



**ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS**

**DEPARTMENT OF STATISTICS**

**CREATIVITY AND SOCIAL COMPROMISE IN  
TERTIARY EDUCATION  
A LATENT VARIABLE MODEL**

**By**

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**ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ**

**ΤΜΗΜΑ ΣΤΑΤΙΣΤΙΚΗΣ**

**ΔΗΜΙΟΥΡΓΙΚΟΤΗΤΑ ΚΑΙ ΚΟΙΝΩΝΙΚΟΤΗΤΑ  
ΣΤΗΝ ΤΡΙΤΟΒΑΘΜΙΑ ΕΚΠΑΙΔΕΥΣΗ.  
ΜΟΝΤΕΛΟ ΛΑΝΘΑΝΟΥΣΩΝ ΜΕΤΑΒΛΗΤΩΝ**

**Ελένη Α. Οικονόμου**

**ΕΡΓΑΣΙΑ**

**Που υποβλήθηκε στο Τμήμα Στατιστικής  
του Οικονομικού Πανεπιστημίου Αθηνών  
ως μέρος των απαιτήσεων για την απόκτηση  
Μεταπτυχιακού Διπλώματος Ειδίκευσης  
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## **GRATITUDE**

I would like to thank my family, who always believe and support me in all the things that I am being involved in, all these years of my life.

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Lastly, I dedicate this dissertation to my new born baby girl.

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## **CURRICULUM VITAE**

I was born in Athens, Greece on April 3, 1974. I finished High School in Athens, in the city of Ilioupoli. After finishing High School I was accepted at the University of Patras and more specific at the Department of Mathematics. A year after I came to the University of Athens, same Department, from which I finished successfully. After a few years I submitted an application for a Master degree to the Athens University of Economics and Business and more specific at the Department of Statistics. I was accepted at the post-graduated program in Statistics where I successfully passed all the lessons and now I finished my dissertation. I speak three languages: Greek, English (Proficiency level) and Italian (Intermedio level).

From 2001, I have been working full time at the University of Athens, Medical School, Department of Hygiene and Epidemiology. I am responsible mainly for the analysis of the data of the European program namely DAFNE (**Data Food Networking**) and partial of the European program EPIC (**European Prospective Investigation into Cancer and nutrition**). I have a significant number of publications in English and in Greek (reports, abstracts, papers, posters) and I have attended many conferences as well as seminars regarding these two European programmes.



## **ABSTRACT**

**Eleni Oikonomou**

### **CREATIVITY AND SOCIAL COMPROMISE IN TERTIARY EDUCATION A LATENT VARIABLE MODEL**

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Many constructs that are of interest to social scientists can not be observed directly. Examples are preferences, attitudes, behavioural intentions, and personality traits. Such constructs can only be measured indirectly by means of observable indicators, such as questionnaire items designed to elicit responses related to an attitude or preference. Various types of scaling techniques have been developed for deriving information on unobserved constructs of interest from the indicators. An important family scaling methods is formed by latent variable models.

In the behaviour sciences, response variables are often no continuous, common types being dichotomous, ordinal or nominal variables, counts and durations. Conventional structural equation models (SEMs) have then been generalized to accommodate different kinds of responses.

A powerful approach to probabilistic modelling involves supplementing a set of observed variables with additional latent or hidden variables.

We will use a latent variable model in order to examine the effect of creativity and social compromise in tertiary education using an Australian dataset.



## **ΠΕΡΙΛΗΨΗ**

**Ελένη Α. Οικονόμου**

### **ΔΗΜΙΟΥΡΓΙΚΟΤΗΤΑ ΚΑΙ ΚΟΙΝΩΝΙΚΟΤΗΤΑ ΣΤΗΝ ΤΡΙΤΟΒΑΘΜΙΑ ΕΚΠΑΙΔΕΥΣΗ. ΜΟΝΤΕΛΟ ΛΑΝΘΑΝΟΥΣΩΝ ΜΕΤΑΒΛΗΤΩΝ**

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Πολλές έννοιες που είναι ενδιαφέροντες για τους επιστήμονες της κοινωνιολογίας δεν μπορούν να παρατηρηθούν άμεσα. Μερικά παραδείγματα μπορούμε να πούμε ότι είναι η συμπεριφορά, οι προτιμήσεις, τοποθετήσεις, προθέσεις συμπεριφοράς καθώς και γνωρίσματα προσωπικότητας. Τέτοιες έννοιες μπορούν μόνο να μετρηθούν έμμεσα με την βοήθεια αξιοσημείωτων – ευδιάκριτων δεικτών, όπως είναι στοιχεία από ερωτηματολόγιο σχεδιασμένα με σκοπό να αποσπάσουν τις απαντήσεις οι οποίες αφορούν μια τοποθέτηση ή κάποια προτίμηση του ατόμου.

Διάφοροι τύποι κλίμακας - διαβάθμισης έχουν αναπτυχθεί για την άντληση των πληροφοριών από δείκτες που αφορούν απαραίτητα κατασκευάσματα ενδιαφέροντος.

Μια σημαντική μέθοδος κλίμακας είναι η χρήση αφανών μεταβλητών.

Στις επιστήμες συμπεριφοράς, οι μεταβλητές αναφοράς δεν είναι συχνά συνεχείς. Ο πιο κοινός τύπος είναι οι διχοτομικές, οι τακτικές ή οι ονομαστικές μεταβλητές.

Τα συμβατικά δομικά πρότυπα εξίσωσης (SEMs) έχουν γενικευτεί για να προσαρμόσουν τα διαφορετικά είδη απαντήσεων των ερωτηματολογίων.

Μια ισχυρή προσέγγιση στην πιθανολογική διαμόρφωση περιλαμβάνει τη συμπλήρωση ενός συνόλου παρατηρηθεισών μεταβλητών με τις πρόσθετες αφανείς ή κρυμμένες μεταβλητές (αφανής μεταβλητές).

Θα χρησιμοποιήσουμε ένα μοντέλο αφανών μεταβλητών, προκειμένου να εξετάσουμε την επίδραση της δημιουργικότητας και του κοινωνικού συμβιβασμού στην ανώτατη εκπαίδευση χρησιμοποιώντας ένα αυστραλιανό σύνολο δεδομένων.



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## **CHAPTER 1**

### **A Summary of the Research and Literature on Creativity**

#### **Historical Overview**

Theories and ideas about creativity stem from far back in history, unsurprising as Ryhammer & Brolin (1999) point out, given that the development of new ideas and original products is a particularly human characteristic. The notion of ‘inspiration’ or ‘getting an idea’ (ibid, page 260), is found in the Greek, Judaic, Christian and Muslim traditions and is founded on the belief that a higher power produces it. During the Romantic era in Europe, the source of inspiration and its artistic expression was seen as being the human being. During this era, originality, insight, the creative genius and the subjectivity of feeling were highly valued. From the end of the nineteenth century, people began to investigate the question of what fostered creativity.

The first systematic study of creativity was undertaken by Galton (1869). His focus was ‘genius’ and there followed a hundred or so studies on this theme, defined as achievement acknowledged in the wider public arena. This line of investigation remained prevalent into the 1920s, when the focus in psychology shifted to the investigation of intelligence. Although Binet’s work included some investigation of the creative side of

intelligence, the major study of creativity in psychology occurred in the 1950s.

### **The Early Part of the Twentieth Century**

Although creativity has a very long history, systematic study of it began at the turn of the last century. The early years of the twentieth century saw a move toward empirical investigation of creativity within the new discipline of psychology. There were four major traditions in which this took place:

- **The psychoanalytic** tradition (including Freud's discussion of creativity as the sublimation of drives and Winnicott's work on development which makes creativity central and intrinsic to human nature)
- **The cognitive** tradition (stemming from Galton's work and including Mednick's exploration of the associative process and Guilford's exploration of divergent production of ideas and products)
- **The behaviourist** tradition (including Skinner's discussion of chance mutation in the repertoire of behaviours)
- **The humanistic** tradition (including Rogers, May and Maslow whose discussions focused on the self-realising person acting in harmony with their inner needs and potentialities).

As Ryhammer and Brolin (1999) point out, some theorists were influenced by more than one tradition or line of work. Overall however, the early decades of the twentieth century were influenced more by philosophical speculation than by empirical investigations, because of the methodological approaches of at least two of the four branches described above. These approaches to the study of creativity continue to provide theoretical frames for investigators, although with different emphases at different points in time.

### **More Recent Directions in Creativity Research**

As indicated above, a particularly rich and influential period of research in creativity occurred during the 1950s. Here the focus was on the psychological determinants of individual genius and giftedness. Empirical work formed the methodological basis for much of the investigative work, usually involving large-scale, and positivist studies. Many would argue that this era of research was launched by

Guilford's (1950) examination of the limitations of intelligence tests and his investigation of 'divergent thinking'. There followed a large amount of research which attempted to test and measure creativity, to pin down its characteristics and to foster it through specific teaching approaches.

### **Lines of Study Stemming from the 1950s**

The 1950s research led to three major lines of development: work on personality, cognition and how to stimulate creativity. The three major lines of development were as follows.

#### **Personality**

This included a focus on prominent creative persons, notably carried out by the Institute of Personality Assessment and Research, at Berkeley (including the work of MacKinnon, 1975, Getzels & Csikszentmihalyi, 1976, and Simonton, 1984). It also studied much narrower personality traits or dispositions which are correlated either positively or negatively with creativity, such as Dogmatism, conformism, narcissism, frustration, resilience, elation, hypomania, and affect tolerance (surveys of these in Shaw & Runco, 1994, and Eisenman, 1997). From this particular strand of creativity research, the creative person can, it seems, be described as having the following characteristics (summarised by Brolin, 1992):

- strong motivation
- endurance
- intellectual curiosity
- deep commitment
- independence in thought and action
- strong desire for self-realisation
- strong sense of self strong self-confidence
- openness to impressions from within and without
- attracted to complexity and obscurity
- high sensitivity
- high capacity for emotional involvement in their investigations.

The studies about creative persons have been too narrow, focused on eminent and/or

productive persons and that consequently the qualities appear to be both contradictory and superficial. In addition, as the criteria for the selection of the individuals and the criteria for defining what is creative vary from study to study, it is difficult to compare one with another. Eysenck, on the other hand, has recently argued that studies of creative individuals have demonstrated surprising agreement over the years (Eysenck, 1997).

Dacey & Lennon (2000) suggest that one distinctive set of attitudes stands out in life-long, high level, creative achievement. These are:

- self-control
- sustained hard work
- determination
- perseverance.

