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A Theoretical Model to Measure Creativity at a University

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ABSTRACT Measuring creativity at a tertiary educational level has been problematic due to the diverse teaching and learning processes and programmes used in tertiary educational institutions. The objective of this research paper is to develop a theoretical model to measure creativity on a tertiary education level to actively support the creative development of students. To develop this model, the experimental design included an extensive literature study of various creativity models in order to identify the constructs that influence the creativity of university students. A total of twenty-eight creativity influences were observed which ultimately culminated into the selection of the eleven most important influences which resulted in a theoretical model. This model is of great value because tertiary education is important in equipping graduates with creative skills to apply in the global and competitive business and social environments.

INTRODUCTION

Universities are amongst the oldest institutions and for many centuries universities contributed to educating students and enriching nations. Universities have the ability to reinvent themselves in the face of large cultural and other macro-environmental challenges to ensure their pivotal role in education and human development. In this regard, Livingston (2010: 61) identified rising costs, increasing direct competition between universities, indirect competition from easily accessible alternative forms of learning, off-campus education possibilities such as the Internet as just a few modern managerial challenges faced by university management. In addition, providing a quality and relevant curriculum to the market are regarded as hygiene factors in education, disqualifying a university as quality supplier of education if absent rather than providing a competitive advantage. This leads modern university management to the ultimate challenge, staying relevant and becoming redundant in a highly competitive market. In this regard, competitiveness expands to additional factors such as off-curriculum activities, innovative and new modules, sport development, development of reading skills, ease of information access and a safe, conducive learning environment (NWU 2012; PRI 2012). One such additional factor is the addition of creativity as stimulus in the development of the university student (Fields 2012: 2-3).

Creativity specifically has become a critical consideration, because "creativity becomes a force of great value when it is applied to causes that benefit humankind and the world at large" (Livingston 2010: 61). Creativity occurs on the right side of the brain when ideas are sparked, but to make creativity useful requires both divergent thinking (generating many unique ideas) and convergent thinking (combining those ideas into the best result), which can be taught according to Kaufman (Bronson and Merryman 2010: 21, 23). Kotelnikov (2010: 1) indicates that three elements are vital for an individual to be creative, namely:

- The individual must have creative thinking skills;
- The individual must have the passion to be creative (internal motivation); and
- The individual must have the necessary resources.

The definition of creativity as indicated above applies to tertiary education as well. The focus in tertiary education will however be more on the heuristic techniques to generate creative solutions to ill-defined problems. These heuristic techniques can be categorised into five categories according to Lau et al. (2009: 73), namely:

- *Identifying and mapping attributes* which work as a cognitive organisational tool for

defining the nature of the problem by using critical analysis.
- *Making possibilities* to help generate new alternatives for further consideration.
- *Changing and shifting perspectives* which use tools mainly to provide divergent views for students in generating ideas and solutions.
- *Making associations and analogical thinking* which help students to generate ideas from cultural and current issues and so facilitate students' associations and imagination.
- *Probing emotion and the subconscious* are used to create possible ideas as well as making creative decisions.

The purpose of universities and other tertiary educational institutions, therefore, lies beyond career preparation only. These institutions should ensure that students can meet the challenges of the future and contribute original thought to challenges in the workplace and society as a whole. It is therefore necessary to support students to apply creative thinking skills and to develop creativity at various levels. The first step will be to measure creativity and then to develop teaching and learning activities to include the heuristic techniques to enhance creative skills. The success of these activities can then be measured at various intervals, using the model to measure creativity, to ensure that graduates have creative skills.

Problem Statement

The problem at hand is not how to teach creativity, but rather how to understand, harvest and build up the creativity that every student already possesses. In order words, the challenge is to measure and monitor creative development. Resultantly, the starting point in tertiary creativity is to assess current creativity levels of students, and to ensure that a proper creativity measurement tool is utilise to gather the necessary information. After determining current levels of creativity of university students, strategies and action steps can be formulated to develop the creative skills of students and to monitor the process during the duration of study. At present, no specialised measuring tool or model are in use to adopt, and resultantly, such a theoretical model needs to be developed.

