

A Model to Measure Creativity in Young Adults

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KEYWORDS Creativity Dimensions. Creativity Approaches. Creativity Measurement. Creativity Tests. Youth

ABSTRACT This article develops a theoretical model to measure the creativity of young adults (18 to 25 years of age). Historical creativity approaches, dimensions, models and tests were researched through a literature study in order to identify selected constructs that influence creativity of young adults. Resultantly, a total of twenty-eight creativity influences were identified which ultimately culminated in the selection of nine key influences. Additionally, from the literature study, measuring criteria were identified for each of the nine influences, resulting in a theoretical model to measure creativity. The research is of value due to the significant role young adults play and will play in society at a socio-economic level. Young adults need to know the value of creativity in society, how creative they are and how they can develop creative abilities. In this context, it is necessary to measure creativity in an effort to actively support creative development in young adults. Measuring creativity at this level has been challenging due to the impact of various cognitive psychological factors and the external environment which can foster or inhibit creativity dramatically.

INTRODUCTION

Companies need to create and innovate regularly to survive and prosper in the long term (Mauzy and Harriman 2003:1). Creativity is a critical economic force due to its ability to bring new economies and social forms into existence (Florida et al. 2006:2) and benefit humankind and the world at large as it offers solutions to complex problems (Livingston 2010:61). Torrance (in Afolabi et al. 2009:2) observed that creativity is “a successful step into the unknown, getting away from the main track, breaking out of the mould, being open to experience and permitting one thing to lead to another, recombining ideas or seeing new relationships among ideas.”

In an effort to understand creativity initially, researchers such as Wallas (1929), Torrance (1966), Sternberg (1995) and Runco (2007) (cited in Bronson and Merryman 2010: 21, 23) attempted to develop measures of creativity to determine how people use their right side of their brains to generate novel ideas and how divergent thinking and convergent thinking are combined to generate creative ideas. More research led to the rise of creativity over the past few

decades especially and indicates that the world is starting to recognise the value of creativity as “powerful means of fostering development gains” (United Nations 2008: ii). Technology is also impacting on the development and use of creativity. Reinartz (2013) writes that creativity can be measured and managed and that technology can be used to find the links between creative persons, processes, products and business related outcomes. The biggest challenges still remains to truly understand the creativity phenomenon, its links to various disciplines and people, and to measure and develop creativity based on the measured results. The reason for these challenges could be the fact that more than 400 definitions of creativity have been developed over the last century, according to Nieman and Bennett (2002: 400). These definitions often focus on various facets of creativity rather than looking at creativity holistically (Treffinger et al. 1971:107; Plucker and Runco 1998:36). These facets include the person where the focus is on the characteristics of creative people; the process which looks at the preferences and aspects of the creative process itself; the products which examines the actual creative products created during the creative process; and the environment or press which determines the factors in the environment that affect the creative performance of individuals.

¹ This article stems from a PhD study by Z. Fields (student number: 11112131) at the Potchefstroom Business School, North-West University, Potchefstroom, RSA.

Other challenges include the problem that most measures of creativity are dependent on the personal judgement of the tester. There also seems to be no universal instrument that can test the creativity quotient (CQ) in the same effective manner as the intelligence quotient (IQ) (Academic Room 2013:1). There is also the trend that younger people are more creative than older people (Academic Room 2013:1). In this regard, Fields and Bisschoff (2012) have developed two models to measure creativity. The first model focused on measuring creativity at a university (Fields and Bisschoff 2013) and the other model focused on measuring creativity aimed at young people in a more generalised context. Although both models focussed specifically on full-time students at a South African university it was necessary to also examine the creativity levels of young people outside a tertiary education application setting.

In the more generalised young context, there is a need for exploring new creativity measurements in an effort to resolve the current challenges and to move towards the development of a universal instrument that can test the creativity quotient (CQ) in the same effective manner as the intelligence quotient (IQ). This will be useful in determining the current level of creativity in individuals, especially in young adults, and then to use the information to assist individuals to optimally develop their creativity potential at various levels of personal development and education. If young adults can develop their creativity meaningfully, an expectation could be that sustainable solutions to economic and social problems can be created by them in the future.

Objectives

The primary objective of this paper is to develop a theoretical model that can be utilised universally to measure creativity of young adults between the ages of 18 and 25 years.

To achieve the primary objective, the following secondary objectives are formulated, namely to:

- ♦ Identify relevant historical creativity models and tests;
- ♦ From these models, identify the constructs that influence behaviour related to creativity;

- ♦ Select, from the literature study, creativity influences relevant to this research;
- ♦ Identify selected measuring criteria pertaining to each of the creativity influences; and
- ♦ Compile a questionnaire to test these influences on young adults.

Historical Overview of Approaches and Dimensions to Measure Creativity

The “study of creativity has different perspectives and approaches” (Vilalba 2008:7) which impacts on the measurement of creativity. The history of human thinking specifically can be linked to four approaches to creativity which led to various creativity models, theories and tests according to Sharma (2004:1). The first and oldest approach is called *the creative leap* and people believe that creative inspiration comes from God and is only given to select few. The second approach focuses on the *natural abilities and personality traits* of people which make people behave in predetermined ways. The third approach is the *socio-dynamic* approach and this approach emphasizes the role of socio-environmental factors that encourage or discourage creativity. The fourth approach is the *pragmatic generative* approach and encourages the use of new techniques to study creativity (Sharma 2004:1). There is the need to create an additional approach due to ongoing research that emphasised that 98% of children between 0-3 years demonstrate creativity at a superior level (Neethling Brain Instruments 2010; Whole Brain Thinking Pty Ltd 2005). This is due to the fact that at birth, the brain is without developed preferences, essentially whole as per Ned Hermann who developed the Herrmann Brain Dominance Instrument (HBDI) (Actionideas 2010:1).