## **Cognition**

Various branches of study emerged in the early years of twentieth century. They can be summarised as follows:

- creativity as an aspect of intelligence (for example, Binet & Henri, 1896)
- creativity as a mainly unconscious process (for example, Poincare, 1913, Freud, 1957)
- creativity as a problem-solving capacity (for example, Wallas, 1926)
- creativity as an associative process (for example, Spearman, 1931).

Creativity has also been described in relation to various processes of thought and experience, summarised by Ryhammer & Brolin (1999) and including the following: thinking in opposites, analogies and metaphors intuition inspiration intelligence various processes of mental representation specific perception processes problem finding problem solving.

Coming to the latter half of the twentieth century, two major lines of creativity investigation under the cognition umbrella have occurred since the 1950s, namely psychometrics and experimental psychodynamics.

***Psychometrics:*** Psychometric approaches to creativity were begun by Guilford, who developed a tool for measuring the extent of divergent thinking, which he later developed into the concept of ‘divergent production’ (Guilford, 1967). Later variations of Guilford’s work include the Torrance tests of creative thinking (1966, 1974), which have permeated school contexts, particularly in the United States

where tests have been used to assess pupils' creative thinking. This approach was influenced heavily by Mooney's (1963) 'four elements' view of creativity, which defined it as encompassing specific aspects of the environment (place) of creation, the product as an outcome of creativity, the process of creation and the person doing the creating.

The tests have, however, come under harsh criticism for measuring intelligence-related factors rather than creativity and for being affected too easily by external circumstances. It has also been suggested that the test procedure purely measures 'creativity on request' as opposed to creativity in daily life. Others, however, have considered that the tests have proved to be useful estimates of the potential for creative thought (Bachelor & Michael, 1997) and some think that they have a future (Kirschenbaum, 1998, Plucker & Runco, 1998).

***Psychodynamics:*** During the 1970s and 1980s work was undertaken on personality, perception and creativity. These studies focused on specific groups such as architects, students, children and young people, artists and university teachers. They indicate that the creative person has the ability to make alternative views of reality, has good communication between logic and imagination, has the courage to go against convention, has a belief in their own ideas and is emotionally involved in the work of creation (Smith & Carlsson, 1990, Schoon, 1992, Andersson & Rhyhammer, 1998).

One of the major developments during the 1980s and 1990s in personal and cognitive research has been the shift of emphasis away from measurable outcomes-based and product-linked approaches such as those developed by Torrance in the 1960s and 1970s, including tests of creative ability (Torrance, 1966, 1974). More recent investigations focus on understanding the creative mind in terms of intelligence (Gardner, 1993) and attempts to explore implicit theories of creativity held by people considered to be representative of certain fields (Sternberg, 1998, Spiell & Von Korff, 1998).

### **Ways to Stimulate Creativity**

Since the 1950s there has been a strong concern that education should prioritise the development of creativity. Implicit in this is the assumption that creativity can be so influenced. Since the 1950s, a range of attempts to stimulate creativity have been developed, although there is, as Ryhammer & Brolin (1999) point out, a serious lack of

systematic, controlled evaluations of such programmes. It is also the case that the methods and criteria for evaluating these are underpinned by differing theories of creativity. In addition, whether looking at attempts by cognitive psychologists, psychodynamicists, humanists or behaviourists, there is no evidence of transfer into new contexts.

There was also work done in the 1980s which suggested that early family responsibilities and opportunities for independent action encourage creative achievement and that creativity training programmes in schools are more effective when teacher involvement is high (Benjamin, 1984).

## **CHAPTER 2**

### **Creativity and Social Compromise in Tertiary Education**

#### **Introduction**

The world itself has a spiritual and a mystical connotation. Looking at the activities of creative people one can define creativity in a more creative way. According to Geoffrey Petty (1998), creative people are receptive, accepting, optimistic and uncritical. He says that creative ideas do not require huge intelligence. It is not an event to happen but it is a process. As such defining creativity as a product or judgment is difficult. As somebody said about quality as something that is noticed when it is not there. It is an action and not an end result. Processes can be creative and people also can be creative. It is up to the educational institutions to decide whether only one is enough or both. For an ideal situation are both.

Creativity can be associated with the essential nature of the humans being curious and find newer and finer meaning to their own existence. The term creativity is thus a continuous process, a process of conceptualization of everything that beholds the mind and awakens the senses. It is an enlightened perspective of the definite and the abstract, the

power of imagination that probes in to the deepest consciousness of the mind. Maybe in time we look for solutions in the outside world but the truth is that we ignore the power of our own mind.

Creative expression depends not on talent alone, but also on motivation, interest, effort, and opportunity. The creative process, contrary to popular opinion, is socially supported, culturally influenced, and collaboratively achieved. Creativity is a complex developmental system that is shaped by at least seven influences: 1) cognitive processes; 2) social and emotional processes; 3) family aspects, both while growing up and current; 4) education and preparation, both informal and formal; 5) characteristics of the domain and field; 6) socio-cultural contextual aspects; and 7) historical forces, events, and trends (Feldman, 1999, pp. 171-172).

### **Structure of the Thesis**

The dissertation has included literature published in books and journals in a range of disciplines and national contexts. There is a large variety of research on creativity. Its range is extremely broad, and as Rhyammer & Brodin (1999) point out, there has been ‘an even broader range of speculation’ about the nature of creativity. Narrowing the literature search to relevant sources was problematic, one reason being the range of related terms used to describe so-called creative activity. In the economic environment, for example, the terms ‘entrepreneurship’ and ‘enterprise’ are used, whereas in sociology the term used is ‘innovation’. Yet in education and psychology, the term ‘creativity’ is widely used.

With this dissertation we will lay down the foundation for a social psychology of creativity. We aim to give answers to the following questions:

- Does social compromise affect the creative way of thinking of the university students?
- Does the role of the parents, meaning the socio-economic conditions of family repression and stress development to the students’ creativity?
- How do learning skills influence creativity in tertiary education?

Answers to the above questions will be archived by developing a latent variable model which will involve the conceptual variables of creativity, social compromise and socio-economic situation as well as stress? We will investigate the relationship between creativity and the social compromise. The data utilized for this study refer to students from the University of Australia.

## **Tertiary Education**

Knowledge and advanced skills are critical determinants of a country's economic growth and standard of living as learning outcomes are transformed into goods and services, greater institutional capacity, a more effective public sector, a stronger civil society, and a better investment climate. Good quality, merit-based, equitable, efficient tertiary education and research are essential parts this transformation. Both developing and industrial countries benefit from the dynamic of the knowledge economy. The capacity for countries to adopt, disseminate, and maximize rapid technological advances is dependent on adequate systems of tertiary education.

### **What is Tertiary Education and Why is it Important?**

Tertiary education broadly refers to all post-secondary education, including but not limited to universities. Universities are clearly a key part of all tertiary systems, but the diverse and growing set of public and private tertiary institutions in every country - colleges, technical training institutes, community colleges, nursing schools, research laboratories, centres of excellence, distance learning centres, and many more - forms a network of institutions that support the production of the higher-order capacity necessary for development.

### **Education in Australia**

It is primarily regulated by the individual state governments. Generally education in Australia follows the three-tier model which includes Primary education (Primary Schools), followed by Secondary education (Secondary Schools / High Schools) and Tertiary education (Universities and TAFE [Technical and Further Education] Colleges).

Education is compulsory up to an age specified by legislation; this age varies from state to state but is generally 15-17, that is prior to completing secondary education. Post-compulsory education is regulated within the Australian Qualifications Framework, a unified system of national qualifications in schools, vocational education and training ([TAFE](#)) and the higher education sector (University). The academic year in Australia varies between states and institutions, but generally runs from late January until mid-

December for primary and secondary schools and TAFE colleges, and from late February until mid-November for universities.

### **Classification of Tertiary Qualifications**

In Australia, the classification of tertiary qualifications is governed in part by the Australian Qualifications Framework (AQF), which attempts to integrate into a single classification all levels of tertiary education (both vocational and higher education), from trade certificates to higher doctorates.

However, as Universities in Australia (and a few similar higher education institutions) largely regulate their own courses, the primary usage of AQF is for vocational education. However in recent years there have been some informal moves towards standardization between higher education institutions.

### **Education and Creativity**

Creativity has become one of those "buzz" words that everyone gives lip services to. People ask: How can be creativity fostered? Is it possible to give exercises for creativity? Is it possible to give exercises for a program? Is it possible to give exercises for a system of education? Is creativity something that can be trained or taught?

You can certainly train people to carry out tasks in a better way, acquire new techniques and skills, and to accumulate new knowledge. But the whole essence of creativity lies in its freshness, its freedom, its newness. Creativity is often unexpected and exciting. It involves seeing things in new ways and breaking rules. Creativity may result in something radically different or it may involve the unfolding of an old, established form with a total freshness

Creativity is not a skill; it is not a sort of muscle of the brain, or a technology of the mind. Creativity makes use of knowledge and skill but that is not where its roots lie. We have always felt that creativity is perfectly natural. We should not ask how to be creative; rather we must question why we are not being creative! Creativity is the essence of life, of evolution, of consciousness, of nature and of matter. The universe itself is in a constant act of creation so, as its children, we should ask ourselves. Why, in such a creative universe, do societies and some individuals at times appear to be stupid, dull, destructive and uncreative? Or are we deceived? Are people really dull or is their creativity simply being

shown in other ways? Are we all, in fact, creative and is it just that there are certain blocks which seem to frustrate us in certain areas of our lives? Do we all have the potential for creativity no matter how old we are?

### **Education Based on Creativity**

We would agree to the idea that education today should focus on producing creative individuals, as the society is frowning upon the latest examination-based education system. Creativity is the mainstream that boosts students to apply knowledge practically and innovatively, to make it better. Therefore, it is one of the most crucial elements to lead our education system to a higher progressing state. Creativity helps in a complete mental development, trains both brains to function in equilibrium, and helps to widen students' scope to a different dimension.

The education system is set on a regular examination basis, where certificates speak louder than one's potential. Bars are set for students to achieve perfect scores. This pressurizes students to work hard in memorizing texts and facts and indirectly, their creativity will be reduced, as most of the time spent on so-called "revision". If the education is focused on producing creative individuals, students will have a more complete mental development and not thinking that only memorizing is the only way to obtain the targeted scores. They would be able to adjust themselves to the subjects creatively without having to think that the particular subject is dull and uninteresting. Hence, more creative individuals will be produced if education involves creativity.

Academic-based education drives students to pursue higher grades in examination. It has become a routine for most of the students to study, study and study. Soon, when they enter the career field, they will realize that studying is not the only key to success but creativity also. For students who often apply creativity in their work, their brains work more efficiently than those mugging the texts. Moreover, it is proven that creative individuals are more sociable which this eases them for more job opportunities. Education today should pay more attention to what is the best for the students in future, especially to portray a positive and likable image at an international level that we are creative and easy to work with.

