore, because of the focused population used in this study, generalizations to other populations should be made with considerable caution. In addition, this study was conducted in Riyadh which is the capital of the kingdom of Saudi Arabia, therefore the results from this study may well not be generalizable to a rural setting or other countries. Finally, the study was further delimited by the duration, which was three months. This may well have affected the applicability.

Limitations - which are almost in every study - identify potential weaknesses of the study, yet, some of these limitations can be seen as potential opportunities for further investigation in future research (Castetter and Heisler, 1988; Creswell, 1994; Locke *et al*., 1993).

A major limitation to this study was the size of the sample, this may be due to the voluntary nature of the study, and the busy schedules for teachers. In addition, all participants are girls, therefore this study did not address gender difference. However, it must be acknowledge that in most, if not all, previous studies no gender difference between males and females was reported.

The literature reviewed for this study acknowledged that the students' academic achievement, self-concept and self-efficacy, and behaviour and social skill development might be positively influenced by creativity training. Unfortunately, this study did not investigate the effect of creativity training (*the CoRT thinking lessons*) on students' self-concept/self-efficacy, students' behaviour and social skill development, and student's academic achievement achieved in variety of curriculum areas such as reading, writing, and mathematics. However, in the present study, concept mapping technique which has been related to creativity and well supported by the literature as a learning, teaching, cognitive, and assessment tool was used to evaluate the generalization of creative behaviour which might result from the creativity training.

A further limitation is that this study did not investigate the long-term advantage of utilizing creativity training. As a result, a follow up and retesting of the students after several months of the training and the post-tests, unfortunately, was not made. However, one must acknowledge that neither any of the literature reviewed for this study nor that reported on meta-analysis studies (e.g. Ma, 2006; Mansfield, 1978; Scott *et al*., 2004a, 2004b) addressed the long-term advantages of utilizing creativity training. Yet, a follow up after several months may determine whether the participants on the creativity training are still using the skills they had learn in the training programme. And whether gains in creativity, if there were any, were maintained, decreased or increased.

Another limitation is that there is no research design without a limitation and the design used in the present study is not an exception. Therefore, this study was further limited by the study design which restricted participants' contribution to a data source generator. However, the aim of the present study was to determine the efficiency of creativity training on the concept map complexity, and the *Pretest-Posttest Control Group Design* which was utilized in this study is an adequate design to achieve that objective.

Finally, it must be acknowledged that when using the *Pretest-Posttest Control Group Design* findings can be problematic in two cases: First, in the case of the experimental group outscores its own pre-test scores. Second, in the case that experimental group outscoring the control group on the post-test scores. In both cases, findings may be in part influenced by the experimental group receiving small group work, rather than creativity training. Although this issue could be managed by having a third group which is provided with placebo treatment, the researcher has chosen not do so for two reasons. First, having a placebo treatment group is usually used when the research aim is to investigate the outcome of a treatment or training programme which is designed or proposed by the researcher (e.g. construct a new creativity training programme which is cheaper than CoRT). This is not the case in the current study. In fact, the purpose of this study (as mentioned in chapter one) was not to construct a new training programme for teachers. Nor was it to evaluate *the CoRT thinking* *lessons* as a creativity programme. Rather, the purpose was to investigate how a proven creativity programme may be employed by teachers when working with children who have ADHD. CoRT is a proven creativity programme which was developed by Edward de Bono who is a theorist and a respected authority in the field of creativity. CoRT has been used by many researchers to enhance creative abilities (fluency, flexibility, originality, and elaboration) in many studies (see chapter seven). These studies reported a positive outcome of using CoRT to enhance creative abilities. However, many of these studies have used CoRT with regular education students and children who are classified as having LD, hearing impaired, mental retardation, and behavioural and emotional disorders, but none - to the researcher's knowledge - have used CoRT or other creativity training programmes with children who are classified as having ADHD. Second and more importantly, is that the number of the participants in the current study is small, therefore it was impossible to have a third group (a placebo treatment group). As mentioned previously in chapter seven, participants' number in the current study is small due to the percentage of children with ADHD is small compared to other children of the same age, most researchers agree that ADHD affects 3-5% of school-aged children (APA, 1994).

Recommendations

The implications from the investigation will be suggested as recommendations in this section. These recommendations are either derived directly from the results of the present study or made based on the literature reviewed for this study.

The overall findings of previous studies and results of the present study demonstrated that creativity can be taught and creativity training can be beneficial for improving creative abilities of students of varying abilities.

Therefore, educators should encourage students to think and behave creatively by teaching them creativity enhancing techniques. Educators also should nurture students' creativity by providing them with creativity training.

Given the intricate relationship between creativity training and improved creative abilities, educators are supposed to integrate creativity enhancing techniques (e.g. brainstorming, analogies, problem solving, questioning techniques and, open-ended activities) as an essential part of the activities performed daily in each subject of the school curriculum. These techniques develop creative abilities (fluency, flexibility, originality, and elaboration) which are life skills that are imperative to students' learning and future successes. For example, creativity enhancing techniques encourage and assist students in thinking not only about what they think, but how they think. Thus, they will learn how to learn and take an active role in their learning. Additionally, all children should receive training in creative thinking as Baer (1994b) and Cramond (1994c) recommended.

A large body of research, in which *the CoRT thinking lessons* has been tested, has verified the effectiveness of using *the CoRT thinking lessons* to develop thinking skills and recommended it to increase creativity in children. Based on the results of the present study the researcher also recommends *the CoRT thinking lessons* to be used as creativity training to enhance the creative ability of children with ADHD.

Results of the present study go hand in hand with that of Russell and Meikamp (1994). Therefore, a recommendation could be taken from their study. Russell and Meikamp concluded that both regular students and students who are classified as special education students did benefit from creativity training, so, they recommended it as a "strategy worthy of use by teacher with students in an integrated setting" (p. 300).

Teaching and fostering creativity via creativity training, traditionally, has been a fundamental part of creativity and talent teachers' preparation to work with the mentally gifted children. Results of both previous studies and this study affirmed that students who are not classified as mentally gifted do benefit from creativity training, then, the researcher suggests that all teachers should be prepared to teach and foster creativity.

Additionally, all teachers should be prepared to teach and serve children with ADHD, thus, a course about ADHD should be included as a requirement in any teacher preparation programme.

Special education teachers who specialized in the field of gifted and talented could and should provide regular teachers who are in-service with workshops in creativity. Likewise, special education teachers who specialized in the field of ADHD could and should provide regular teachers who are in-service with workshops in ADHD. Piccolo-Torsky and Waishwell (1998) argued that 90% of the regular teachers need and desired more training and the majority had recently taught at least six ADHD children. Moreover, they reported that the vast majority (90%) "indicated they could benefit from additional training regarding ADHD" (Piccolo-Torsky and Waishwell, 1998, p. 39).

Concept mapping appears to be a technique worthy of use by teachers to teach their students because it is a valuable technique “for helping students learn about the structure of knowledge and knowledge of production, or metaknowledge” (Novak and Gowin, 1984, p. 8). Additionally, as students become more proficient or engaged in constructing concept maps, they learn how to learn and become better at learning (Novak, 1998). Furthermore, as a tool for learning, concept maps are well supported by cognitive theories of learning. More importantly, experimental researchers have concluded that concept mapping technique has positive effects on the learning of both students with and without learning problems, and improves their learning in a wide variety of subject areas such as reading, writing, biology, chemistry, and mathematics.

The majority of today's schools include students with a wide variety of abilities and learning characteristics which without a doubt they bring to the classroom. Concept maps (which represent the student's knowledge structure on a particular topic and own understanding of a specific material) are very supportive in helping teachers in celebrating and highlighting individual differences in learning among their students (Bos and Vaughn, 2005; Plloway *et al*., 2002; Sherman *et al*., 2006; Stainback *et al*, 1994). In addition, teachers can use concept maps to take advantage of the students' diversity by using it as a collaborative tool. Group mapping allows students to teach and correct each other's misconceptions. More importantly, it gives students who have difficulty in understanding a topic the chance to get an explanation from their peers who do understand. It also provides those giving the explanations an opportunity to develop a better and deeper understanding of the topic (Boxtel *et al*. 2002; Brown, 2003, p. 193; Esibou and Soyibo, 1995; Gijiers and Jong, 2005).

According to La Vecchia and Pedroni (2007) concept mapping is very valuable in testing comprehension of the relationship-based foundation of a domain of knowledge. Therefore, it can be used as an assessment tool alongside traditional methods such as oral-based tests which are based on subjective judgment or the structured tests which are more objective.