Sternberg and Lubart (cited in Vilalba 2008:8) indicate that creativity research has been marginalised due to the lack of multi-disciplinary approaches. Vilalba (2008:8) identifies five shared aims in creativity research, namely:

- ♦ Creativity involves thinking that aims to produce novel ideas and products;
- ♦ Creativity has domain-specific and domain-general elements;
- ♦ Creativity can be measured to an extent (the focus of this study);
- ♦ Creativity can be developed, nurtured and promoted; and

- ♦ Creativity is not valued and rewarded in practice and efforts are made to change this.

At first, creativity research was seen as spiritual process and made use of psychodynamic studies where inner forces (conscious and unconscious emotional and motivational forces) affecting behaviour and mental states were studied (Sternberg and Lubart 1999:5). Later creativity research concentrated on pragmatic approaches which focused on the development of techniques to promote creative thinking in organisations and not scientific researchers (Lin 2012:13). Both approaches lacked theory of creativity as it did not provide a clear idea of what the characteristics of creativity are and they were mainly practical approaches to enhance creativity.

Cognitive psychology studies were used to comprehend the process of creative thinking which led to most of the model development on creativity. Researchers had different views of creativity. Certain authors assumed that creativity is simply “extraordinary results of ordinary processes” and others believed that creativity is not different from intelligence (Vilalba 2008:9). The threshold theory, for example, assumes that there is a “minimum level of intelligence (the lower threshold) below which the person cannot be creative” (Runco 2007:7). This theory shows a link between creativity and intelligence at certain level of ability only. Other cognitive psychology studies examined the process of creative thinking and the arguments of these studies were based on the possibility of whether creative thinking can be defined or not.

Psychometric approaches to creativity were also developed and the main focus was to develop tests to measure creativity. Four areas can be differentiated where psychometric methods have been applied in creativity research (Vilalba 2008:10), namely:

- ♦ Creative process;
- ♦ Personality and behavioural correlates;
- ♦ Characteristics of creative products; and
- ♦ Attributes of creative fostering environments.

In the review of the historic development of creativity it became evident that a large number of models exist to explain the process of creative thinking and that certain themes can be identified from these models. These themes can be summarised (Plsek 1996:6), namely:

- ♦ The total creative process requires a “balance between purposeful analysis, imagination, and critical evaluation”.
- ♦ Older models imply that creative ideas are the result from subconscious processes outside the control of the thinker. Modern models, on the other hand, indicate that creative ideas are under the direct control of the thinker and involve the purposeful generation of new ideas.
- ♦ Creativity involves action and implementation of ideas to be of real value.

Modern theory of creativity indicates that strong skills in practical, scientific, actual, and analytical thinking should be supplemented with new thinking to support the generating of novel insights and ideas. People should also acquire the mental ability to balance and direct traditional and new thinking skills to meet the challenges of the future and to become innovative.

From the above, it can be inferred that creativity is a complex phenomenon and different perspectives and approaches are used to explain the phenomenon. Since 1950 researchers focused on the developed of formal methods for measuring creativity based on five major research approaches. These approaches offer unique insights, comprehension and application of creativity on a personal-, organisational- and educational level (Petrowski 2000:305). The five approaches are:

- ♦ The psychometric approach;
- ♦ The contextual approach;
- ♦ The experimental approach;
- ♦ The biographical approach; and
- ♦ The biological approach.

It should be noted that these approaches can be grouped into two different forms of measuring creativity.

Approaches to Measure Creativity

The first approach relates to the *psychological study* of creativity. The approach is based on developing tests to measure creativity (Vilalba 2008:15). Torrance and Goff (1989) (cited in Cropley 2008:1) identified no fewer than 255 creativity tests. These tests include personality tests that encompass different creativeness scales, tests that measure the different styles with which people express creativity, tests that measure divergent thinking, tests that measure the suitability of various environments for cre-

ative expression and tests that measure creative achievement (Epstein et al. 2008:8).

Hocevar (1981) (cited in Vilalba 2008:15) classified these tests into the following classifications:

- ♦ Tests of divergent thinking;
- ♦ Attitude and interest inventories;
- ♦ Personality inventories;
- ♦ Biographical measures;
- ♦ Ratings by teachers, peer or supervisors;
- ♦ Product judgements; self-reports of creative achievements; and
- ♦ Eminence or the study of well-known and established creative people.

The second approach is referred to as a *sector approach*, which looks at the impact of a society on creativity (Vilalba 2008:15). Florida's "creative class" approach is a good example of this approach.

Dimensions to Measure Creativity

Many creativity-related measurements in the form of tests have been developed based on creativity research dimensions. All these tests have merit and are multifaceted. A number of reviewers have questioned their usefulness on the grounds of technical shortcomings (Cropley 2008:1). This can be due to the fact that different dimensions of creativity are used in creativity tests, for example creativity research is based on the nature of creative thinking, the characteristics of the creative person, the role and impact of social environments on creative activity and the development of creativity at various stages of an individual's life span (Kerr and Gagliardi 2003:2). This research is significant as it enabled various psychologists to assess levels of creative thinking and to identify creative traits in people.

Each creativity dimension, will be briefly explained to identify the key determinants these tests focus on. It is important to note that there are more creativity tests and only a few are highlighted below.