On the other hand, when students are exposed to creativity, they will have a wider scope of different dimensions. The things they view and the way they interpret will not only be restricted to a certain level, but will be extended further. This will not limit students

ability and potential in the academic realm but provides an overview to other areas like selecting the suitable job based on their gifts, or for example, how to modify an object and increase its function innovatively.

It is clearly known that the world is aiming of creative individuals. In a nutshell, the Education Ministry should be aware of which step to take in order to bring benefits to our country, that is, through producing creative individuals

### **The Child**

The whole essence of the infant is creative leaning to walk, leaning to talk, word games, songs, play. Imagine creating a world of your imagination and playing with it for hours on end. Physicists say that creating a theory is just like that it is a play of ideas within the mind. Playing with mud, your food, with fabrics, with paints, this is totally natural to the child and something that Picasso could do this all his life. Dressing up, playing jokes, play-fighting, it's all an immense energy of the mind. It is hard to stop creativity in a young child. Creativity is an energy that constantly bubbles out of a child, even if he or she is forced to sit at a school desk for hours on end. You can't make your child creative, it simply is creative. The most difficult thing in the world is to get out of the way and let this creativity happen.

### **Blocks**

The thrill, the imagination, the play of childhood passes, although for some it never really goes. The low value that adults put on play and the high value they put on learning, knowledge, technique, seriousness and making a living.

But praise and reward can be just as serious a block as punishment. Children loose the fun of painting and begin to look at what their fellows are doing, this can be an important phase in leaning, or it can be the first step to becoming over compliant to external values and rules.

As adults we have internalized authority; we have roles, models, values that are not are own, goals that are placed upon us. All this can destroy creativity. The deadline, the writer's block, the program's goals, all can kill.

By contrast, creativity is unconditioned; it is its own reward. But external goals, rules, etc. that become internalized can destroy creativity and cripple the mind. We have to

mention that the idea of an "undetectable brain damage" which is the result of pain, anger and frustration which all conspire to destroy the subtle nature of the brain and make it dull and mechanical.

When creativity is blocked the mind becomes terribly frustrated. It may become angry, violent and destructive. Or it may become dull, mechanical, depressed. Is our whole society suffering from a creativity that is frustrated?

In advocating creativity and the joy of play I am not advocating anarchy. I do not mean that there are no constraints, no rules, or morals to be placed on a creative person. Creative minds have always become engaged in a dialogue with rules and structures. But these rules are never arbitrary or mechanical; they are established by the medium itself paint, words, sounds, physical processes, the needs of others, the health of the planet, and the fabric of society. Bach chose the limitations of the fugue, Wordsworth wrote sonnets, and theoretical physicists must constantly submit their creations to the court of experiment. Creativity is not anarchy, yet it is free and unconditioned in the way it engages of the rules and a particular form and in so doing transforms and enlarges their meaning and significance. Again let me emphasis that while creativity must make use of rules, techniques, skills etc. these are not the origin of creativity, they are simply its tools.

### **Further Blocks**

Our civilization praises the new, the novel, and the unexpected. This can be another block. Does creativity always have to involve the novel and *different*? Or can creativity be a revisit, something that is immanent in the known, something fresh like a new loaf of *bread* which looks exactly the same as every other loaf but has a fresh smell and taste about it. So we should not feel that we have to be different. Simply trying to do something different each time can be another block to creativity.

Creativity for many people means production; "I have to write a poem, I have to get down to a new novel; I have to come up with a better theory". Creativity may indeed lead to new structures and forms, to new objects in the world. But is that its deepest essence or simply the by product of its bubbling energy? Creativity is a mind that is fresh, alert, sensitive. It is a mind that is not dull, mechanical, afraid, restricted. Creativity is an energy which moves through the whole body. Creativity can simply be seeing each day as new and fresh and full of potential. Creativity can exist in relationships, in the way we see nature, in the way we conduct our live. Must creativity always mean paintings, theories,

symphonies, poems and novels? Isn't it creative to teach and to learn? Again, when we think of creativity in children, we must not impose all these goals and presuppositions upon them.

What does the world need today? We need more, a totally different form of living, a way of facing the problems that plague our whole planet? We need teachers, politicians, parents who are highly creativity. We need people whose minds are not damaged. Who are alert, sensitive, who listen and watch both themselves and others?

## **Challenge**

We ask how children can be more creative. We would suggest that the first step is to allow *ourselves* to be creative. To act in a way that is free and unconditioned and not directed by anything outside itself.

The hardest thing is to allow this creativity in ourselves and in others. Can we really stand back and let it happen? *Not encourage it, reward it, direct it, structure it, and give it goals*

Creativity is so important to us that we find we can't leave it alone when we see it in others we can't allow our children simply to be themselves. And so we must praise, reward, direct and intervene. We all know a better way to do things, an easier path and all this does is to divert the creative action from its source by introducing something external. It is so easy to "help" the child, to enlarge its world. But if we are all to play we must learn the importance of having the total freedom to be wrong, to make mistakes, to push something to its limits and then throw it away. (It's said that the test of a really good mathematician is how many bad proofs they produce!) The teacher and the parent must develop courage and creativity. There are no rules, no one can tell us when to step in or when to stand back.

Can we learn to be creative in the presence of the other? Can we learn to be creative to ourselves? Can we allow that play to take place without interference. Can we be watchful, alert and sensitive? Can we know the moment to engage with the other, to express our excitement, to share our skill and knowledge? In the end, being a parent or a teacher has to be a creative act in its own right. The creative parent allows the child that security and solitude in which to explore the universe in a creative way. The most important freedom that the parent or teacher can allow is the freedom to play and to make

mistakes. But can we act as creative parents to ourselves? Can we allow ourselves the security and freedom to explore, to create and to make mistakes?

## **CHAPTER 3**

### **Definition of “Creativity”**

#### **Introduction**

Although it is necessary to specify an operational definition of creativity that relies solely on subjective criteria, such definition is not, by itself, sufficient for use in a theory of creativity. Although empirical studies of human creativity cannot at this time apply specific criteria for identifying creative products, any theoretical formulation of creativity must make assumptions about these criteria and their characteristics. Thus to lay the foundation for a theoretical model of creativity, it is necessary to make assumptions about the nature of observers' responses when they call something “creative”.

In the introductory remarks of his book, Csikszentmihalyi (1996) comments that, if it were not for man's creativity, there would be little difference between man and ape, whose genes are 98% identical with those of a man. This comment introduces the importance of creativity for human development.

Creativity has been studied from a variety of perspectives and is important in numerous contexts. Most of these approaches are unidisciplinary, and it is therefore difficult to form a coherent overall view.

Creativity (or creativeness) is a mental process involving the generation of new ideas or concepts, or new associations between existing ideas or concepts. From a scientific point of view, the products of creative thought (sometimes referred to as divergent thought) are usually considered to have both *originality* and *appropriateness*. An alternative, more everyday conception of creativity is that it is simply the act of making something new. It is the ability to generate novel and useful ideas and solutions to everyday problems and challenges.

Although intuitively a simple phenomenon, it is in fact quite complex. It has been studied from the perspectives of behavior psychology, social psychology, psychometrics, cognitive science, artificial intelligence, philosophy, history, economics, design research, business, and management, among others. The studies have covered everyday creativity, exceptional creativity and even artificial creativity. Unlike many phenomena in science, there is no single, authoritative perspective or definition of creativity. Unlike many phenomena in psychology, there is no standardized measurement technique.

Amabile has attempted to capture the essential characteristics of the conceptual definition of creativity. She used an approach to investigate environmental influences on creativity. *The impact of environmental factors on motivation and creativity is significant and highly complex*. In order for a creative idea to be generated, however, it is often necessary to temporarily 'step-away' from environmental constraints. (Newell *et al.* 1962).

According to Amabile (1988, 1996), creativity is the production of novel and useful ideas by an individual or small group of individuals working together. That is, creativity requires a collaborative environment. Creativity cannot be ordered, but it relies heavily on intrinsic motivation (Amabile, 1996, and Amabile, *et al.*, 1996) and can be stimulated and supported through training and education.

Rhodes (1961) has studied dozens of literatures on creativity to propose the 4Ps aspects of creativity: person, process, product and place. Based on Rhodes' conceptual framework, Sternberg and Lubart (1993) argue for the value of an integrative approach and propose an investment theory of creativity that elaborates on the creative process in an integrative approach that provides valuable points of reference and implications for research. Their theory covers six factors of creativity: intelligence, knowledge, thought pattern, personality, motivation and environment.

- **Intelligence.** The synthetic intelligence helps us review and redefine problems from a new angle; the analytical intelligence helps individuals discern potential ideas to solve fundamental problems through effective allocation of resources; and the practical intelligence allows for effective presentation of performance.
- **Knowledge.** Knowledge mainly plays the roles of bringing a creative idea into reality and of helping the individual overcome limitations of prior knowledge.
- **Thought pattern.** To ensure the validity of his organization, a leader has to lead his team on a continuous journey of innovative thinking (Basudur, 2004). However, people of different thought patterns may demonstrate their creativity in different ways.
- **Personality.** Sternberg and Lubart (1993) points out a number of personal traits in the personality aspect that help develop creativity, such as perseverance in face of obstacles, willingness to take reasonable risks, willingness to grow, tolerance to ambiguity, acceptance of new experience, and self – confidence.
- **Motivation.** Almost all creative people have a great passion for what they are doing, and their creation is always driven by some intrinsic motivation (Shalley and Oldman, 1997).
- **Environment.** In terms of the environment aspect, a fully supportive environment may not be the best for stimulating personal creativity. On the contrary, an environment that is generally supportive yet with some obstacles is more effective in stimulating creativity.

### **Creativity in Psychology and Cognitive Science**

The study of the mental representations and processes underlying creative thought belongs to the domains of psychology and cognitive science.

A psychometric approach to understanding creativity was proposed by Sigmund Freud, who suggested that creativity arises as a result of frustrated desires for fame, fortune, and love, with the energy that was previously tied up in frustration and emotional tension in the neurosis being sublimated into creative activity. Freud later retracted this view.

Graham Wallas, in his work “*Art of Thought*”, published in 1926, presented one of the first models of the creative process. In the Wallas stage model, creative insights and illuminations may be explained by a process consisting of 5 stages:

- **preparation** (preparatory work on a problem that focuses the individual's mind on the problem and explores the problem's dimensions),
- **incubation** (where the problem is internalized into the unconscious mind and nothing appears externally to be happening),
- **intimation** (the creative person gets a 'feeling' that a solution is on its way),
- **illumination** or insight (where the creative idea bursts forth from its preconscious processing into conscious awareness)
- **verification** (where the idea is consciously verified, elaborated, and then applied).