Evaluating knowledge acquired by students classified as special education students is difficult and cannot always be measured by the traditional methods. Concept mapping technique which has been verified by a large body of research as an effective method to evaluate declarative, procedural, and structural knowledge might provide an alternative or additional measure to assess special education students. However, since participants of most of the studies are normal students, further research to explore the use of concept mapping to evaluate special education students are required.

A concept map condenses the student's knowledge of a subject into a small space "one sheet" and takes short time to create. Therefore, concept maps may help students with ADHD to get an overall idea of their knowledge of the subject, and encourage them to focus on the relationships between concepts to recognize the gaps in their understanding. It also helps students to get a long-term and well-organized overview of a topic. In addition, concept maps may also help ADHD teachers to identify the student difficulties and help him/her to deal with it more effectively.

Today, in every school, if not in every classroom, there are children with ADHD. Unfortunately, most of the teachers who teach children with ADHD focus on the child's weakness and try to help the child to deal with his/her weak areas. Similar to the suggestion made by Flint (2001), Schlozman and Schlozman (2000), Sherman *et al*., (2006), and Weiss (1997), results of the present study recommend that teachers should also focus on the child's strength areas in order to establish an appropriate style of teaching or educational placement from which children with ADHD could benefit.

Future Research

As with all studies, the current study has raised many further questions and issues for future work. Research for further investigation will be suggested in this section. These suggestions are either derived directly from the results of the present study or made based on the literature reviewed for this study.

There has been more than fifty five years of research on the topic of creativity, yet, among both researchers and leaders of this field there is no agreement on what creativity is, or how to assess it. However, the need for more qualitative and quantitative research for assessing and developing creativity is one point that was clear and approved by every one who works in the field of creativity.

Creativity and ADHD are currently being researched intensively, but the area of creativity among individuals with ADHD is greatly lacking in research. Additionally, concept mapping technique has been a research topic for more than three decades, yet, to date, it is rarely used as a research topic in both creativity and ADHD. Therefore, more research still needs to be done in these areas.

Experimental results from the present study have demonstrated the feasibility of creativity training in enhancing students' creativity scores on the TTCT and performance on the concept maps. These results are interesting and highly promising for further study using different research designs (e.g. *single-Subject Design*) which maybe provide us with more information and details. Additionally, because of the limited amount of research on creativity among children with ADHD, further study to address this area using larger sample (e.g. both gender, and a wide range of development age and academic grades) which could generalize results to a larger population is needed.

Since the present study did not address the effect of the creativity training on students' self-concept/self-efficacy, students' behaviour and social skill development, and students' academic achievement achieved in a variety of curriculum areas such as reading, writing, and mathematics further studies could investigate these areas. Future research also could evaluate the effect of creativity training over a longer duration, and the long-term advantages of it by following up retest after several months of the training.

Results of the present study add to a large number of experimental results on *the CoRT thinking lessons* which have confirmed the usefulness of using it to enhance students' thinking skills. However, the present study used only twenty lessons from CoRT 1, 4, and 6. Therefore, an examination of the other parts or the entire programme is suggested for further study.

Unfortunately, most, if not all, of the research and intervention on ADHD were overly focused on identifying deficiencies among children with ADHD to help the children, parents, and teachers deal with these deficiencies (Burcham *et al*., 1993; Frick and Lahey, 1991; McBurnett *et al*., 1993; Purdie *et al*., 2002). Therefore, it would be valuable for further research to focus on strengths as well as weakness among children with ADHD. For example, examine the effective of using CoRT 2 (organization), CoRT 3 (interaction), and CoRT 5 (information and feeling) among children with ADHD.

The high correlation found between concept maps and TTCT scores in the present study is encouraging and could be confirmed by a factor analysis study using a large sample - similar to that used to develop the TTCT (that is, a large group of participants "more than 10,000", wide range of development age "e.g. 5 to +18" wide range of development ability "e.g. gifted, average, mental retardation, LD, ADHD, and low achievement" wide range of academic grades "e.g. from kindergarten to 12 grade" and both gender) - and addressing specific correlations between the subscale scores of the concept map and the TTCT. For example, is there a correlation between scores of originality on the TTCT and the scores of cross links on concept maps? In other words is the ability of originality equivalent or correlated to cross links' scores, the ability of fluency with propositions, flexibility with hierarchy, and elaboration with examples? And if so, does concept mapping technique measure creative ability in the way the TTCT does?

Concept mapping has been seen by it is creator (Novak, 1998) as a teaching and learning tool which aids creativity. If indeed, as the results of both Russell and Meikamp (1994) and the present study suggest, creativity training has a positive affect on concept mapping complexity, then concept mapping possibly will also be used to aid creativity. However, Riley and Ahlberge (2004) found no significant positive correlation between concept mapping connectivity and creativity, but they used a different scoring method than that suggested by Novak, and the sample they used was small. Since Riley and Ahlberge' study is the only academic work done to test the effect of using concept mapping on creativity - to the researcher's knowledge - and their results do not come into line with Novak's notion that concept mapping technique will aid creativity, further research in this area is required.

Wallach and Kogan (1965) proposed four categories of characteristics of children aged 10-11 years, classified on the basis of their levels of creativity and intelligence. Wallach and Kogan described children who are "High creativity-low intelligence" as angry children who have conflict with themselves and their school environment, and have feelings of unworthiness and inadequacy, but they are able to blossom cognitively. Based on the above characteristics creativity training could help high creativity/low intelligence children to grow cognitively, but also create more negative personality characteristics, so, creativity training could not be suitable for those children. However, Wallach and Kogan also found that "low creativity-low intelligence" are suffer from psychosomatic symptoms, passivity, or are involved in antisocial activities. Therefore, further research to understand the exact influence of creativity training on the personality characteristics of children of different abilities is required.

Some academics and clinical professionals argue that there is a relationship and similar characteristics between ADHD and creativity. However, to date, the exact nature of the relationship, if any, between ADHD and creativity is not known. Therefore, further academic research in this particular area is much needed.

Conclusion

Human creativity, to date, is difficult to define and evaluate, but it is valuable and can be taught. Teaching creativity to children with ADHD through *the CoRT thinking lessons* was the focus of this study. The initial results which are very interesting and highly promising show that creativity training did benefit children with ADHD. Therefore, teachers should design and establish educational activities and environments in which the creative abilities of children with ADHD can be developed. Additionally, children with ADHD should also have the opportunity to enter creativity programmes in their schools. However, since research in this area is limited, further works still needs to be done.

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APPENDIX A

Life in a Pack [*]
"Wolves"

By
Richard and Louise Spilsbury

Wolves are large wild dogs. They have long legs, big feet and a long pushy tail. Although each <u>wolf</u> does some things alone, wolves are social animals and spend most of their time doing things with other wolves in a group. A group of wolves is called a <u>pack</u>.

A wolf pack is basically a <u>family</u> group. Most packs contain two <u>parents</u> and their young. Some packs also include a <u>brother or sister</u> of one of the parent wolves, an aunt or uncle to the youngsters. Every wolf has a particular <u>rank</u> or place in the pack. Wolves know who is above them and who is below them in rank.

The two parents are called the <u>alpha</u> pair. They are the dominant or top-ranking wolves in the pack. The other wolves show respect to them and often do what they want. Although the alpha <u>male</u> and alpha <u>female</u> usually decide what the pack does, such as choosing where to sleep and when to hunt, they do not always tell the others what to do. The next most important are the <u>beta</u> wolves. These are usually wolves aged between one and three years old. The older beta wolves are higher up than the youngest beta wolves. The <u>pups</u> (wolves that are one-year-old or younger) come below their older brothers and sisters and the alpha wolves.

A dominant wolf and a lower-ranking wolf show their rank almost every time they meet. The dominant wolf stands up tall, with its tail up, ears pointing forward and looks directly at the other wolf. The lower-ranking wolf crouches down, tucks its tail between its legs, holds its ears flat and looks away from the dominant wolf.

Each pack of wolves usually stays in a particular area, called its <u>territory</u>. This is the area in which they hunt, rest, sleep, play and raise pups. A pack tries to stop wolves from others packs going into their territory. Some packs have large territories; others have smaller territories. The size of a territory depends on the amount of food that is available in it.

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[*] 610 words

The alpha pair in a pack usually stay together for life. Each year they mate in late winter. Tow months later they have a new litter of baby wolves, called pups. The pups are born in a <u>den</u>, which may be a <u>cave</u>, <u>a hollow log</u>, but most often in <u>a hole underground</u>. A den is usually near a river or lake, so that the mother does not have to go far to get water. While the mother wolf is in the den with the pups, the other wolves hunt and bring food for her to eat.