Dimension 1: Creative Products

Creative products are physical manifestations (for example: art work, novels, products and furniture) of creative thought and usually valued for its usefulness, unusualness, novelty, synthesis and relevancy, for example. This is often

seen as the innovation aspect of creativity where creative thought is applied to create an artefact or method that often leads to commercialisation.

Two tests are briefly described below.

- ♦ *Taylor's Creative Product Inventory (1975)*

The "Creative Product Inventory measures generation, reformulation, originality, relevancy, Hedonics, complexity, and condensation" and was one of the early models to measure the creativity of products (Cropley 2008:3).

- ♦ *Creative Product Semantic Scale (CPSS) (1987)*

Besemer and O'Quin developed the Creative Product Semantic Scale (1987), which is based on three dimensions: "novelty (the product is original, surprising and germinal), resolution (the product is valuable, logical, useful, and understandable) and elaboration and synthesis (the product is organic, elegant, complex and well-crafted)" (Cropley 2008:3).

Dimension 2: Creative Process

Graham Wallas is seen as the pioneer in creativity research and was the first to be recognised for a model to explain the process of creative thinking (Plsek 1996:2). Wallas believed that creative thinking takes place in four stages. This process is necessary to ensure that novel ideas can appear and can be verified. If the incubation stage (stage two) is skipped, for example, new ideas cannot emerge. Numerous models followed in an effort to explain the creative process and to develop tests to explain creativity.

Four tests are briefly explained below.

- ♦ *The Torrance Tests of Creative Thinking (TTCT)*

This test was developed in 1966, and it has been re-normed in 1974, 1984, 1990 and 1998. The TTCT is the most commonly used test and is based on divergent thinking (Cropley 2008:4; Bronson and Merryman 2011:21). The test materials include a verbal section consisting of six verbal activities (asking, guessing causes, guessing consequences, product improvement, unusual uses, unusual questions and just suppose) and a nonverbal or figural section consisting of three figural activities (picture construction, picture completion and lines or circles). The verbal activities score on fluency, flexibility and originality. The non-verbal activities score on fluency, originality, elaboration, abstractness of titles, and resistance to premature

closure. The figural tests score on aspects like storytelling articulateness, synthesis of incomplete figures and fantasy.

- ♦ *Wallach and Kogan (1965) Creativity Test*

This test contains three verbal subtests (instances, alternative uses and similarities) and two figural stimuli subtests (pattern meaning and line meanings). Certain users also score the test for flexibility, originality (statistical uncommonness) and usefulness (practicality and relevance to reality) (Cropley 2008: 4-5).

- ♦ *Sternberg's Triarchic Abilities Test (1997)*

An important development in creativity testing originates from increasing recognition of the fact that actual creative production does not depend on divergent thinking alone, but also requires convergent thinking. Rickards (1994) (cited in Cropley 2008:5) claims that the process of creativity needs both kinds of thinking to be effective. Sternberg's Triarchic Abilities Test (1997) highlights that intellectual ability can be better understood in terms of analytical-, practical- and synthetic ability (Koke and Vernon 2003:1803-1807).

- ♦ *The Creative Reasoning Test (CRT)*

Developed by Doolittle in 1990, this test proves to be a problem-solving test that adopts a novel approach (Cropley 2008:6). The novel aspect of this test is that the problems to solve are presented in the form of riddles. The test requires associative, inductive and divergent thinking (Cropley 2011:3).

Dimension 3: Creative Person

Three aspects are relevant in evaluating the creative person, namely biographical inventories, special personal properties and motivation and attitude (Cropley 2011:4; Runco 2007:315; Cropley 2008:8-9; Hennessey and Amabile 1987:6; Davis and Rimm 1985:231). Biographical inventories are standardised questionnaires used for collecting biographical data (for example demographical information, family background, educational history, employment history, as well as items involving opinions, values, beliefs and attitudes). Three biographical inventories are indicated below.

- ♦ *Schaefer and Anastasi's Biographical Inventory and Taylor's Alpha Biographical Inventory (ABI)*

These tests were created in 1968. The Schaefer and Anastasi's biographical inventory

consists of 165 items, and Taylor's Alpha Biographical Inventory (ABI), consists of 300 items. These tests do not focus exclusively on creativity but is usually employed in terms of known characteristics of creative people. The areas it focus on includes family background (such as educational level of parents, degree of public recognition of parents or siblings), intellectual and cultural orientation (such as interests and hobbies, level of availability of demanding literature, frequency of visits to museums or art galleries), motivation (such as possession and use of special equipment such as a microscope, taking summer jobs in a field of interest) and drive towards novelty and diversity (such as level of interest in unusual art forms, extent of unconventional collections) (Cropley 2011:4).

- ♦ *The Life Experience Inventory (LEI)*

This test, developed by Michael and Colson in 1979, is a 100 item inventory that focuses on factual information (such as number of changes of address in childhood, composition of family, education, hobbies and recreation) (Cropley 2011:4).

- ♦ *Creative Activities Checklist*

Runco developed the Creative Activities Checklist in 1987. The test simply asks respondents to indicate the frequency of their participation in literature, music, drama, arts, crafts and science (Cropley 2008:7-8). Runco maintains that creative personality encompasses: autonomy, flexibility, preference for complexity, openness to experience, sensitivity, playfulness, tolerance of ambiguity, risk taking or risk tolerance, intrinsic motivation, psychological androgyny, self-efficacy and wide interest and curiosity. He further notes that creative personality varies from domain to domain (Runco 2007:315).

According to Cropley (2008), special personal qualities refer to personal traits or personal unique characteristics that make individuals unique and can be useful as an indication of personality types and creative personalities. Three tests are briefly explained below.