## **Creativity and Innovation**

In many cases in the context of examining creativity in organizations, it is useful to explicitly distinguish between *creativity* and *innovation*. Creativity can be defined as problem identification and idea generation whilst innovation can be defined as idea selection, development and commercialisation. This reveals at least two issues:

- Creative measurement requires isolation of problems and ideas.
- Innovation measurement requires isolation of idea selection, development and commercialisation processes.

The above means that creativity can be measured without the production of a final, commercially successful product or service. We can simply measure how good an organization is at identifying problems and generating ideas. Second, we need a measurement system. A very simple and often used quantitative system is to list criteria and rate them on a scale. A rating before and after, say, a training session or activity, will indicate tangible levels of change.

Innovation typically involves creativity, but is not identical to it. Innovation involves acting on the creative ideas to make some specific and tangible difference in the domain in which the innovation occurs, Luecke and Katz (2003).

In such cases, the term *innovation* is often used to refer to the entire process by which an organization generates creative new ideas and converts them into novel, useful

and viable commercial products, services, and business practices, while the term *creativity* is reserved to apply specifically to the generation of novel ideas by individuals or groups, as a necessary step within the innovation process (Amabile et al., 1996). For example, Amabile et al., suggest that while innovation “begins with creative ideas”, . . . Creativity by individuals and teams *is a starting point for innovation*; the first is a necessary *but not sufficient* condition for the second". (Amabile et al., 1996 p. 1154-1155, emphasis added)

Amabile (1993) proposes the four phases of the innovation process to be as follows:

**Phase 1:** manifestation of problem: an individual may be given a problem or has identified one by himself;

**Phase 2:** “preparation”: in this phase, the individual will collect necessary information and resources;

**Phase 3:**“generation of creative ideas”: the individuals come up with creative ideas through his ability of creative thinking, or his intrinsic motivation;

**Phase 4:** “validation”: using his own knowledge, the individual legitimates the creative ideas, thus generated.

Definitely, there is a difference between creativity and innovation. For innovation to occur, something more than the generation of a creative idea or insight is required: the insight must be put into action to make a genuine difference, resulting for example in new or altered business processes within the organization, or changes in the products and services provided. Through these varieties of viewpoints, creativity is typically seen as the basis for innovation, and innovation as the successful implementation of creative ideas within an organization (Amabile, 1996). From this point of view, creativity may be displayed by individuals, but innovation occurs in the organizational context only. It should be noted, however, that the term 'innovation' is used by many authors rather interchangeably with the term 'creativity' when discussing individual and organizational creative activity.

Creativity is the process of generating something new. It is a prerequisite for innovation. Innovation however, is the practical application of creativity. A good idea is a great thing, but if the idea is not implemented, for whatever reason, we simply have creativity. Innovation is therefore, in effect, proof of an idea. This makes implementation part of the mix

Creativity as a concept is seen as the main source of innovation. Creativity is about thinking of new ideas that are different from the existing situation. Creative thinking involves using existing knowledge and talent to develop new ideas by being prepared to see things from different mindset. Creative thinking enables us to acquire a better understanding about a situation or problems we face. Innovation and inventions are the outcomes that are based on creative thinking.

How that creativity is a dominant aspect of our childhood days, simply seems to have disappeared as we reach our adulthood? Can we get back the ability to think creatively as an adult? The answer to that question – 'Yes. We can get back that skill, provided we understand some of the underlying aspects about creativity and creative thinking. Though creative thinking can be accidental, we are interested in acquiring a creative thinking process that can be managed in a planned and deliberate manner.

Creative thinking requires us to view situations with an open mind. It is journey we need to embark upon to discover new and different things as we move on. The discovery process demands that we continue to remind ourselves of the need to set aside our long established assumptions and attitudes. Researches and experts recommend that we accept the following for creativity to really work:

- One needs to accept the fact that any existing knowledge is inadequate at time for innovative solutions.
- Be prepared to seek solutions/ideas from different sources.
- Logical thinking is useful but its role in enabling new and innovative solutions is rather limited.
- Be ready to experiment with radically different approaches when seeking new solutions.
- Be willing to unlearn, so that we can offload useless knowledge, enabling us to relearn.
- Always willing to experiment and ask: 'what if' and 'what else' to unfold new ideas and solutions.

Once we are prepared to accept the above elements, we are in a better position to develop new ideas and add, modify and further refine the ideas into something more innovative. Because of our willingness and ability to combine ideas, we are able to bring out a concept or an idea that is new – something that did not exist before.

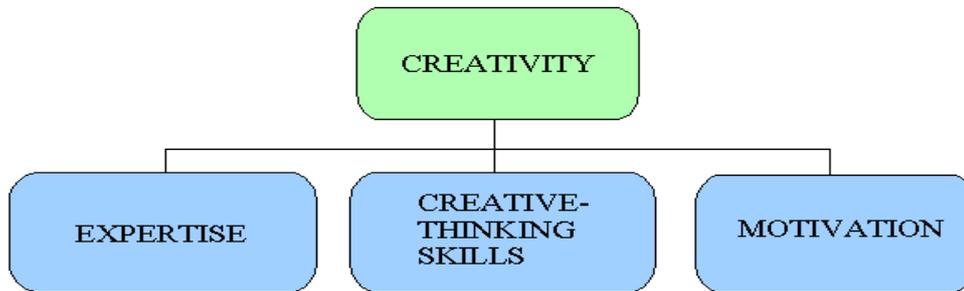
There are several techniques we can use to develop new ideas. Asking questions is a key element in the creative thinking process. The only way to become fully aware of the situation and the related factors is to ask questions.

### **Components of Creativity**

The componential model of creativity proposes three basic intra individual components that are necessary for creativity: *domain relevant skills* (competencies and talents applicable to the domain or domains in which the individual is working; creativity – *relevant processes*, the personality characteristics, cognitive styles, and work habits that promote creativity in any domain; and *intrinsic task motivation*, an internally driven involvement in the task at hand, which can be influenced significantly by the social environment.

Thus, creativity does not stem from expertise alone. Expertise is one of the three components of creativity. The other two necessary components are creative thinking skills and intrinsic motivation<sup>1</sup>. In order for a person or a team to be creative, all three components must be present. The challenge for a leader of a knowledge-based team composed of highly skilled professionals then is to assure that the team environment is one that facilitates the free flow of expertise, encourages creative thinking and capitalises on intrinsic motivation. This literature review outlines the team factors that affect team creativity and performance, and discusses tools that a leader of a knowledge-based team can use to enhance team performance and "lead" creativity.

According to Amabile, "Creativity within each of us is a function of three components: expertise, creative thinking skills, and motivation." (p.78)



- ▶ Expertise = knowledge.
- ▶ Creative thinking skills = how people approach problems.
- ▶ Motivation = the desire to do something.

- Expertise = knowledge, technical, procedural, and intellectual.
- Creative thinking skills = how people approach problems.
- Motivation = the desire or driver for what we will actually do, e.g., solve a problem.

While the first two components are important, the basis of the article focuses on two key elements relating to motivation:

- How it impacts creativity
- How we as managers influence creativity through motivation

There are two types of motivation: *extrinsic and intrinsic*. Extrinsic factors are external factors, like money as a reward or threats of being fired, as a way for managers to motivate workers. Managers surprisingly enough think these are the best ways to motivate their employees. While these are the most common, they are also the least successful tools.

Intrinsic motivation is the key ingredient to help spark creativity. It refers to personal enthusiasm and engagement toward work. An individual with intrinsic motivation is curious, non binding to rigid thinking, adventurous, and determined to overcome difficulty in face of obstacles.

These are factors like passion and self-interest. “When people are intrinsically motivated, they engage in their work for the challenge and enjoyment of it. The work itself is motivating.” (p.79)

## **Creativity and Social Systems**

By contrast with these earlier developments, research into creativity in the 1980s and 1990s became rooted in a social psychological framework which recognises the important role of social structures in fostering individual creativity (Rhyammar & Brolin, 1999, Jeffrey & Craft, 2000). This has been described as being a fourth, coherent area of study (Jeffrey & Craft, 2000): creativity and social systems.

Some significant theories have been put forward in which creativity is seen from a systems perspective (Cziksentmihalyi, 1998, Sternberg, 1998, Sternberg & Lubart, 1991a, 1991b, 1995), where various elements of the overall social and cognitive context are seen as highly relevant to the activity of creating.

Three major studies were undertaken: one in Europe (Ekvall, 1991, 1996) and two in the USA (Amabile, 1988, Isaksen, 1995), which explored the organisational climates which serve to stimulate creativity. The results from these three programmes have converged at several major points, suggesting that, in a creative climate, the participants in the organisation:

- feel challenged by their goals, operations and tasks
- feel able to take initiatives and to find relevant information
- feel able to interact with others
- feel that new ideas are met with support and encouragement
- feel able to put forward new ideas and views
- experience much debate within a prestige free and open environment
- feel uncertainty is tolerated and thus risk-taking is encouraged.

In addition, Amabile's (1988) model suggests that individual creativity may be affected by even very minor aspects of the immediate social environment. For example, creativity may be impeded where rewards are determined in advance, where there is undue time pressure, over supervision, competition or where choices are restricted in terms of approach or working materials, or where evaluation is expected. The role of the context or subject domain has been increasingly emphasised since the early 1990s.

In addition, 1970s debates on creativity within philosophy regarded creativity as moving away from product outcomes and being connected with imaginativeness (Elliott, 1971). During the 1980s a new line was developed, born of social psychology and systems theory, where environmental conditions were taken into account. Within these four lines

of development, (personality, cognition, stimulating creativity and social theories) there were specific foci such as the person who creates, the creative process, environmental factors, and the outcome (a fourfold set of foci, originally proposed by Mooney in 1963 as indicated above).

During the 1990s, due to the development of the approach from social psychology, research into creativity became more comprehensive, integrating these specific foci. Research began to focus more on the creativity of ordinary people within aspects of education. At the same time the methodology for investigating creativity in education also shifted, within a general trend, from positivist, large scale studies aiming to measure creativity, toward ethnographic, qualitative research focusing on the actual site of operations and practice, as well as philosophical discussions around the nature of creativity.

### **The Social Psychology of Creativity**

Despite the clear importance of social and environmental influences on creativity performance, a social psychology of creativity is yet to be developed. Theory and research have been focused almost exclusively on a personality approach to creativity and, to a lesser extent, a cognitive – abilities approach. A striking feature of many phenomenological accounts of creativity is the degree to which outstandingly creative individuals feel influenced by social and environmental factors. In many cases, these factors are quite ordinary, mundane events; it appears that even seemingly insignificant features of the environment can be detrimental or conducive to creativity in some individuals.