The pups first leave the den when they are about a month old. The other wolves in the pack gather round to meet the pups as they come out. They all lick each other and wag their tails in excitement. The whole pack helps to look after the pups when they are out of the den. Each wolf watches out for eagles, bears and other predators, which may attack a pup, and they all do their best to protect the pups. As well as looking after them, all the wolves in a pack seem to be very fond of the pups.

When the pups are about three months old, they start to go along on some hunts. They watch the adults to learn what to do, what to catch and how to follow scent trails. By winter, the young wolves are able to travel and hunt along with the rest of the pack.

STUDENT NAME

DATE

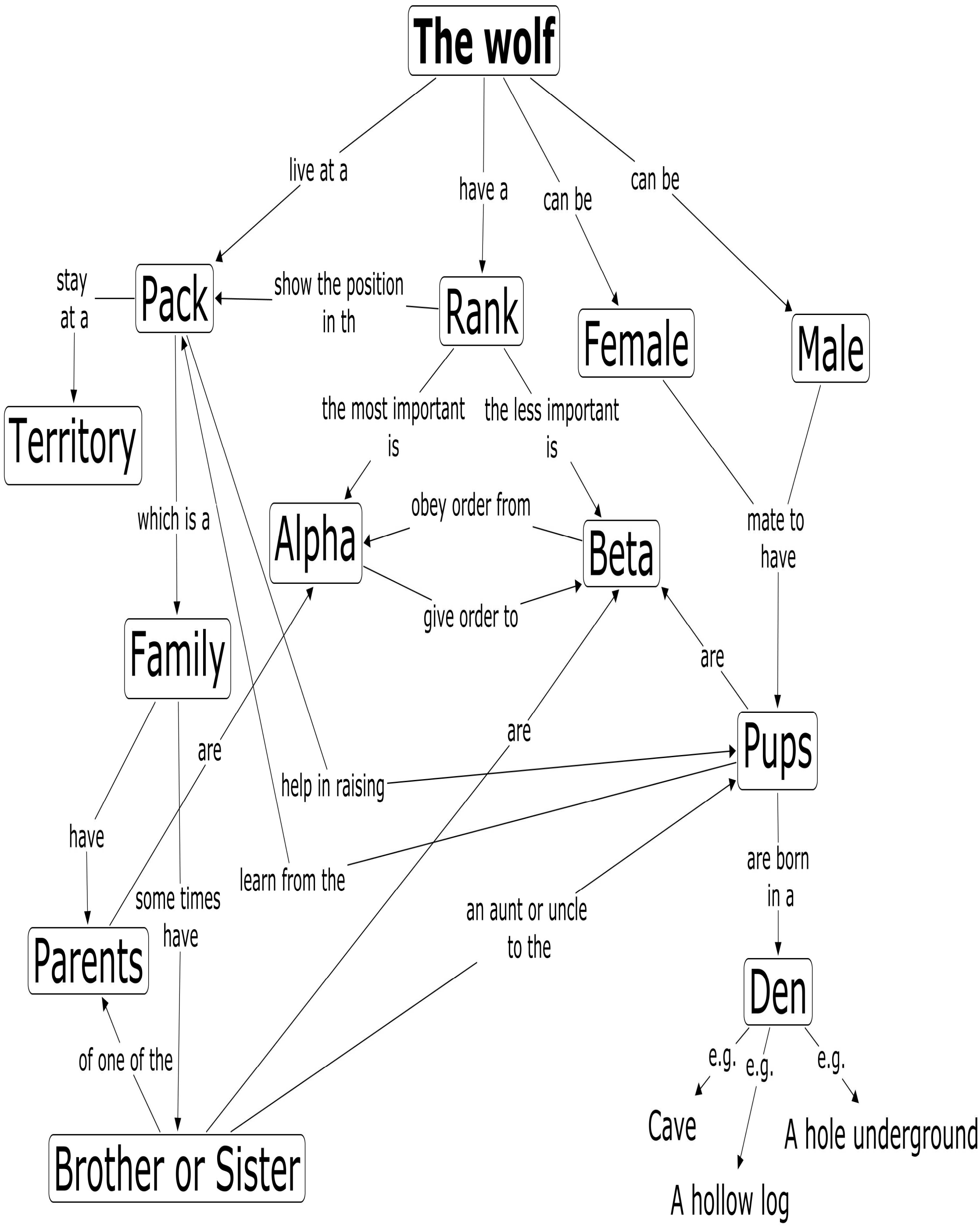
Map Title

Map a concept map to answer this question:

How Wolves live in a back?

<u>Using the flowing concepts</u>

The wolf	Pack	Family	Parents	Rank
Alpha	Male	Female	Beta	Pups Territory
Den	Cave	Brother or sister	Hollow log	Hole
underground				


The wolf
live at a
have a
can be
can be
Pack
stay
at a
show the position
in th
Rank
Female
Male
Territory
the most important
is
the less important
is
which is a
Alpha
obey order from
Beta
mate to
have
give order to
Family
are
are
are
Pups
help in raising
have
learn from the
are born
in a
some times
have
an aunt or uncle
to the
Parents
Den
of one of the
e.g.
e.g.
e.g.
Cave
A hole underground
Brother or Sister
A hollow log

APPENDIX B

Looking After the Egg*
"Emperor Penguins"

By
Meredith Hooper

Emperor Penguins live in the coldest, windiest place on Earth. They live in the Antarctic. Winter in the Antarctic is extremely cold. In the middle of winter, it is dark all day as well as all night.

Emperor Penguins lay their eggs in winter. The female lays one egg. She puts the egg on her feet. The egg must not stay on the ice. The ice would freeze the egg very quickly.

The male takes the egg from the female and puts it on to his feet. The female Emperor Penguins are very hungry. Egg laying uses up a lot of energy. The penguin's food is in the sea, they feed mainly on Krill, fish and small squid. They must go to the sea and find food, but the sea is a long way away across the ice. The female Penguins walk towards the sea, one behind the other. When they reach the sea they dive in and begin hunting for food. Every day they swim and eat.

The male Emperor penguins stand on the ice looking after the eggs. They stand day after day, week after week. When cold winds blow the penguins stand very still. They hunch their heads down into their shoulders to keep warm.

After 65 days the chick hatches. It must not stand on the ice. It would freeze to death in two minutes. The chick stands on the male's feet. It keeps warm under the fold skin.

The males feed the chicks with special food from their gullets. But they can only do this for few days. They wait for the females to com back.

The female Emperor penguins walk back from the sea just after the chicks hatch.

There are thousands of Emperor penguins on the ice. The males and females must find each other. Each pair of penguins has a special call. They call to each other in the crowd.

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* 470 words

The female has plenty of food to give the hungry little chick. She takes the chick from the male. She puts the chick on her feet, under the fold of skin.

The male penguins have not eaten for nearly four months. They are very thin and tired and hungry. Now they can begin walking to the sea.

After three weeks the male comes back from the sea. Now he looks after the chick while the female walks back to the sea to find food.

Emperor penguins lay their eggs in winter so that the chicks can hatch in spring. This gives the chicks as much time as possible to grow big and strong before winter comes again.

Emperor penguins have to work hard to look after their chicks. Only about half the chicks <u>survive</u> this first hard year of life.