- ♦ *Creativity Checklist (CCL)*

This test can be used for people of all ages and was created by Johnson in 1979. Observers rate the behaviour of people in terms of eight dimensions: fluency, flexibility, constructional skills, ingenuity, resourcefulness, independence, positive self-referencing and preference for complexity (Cropley 2008:8).

- ♦ *The Creative Styles Questionnaire (CSQ)*

This test, created by Kumar, Kemmler and Holman in 1997 (cited from Cropley 2008:9), measures seven dimensions: belief in unconscious processes, use of techniques, use of other people, final product orientation, environmental control, superstition and use of senses.

- ♦ *The Abedi-Schumacher Creativity Test*

This test was created in 1994 by O'Neil, Abedi and Spielberger 1997 (cited from Cropley 2008:9). Here, indicators of creativity are flexibility, fluency, originality and elaboration.

Creativity is influenced by motivation and attitude. Research has shown that intrinsic motivation is the principle of creativity (Hennessey and Amabile 1987:6) and that creative attitude can be taught (Davis and Rimm 1985:231). Three tests are discussed briefly to indicate the determinants used in these tests.

- ♦ *Williams's "How do you really feel about yourself?" test*

This test, created in 1972, measures curiosity, imagination, risk-taking and preference for complexity. Divergent feelings and aspects like fluency, flexibility, originality and elaboration are tested (Cropley 2008:9).

- ♦ *The Creatrix Inventory (C and RT)*

This test was created by Byrd in 1986 and integrates both cognitive (thinking) and non-cognitive (motivation) dimensions of creativity. The inventory looks at eight styles, namely: reproducer (low on creative thinking and risk taking), modifier, challenger (high on risk taking and low on creativity), practicaliser, innovator (high on creative thinking and risk taking), synthesizer, dreamer (high on creativity and low on risk taking), and planner (Cropley 2008:10).

- ♦ *Kirton's Adaptation-Innovation Inventory (KAI)*

This test, created in 1989, distinguish between people who seek to solve problems by making use of what they already know and can do (adaptors), and people who try to reorganise and restructure the problem (innovators). Both styles are involved in creative problem solving. The innovative style leads to higher productivity and involves greater motivation to be creative, higher levels of risk-taking, and greater self-confidence (Cropley 2011:6).

Based on the approaches, dimensions and tests explained, creativity influences were identified from literature.

METHODOLOGY: DEVELOPING THE MODEL

Quantitative research was used to extract and select creativity influences from literature and to identify measuring criteria for each creativity influence. A measuring instrument (questionnaire) was constructed from literature to test creativity. The questionnaire was constructed in four steps as shown in Figure 1.

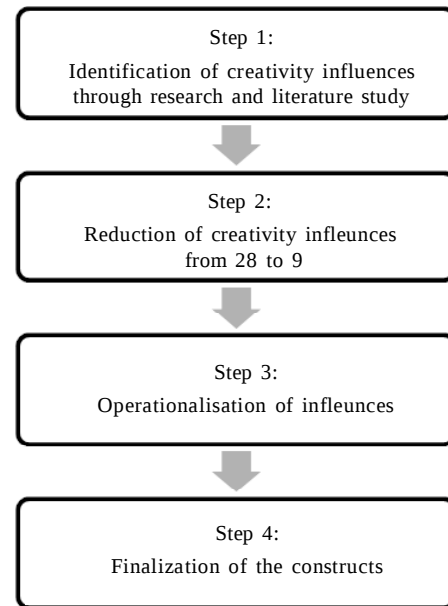


Fig. 1. Steps in developing the model

The questionnaire consisted of a 7-point Likert scale to capture the views of respondents and becomes a critical instrument for the outcome of the study.

A convenience sample of 500 full-time university students at the North-West University (Potchefstroom Campus) was drawn. A total of 322 questionnaires were completed (signifying a response rate of 64.4%).

Data was collected, analysed, purified and tested. The reliability measure, Cronbach alpha was used to test the reliability and internal stability of the questionnaire. The data was subjected to a principle factor analysis using a Varimax, normalized rotation. Kaiser, Meyer and Olkin (KMO) analysis was used to determine if the sample employed is suitable for analysis. The Bartlett test of sphericity was employed to test the data's suitability for factor analysis.

RESULTS

The results are step-wise determined by means of the research methodology.

Step 1: Identification of Creativity Influences Through Research and Literature Review

Twenty-eight creativity influences were identified from literature and grouped in two groups, namely cognitive psychology and personality characteristics. Eighteen influences were identified in the cognitive psychology group and ten in the personality characteristics group as indicated in Table 1.

Table 1: Creativity constructs from literature

<i>Cognitive psychology</i>	<i>Personality characteristics</i>
Cognition	Perseverance
Explore	Proactive
Four dimensional thinking	Sensitivity
Eight dimensional thinking	Self-confidence
Analysis	Self-efficient
Development	Curiosity
Elaboration	Desire to achieve
Communication experience	Openness to
Inventive	Frustration
Adaptive	Independence
Innovative	
Motivation	
Fluency	
Synthesis	
Observation	
Flexible	
Imagination	
Originality	

Step 2: Reduction of Creativity Influences from Twenty-eight to Nine

In order to get a more parsimonious set of variables without losing the ability to measure creativity, the influences in Table 1 were reduced to 9 influences represented in Table 2 and defined. The process of elimination involved exploring creativity models, approaches, dimensions and tests and influences were identified that received support from five or more sources.

The 9 identified influences were used to construct the questionnaire.

Step 3: Operationalisation of Influences

The 9 influences were operationalised to reflect the understanding of the concepts in the

context of the present study. The complete set of operationalisations appears in Table 3.