### **Task Motivation**

Few theorists have given extensive attention to the role of motivational variables in creativity. There are some, however, who have suggested that creativity is most likely to appear under intrinsic motivation – a motivational state generated by the individual's reaction to intrinsic properties of the task and not generated by extrinsic factors. Koestler (1964), speculated that the highest form of creativity are generated under conditions of freedom from control, since it is under these conditions that a person may most easily reach back into the “intuitive regions” of the mind.

Thus, within the componential formulation, task motivation includes two elements: the individual's baseline attitude towards the task, and the individual's perceptions of his reasons for undertaking the task in a given instance.

### **Sex, Age and Creativity**

The componential framework can be useful in suggesting an explanation in the vastly different average ages at which peak creativity is achieved in different domains of endeavour. The key to this explanation is that certain domain, relevant skills may be relatively less crucial for creative work in some domains than in others. For example, in philosophy and the nature sciences, an enormous amount of formal and informal education is necessary for an individual to even begin to produce significantly creative work. By contrast, a relatively low level of exposure to formal training in music might be sufficient to allow an individual to compose creative work if his other skill and task motivation were high.

There is some evidence (Spiel & Von Korff, 1998) that females mostly associate 'idea' to creativity, whilst males mainly focus on the aspect of 'novelty'. In addition, males use the concept of 'fantasy' as important in creativity and females frequently describe creativity by what it is not. Fryer's (1996) large scale study of teachers in primary, secondary and further education suggested that male teachers were far more inclined to view creativity in terms of the product's 'elegance' and the critical thinking involved in its conception and evolution, assessing a product's creativity per se, rather than seeing it as a product of experience. By contrast, women teachers were far more likely to see creativity in terms of depth of thought, depth of feeling, originality and experience.

Thus, it is not surprising that the average age of outstanding creativity in the arts is reached in the 30's and 40', while the average age of outstanding creativity in philosophy is reached in the 60s (Dennis 1966; Lehman 1953).

In one of the early studies reported in 1983 edition of Amabile's book, they found a marginally significant sex difference: women produced collages that were rated as more creative than those produced by men. In order to avoid possible complication effects, they relied primarily on female subjects in many of their later studies. In many studies where they have included both men and women, or boys and girls, they found sex differences,

generally with children. From the small body of data they have collected, it appears that girls may be more creative on some verbal tasks (Picariello, 1994), and boys may be more creative on some verbal studies (Philips, 1993).

### **Measuring Creativity**

Briefly creativity is a highly important human characteristic. As just indicated, it leads to inventing printing presses, light bulbs, cures for diseases, great symphonies, and solutions to public policy problems. It is something that we should be seeking to measure.

### **Creativity Quotient**

Several attempts have been made to develop a *creativity quotient* of an individual similar to the Intelligence quotient (IQ), however these have been unsuccessful (Kraft, U. (2005)). Most measures of creativity are dependent on the personal judgment of the tester, so a standardized measure is difficult to develop.

### **Creativity and Intelligence**

Assuming that creativity can be assessed using psychometric scales similar to tests of intelligence, researchers have set out to look at whether creativity and intelligence correlate. The most popular hypothesis has been the so-called *threshold hypothesis* (also known as the *threshold effect* or *threshold theory*), which says that a high degree of intelligence appears to be a necessary but not sufficient condition for high creativity (Guilford, J.P (1967)) This means that, in a general sample, there will be a positive correlation between creativity and intelligence, but this correlation will not be found if only a sample of the most highly intelligent people is assessed. Research into the threshold hypothesis, however, has produced mixed results ranging from enthusiastic support to refutation and rejection (Plucker, J.A. & Renzulli, J.S. (1999)).

### **Psychometric Approach**

J.P Guilford's group (Guilford, J.P (1967)) developed the Torrance Tests of Creative Thinking. They involved simple tests of divergent thinking and other problem solving skills, which were scored on:

- **Fluency.** The total number of interpretable, meaningful, and relevant ideas generated in response to the stimulus.
- **Flexibility.** The number of different categories of relevant responses.
- **Originality.** The statistical rarity of the responses among the test subjects.
- **Elaboration.** The amount of detail in the responses.

### **Social-Personality Approach**

Some researchers have taken a social-personality approach to the measurement of creativity. In these studies, personality traits such as independence of judgment, self-confidence, and attraction to complexity, aesthetic orientation and risk taking are used as measures of the creativity of individuals (Sternberg, R.J, Lubart, T.I. (1999)). Other researchers (McCrae, R.R. (1987)) have related creativity to the trait, *openness to experience*.

### **Negative Approach**

A negative approach to measuring creativity may involve measuring what was missing in a preplanned task or environment and what was previously known by the subject of observation. This is essentially measuring what is considered "not creative" in order to determine what is creative. The amount of creativity from the subject is the amount of adaptation or improvisation that was conceptualized (during the task, in the environment) without clues or hints from that procedure or environment.

### **Data**

Although most of the research on educational environment has focused on elementary schools, some investigators have studied college environment that might be conducive or detrimental to creativity. Of greater interest, however, are the measures of social climate that correlate with a school's productivity.

A great deal of research has examined the influence of family characteristics and parental behaviours on creativity development.

The data analyzed for this study refer to the Australian University. In total a random sample of 190 students were selected.

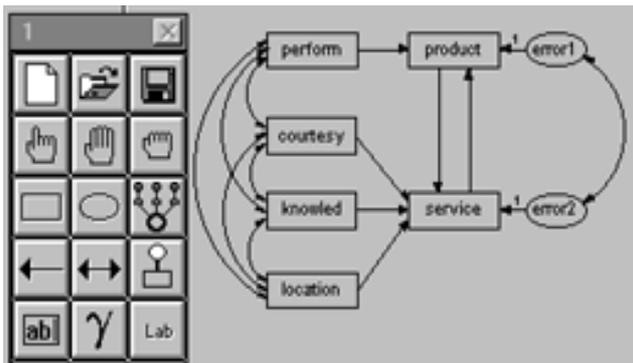
The purpose of this study is to explore some societal and psychological characteristics, which influence a student's creativity.

The statistical package used for the analysis is AMOS 7.0 of SPSS 15.

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## **CHAPTER 4**

### **Methodological Discussion**

#### **Latent Variables**

Many constructs that are of interest to social scientists can not be observed directly. Examples are preferences, attitudes, behavioural intentions, and personality traits. Such constructs can only be measured indirectly by means of observable indicators, such as questionnaire items designed to elicit responses related to an attitude or preference. Various types of scaling techniques have been developed for deriving information on unobserved constructs of interest from the indicators. An important family scaling methods is formed by latent variable models.

In the behaviour sciences, response variables are often no continuous, common types being dichotomous, ordinal or nominal variables, counts and durations. Conventional structural equation models (SEMs) have then been generalized to accommodate different kinds of responses.

A powerful approach to probabilistic modelling involves supplementing a set of observed variables with additional latent or hidden variables. By defining a joint distribution over visible and latent variables, the corresponding of the observed variables is then obtained by marginalization. This allows relatively complex distributions to be expressed in terms of more tractable joint distributions over the expanded variable space.

Latent variable models are applicable in situations where some variables are not directly observed. Such variables can be used to explain the covariations between a numbers of measurable variables.

A latent variable model is a, possibly nonlinear path analysis or graphical model. In addition to the manifest variables, the model includes one or more unobserved or latent variables representing the constructs of interest. Latent variable models are used in most empirical disciplines, but under various names and with various motivations and methods of analysis. The aim is to establish a unified conceptual framework for modeling and analysis. Various examples or applications from genetics, ecology, evolution, economics and other fields will be reviewed for the purpose of cross fertilization.

**Structural equation models** (SEMs) comprise two components, a measurement model and a structural model. The measurement model relates observed or ‘indicators’ to **latent variables** and sometimes to observed covariates. The structural model then specifies relations among latent variables and regressions of latent variables on observed variables. When the indicators are categorical, we need to modify the conventional measurement model for continuous indicators. However, the structural model can remain essentially the same as in the continuous case.

## **Approaches and Techniques**

### **The Theoretical Model**

In some disciplines such as psychology or sociology, the variables we are interested in are not directly measurable. Instead, we have to do with observed measurable quantities. For example we cannot measure “intelligence” but we can measure test scores in various subjects, and it might be that intelligence is one explaining factor in these scores.

Latent Variable Modeling (LVM) has been used in social sciences and economics to resolve successfully the problem of statistical and econometric analysis of phenomena,

which cannot be accurately expressed in a quantitative dimension only. The LVM approach has been developed mainly by Joreskog and Sorbom, Hayduk and Bollen, and further discussed and extended by these and other scientists researchers.

LVM use the analysis of variance-covariance to study the complex path structure of direct and indirect interdependencies of observed factors and their influence on the latent phenomena under investigation.

LVM is based on the following three fold postulation:

1. Formulation of the hypothesis to be investigated as a causal structure among a set of latent variables.
2. Detection of a set of observed factor variables, which can be used as proxies of the latent variables. Such observed variables are called indicator variables.
3. Specification of the latent variables as functional combinations of the indicator variables and measurement errors in a casual chain of observed and non observed variables.

The general form of a latent variable model includes the following three matrix equations:

$$\eta = B\eta + \Gamma\zeta + \zeta \quad (\text{structural equation model}) \quad (1)$$

$$y = A_y\eta + \varepsilon \quad (\text{Measurement Model for } y) \quad (2)$$

$$x = A_x\zeta + \delta \quad (\text{Measurement Model for } x) \quad (3)$$

$\eta$  and  $\zeta$  are random vectors of latent dependent and independent variables, respectively,  $B$  and  $\Gamma$  are coefficient matrices and  $\zeta$  is a random vector of disturbance terms. The elements of  $B$  represent direct causal effects of  $\eta$ -variables on other  $\eta$ -variables and the elements of  $\Gamma$  represent direct causal effects of  $\zeta$  – variables on  $\eta$ -variables. The vectors  $\eta$  and  $\zeta$  are not observed but instead vectors  $y$  and  $x$  are observed, such as the two measurements models represented in equations (2) and (3) hold.  $A_y$  and  $A_x$  are coefficient matrices, and  $\varepsilon$  and  $\delta$  are vectors of errors of measurement in  $y$  and  $x$ , respectively.