STUDENT NAME

DATE

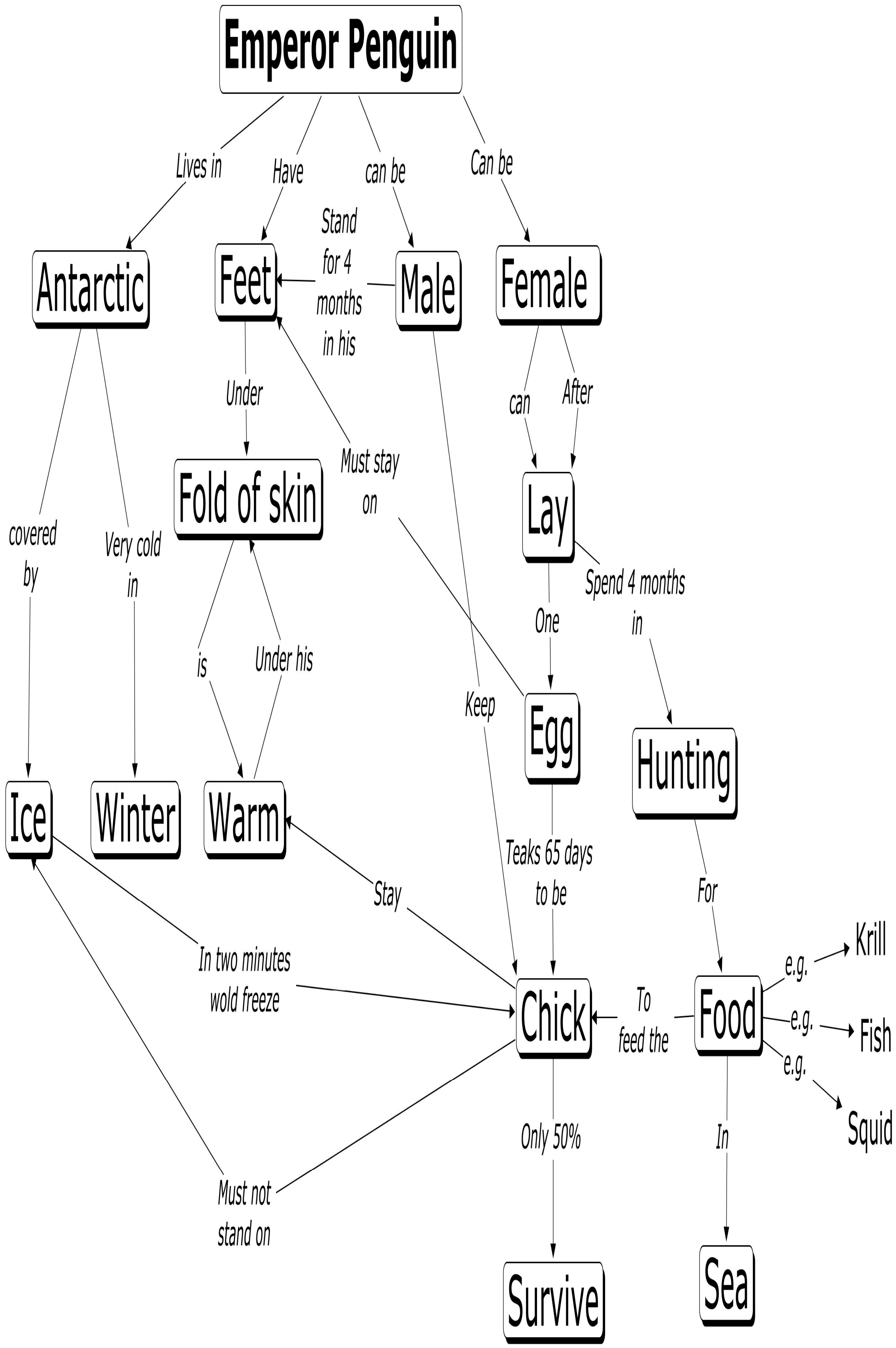
Map Title

Map a concept map to answer this question:

How Emperor Penguin looks after the egg?

<u>Using the flowing concepts</u>

Emperor Penguin	Female	Male	Fish	Chick
Antarctic	Egg	Food	Squid	Fold skin
Winter	Feet	Sea	Hunting	Survive
Lay	Ice	Krill	Warm	


Emperor Penguin
Lives in
Have
can be
Can be
Antarctic
Feet
Stand for 4 months in his
Male
Female
Under
can
After
Fold of skin
Must stay on
Lay
covered by
Very cold in
Spend 4 months in
One
is
Under his
Keep
Egg
Hunting
Ice
Winter
Warm
Teaks 65 days to be
Stay
For
In two minutes wold freeze
Krill
e.g.
Chick
To feed the
Food
e.g.
Fish
e.g.
Squid
Only 50%
In
Must not stand on
Survive
Sea

STUDENT'S NAME:

Focus Question:

	THE SCORE
Propositions	
Hierarchy	
Cross Links	
Examples	
TOTAL	

Rater's Name:

Date:

APPENDIX C

CONCEPT MAPS
"Workshop"

What are concept maps?

Concept maps are representation of spatial relationships, just like all maps, but rather than portraying the physical structure of space they reflect the psychological structure of an individual's knowledge (Novak, 1998)

Knowledge is structured as a semantic network, so learning is not only the acquisition of new concepts but the construction of meaningful links among concepts (Ausubel, 1968; Collins and Quillian, 1969)

Concept maps show what individuals know and how their knowledge of a particular topic of interest is structured.

Concept maps are sketches showing the links or relationships between ideas that individuals have in their mind about a particular subject.

Concept maps help individuals to capture the most relevant information about a topic and then present it in simple and structured way.

Concept maps were first introduced by Novak and Gowin in the 1970s as a means of enhancing meaningful learning in the classroom.

Cañas *et al.*, (2003) distinguish concept maps from other mapping systems such as knowledge maps, mind maps, cognitive maps, and semantic networks by:

- Their theoretical basis in Ausubel's Assimilation Learning theory which posits that new knowledge can be learned most effectively by relating it to previously existing knowledge. Thus, concept maps may be viewed as a methodological tool of Assimilation Learning theory that displays fundamental elements of the theory such as subsumption, integrative reconciliation and progressive differentiation.

- Their semi-hierarchical organization. Ausubel's theoretical notion of subsumption, that more general, superordinate concepts subsume more specific, detailed concepts translates in concept maps to an arrangement of concepts from those that are more general toward the top of the map, with those that are more specific or detailed distributed beneath. "In practice, the concepts in concept maps are not arranged in a strict hierarchy, but are arranged in a semi-hierarchical manner. Concept maps allow for the representation of non- hierarchical relationships or cross-links, as well as other types of non- hierarchical arrangements"

- The use of unconstrained and meaningful linking words/phrases. Thus, concepts should join by linking words/phrases to form meaning proposition, which is according to the theory of meaningful learning and Ausubel's Assimilation Learning theory a basic unit of knowledge. "Concept mapping theory does not constrain the labels that can be used, allowing map makers more freedom and precision in describing the relationships among concepts"

- The way concepts are defined. Novak and Gowin (1984) defined a concept as a "perceived regularity in objects or events". Other mapping systems allow for concepts that can be images, thoughts, ideas, sentences, or paragraphs. However, in concept maps a concept is expressed using one or at most two or three words. "Limiting node contents to concepts allows for a more explicit representation of the interrelationships among concepts" (Cañas *et al*., 2003, p.13-14)

Concept maps components

- *Nodes*: represent concepts which written in boxes. Concepts are perceived regularities in events or objects, designated by a label. For example 'Dog' is a concept, 'Rain' is a concept, and so is a 'tea time'. Thus, all concepts are label with meaning for us even thought we may understand these labels differently.
- *Linking Lines*: represent relations between concepts, arrowheads indicate direction.
- *Linking words/phrases*: on the lines describe the nature of the relationship between concepts which linked together.
- *Propositions*: meaningful statements created by combine the above three components. (Novak and Gowin, 1984)

How to build a concept map?

Concept maps can be constructed by individuals or groups, either by hand or with the assistance of software. Novak's concept mapping method involves a series of steps as follows:

- Define the topic or focus question that addresses the problem, issues, or knowledge domain you wish to map. It is difficult to manage and read concept maps that attempt to cover more than one topic or question. Using the focus question create a title for your concept map.

- Think about the focus question or the topic of interest and list all concepts associated with your topic or question. Do not worry about redundancy, relative importance, or relationships at this point. The objective is to generate the largest possible list.

- Write your concepts on Post its™ so that they can be moved around, concepts labels should be one word or phrase (three words at most) per not. Spread concepts on a table or blackboard so all can be read easily then rank order them by placing the broadest and most inclusive idea at the top of your map, if it is difficult for you to do so, then reflect on your focus question to help you decide the ranking of the concepts. This process might lead you to modification of the focus question or writing a new one.

- Create groups and sub-groups of related concepts to emphasize hierarchies by placing related concepts near to each other. Feel free to rearrange concepts and add more concepts as needed, but do not include so many concepts that the overall structure becomes unclear (10 to 20 concepts are recommended). Each concept can only be written in one place on the map. Some concepts will fall into multiple groupings; this will become important in the linking step.

- Build your map by placing the most inclusive concepts – which are two or three if it is not only one – at the top of the map.

- Place under each inclusive concept from two to four subconcepts. Avoid placing more than four concepts under an inclusive concept and if there six or eight concepts that seem to be belong under an inclusive concept or subconcept, it is possible for you to identify some appropriate concept of intermediate inclusiveness, thus creating another level of hierarchy in your map.