The operationalization in Table 3 was based on the relevant definitions in the literature sources indicated. In some cases, operationalization was slightly adopted to reflect the objectives of the present study.

Step 4: Finalising the influences

Upon finalization of the 9 influences, items to measure the influences were also identified. These questions, its literature origin and the relevant constructs appear in Table 4.

These influences can be grouped into two groups and some influences were renamed based on the research findings:

- ♦ Five influences that fall into the cognitive psychology group were identified, namely cognition and communication, problem-solving, dimensional thinking, uniqueness and challenging the status quo.
- ♦ Four external influences were identified, namely: religion, culture, family and country of origin

The developed model to measure creativity is shown in Figure 2. This model shows that the creativity in young people should be measured by looking at the impact of the cognitive psychology and the impact of external influences on individuals specifically. To develop lifetime creative accomplishments the link between childhood and the external environment needs to be understood and improved. The model also highlights that religion, culture, family and a country will impact on the level of creativity. The awareness of the impact of external influences can be used in developing countries to enhance creativity nationally and to overcome the limitations created by either religion, family or culture. Schooling systems also need to be considered to develop and enhance the cognitive psychology of individuals with the aim to enhance the creative output of young people, which could have a positive effect on youth entrepreneurial activity and an economy overall.

CONCLUSION

An exploratory perspective was taken to examine a broad range of creativity models, dimensions, approaches and influences. Although

Table 2: Influences considered

	<i>Influence</i>	<i>Description</i>	<i>Researchers</i>
1	<i>Eight Dimensional Thinking</i>	The ability to consider the dimensionality (that is, space, time, cost, colour) of an issue to create ideas and combine objects, concepts and processes to find creative solutions	Berne and Raviv (2004:237-238), Bergh and Theron (2009:124, 414-415), Forex (2010:1), Creative Creativity (2007:1), Plsek (1996:3-4), Runco (2007:395)
2	<i>Fluency</i>	The ability to produce a great number of ideas or problem solutions in a short period of time	Pérez Alonso-Geta (2009: 311), Forex (2010:1), Creative Creativity (2007:1), Plsek (1996:3-4), Bergh and Theron (2009:124), Runco (2007:95)
3	<i>Motivation</i>	The drive to solve problems internally and externally.	Pérez Alonso-Geta (2009: 311), Unsworth (2001: 289-297), Bergh and Theron (2009:415), Runco (2007:403), Zusman and Zlotin (1998:1)
4	<i>Cognition</i>	The ability to understand a variety of information easily, to discover different links (obvious and not so obvious) and to identify contradictions in accepted knowledge	Baer and Kaufman (2005:4-6), Bergh and Theron (2009:414), Runco (2007:403), Pérez Alonso-Geta (2009: 308), Cropley (2008:262)
5	<i>Communication</i>	The ability to persuade others that creative ideas are valuable and reveal creative ideas to knowledgeable others	Jackson and Shaw (2005) in Kleiman (2008:210), Pérez Alonso-Geta (2009: 311), Cropley (2008:258), Forex (2010:1), Bergh and Theron (2009:115, 124), Runco (2007:396)
6	<i>Originality</i>	The ability to produce new and original ideas on a regular basis	Jackson and Shaw (2005) in Kleiman (2008:210), Pérez Alonso-Geta (2009: 308), James, Gerard and Vagt-Traore, 2004:3), Forex (2010:1), Creative Creativity (2007:1), Bergh and Theron (2009:124, 414), Runco (2007:95)
7	<i>Synthesis</i>	The ability to find the connection between items or variables by using associations, sequences or analogies between items or variables	Pérez Alonso-Geta (2009: 311), Vilalba (2008:13), Forex (2010:1), Runco (2007:402), Bergh and Theron (2009:414), Plsek (1996:3-4), James, Gerard and Vagt-Traore (2004:3)
8	<i>Culture</i>	The influence of culture in providing the defined symbol system which enables a person to be creative	Csikszentmihalyi (1999:314), Bergh and Theron (2009:114), Runco (2007:396), Baer and Kaufman (2005:4-6), Florida (2010:1)
9	<i>Environment</i>	The influence of family, community, religion, society and country on a person's creative ability	Brunn (2009:2), Bergh and Theron (2009:415), Runco (2007:403), Csikszentmihalyi (1999:314), Brunn (2009:2), Vilalba (2008:20-21)

28 influences were identified, 9 were selected as the most frequently used to determine and measure creativity. The examination of literature models, approaches and dimensions ensured that the influences along with questions for the measuring instrument were scientifically select-

ed even through verification and validation tests were not performed at that stage. The model developed combined creative behaviour and thinking and linked it in a sophisticated interrelationship, which is evident from the nine factors which were identified to measure creativity.