The observed variables  $y$  and  $x$  contain indicator variables for the unobserved or latent variables  $\eta$  and  $\zeta$  respectively. The latent variables correspond to theoretical constructs or variables measured correctly. For this reason, they may be called “true” variables. The structural equation model represented by equation (1) specifies the causal relationship between the “true” or latent variables  $\eta$  and  $\zeta$ . The measurement models represented by equations (2) and (3) specify how the latent variables or hypothetical

constructs  $\eta$  and  $\zeta$ , are measured in terms of the observed variables  $y$  and  $x$ , respectively. It is emphasized that  $\zeta$  in equation (1) is a vector of classical disturbances, including all random discrepancies that emerge between the actual values of  $\eta$  and the values that would be obtained by the corresponding exact or, in the case of no disturbances, stable functional relationship. Such random discrepancies may be due to omitted variables from the model, or to some “intrinsic” randomness in elements of vector  $\eta$  which cannot be explained anyway, or to any other non systematic influence on vector  $\eta$  which cannot be captured by the right hand part of equation (1) no matter how elaborate it is. What  $\zeta$  does not include are measurement errors, which are instead cast into vectors  $\varepsilon$  and  $\delta$  in equations (2) and (3).

For the LV model (1) - (3) the following classical assumptions are made:

- i. The error terms  $\zeta$ ,  $\varepsilon$  and  $\delta$  have zero mean value.  $\zeta$  is uncorrelated with the vectors  $\eta$  and  $\zeta$ ,  $\varepsilon$  and  $\delta$  are uncorrelated with the corresponding vectors  $n$  and  $\zeta$  respectively
- ii. The matrix  $B$  has zeroes in the diagonal and
- iii. The matrix  $(I-B)$  is non – singular.

Assumption (i) ensure that equations (1)-(3) are well specified including all the important determinants of the dependent variables. Regarding assumption (ii), the elements of matrix  $B$  is assumed not to depend on themselves. Assumption (iii) is required for estimation purposes, i.e. the inverse of matrix  $(I-B)$  or  $(I-B)^{-1}$  must exist.

Following the LVM methodology, the theoretical model can be formulated as follows:

$$\begin{bmatrix} \eta_1 \\ \eta_2 \end{bmatrix} = \begin{bmatrix} \beta_1 & \beta_2 \\ \beta_3 & \beta_4 \end{bmatrix} \begin{bmatrix} \eta_1 \\ \eta_2 \end{bmatrix} + \begin{bmatrix} \gamma_1 & \gamma_2 & \gamma_3 \\ \gamma_4 & \gamma_5 & \gamma_6 \end{bmatrix} \begin{bmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \end{bmatrix} + \begin{bmatrix} \zeta_1 \\ \zeta_2 \end{bmatrix}$$

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \end{bmatrix} = \begin{bmatrix} \lambda_1 & \lambda_2 \\ \lambda_3 & \lambda_4 \\ \lambda_5 & \lambda_6 \\ \lambda_7 & \lambda_8 \end{bmatrix} \begin{bmatrix} \eta_1 \\ \eta_2 \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \end{bmatrix}$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} \lambda_9 & \lambda_{10} & \lambda_{11} \\ \lambda_{12} & \lambda_{13} & \lambda_{14} \\ \lambda_{15} & \lambda_{16} & \lambda_{17} \end{bmatrix} \begin{bmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \end{bmatrix} + \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \end{bmatrix}$$

## **The Empirical Data**

The empirical investigation is based on the databank DATED. The data utilized for this study refer to students from the University of Australia. A sample of 190 students was selected, where 85 men and 105 women. Students were appropriate asked to pay attention to the completion of the questionnaire, which was structured in 11 major sections with closed and open questions. The sections were the following:

- General personal and family details
- Motivation (13 questions)
- Effectiveness of lecturers (4 questions)
- Committing information from lecturers to long – term memory (7 questions)
- Effective use of books and journals (5 questions)
- Book reading strategy (7 questions)
- Committing information from lecturers to long term memory (5 questions)
- Writing skills (8 questions)
- Oral skills (5 questions)
- Use of English (10 questions)
- Comments and opinions (7 open questions)

It is noted that all the above fields include questions on collaboration and personal stress. Achievement scores and success factors were also collected from the secretaries of the Australian university for all students individually.

The completed questionnaires were used to construct indicator variables for learning skills, collaboration, stress, and family support. These indicator variables were used to estimate the empirical model.

## **The Empirical Model**

In order to analyze our data, a latent variable model is constructed, identified and estimated. The empirical application of the model is based on the databank DATED, which contains 300 variables, mainly on motivation, learning skills, socio-economic factors, score achievements and self-assessments of sophomores.

According to the methodology described at the paper of Georganta and Hewitt, the following model is conducted (4) – (6). The specification of the fixed parameters is based on information contained in the databank DATED.

$$\begin{bmatrix} CR^* \\ SC^* \end{bmatrix} = \begin{bmatrix} 0 & \beta \\ 0 & 0 \end{bmatrix} \begin{bmatrix} CR^* \\ SC^* \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 \\ \gamma_1 & \gamma_2 & \gamma_3 \end{bmatrix} \begin{bmatrix} PAC^* \\ FAMREP^* \\ STRESS^* \end{bmatrix} + \begin{bmatrix} \zeta_1 \\ \zeta_2 \end{bmatrix} \quad (4)$$

$$\begin{bmatrix} CR1 \\ CR1 \\ SC1 \\ SC2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ \lambda_1 & 1 \\ 1 & 1 \\ 0.4 & 1 \end{bmatrix} \begin{bmatrix} CR^* \\ SC^* \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \end{bmatrix} \quad (5)$$

$$\begin{bmatrix} PAC \\ FAMREP \\ STRESS \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} PAC^* \\ FAMREP^* \\ STRESS^* \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \quad (6)$$

### Description of variables

**PAC**: parent's social status, measured as the average of both parent's education

**FAMREP**: psychological oppression within family, indicating whether parents actively encourage their child to pursue a more preferable career, opting out of university

**STRESS**: the average student's stress development due to lack of learning skills. It was based on 3 questions in the questionnaire where in each question student's stress has eight different values (value 1 refers to no students stress and 8 to a severe student's stress)

**CR1** and **CR2**: are the two indicators of student's creativity. Three different values are assigned to CR1, according to the way a student takes lecturer notes' value 3 and 1 reflects to the most and least creative way, correspondingly.

**CR2** reaps also 3 different values reflecting mutually the respondents stated opinion on two questions (value 3 and 1 are a sign of the most and the least creative way of thinking respectively)

**CR\***: denotes the conceptual variable of creativity

**SC\***: is a conceptual variable represented by the two indicator variables

**SC1** and **SC2** which are two indices constructed to measure social compromise in two different motivation areas.

**SC1** takes two different values. 0 and 1 where 1 reveals social compromise when a respondent denotes that she/he would like to opt out university if any chance in favor of another preferable career, whereas value 0 implies no social compromise.

**SC2** takes 3 different values ‘value 3’ manifests the highest level of social compromise (whether the student would resist and be uncooperative if his/her child decided to give up university studies for a new desired career) and value 1 shows the lowest level.

The above mentioned variables were used to estimate the model (1) – (3).

We will analyze the direct and indirect relationships between social compromise (SC), students’ creativity (CR), parent’s social status (PAC), psychological oppression with family (FAMREP) and student’s development due to lack of learning skills (STRESS)

Using the LVM model, we are distinguishing two sets of variables, the observed indicator variable and the nonobserved latent or conceptual variables (denoted by stars). The indicator variables which are observed with systematic measurement errors, are used as proxies for the conceptual variables, which are the “true” or “without errors” variables.

**Table 1: Description of the two sets of variables used in our model.**

<b>Notation</b>	<b>Description</b>
<b>CR*</b>	Creativity (endogenous conceptual variable)
<b>SC*</b>	Social compromise (endogenous conceptual variable)
<b>PAC*</b>	Socio-economic situation (exogenous conceptual variable)
<b>FAMREP*</b>	Family supportive situation (exogenous conceptual variable)
<b>STRESS*</b>	Stress (exogenous conceptual variable)
<b>CR1</b>	Index 1 of creativity (constructed by the authors) *
<b>CR2</b>	Index 2 of creativity (constructed by the authors) *
<b>SC1</b>	Index 1 of social compromise (constructed by the authors) *
<b>SC2</b>	Index 2 of social compromise (constructed by the authors) *
<b>PAC</b>	Parents’ socio-economic conditions (index constructed by the authors) *
<b>FAMREP</b>	Repression within family (index constructed by the authors) *
<b>STRESS</b>	Stress due to lack of learning skills (index constructed by the authors) *
Note: based on the authors’ databank DATED	

We have to mention that all the above sections include information on creativity, social compromise and personal tests. Achievement scores and success factors were also collected.

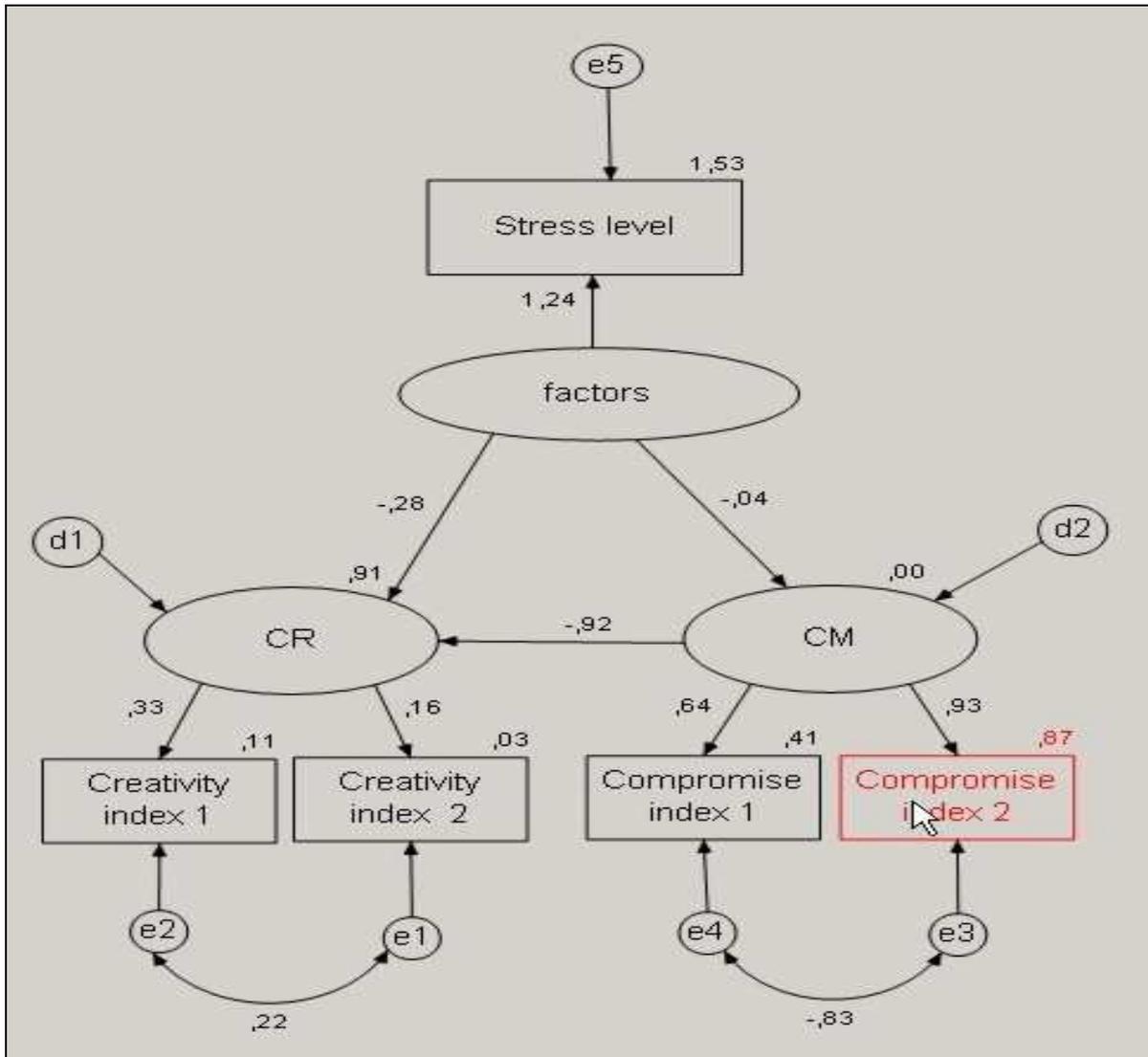
The model (4)-(6) is over identified. It has 28 moments and 17 free parameters to be estimated. These are the 5 coefficients, b, g and l, the variables of the six error terms and the variance – covariance matrix of the three exogenous indicator variables. The model's parameters are estimated by using the Maximum Likelihood Estimation (MLE) method, which is provided by the specialized and popular statistical package *AMOS 7.0 of SPSS 15*.