- Connect the concept by lines with arrows that imply the direction in which a link is meant to be read. Depending on the nature of the concepts' relationship lines can have single or double arrowheads. Causal relationships are one-directional and mutually influential relationships require double-headed arrows. Label the lines with one word or short phrase. The linking word/phrase should explain the nature of relationship between the two concepts so that it reads as a valid statement or proposition. The connection creates meaning, so each pair of linked concepts should read like a sentence. Many arrows can originate or terminate on particularly important concepts. When you hierarchically link together a large number of related ideas, you can see the structure of meaning for a given subject domain.

- Rework the structure of your map to represent your collective understanding of the interrelationships and connections among groupings, which may include adding, subtracting, or changing superordinate concepts. You may need to exam the draft concept map several times; in fact this process can go on indefinitely as you gain new knowledge or new insights.

- Look for crosslinks between concepts in different sections of the map and label these lines. Crosslinks can often help you to see new, creative relationships in the knowledge domain.

- Attached to the concept labels a specific example of concepts (e.g., Saluki is a specific example of a dog breed).

- From the same set of concepts you could make many different forms of concept maps. There is no one way to draw a concept map. Concept maps can be intrinsically different without being wrong.

- Be creative through the use of colors, fonts, and shapes to stimulate interest without being distracting. (Cañas *et al*., 2003 p.16) (Novak, 1998, p.229)

How to evaluate a concept map?

Look at the concept map carefully and try to answer the following questions:

- Does your concept map have a title (focus question)?
- Does your concepts written in boxes?
- Does each concept written only in one place on your concept map?
- Are important concepts missing?
- Does the most inclusive concepts appear at the top of your concept map and more specific concepts appear lower down?
- Does your links have arrowheads to show the direction in which they should be read?
- Does your links have labels (word/short phrases) to give them meaning?
- Does the proposition you have created make sense?
- Does your concept map reflect an attention to details such as spelling and penmanship?
- Does your concept map appear orderly and tidy or chaotic and messy?
- Does your concept map reflect creativity in using unusual elements that stimulate interest without being distracting such as colors, fonts, and shapes?

APPENDIX D

SCORING CRITERIA FOR CONCEPT MAPS*

- *Propositions*: Is the meaning relationship between two concepts indicated by the connecting line and linking word(s)? Is the relationship valid? For each meaningful, valid proposition shown, score 1 point.

- *Hierarchy*: Does the map show hierarchy? Is each subordinate concept more specific and less general than the concept drawn above it (in the context of the material being mapped)? Score 5 points for each valid level of the hierarchy.

- *cross links*: Dos the map show meaningful connections between one segment of the concept hierarchy and another segment? Is the relationship shown significant and valid? Score 10 points for each cross link that is both valid and significant and 2 points for each cross link that is valid but does not illustrate a synthesis between sets of related concepts or propositions. Cross links can indicate creative ability and special care should be given to identifying and rewarding its expression. Unique or creative cross links might receive special recognition, or extra points.

- *Examples*: Specific events or objects that are valid instances of those designated by the concept label can be scored 1 point each. (These are not circled because they are not concepts.)

- In addition, a criterion concept map may be constructed, and scored, for the material to be mapped, and the student scores divided by the criterion map score to give a percentage for comparison. (Some students may do better than the criterion and receive more than 100% on this basis).

* Adapted from: Novak and Gowin (1984, p.36)

APPENDIX E

DESCRIPTION OF THE CoRT THINKING LASSONS[*]

CoRT-1: BREADTH

Lessons 1-10

Often, we take too narrow a view when we think, we tend to judge rather than explore. The purpose of this group of lessons is to encourage students to broaden their thinking, so that in any thinking situation they can see beyond the obvious, immediate and egocentric.

The CoRT Lessons	*Achievement Objective*
Lesson (1) PMI (Plus, Minus, Interesting**)**	PMI (Plus, Minus, Interesting) or how to treat an idea help students to deliberate examination of an idea for good (Plus), bad (Minus) or interesting possibilities instead of immediate acceptance or rejection
Lesson (2) CAF (Consider All Factors)	CAF (Consider All Factors) or the factors involved help students to think more effectively about a situation by looking as widely as possible at all the factors involved in that situation before coming up with an idea. Otherwise, students tend to think only about the first factors that come to mind.
Lesson (3) RULES	RULES. The purpose of this lesson is to summarises the first two lessons and gives students the opportunity to practice PMI and CAF. CAF is used when making a rule while PMI is used on an existing or proposed rule.
Lesson (4) C & S (Consequence and Sequel)	C & S (Consequence and Sequel) or focus on the consequences. Any action has either an immediate, short, medium or long term consequence. In some circumstances, action has all these consequences. A thinker needs to be aware of these possibilities. The purpose of this lesson is to help students to forecast the possible consequences of a decision or action over time.
Lesson (5) AGO (Aims, Goals, Objectives)	AGO (Aims, Goals, Objectives) or focus on purpose. The intention of this lesson is to teach students the value of picking out and defining objectives. It explains how students should be clear about their own aims and understanding those of others. It is also help students to focus attention directly and deliberately on the intention behind actions. Both aspects –"because" and "in order to"- are explored.

[*] This description is adapted from de Bono's CoRT thinking lessons (1998)and also available at de Bono's website: http://www.edwarddebono.com/Default.php

Lesson (6) PLANNING	PLANNING. There are basic features and processes involved in planning and this is the second practice lesson providing an opportunity for student to practice C&S and AGO, and to a lesser extent PMI and CAF.
Lesson (7) FIP (First Important Priorities)	FIP (First Important Priorities) or focus priorities. The intention of this lesson is to teach students choose from a number of different possibilities and alternatives and to put priorities in order. Priorities need to be put into order before effective thinking can take place. FIP is a focusing tool where students are required to pick out the most important ideas, factors, objectives or consequences. This tool should be applied in order to trim a list of ideas which have been generated using previous skills.
Lesson (8) APC (Alternatives, Possibilities, Choices)	APC (Alternatives, Possibilities, Choices) or focus on alternatives. A generative thinker or action thinker is always interested in generating new alternatives and finding new possibilities. The purpose of this lesson is to help students to generate new alternatives and choices, instead of feeling confined to the obvious ones. APC is a focusing tool where students are required to focus attention on exploring all the alternatives or choices beyond the obvious and satisfactory ones. It is used as an antidote to emotional reaction or rigid thinking.
Lesson (9) DECISIONS	DECISIONS. Because de Bono thinking is about making decisions in which different operations involved, this lesson provides students the opportunity to bring together the use of the principles and skills already.
Lesson (10) OPV (Other People's Views)	OPV (Other People's Views) or the other people involved. A useful thinking skill is to move away from one's own viewpoint and consider the points of view of others. This lesson encourages students to move out of there's own viewpoint to consider the points of view of all others involved in any situation by asking "Why does that person have that point of view?" OPV provides an antidote to selfishness.

CoRT- 2: ORGANIZATION

Lessons 11-20

The purpose of this group of lessons is to teach students some basic thinking operations and their organisation for use. The first five lessons, 11-15, deal with the five traditional operations. Each of these is given deliberate attention so that you can organise them with confidence, and skill. The next five lessons, 16-20, deal with the overall organisation of thinking so that thinking can be both organised and productive.

The CoRT Lessons	***Achievement Objective***
Lesson (11) RECOGNISE	RECOGNISE. Every situation is different and we need to make a deliberate effort each time we encounter a new situation to identify its characteristics in order to be able to think about it more effectively. This lesson encourages students to make a deliberate effort to identify a situation.
Lesson (12) ANALYSE	ANALYSE. Often, a situation has a number of parts, each of which is important to identify before thinking effectively. The purpose of this lesson is to teach student to deliberately divide up a situation in order to think about it more effectively.
Lesson (13) COMPARE	COMPARE. An excellent thinking skill is to use comparison in order to understand a situation. This is sometimes called "going from the known to the unknown". This lesson asks students to examine points of similarity and points of difference in a situation.
Lesson (14) SELECT	SELECT. We need to learn how to select from among a collection of different possibilities. Sometimes this is difficult and time-consuming. This lesson teaches students that they need to make a deliberate effort to find something that fits theirs thinking requirements.
Lesson (15) FOW (Find Other Ways)	FOW (Find Other Ways). Looking for alternatives is the basis of lateral thinking, generative thinking and action thinking. The emphasis in this lesson is to help students on making a deliberate effort to find alternative ways of looking at things.
Lesson (16) START	START. Everything has a beginning. Sometimes, making a move in the right direction is a problem. The purpose of this lesson is to help students to learn that the practical business of starting is to think and ask what the first thing to do is.
Lesson (17)	ORGANISE. When we think about a situation, we need to design a strategy. The purpose of this lesson is to teach

ORGANISE	student the practical business of organising the way a situation is to be tackled.
Lesson (18) FOCUS	FOCUS. Looking at different aspects of a situation, especially being clear as to what aspect is under consideration at the moment is an important thinking skill. This lesson teaches students that there may be a number of different aspects to a situation but they need to be clear about what aspect is being considered at the time.
Lesson (19) CONSOLIDATE	CONSOLIDATE. When thinking about any situation, we need to ask, "What has been achieved so far?" This lesson encourages students to be clear about what has been done and what has been left out.
Lesson (20) CONCLUDE	CONCLUDE. On most occasions, we need to be able to design a conclusion even if we conclude that a conclusion is not possible. This lesson encourages students to make a definite conclusion; even if that declares that no definite conclusion is possible.