Table 3: Operationalisation of influences

<i>Influence</i>	<i>Description</i>	<i>Source</i>	<i>Operationalisation</i>
1 <i>Eight Dimensional Thinking</i>	The ability to consider the dimensionality (that is, space, time, cost, colour) of an issue to create ideas and combine objects, concepts and processes to find creative solutions	Berne and Raviv (2004:237-238), Bergh and Theron (2009:124, 414-415), Forex (2010:1), Creative Creativity (2007:1), Plsek (1996:3-4), Runco (2007:395)	The ability to consider various dimensions of creative ideas
2 <i>Fluency</i>	The ability to produce a great number of ideas/ problem solutions in a short period of time	Pérez Alonso-Geta (2009: 311), Forex (2010:1), Creative Creativity (2007:1), Plsek (1996:3-4), Bergh and Theron (2009:124), Runco (2007:95)	The ability to generate a lot of ideas quickly
3 <i>Motivation</i>	The drive to solve problems internally and externally	Pérez Alonso-Geta (2009: 311), Unsworth (2001: 289-297), Bergh and Theron (2009:415), Runco (2007:403), Zusman and Zlotin (1998:1)	The internal and external energy to solve problems
4 <i>Cognition</i>	The ability to understand a variety of information easily, to discover different links (obvious and not so obvious) and to identify contradictions in accepted knowledge	Baer and Kaufman (2005:4-6), Bergh and Theron (2009:414), Runco (2007:403), Pérez Alonso-Geta (2009: 308), Cropley (2008:262)	The higher intellectual ability to understand and practically use theory
5 <i>Communication</i>	The ability to persuade others that creative ideas are valuable and reveal creative ideas to knowledgeable others	Jackson and Shaw (2005) in Kleiman (2008:210), Pérez Alonso-Geta (2009: 311), Cropley (2008:258), Forex (2010:1), Bergh and Theron (2009:115, 124), Runco (2007:396)	The ability to persuade knowledgeable others
6 <i>Originality</i>	The ability to produce new and original ideas on a regular basis	Jackson and Shaw (2005) in Kleiman (2008:210), Pérez Alonso-Geta (2009: 308), James, Gerard and Vagt-Traore, 2004:3), Forex (2010:1), Creative Creativity (2007:1), Bergh and Theron (2009:124, 414), Runco (2007:95)	The skill to generate unique ideas
7 <i>Synthesis</i>	The ability to find the connection between items or variables by using associations, sequences or analogies between items or variables	Pérez Alonso-Geta (2009: 311), Vilalba (2008:13), Forex (2010:1), Runco (2007: 402), Bergh and Theron (2009:414), Plsek (1996:3-4), James, Gerard and Vagt-Traore (2004:3)	The capability to connect and make associations between different items/ ideas
8 <i>Culture</i>	The influence of culture in providing the defined symbol system which enables a person to be creative	Csikszentmihalyi (1999:314), Bergh and Theron (2009:114), Runco (2007:396), Baer and Kaufman (2005:4-6), Florida (2010:1)	The cultural impact from the environment on an individual
9 <i>Environment</i>	The influence of family, community, religion, society and country on a person's creative ability	Brunn (2009:2), Bergh and Theron (2009:415), Runco (2007:403), Csikszentmihalyi (1999:314), Brunn (2009:2), Vilalba (2008:20-21)	The impact of the external environment on a person's creative ability

Table 4: Origins of questionnaire items

<i>Dimension</i>	<i>Code</i>	<i>Item</i>	<i>Source</i>
<i>Eight Dimensional Thinking</i>		To help me find solutions or generate ideas	Berne and Raviv (2004:237-238), Bergh and Theron (2009:124, 414-415), Forex (2010:1), Creative Creativity (2007:1), Plsek (1996:3-4), Runco (2007:395)
		I look for the uniqueness in:	
	A1N1	processes	
	A1N2	1.1 objects	
	A1N3	1.2 features	
	A1N4	1.3 situations	
		I consider the dimensionality of an issue to create ideas in terms of:	
	A2N1	2.1 space	
	A2N2	2.2 time	
	A2N3	2.3 cost	
	A2N4	2.4 colour	
	AQ3	I determine if things can be done from different points of view	
		To find creative solutions, I combine:	
	A4N1	4.1 objects	
	A4N2	4.2 concepts	
	A4N2	4.3 processes	
	A4N3	To find creative solutions, I separate:	
		5.1 concepts	
	A5N1	5.2 processes	
	A5N2	5.3 resources	
	A5N3	5.4 objects	
	A5N4	5.5 dimensions	
	A5N5	I like to modify my creative solutions	
	AQ6	I look for similarity in:	
	A7N1	7.1 concepts	
	A7N2	7.2 problems	
	A7N3	7.3 solutions	
	A7N4	7.4 patterns	
	A7N5	7.5 processes	
<i>Fluency</i>		To find the best creative solution, I:	
	A8N1	8.1 estimate	
	A8M2	8.2 simulate	
<i>Motivation</i>	A8N3	8.3 experiment	
	B1	I have the ability to produce a great number of ideas	Pérez Alonso-Geta (2009: 311), Forex (2010: 1), Creative Creativity (2007: 1), Plsek (1996: 3-4), Bergh and Theron (2009: 124), Runco (2007: 95)
	B2	I have the ability to produce solutions to problems in a short period of time	
	B3	I can simultaneously propose a variety of solutions to a specific problem	
<i>Cognition</i>	CN1	I am driven by external pressures (including other people) to solve problems	Pérez Alonso-Geta (2009: 311), Unsworth (2001: 289-297), Bergh and Theron (2009: 415), Runco (2007: 403), Zusman and Zlotin (1998: 1)
	CN2	I am driven by external pressures (including self-discovered problems)	
	CN3	I am self-motivated to resolve externally	
	CN4	I am self-motivated to solve self-defined problems	
	CN5	I am always motivated to be creative in my own interest areas	
	CN6	I am motivated to be creative in an environment that tears down my barriers to creative thinking	
	CN7	I am always motivated by other people to use my creative skills	
<i>Cognition</i>	DN1	I attain understanding from a variety of information sources without difficulty	Baer and Kaufman (2005:4-6), Bergh and Theron (2009:414), Runco (2007:403), Pérez Alonso-Geta (2009: 308), Cropley (2008:262)
	DN2	I can discover different links and relationships (obvious and not so obvious) when I look at different information sources	
	DN3	I can cope with complexities when I need to resolve a problem	
	DN4	I do not get stuck on a set of rules to solve a problem	

Table 4: Contd.....