Objectives

The primary objective of this paper is to develop a theoretical model to measure creativity at university level.

To achieve the primary objective, the following secondary objectives are formulated, namely to:
- Identify relevant historical creativity models;
- From these models, identify the constructs that influence behaviour related to creativity;
- Select, from the literature study, the more important creativity influences;
- Identify measuring criteria pertaining to each of the creativity influences;
- Compile a questionnaire to test these influences at tertiary educational level; and
- Developing a model to measure creativity.

Historical Overview of Creativity at Tertiary Institutions

From the literature study, a number of relevant creativity measurement models have been identified that can be applied to tertiary education.

The first model is called the *Enrichment Triad Model (ETM)* which was developed by Renzulli in the 1970s. It is a programme for infusing high-end learning strategies into existing educational programmes to promote excellence, enhance self-confidence, and nurture creativity in students (Garcia-Cepero 2008: 295). The programme was developed as an alternative to the available models for gifted education and has been transferred to the regular classroom as a model to develop students' creative productivity.

ETM in tertiary educational settings can contribute to the development of creative productivity, high-end learning and skill, high self-regulating skills and high levels of motivation among students (Garcia-Cepero 2008: 300). This programme is still unexplored and unknown in tertiary education faculties but has the potential to infuse enriched experiences into higher education (Garcia-Cepero 2008: 295). The model however does not offer insight into measuring creativity at tertiary educational level.

The second model is called the *conceptual map of creativity in teaching and learning* which was created from Phenomenography in 2004 (Tan and Prosser 2004: 269). Phenomenography focuses on the limited but qualitatively different number of ways in which individuals experience, perceive, apprehend, understand and conceptualise various phenomena. The central part of the research consisted of in-depth, semi-structured, face-to-face interviews undertaken with twelve academics from a range of disciplines. Using only twelve academics limit the value of the research and further analysis is required, however, the research offers helpful clues regarding creativity in the context of learning and teaching.

What initially emerged from the research was a list of thirty possible different variations in conception of the experience of creativity in learning and teaching. A process then followed in which the variations were categorised, distilled and reduced under five main categories which focused varyingly on the experience of creativity as:

- A constraint-focused experience which appears in several forms, for example, constrained in order to enable student creativity, constrained by institutional environment, and constrained in order to meet the expectations of the students.
- A process-focused experience which include those processes that lead to explicit outcomes or products, those that lead to implicit outcomes, and those that are not necessarily linked to any outcome.
- A product-focused experience focuses on the production of either something that is simply new and original, or the production of something in which notions of novelty and originality combine with notions of utility and value.
- A transformation-focused experience is the engagement in a process that is transformative either in itself, or is undertaken with the intention (implicit or explicit) of being transformative. Encountering and exploiting chance and risk-taking appear as important factors in this category.
- A fulfilment-focused experience is strongly linked to notions of personal and professional fulfilment and freedom in the way academics conceptualise creativity.

If the five key aspects of variation are placed on a continuum of inclusivity, it would position creativity as a constraint-focused experience at the "lower" end and a fulfilment-focused experience at the "higher" end. It also appears logical that creativity as a process-focused experience should precede creativity as a product-focused experience (Kleiman 2008: 211-212).

The third model is called the *Educational Model for Creative development (PECEI)* which was developed by the Institute of Creativity and Educational Innovations (INCEI). The model is based on the indicators that have traditionally been considered as those that define creativity and innovation (Pèrez Alonso-Geta 2009: 305). The model adopts the approach that creativity is an acquired skill, although some individuals possess this quality naturally, which enables students to find new solutions to different problems posed. The model is a strategic model that relates to the individual (development of creative and entrepreneurship spirit), to the process (of innovation), to the product, and to the context. In order to evaluate creativity, mental and behavioural aspects are measured and basic indicators are used that can be categorised in terms of the subject, the process and the context (Pèrez Alonso-Geta 2009: 311). Behavioural and biographical inventories are then used on those identified as creative through a questionnaire.