CoRT- 3: INTERACTION

Lessons 21-30

The purpose of this group of lessons is to deal with two-people situations. The thinker is no longer looking directly at the subject matter but at someone else's thinking. This is the area of argument, debate, conflict, and opinion. The lessons look at ways of assessing evidence. They look at different ways to prove a point. The aim of this group of lessons is to encourage students to listen to what is being said and to assess its value. They are also encouraged to adopt a constructive approach to resolving arguments. Winning an argument for the sake of winning an argument is not especially worthwhile. The emphasis here is not on point scoring, proving somebody wrong or winning debates. The emphasis is on bringing forth something useful from the argument or the negotiation

The CoRT Lessons	***Achievement Objective***
Lesson (21) EBS (Examine Both Sides)	EBS (Examine Both Sides). Examining both sides of an argument instead of blindly supporting one side is an important thinking skill. Just as OPV encouraged students to look at the viewpoint of others, EBS asks students to examine both sides of an argument, theirs side and the sides of those with other points of view.
Lesson (22) EVIDENCE: TYPE	EVIDENCE: TYPE. Many arguments are a mixture of fact and opinion. This lesson teaches students to look carefully at the type of evidence being promoted in an argument and distinguish between fact and opinion.
Lesson (23) EVIDENCE: VALUE	EVIDENCE: VALUE. Not all evidence promoted in an argument is good evidence. Some evidence has high value. Some evidence has little value. This lesson teaches students to assess the value of evidence.
Lesson (24) EVIDENCE: STRUCTURE	EVIDENCE: STRUCTURE. This lesson encourages students to use the following structure to exam evidences. Does this evidence stand on its own? Is it dependent on other evidence which in turn depends on something else? What would happen if this evidence is questionable?
Lesson (25) ADI (Agreement, Disagreement, Irrelevance)	ADI (Agreement, Disagreement, Irrelevance). This lesson encourages students to use ADI when analysing an argument or situation in order to increase areas of agreement and reduce areas of disagreement.
Lesson (26) BEING RIGHT 1	BEING RIGHT 1. This lesson encourages students to consider two of the main ways of being right: (1) Examining the idea itself, its implications and potential effects. (2) Referring to facts, authority, feelings.

Lesson (27) BEING RIGHT 2	BEING RIGHT 2. This lesson encourages students to consider the other two ways of being right: (1) Use of names, labels, classifications. (2) Judgment, including the use of value words.
Lesson (28) BEING WRONG 1	BEING WRONG 1. This lesson encourages students to consider two of the main ways of being wrong: (1) Exaggeration - false generalizations, taking things to extremes. (2) Basing conclusions on only part of the situation.
Lesson (29) BEING WRONG 2	BEING WRONG 2. This lesson encourages students to consider the other two ways of being wrong: (1) Making a genuine mistake. (2) Being prejudiced.
Lesson (30) OUTCOME	OUTCOME. This lesson encourages students to make a conscious and deliberate effort to assess what has been achieved from an argument.

CoRT- 4: CREATIVITY

Lessons 31-40

It is quite wrong to suggest that creative ideas come only from inspiration. This group of lessons covers the basic creative techniques, procedures and attitudes. Creativity is always fun and highly motivating to the people involved. This sense of fun should be kept throughout CoRT-4, but at the same time creativity is a serious matter.

The CoRT Lessons	*Achievement Objective*
Lesson (31) YES, NO AND PO	YES, NO AND PO. While YES and NO are judgements made within the channels of personal experience, PO is offered as a provocation or creative stimulus in order to start up new ideas or new ways of looking at things. This lesson encourages students to use PO as a device for showing that an idea is being used creatively without any judgment or immediate evaluation.
Lesson (32) STEPPING STONE	STEPPING STONE. Stepping Stone is a method for getting out of existing ways of thinking by using deliberately provocative statements as “stepping stones” to new insights. One idea can lead to another and once new ideas are generated the stepping stone can be forgotten. This lesson teaches students that they can use ideas, not for their own sake but because of other ideas they might lead to.
Lesson (33) PANDOM INPUT	PANDOM INPUT. The random input technique involves a deliberate association with something that is unconnected to the situation so that new ideas might be triggered. This lesson teaches students that the process of generating new ideas sometimes needs to include the input of unrelated spurious ideas into the situation.
Lesson (34) CONCEPT CHALLENGE	CONCEPT CHALLENGE. Just because something has "worked" for ages does not mean it should be taken for granted. This lesson teaches students that testing of the "uniqueness" of concepts may lead to other ways of doing things.
Lesson (35) DOMINANT IDEA	DOMINANT IDEA. In most situations there is a dominant idea. In order to be creative, to find other ways and to generate new ideas one must find the dominant idea and escape from it. The aim of this lesson is to help students to recognize the idea which dominate a situation and escape from it.
Lesson (36) DEFINE THE	DEFINE THE PROBLEM. When thinking about anything, we need to ask, "What is the problem?" An effort to define a problem exactly may make it easier to

PROBLEM	solve. This lesson encourages students to strive towards a more exact definition of problems throughout the lesson. Multiple definitions are first generated to allow one to define the problem more precisely.
Lesson (37) REMOVE FAULTS	REMOVE FAULTS. When thinking, we need to recognise faults and remove them. This lesson encourages students to ask the following questions: What is a fault? Why is it a fault? to recognise faults and remove them from an idea.
Lesson (38) COMBINATION	COMBINATION. When thinking creatively, combining the parts of apparently unrelated items may be a valuable technique. This lesson teaches students that by examining the attributes of seemingly unrelated items new items may be created either by fusion or by combination.
Lesson (39) REQUIREMENTS	REQUIREMENTS. An awareness of requirements may influence the creation of ideas. This lesson teaches students that knowing what is required in a particular situation may influence the way ideas are generated.
Lesson (40) EVALUATION	EVALUATION. This lesson encourages students to ask the following questions: Does an idea fulfill the requirements and what are its advantages and disadvantages could there be if the idea is applied?

CoRT- 5: INFORMATION AND FEELING

Lessons 41-50

Information and feeling underlie all thinking. Thinking depends on information and is strongly influenced by feeling. The purpose of this group of lessons is to deal with information processes such as questions, clues, guessing, belief, ready-made opinions and the misuses of information. It also deals with emotions and values. The aim of CoRT-5 is to encourage a definite awareness of these influences - not necessarily to change them. The students are also trained to recognise what information they have, what they still require and how to use information. The techniques used in each lesson are designed to develop detachment and observation.