<i>Dimension</i>	<i>Code</i>	<i>Item</i>	<i>Source</i>
<i>Communication</i>	DN5	I can easily see different aspects of a problem	Jackson and Shaw (2005) in Kleiman (2008:210), Pérez Alonso-Geta (2009: 311), Cropley (2008:258), Forex (2010:1), Bergh and Theron (2009:115, 124), Runco (2007:396)
	DN6	I can recognise gaps in my existing knowledge	
	DN7	I can identify contradictions in accepted knowledge	
	DN8	I can predict appropriate creative solutions to a problem after analysing the contradictions in a problem	
	DN9	I agree that the use of scientific approaches outside a specific field of study can be helpful to develop creative solutions	
	EN1	I am able to persuade others that my ideas are valuable	
<i>Originality</i>	EN2	I use communication as a tool to reveal my creative ideas to knowledgeable others	Pérez Alonso-Geta (2009: 308), James, Gerard and Vagt-Traore, (2004:3), Forex (2010:1), Creative Creativity (2007:1), Bergh and Theron (2009:124, 414), Runco (2007:95)
	FN1	I propose new ideas on a regular basis	
	FN2	I intentionally engage in unpopular ideas	
	FN3	I am able to redefine a known problem from a completely different perspective	
<i>Synthesis</i>	GN1	I can find the connection between items	Pérez Alonso-Geta (2009: 311), Vilalba (2008:13), Forex (2010:1), Runco (2007:402), Bergh and Theron (2009:414), Plsek (1996:3-4), James, Gerard and Vagt-Traore (2004:3)
	GN2	I find new solutions by using associations between items	
	GN3	I like to combine various concepts to find solutions to problems	
	GN4	I am able to see problems in a novel way	
<i>Culture</i>	HN1	My culture provides the defined symbol system which enables me to be creative	Csikszentmihalyi (1999:314), Bergh and Theron (2009:114), Runco (2007:396), Baer and Kaufman (2005:4-6), Florida (2010:1)
	HN2	My culture is open-minded to novel ideas	
	HN3	My culture supports my creative thoughts	
<i>Environment</i>	IN1	My family influenced the way I think about my own creative ability	Brunn (2009:2), Bergh and Theron (2009:415), Runco (2007:403), Csikszentmihalyi (1999:314), Brunn (2009:2), Vilalba (2008:20-21)
	IN2	My family encouraged me to be creative when I was growing up	
	IN3	My family did not value my creative output when I was growing up	
	IN4	My community encourages creativity in people	
	IN5	Society stimulates novelty in me	
	IN6	Society selects what novelty is	
	IN7	My religion encourages my creative thinking	
	IN8	My religion encourages my creative output	
	IN9	My country recognizes self expression values	

It became evident that cognitive psychology and the external environment impacts on the creativity of individuals.

The use of a model to measure creativity in young adults has the potential to be applied and tested in various settings, for example education, the workplace, entrepreneurship and in-

novation. The model also offers the possibility to be used in future creativity research and to be developed further to play an important role in the measurement and development of individuals' creative abilities.

The variance explained indicated that the measuring tool to measure creativity was valid

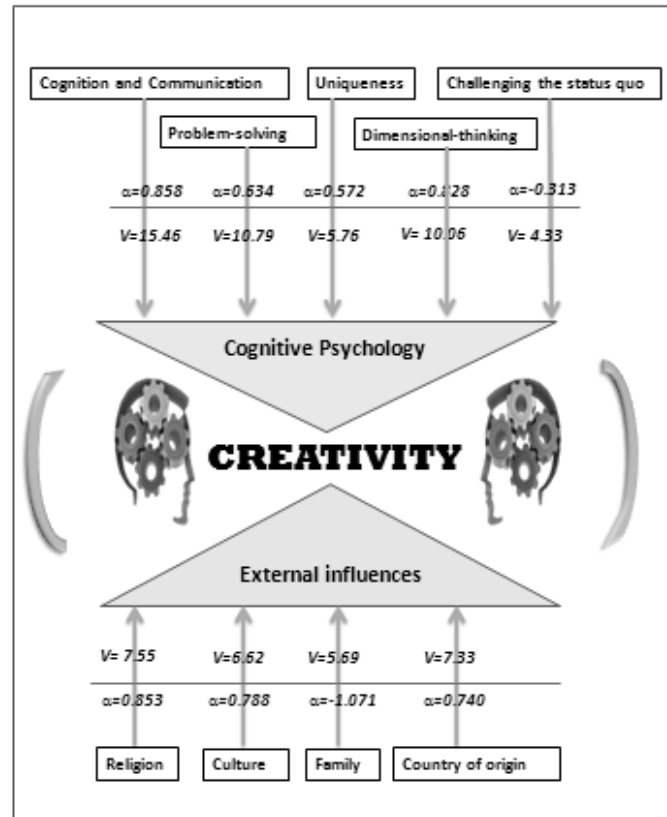


Fig. 2. A model to measure creativity
Source: Fields and Bisschoff 2013:107

and the Cronbach Coefficient Alpha indicated that the overall reliability was good.

The researcher acknowledges, however that measuring creativity in general, and in young adults specifically, remains challenging. The reasons for this are that cognitive psychological factors and the external environment impact dramatically in fostering or inhibiting creativity.

RECOMMENDATIONS

From the research it is recommended that:

- ♦ The model to measure creativity at tertiary level in young adults should be empirically evaluated and compared in various regions and countries.
- ♦ The reliability of each of the data sets be determined to ensure that the model has satisfactory levels of reliability.