Results will be discussed in the next section

## RESULTS

Firstly we tried to examine the association between *stress*, creativity and social compromise.

**Figure 1: The association between stress, social compromise and creativity**



In this model the chi-square value was found to be 21.075.

**Table 2: Model fit summary tables of the association between stress, social compromise and creativity**

	NPAR	CMIN	DF	CMIN/DF	RMR	GFI	AGFI	PGFI	NFI Delta1
Default model	11	21.085	4	5.271	0.081	0.959	0.846	0.256	0.758

	RFI	IFI	TLI	CFI
	rho1	Delta2	rho2	
Default model	0.758	0.794	0.446	0.779

Analytical explanation of the above mentioned indexes:

**NPAR** shows the number of distinct parameters (q) that are being estimated

**RMR** (root mean square residual) is the square root of the average squared amount by which the sample variances and covariances differ from their estimates obtained under the assumption that your model is correct. The smaller the **RMR** is the better. An **RMR** of zero indicates a perfect fit

**GFI** is the goodness of fit index. GFI's values are less than or equal to 1. A value of 1 indicates a perfect fit.

**AGFI** is the adjusted goodness of fit index which takes into account the degrees of freedom available for testing the model. The **AGFI** is bounded above by one, which indicates a perfect fit. It is not, however, bounded below by zero, as the **GFI** is.

**PGFI** is the parsimony goodness of fit index, suggested by [Mulaik, et al. \(1989\)](#), is a modification of the **GFI** that takes into account the degrees of freedom available for testing the model

**NFI** is the Bentler-Bonett ([Bentler & Bonett, 1980](#)) normed fit index. Models with overall fit indices of less than .9 can usually be improved substantially.

**RFI** (Bollen's relative fit index) takes the degrees of freedom for the two models into account. When RFI's values are close to 1, this indicates a very good fit of the model.

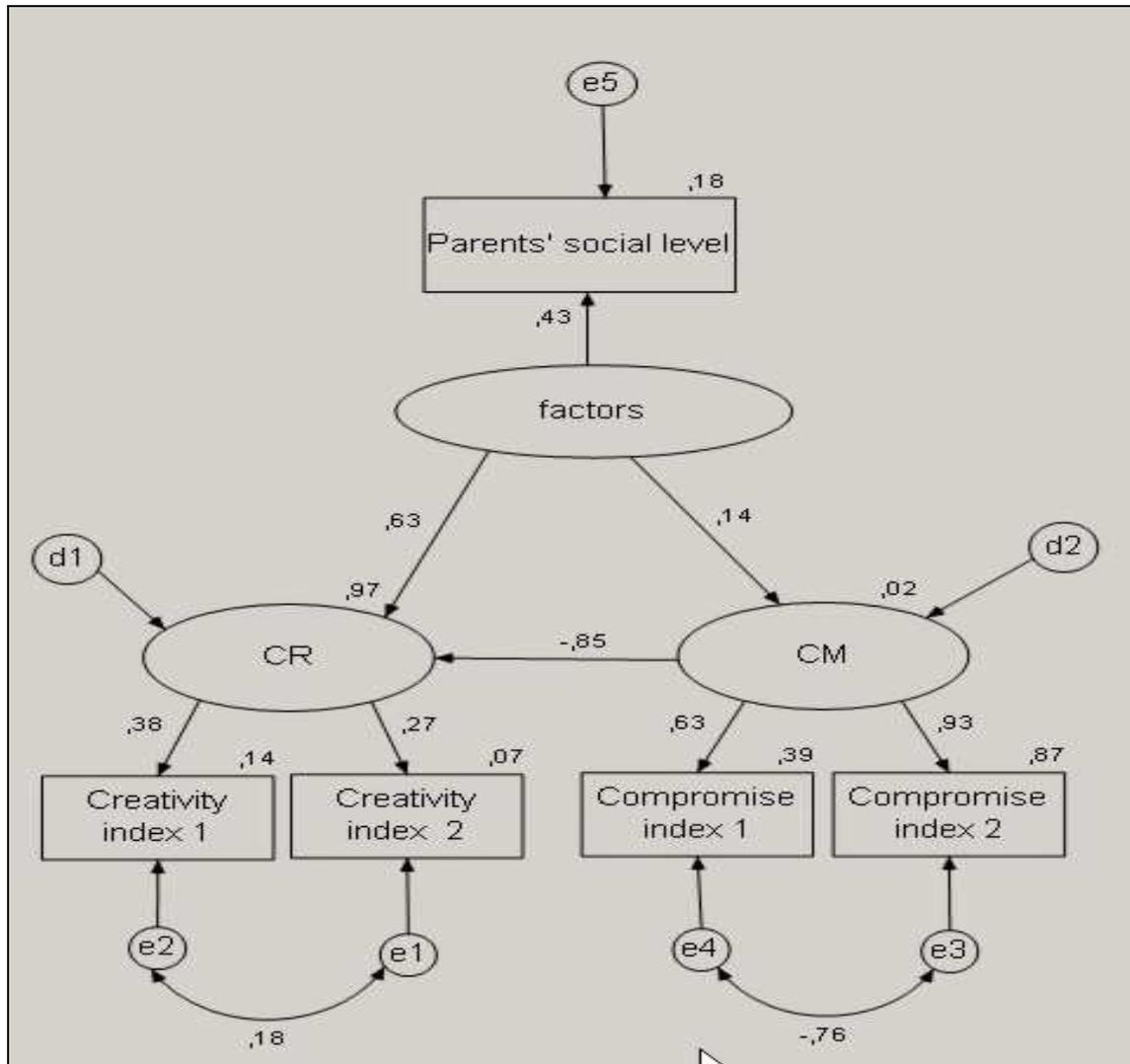
**IFI** (Bollen's incremental fit index) is the incremental fit index. Values close to 1.0 indicate a good fit of the model.

**TLI** is the Tucker-Lewis Coefficient and also is known as the Bentler-Bonett non-normed fit index (NNFI). Values close to 1.0 indicate a good fit of the model.

**CFI's** is the comparative fit index. Values close to 1.0 indicate a good fit of the model. Thus, the model fit indices are showing a very good fit of this model.

In the next step we examined the association of *parent's social level* in creativity and social compromise.

**Figure 2: The association between parent’s social level, social compromise and creativity**



The chi-square value of this model was found to be 31.458 and the following model fit summary tables were created:

**Table 3: Model fit summary tables of the association between parent’s social level, social compromise and creativity**

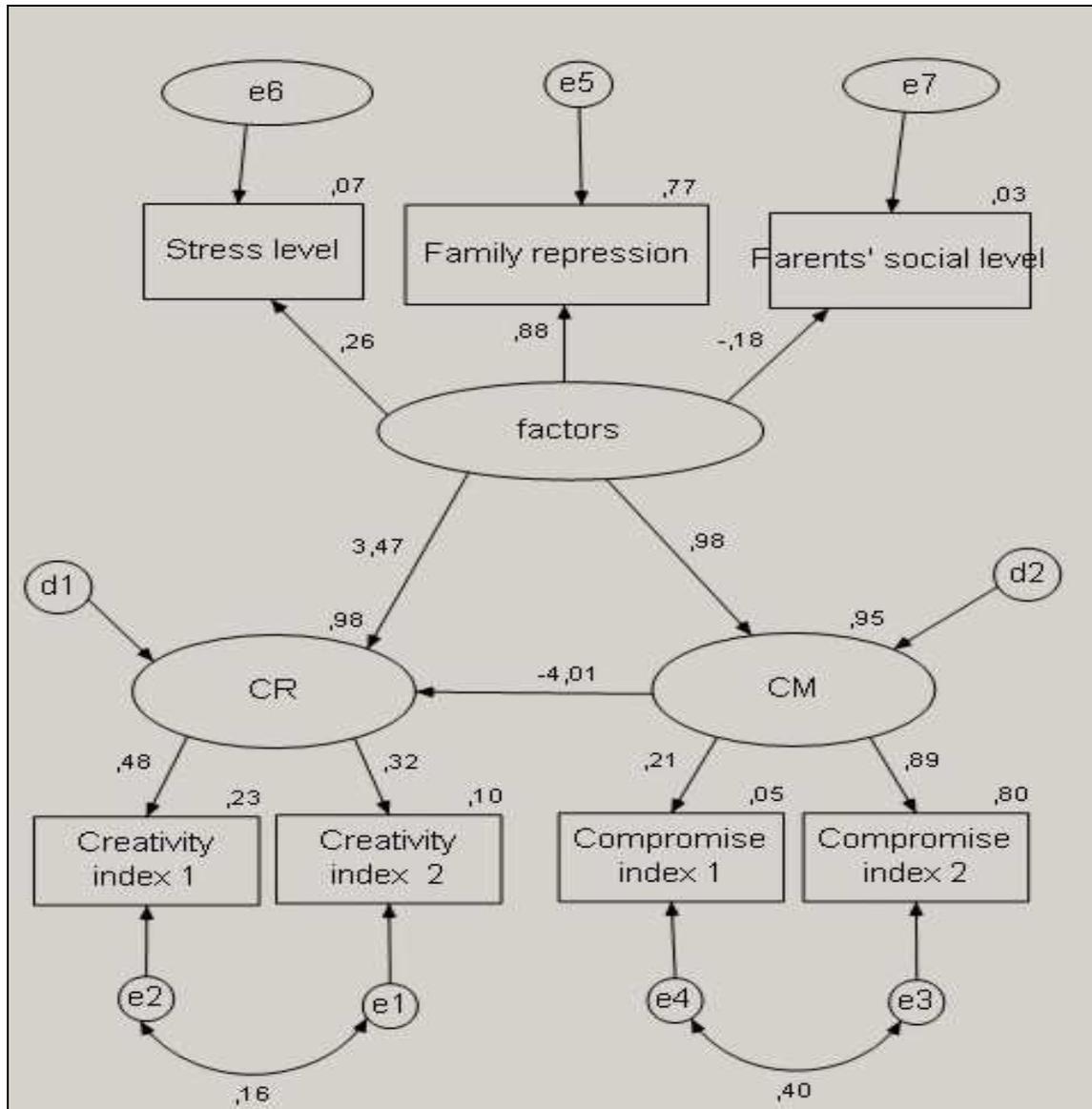
	NPAR	CMIN	DF	CMIN/DF	RMR	GFI	AGFI	PGFI	NFI Delta1
Default model	11	31.458	4	7.865	0.069	0.944	0.789	0.252	0.678