The CoRT Lessons	*Achievement Objective*
Lesson (41) INFORMATION	INFORMATION. We need to ask, "What information do we have and what information do we need?" When we have sufficient quality information, our thinking can be more effective. This lesson encourages students to be aware of analysis of information and appraisal of its completeness. And to ask what desirable information is missing?
Lesson (42) QUESTIONS	QUESTIONS. Asking questions skilfully is a way of giving purpose and direction to thinking. This lesson teaches students the purpose and direction of questions and how to opening-up questions and closing-down questions.
Lesson (43) CLUES	CLUES. Sometimes, we gather clues that help our thinking processes. From clues, we can deduce and imply. Clues help us assemble better ideas. This lesson encourages students to use clues by putting things together to maximum extrapolation of given information.
Lesson (44) CONTRADICTION	CONTRADICTION. In the search for good information, we are sometimes at risk of making false jumps, false conclusions and incorrect uses of that information. This lesson encourages students to be aware of false jumps, false conclusions and other incorrect uses of information.
Lesson (45) GUESSING	GUESSING. Sometimes, we cannot obtain sufficient information and we have to guess. On most occasions, information is incomplete. Guesses can be good or bad. This lesson teaches students the use of guessing when information is incomplete. Good guesses and bad guesses.
Lesson (46)	BELIEF. Sometimes we may hold our beliefs until they are challenged and proved to be wrong. At other times

BELIEF	we may continue to insist that our belief is right even though all the evidence indicates that it must be wrong. This lesson encourages students to be aware of the origin of theirs beliefs. Where do theirs beliefs come from? Why do they hold them? Why do they believe something to be true? No attempt is made to show that one type of belief is more valid than another. It is enough that a person should be aware of the origin of a belief.
Lesson (47) READY-MADES	READY-MADES. When thinking, we can sometimes use substitutes for effective thinking (e. g. stereotypes, prejudices, and standard opinions). This lesson encourages students to be aware of the commonly accepted opinions and the like.
Lesson (48) EMOTIONS AND EGO	EMOTIONS AND EGO. Emotions are always involved in thinking. Emotions and ego colour our thinking. Usual emotions and ego-emotions (having to be right, trying to be funny, face-saving, etc.) restrict effective thinking. This lesson encourages students to be aware of the way emotions are involved in thinking.
Lesson (49) VALUES	VALUES. Values are firmly-held opinions or beliefs. Values are difficult to change. Values determine thinking and the acceptability of the result. When thinking, we should be wary of our own values and the values of others. This lesson encourages students to be aware of the way values determine thinking and acceptability of the result. Appreciation of the values involved rather than trying to change them.
Lesson (50) SIMPLIFICATIO N AND CLARIFICATION	SIMPLIFICATION AND CLARIFICATION. Often, the skill of simplification improves our thinking skills. This lesson encourages students to ask the following questions: What is the thinking about? What does it boil down to? What is the real situation?

CoRT- 6: ACTION

Lessons 51-60

The "action" in the title of this group of lessons suggests that the purpose of the thinking is to end up with some action. In this set of ten lessons the structure takes the form of a framework. The purpose of the framework is to divide the total thinking process into definite stages, each of which can be tackled in turn. At each stage in the overall framework there is a definite thinking task to be carried out and a definite aim for the thinking. This simplifies thinking by removing the complexity and confusion. Without a framework everything tends to crowd in at once on the thinker, who tends to be overwhelmed by all the aspects of the situation. The result is that the thinker takes the easiest way out and uses a slogan, cliché or prejudice instead of thinking. The stages suggested in the framework are very simple and straightforward. At each stage the thinker concentrates on carrying out the task defined by that stage.

The CoRT Lessons	***Achievement Objective***
Lesson (51) TARGET	TARGET. This is the first step in thinking. We need to direct attention to the specific matter that is the subject of the thinking. It is important that we pick out the 'thinking target' in a definite and focused manner. This lesson teaches students to direct attention to the specific matter that is to be the subject of the thinking and to learn the importance of picking out the "thinking target" in as definite and focused a manner as possible.
Lesson (52) EXPAND	EXPAND. Having picked out the target the next step is to expand upon it: in depth, in breadth, in seeking alternatives. This is the opening-up phase of thinking, therefore, in this lesson students encouraged to "Say as much as they can about...".
Lesson (53) CONTRACT	CONTRACT. This lesson teaches students the third step which is to narrow down the expended thinking to something more tangible and more usable: main points, a summary, a conclusion, a choice or selection.
Lesson (54) TEC (Target-Expand-Contract)	TEC (Target-Expand-Contract). The use of the thinking tools in Lessons 51-53 is the basis for this sequence. Therefore, in this lesson students encouraged to practice the use of defining the target, exploring the subject and narrowing down to a usable outcome.
Lesson (55)	PURPOSE. We must be clear about the exact purpose of our thinking. This lesson summarises the general purpose of thinking and the need for a specific

PURPOSE	objective. It also reinforces what was learned in the AGO lesson from CoRT-1. Students are encouraged not to lose sight of the final objective in projects by reference to two questions: “What is the purpose of this thinking?” and “With what do I want to end up: a decision, a problem solution, an action plan or an opinion?"
Lesson (56) INPUT	INPUT. This lesson revisits the situation, the scene, the setting, the information available, the factors and people to be considered. The lesson reviews the total input that goes into the thinking being done. Therefore, in this lesson students learn to appreciate the need to avoid leaving out important input by reference to two questions: “What is the input?” and “What sources of input are available to me?"
Lesson (57) SOLUTIONS	SOLUTIONS. This lesson looks at alternative solutions including the most obvious, the traditional and the new. It also introduces a range of techniques for generating solutions and filling gaps. This lesson encourages students to generate at least three solutions to various problems with reference to two questions: “What is the solution here” and “What alternative solutions are there?"
Lesson (58) CHOICE	CHOICE. Once several possible solutions to a problem have been generated the Choice lesson from the PISCO procedure focuses attention on the “best” solution. A range of choice procedures are introduced leading to the best solution for an identified purpose-further linking each of the PISCO components. This lesson teaches students the decision process, choosing between the alternative solutions, priorities and the criteria for choice, and reconsider consequences and review of decisions made.
Lesson (59) OPERATION	OPERATION. This lesson is about implementation, carrying through the results of thinking. It also considers ways of setting up specific action steps that will help bring about the desired result. In this lesson which put the thinking into effect and the last lesson of the PISCO procedure students use at least four operating steps to implement their preferred solution for a particular purpose. The emphasis is on establishing a specific action plan.
Lesson (60) TEC-PISCO	TEC-PISCO (Target, Expand, Contract - Purpose, Input, Solutions, Choice, Operation). This lesson presents a consolidation of the total TEC-PISCO framework in which the first three tools (TEC) are used to define and

(Target, Expand, Contract - Purpose, Input, Solutions, Choice, Operation)	elaborate each of the five stages of the PISCO procedure. These five stages are the final component of "action thinking", the summary of the CoRT thinking lessons. This lesson encourages students to use the whole PISCO sequence.

CREATIVIY TRAINING SESSIONS *

Session	*Component*
1	CoRT-1 Lesson (1) PMI (Plus, Minus, Interesting)
2	CoRT-1 Lesson (2) CAF (Consider All Factors)
3	CoRT-1 Lesson (3) RULES
4	CoRT-1 Lesson (4) C & S (Consequence and Sequel)
5	CoRT-1 Lesson (5) AGO (Aims, Goals, Objectives)
6	CoRT-1 Lesson (6) PLANNING
7	CoRT-1 Lesson (7) FIP (First Important Priorities)
8	CoRT-1 Lesson (8) APC (Alternatives, Possibilities, Choices)
9	CoRT-1 Lesson (9) DECISIONS
10	CoRT-1 Lesson (10) OPV (Other People's Views)
11	CoRT-4 Lesson (31) YES, NO AND PO
12	CoRT-4 Lesson (32) STEPPING STONE
13	CoRT-4 Lesson (33) PANDOM INPUT
14	CoRT-4 Lesson (35) DOMINANT IDEA
15	CoRT-4 Lesson (36) DEFINE THE PROBLEM
16	CoRT-6 Lesson (55) PURPOSE
17	CoRT-6 Lesson (56) INPUT
18	CoRT-6 Lesson (57) SOLUTIONS
19	CoRT-6 Lesson (58) CHOICE
20	CoRT-6 Lesson (59) OPERATION

* Adapted from de Bono's CoRT thinking lessons 1998 and Ritchie and Edwards, 1996, P.65.

APPENDIX F

UNIVERSITY
of
GLASGOW

PARTICIPATION CONSENT FORM
(TEACHER'S FORM)

Creativity Training Effects Upon Concept Map Complexity of Children with Attention and Deficit Hyperactivity Disorder (ADHD): An Experimental Study

ANTRODUCTION: I, ..., have been asked to participate in this study. Keetam Alkahtani, who is conducting this research to fulfill the requirements for a doctoral dissertation in Educational Studies at University of Glasgow, has explained the study to me. She invited me to take part in her study because I am a trained creativity and talent teacher and I had taught the creativity class for at last two years.

PURPOSE OF THE STUDY: The purpose is to learn more about the effects of the creativity training on the complexity of concept mapping which produce by children with ADHD.

DESCRIPTION OF PROCEDURES: This study will be performed at my school. I will be asked to attend the workshop in concept mapping which will take two days (four hours each day) and will be presented by the investigator. I will be asked to give the *Torrance Test of Creative Thinking* to all of the participant students in this study in my school. I will be asked to give the participant students training in concept mapping which will be divided into two sessions each will take from 45 to 55 minutes, and I will ask them to complete two concept maps (each will take from 30 to 45 minutes) as well. I will be also asked to give creativity training for 10 weeks (two hours each week) to the experimental participant's students in my school at the resource room.