- ♦ The model can also be subjected to various fitness measures to determine how well the model fits, for example the Comparative Fit Index (CFI), the Hoelter's Fit Index and the RMSEA measure.

ACKNOWLEDGEMENTS

This article is based on the doctoral studies by Dr. Z. Fields at the Potchefstroom Business School of the North-West University in Potchefstroom, South Africa. Prof. C.A. Bischoff was the research supervisor and corresponding author of this article.

REFERENCES

- Academic Room 2013. Creativity. From <<http://www.academicroom.com/topics/creativity-and-innovation>> (Retrieved on April 8, 2013).

- Actionideas 2010. Background of Whole Brain Technology and the HBDI™. From <http://www.actionideas.com.au/hbdi_background.htm> (Retrieved on August 1, 2010).
- Afolabi MO, Dionne S, Lewis H 2009. Are We There Yet? A Review of Creativity Methodologies. From <http://www.cs.cornell.edu/Conferences/ASEE2006/ASEE%20Papers/Session%204/ASEE%20Final%20vs%203_Afolabi.pdf> (Retrieved May 18, 2010).
- Bronson P, Merryman A 2010. The Creativity Crisis. *Newsweek*, July 19, 2010, pp. 21-25.
- Cropley AJ 2011. Defining And Measuring Creativity: Are Creativity Tests Worth Using? From <http://findarticles.com/p/articles/mi_hb6470/is_2_23/ai_n28809695/?tag=content;coll1> (Retrieved on December 11, 2011).
- Cropley DH 2008. Fostering and measuring creativity and innovation: Individuals, organisations and products. *Mendeley Issue*, 1942: 257-278.
- Davis GA, Rimm SB 1985. *Education of the Gifted and Talented*. Englewood Cliffs, NJ: Prentice Hall.
- Epstein R, Schmidt SM, Warfel R 2008. Measuring and training creativity competencies: Validations of a new test. *Creative Research Journal*, 20(1): 7-12.
- Fields Z 2012. *A Conceptual Framework to Measure Creativity at Tertiary Educational Level*. PhD Thesis, Unpublished. North-West University, Potchefstroom.
- Fields Z, Bisschoff CA 2013. A theoretical model to measure creativity at a university. *Journal of Social Sciences*, 34(1): 47-59.
- Florida R, Gates G, Knudsen B, Stolarick K 2006. The University and the Creative Economy. From <http://creativeclass.com/rfcdgb/articles/univ_creative_economy082406.pdf> (Retrieved on November 9, 2010).
- Hennessey B A, Amabile T M 1987. *Creativity and Learning*. Washington, DC: NEA Professional Library.
- Kerr B, Gagliardi C 2003. Measuring creativity in research and practice. *Mendeley*, 4(1): 155-169.
- Koke L, Vernon P 2003. The Sternberg Triarchic Abilities Test (STAT) as a measure of academic achievement and general intelligence. *Mendeley*, 35(8): 1803-1807.
- Lin H F 2003. A review on the pragmatic approaches in educating and learning creativity. *International Journal of Research Studies in Educational Technology*, 1(1): 13-24.
- Livingston L 2010. Teaching creativity in Higher Education. *Arts Education Policy Review*, 111:59-62.
- Mauzy J, Harriman R 2003. *Creativity Inc.: Building an Inventive Organization*. Boston: Harvard Business Press.
- Neethling Brain Instrument 2010. *Neethling Brain Instrument*. Johannesburg: NBI
- Nieman G H, Bennett J A 2002. *Business Management: A Value Chain Approach*. Pretoria: Van Schaik.
- Petrowski, M J 2000. Creativity research: Implications for teaching, learning and thinking. *Emerald*, 28(4): 304-312.
- Plsek PE 1996. Working Paper: Models for the Creative Process. From <<http://www.directedcreativity.com/pages/wpmmodels.html>> (Retrieved on December 10, 2011).
- Plucker JA, Runco MA 1998. The death of creativity measurement has been greatly exaggerated: Current issues, recent advances, and future directions in creativity assessment. *Roeper Review*, 21: 36-39.
- Reinartz W 2013. Measuring Creativity: We Have the Technology. Harvard Business Review Blogs. From <http://blogs.hbr.org/cs/2013/03/measuring_creativity_we_have_t.html> (Retrieved on March 20, 2013).
- Runco MA 2007. *Creativity, Theories and Themes: Research, Development and Practice*. Amsterdam: Elsevier.
- Sharma P 2004. Teaching Creativity – A Systematic Viewpoint. From <http://www.arts.ac.uk/docs/cltd_2002sharma.pdf> (Retrieved on February 15, 2010).
- Sternberg RJ, Lubart TI 1999. The concept of creativity: Prospects and paradigms. In: RJ Sternberg (Ed.): *Handbook of Creativity*. London: Cambridge University Press, pp. 3-16.
- Treffinger DJ, Renzulli JS, Feldhusen JF 1971. Problems in the assessment of creative thinking. *The Journal of Creative Behavior*, 5: 104-111.
- United Nations 2008. Creative Economy Report 2008. From <<http://www.unctad.org/creative-economy>> (Retrieved on April 8, 2013).
- Vilalba E 2008. *On Creativity – Towards an Understanding of Creativity and its Measurement*. Luxembourg, Italy: Office for Official Publications of the European Communities.
- Whole Brain Thinking (Pty) Ltd. 2005. What is a Brain Profile? From <<http://www.wholebrainthinking.com.au>> (Retrieved on November 16, 2011).