	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	0.195	0.707	0.217	0.687

Then we tried to examine the influence of the *three factors (stress, family repression and parent's social level)*.

In this case the model did not fit good as the chi-square values was found to be 62.9

**Figure 3: The association between stress, family repression and parent's social level**



**Table 4: Model fit summary tables of the association between stress, family repression and parent's social level**

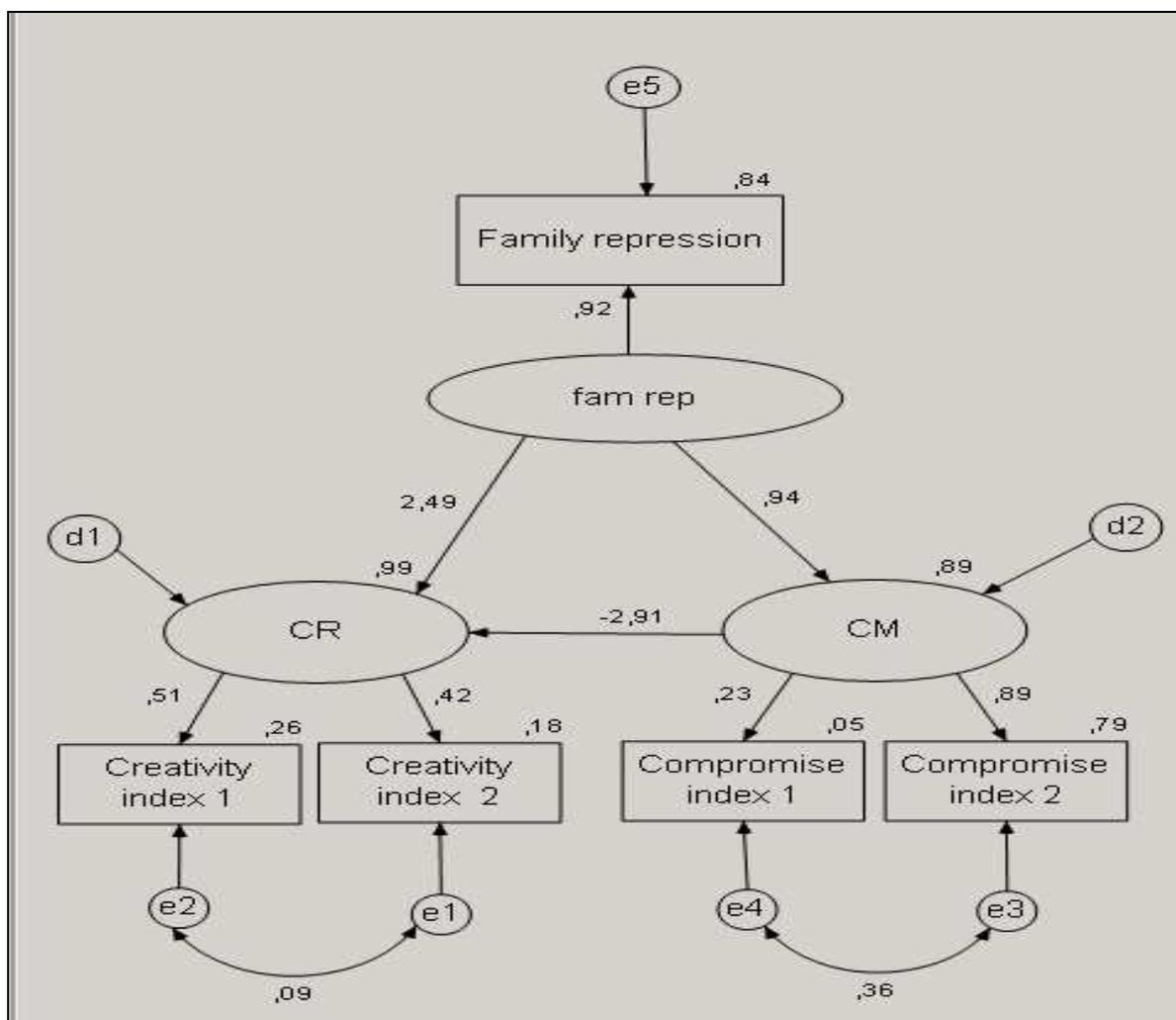
	NPAR	CMIN	DF	CMIN/DF	RMR	GFI	AGFI	PGFI	NFI Delta1
Default model	14	62.865	14	4.490	0.075	0.909	0.819	0.455	0.798

	RFI	IFI	TLI	CFI
	rho1	Delta2	rho2	
Default model	0.697	0.835	0.747	0.831

Lastly we examined the case of the *family repression*.

The following table and diagram give the maximum likelihood estimates of the empirical model; moreover, the diagram shows with eloquence the direct and indirect effects of repression within family on creativity and social compromise.

**Figure 4: The association between family repression, social compromise and creativity**



**Table 5: Model fit summary tables of the association between family repression, social compromise and creativity**

	Estimate	S.E.	C.R.	P	Label
CR <--- CM	-1,105	,053	-20,933	***	$\beta$
CR <--- Fam Rep	2,295	,206	11,116	***	$\gamma_2$
$X^2$ (p = ,043)	9,86 (df = 4, iterations = 10)				

	NPAR	CMIN	DF	CMIN/DF	RMR	GFI	AGFI	PGFI	NFI Delta1
Default model	11	9,858	4	2,465	,016	,979	,923	,261	,960

	RFI	IFI	TLI	CFI
	rho1	Delta2	rho2	
Default model	,900	,976	,938	,975

The above mentioned model was selected after reviewing the modification indices of Amos 7. As mentioned above, it was not possible to include at this model Stress and Parents' socio-economic conditions parameters ( $X^2 > 20$ ). The Error Terms e1 and e2 was connected (sharing the same variance) because the items of the Creativity Index 1 and Creativity Index 2 was derived with the same way and from the same population. Also, this is true for e3 and e4 Compromise Error Terms.

In comparison to the three above mentioned models (*stress, parent's social level and the combination of the three factors*) the one mentioned lastly (*family repression*) seems to be the most fixable one.

As the model fit table demonstrates, the fit of the model is satisfactory as can be seen from the value of chi-square statistic, as well as from the chi square to df ratio (2 to 1). In addition, Table 2 shows the assessments for model fit in which all the measures are statistically significant. In short, RMR is the Root Mean Square Residual. It is the square root of the average amount that the sample variances and co-variances differ from their estimates. Smaller values are better. GFI and AGFI is between 0 and 1 where 1 indicates a perfect fit. Acceptable values are above 0.90. It compares the improvement in the minimum discrepancy for the specified (default) model to the discrepancy for the Independence model.

Also, according to Diagram 1, the effect of social compromise on creativity is negative and significant. In addition, family repression affects positively both social compromise and creativity significantly.

In conclusion, family influences on the development of creativity in children. Creativity may be more influenced by environmental rather than genetic factors. In fact, it develops when examples of different approaches are analyzed. It is more likely to thrive when adults express the idea that any problem can be worked out.

## **CHAPTER 5**

### **Conclusions and Further Research**

#### **Conclusions**

Creativity has been considered in terms of process, product or person (Barron and Harrington, 1981) and has been defined as the interpersonal and intrapersonal process by means of which original, high quality, and genuinely significant products are developed. There is the genius myth that creativity is tied to genius. To the contrary, Amabile has found that although some people have extreme levels of talent, everyone with normal human capacities is capable of producing creative work under the right circumstances. Creative thinking is rarely supported or encouraged. To enable creative, innovative design among students, consideration must be given to the student's potential lack of experience, low self-esteem and lack of knowledge concerning creativity. Creative abilities are present in every person, but need tools, training, believe in one's own creativity, motivation and opportunities to be used in achieving task and goals to be unblocked. Unmotivated students are rarely creative. Creativity needs a certain kind of energy and focus to surface.

## Further Research

A striking feature of many phenomenological accounts of creativity is the degree to which outstandingly creative individuals feel influenced by social and environmental factors. It has been argued by some that creativity is a state of being which is challenged by the ways in which western civilisation socialises young people, in that their creativity is stifled from early childhood. It could be argued, however, that the continual innovation and constant change characteristic of the culture of today's western world is not necessarily desirable. The desirability of cultural norms of constant change and innovation (and thus the overall role of creativity) may need to be debated. For it could be argued that there are socially and environmentally destructive aspects to fostering a culture of innovation. There are also gender differences as well. For example female teachers seem to value the personal sides of creativity more than male teachers who place higher value on the elegance of an outcome, and this affects their judgements of pupil creativity.

In conclusion we may say that there are many factors that may affect creativity. Some of these factors are pointed below:

- One parent family
- Parent in life or not
- Only child in family (or with brothers / sisters) or he/she is the first child in the family
- Age of all the persons in the family
- Age of parents when they have had their first child (ren)
- Physical activity of the persons (team games, individual game, team leaders?)
- Hours of sleep of the person
- Culture of the country some someone lives at
- Religion and nationality of the person and the persons related with
- Active involvement of parents into their children's free time

It would be of much interest if in future someone could examine the affect if not all of them, then some of the above mentioned factors affecting creativity.

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