RISK AND DISCOMFORTS: There are no known or expected risks from participating in this study.

BENEFITS: I understand that this study is not expected to be of direct benefit to me or my students, but the knowledge gained may be of benefit to others. However I will have the opportunity to reflect on the impact, if any, of creativity training among students with ADHD.

CONTACT PERSON: For more information about this research, I can contact Keetam Alkahtani (e-mail keetam_alkahtani@yahoo.com) or her supervisor Dr. George Head (e-mail g.head@edu.gla.ac.uk)

CONFIDENTIALITY: I understand that any information obtained as a result of my participation in this research will be kept as confidential as legally possible. In any publications that result from this research, neither my name nor any other information from which I might be identified will be published without my consent. I also understand that all data will be destroyed by shredding all data held on paper and wiping all electronic files on completion of this study.

VOLUNTARY PARTICIPATION: Participation in this study is voluntary. I understand that I may withdraw from this study at any time. Refusal to participate or withdrawal will involve no penalty for me. I have been given the opportunity to ask questions about the research, and I have received answers concerning areas I did not understand. Upon signing this form, I will receive a copy. I also will receive a written summary of results and if I wish a copy of this study.

I willingly consent to participate in this study.

…………………..……………..   ……………….
Signature of participant   Date

………………………………   …..……………
Signature of Investigator   Date

I wish to have:

□ Written summary of results.   E-mail:

□ Copy of this study.   Address:

If you have any queries or concerns relating to the research being undertaken, please contact:
Dr George Head
Faculty of Education Ethics Officer
Faculty of Education
University of Glasgow
St Andrew's Building
11 Eldon Street
Glasgow
G3 6NH
E-mail: G.Head@educ.gla.ac.uk

APPENDIX G

UNIVERSITY
of
GLASGOW

PARENTAL OR GUARDIAN CONSENT FORM

Creativity Training Effects Upon Concept Map Complexity of Children with Attention and Deficit Hyperactivity Disorder (ADHD): An Experimental Study

ANTRODUCTION: I, ..., have been asked to allow my child ....to participate in this study. Keetam Alkahtani, who is conducting this research to fulfill the requirements for a doctoral dissertation in Educational Studies at University of Glasgow, has explained the study to me. She invited me to take part in her study because my child have been diagnosed as an ADHD.

PURPOSE OF THE STUDY: The purpose is to learn more about the effects of the creativity training on the complexity of concept mapping which produce by children with ADHD.

DESCRIPTION OF PROCEDURES: This study will be performed at the school in which my child attends. My child will be asked to complete the *Torrance Test of Creative Thinking* which will take 30 minutes to complete, then will be given training in concept mapping which will be divided into two sessions each will take from 45 to 55 minutes, and will be asked to complete a concept map not relating to her classroom textbook which will take from 30 to 45 minutes. My child will be assigned either to the experimental group or the control group on a randomly basis. If my child is assigned to the experimental group, she will then participate in 10 weeks of creativity training (two hours each week at the resource room in her school) and then complete a second concept map not relating to her classroom textbook. If my child is assigned to the control group, she will follow the same procedure for the experimental group with the exception of receiving creativity training.

RISK AND DISCOMFORTS: There are no known or expected risks from participating in this study, however concept mapping may be difficult and my child may not enjoy doing it.

BENEFITS: I understand that this study is not expected to be of direct benefit to my child, but the knowledge gained may be of benefit to others. However, my child will have had the chance to learn more about concept mapping (and if she assigned to the experimental group she will have had the chance to attend creativity training) which might be of help to her in the future.

CONTACT PERSON: For more information about this research, I can contact Keetam Alkahtani (e-mail keetam_alkahtani@yahoo.com) or her supervisor Dr. George Head (e-mail g.head@edu.gla.ac.uk)

CONFIDENTIALITY: I understand that any information obtained as a result of my child’s participation in this research will be kept as confidential as legally possible. In any publications that result from this research, neither my name nor that of my child or any other information from which we might be identified will be published without my consent. I also understand that all data will be destroyed by shredding all data held on paper and wiping all electronic files on completion of this study.

VOLUNTARY PARTICIPATION: Participation in this study is voluntary. I understand that I may withdraw my child from this study at any time. Refusal to participate or withdrawal will involve no penalty for me or my child. I have been given the opportunity to ask questions about the research, and I have received answers concerning areas I did not understand. Upon signing this form, I will receive a copy. I also will receive a written summary of results and if I wish a copy of this study.

I willingly consent to my child's participation in this study.

…………………..…………….. …………………

Signature of Parent or Guardian Date

………………………………… …..………………

Signature of Investigator Date

I wish to have:

□ Written summary of results. E-mail:

□ Copy of this study. Address:

If you have any queries or concerns relating to the research being undertaken, please contact:
Dr George Head
Faculty of Education Ethics Officer
Faculty of Education
University of Glasgow
St Andrew's Building
11 Eldon Street
Glasgow
G3 6NH
E-mail: G.Head@educ.gla.ac.uk

APPENDIX H

UNIVERSITY
of
GLASGOW

PARTICIPATION CONSENT FORM
(STUDENT'S FORM)

Creativity Training Effects Upon Concept Map Complexity of Children with Attention and Deficit Hyperactivity Disorder (ADHD): An Experimental Study

ANTRODUCTION: I, ..., have been asked to be in this research, which has been explained to me by Keetam Alkahtani. She invited me to take part in her study because I have been diagnosed as an ADHD.

PURPOSE OF THE STUDY: I have been told that the purpose of this study is to learn more about the effects of the creativity training on the complexity of concept mapping which produce by children with ADHD.

DESCRIPTION OF PROCEDURES: This study will be performed at my school. I will be assigned either to the experimental group or the control group on a randomly basis. If I assigned as an experimental participant, I will be given training in concept mapping which will be divided into two sessions each will take from 45 to 55 minutes, and in creativity for 10 weeks (two hours each week at the resource room in my school). If I am assigned as a control participant, I will be given training only in concept mapping. In either case, I will be asked to complete the *Torrance Test of Creative Thinking* which will take 30 minutes, and two concept maps each will take from 30 to 45 minutes. I understand that I do not have to complete the test, the maps or attend concept mapping or creativity training if I so choose.

DISCOMFORTS: Concept mapping may be difficult and I may not enjoy trying to complete my concept map.

BENEFITS: I understand that this study is not expected to help me, but what they learn from the study may help other people. However, I will have had the chance to learn more about concept mapping (and if I assigned to the experimental group I will have had the chance to attend creativity training) which might help me in the future.

CONFIDENTIALITY: I have been promised that anything they learn about me in this study will be kept as secret as possible.

VOLUNTARY PARTICIPATION: I have been told that I do not have to do this. No one will be mad at me if I refuse to do this or if I decide to quit. I have been allowed to ask questions about the research, and all of my questions were answered. I will receive a copy of this form after I sign it. My Parent or Guardian also will receive the results of this study.

I willingly agree to be in this study.

Signature of participant	Date
…………………………………	……………………
Signature of Investigator	Date
…………………………………	……………………

If you have any queries or concerns relating to the research being undertaken, please contact:
Dr George Head
Faculty of Education Ethics Officer
Faculty of Education
University of Glasgow
St Andrew's Building
11 Eldon Street
Glasgow
G3 6NH
E-mail: G.Head@educ.gla.ac.uk

APPENDIX I

The Distribution of the Participants across the Participating Schools

School's Number	Control Group		Experimental Group	
	Number of Students	*Student's Number*	*Number of Students*	*Student's Number*
1	2	15 and 29	1	8
2	2	9 and 47	2	42 and 52
3	1	23	1	16
4	1	55	1	38
5	1	37	1	20
6	2	57 and 41	2	60 and 28
7	1	11	1	32
8	1	5	1	36
9	1	31	2	54 and 18
10	2	45 and 21	2	62 and 12
11	1	39	1	22
12	1	33	1	24
13	1	1	2	30 and 40
14	2	49 and 17	1	56
15	1	13	2	64 and 26
16	1	61	1	44
17	2	3 and 63	1	4
18	1	25	1	50
19	1	51	1	14
20	2	35 and 7	2	46 and 6
21	1	19	1	48
22	1	34	1	58
23	1	53	1	10
24	2	27 and 59	2	34 and 2
Total	32		32	

APPENDIX J