The process in the PECEI model requires the following:

- Inventiveness by having an idea, a hypothesis, a project and being able to develop it.
- The ability to use ideas outside of the judgment system.
- Ideas have to manifest, be developed, tested, evaluated and modified and the ability to escape the typical dominant idea should be enhanced.
- Stimulation, intuition, direction and perseverance are required to overcome the environment and its resistance and to give incentive to the effort of achieving.
- Divergent and critical thinking are essential because it defines the direction when confronted with multiple options.
- Various strategies can be used to improve the creative process.

The model assumes that creativity involves a set of attributes and thinking skills. The model

can be used for teaching creativity and can be seen as a model with a measurement tool for judging the educational quality of creativity (Pèrez Alonso-Geta 2009: 308). This model is important to consider in the development of a structural framework to measure creativity at tertiary educational level because it identifies indicators of creativity and offers insight into the measurement of creativity.

Additional to the indicators of creative performance in this model, there are other common indicators that can also be used as well that are important in developing a structural framework to measure creativity. Baer and Kaufman (2005: 4-6) highlighted the initial requirements for creativity in their *Amusement Park Theoretical (APT) Model* as:

- Intelligence – some basic level of cognitive ability is needed to be creative. Once a person's IQ reaches approximately 120, the chances are small that any further advances in IQ will increase creativity. In extreme cases, Simonton (1994 as cited in Baer and Kaufman 2005: 5) suggests that a very high-IQ individual may not be able to communicate ideas in an effective manner to other people. This lack of communication may result in brilliant ideas never being implemented. However, there is a positive correlation between IQ scores and creative performance in virtually all domains.
- Motivation – This refers to the simple necessity of being highly motivated one way or another. If a person is not motivated to do something, then that person will not create anything in the first place. Motivation is a different construct from intelligence because it changes from moment to moment and from task to task. Motivation result from both positive and negative experiences that interact within the individual to produce very unique interests and drives in individuals. Motivation that increases productivity is likely to also lead to higher levels of creativity success.
- Suitable environments – refers to past and present environments and environmental influences. Individuals will be creative if creative thoughts are supported by their culture or family. If it is not supported, the individual will find it difficult to be creative. Environments often contains the tools and material necessary to one kind of creativity but not another.

A *phenomenographic analysis* was done on business students (Petocz et al. 2009: 409-415). This study identified that although the notion of creativity makes an appearance in the lists of graduate attributes from many universities, it seems that it is rarely discussed as a concept with students, and rarely appears as part of the formal material of a course of tertiary study, at least in business. Rather, it is held up as a characteristic to aim for, and students are told that the highest marks will be reserved for work that displays creativity. The study highlights the importance for students to be aware of the contextual aspects of creativity and the different ways in which creativity is recognised in the particular domain in which they are working (Petocz et al. 2009: 414-415).

In 2005, Scientific American listed the following indicators of creativity (Creative Creativity 2007: 1) which corresponds to Guilford's Divergent Thinking Model and the Torrance Test of creative thinking. The six indicators are:

- Ideational fluency - The number of ideas, sentences and associations a person can think of when presented with a word.
- Variety and flexibility - The diversity of different solutions a person can find when asked to explore the possible uses of an item/s.
- Originality -The ability to develop potential solutions other people cannot think of.
- Elaboration -The skill to formulate an idea expands on it, and then works it to form a concrete solution.
- Problem sensitivity - The ability to recognize the central challenge within a task, as well as the difficulties associated with it.
- Redefinition - The capacity to view a known problem in a completely different light.

Based on the models and research discussed thus far, creativity influences were identified from literature.

METHODOLOGY: DEVELOPING THE MODEL

The outcome of the theoretical model resides in the successful identification of the creativity influences, and the respective measuring crite-

ria pertaining to each influence. This outcome was achieved by following the steps below:

- Step 1: Identification of creativity influences through research and literature study;
- Step 2: Reduction of creativity influences from 28 to 11;
- Step 3: Operationalisation of influences; and
- Step 4: Identify the measuring criteria pertaining to the constructs.

RESULTS AND DISCUSSION

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

Table 1: Tertiary education creativity constructs from literature

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

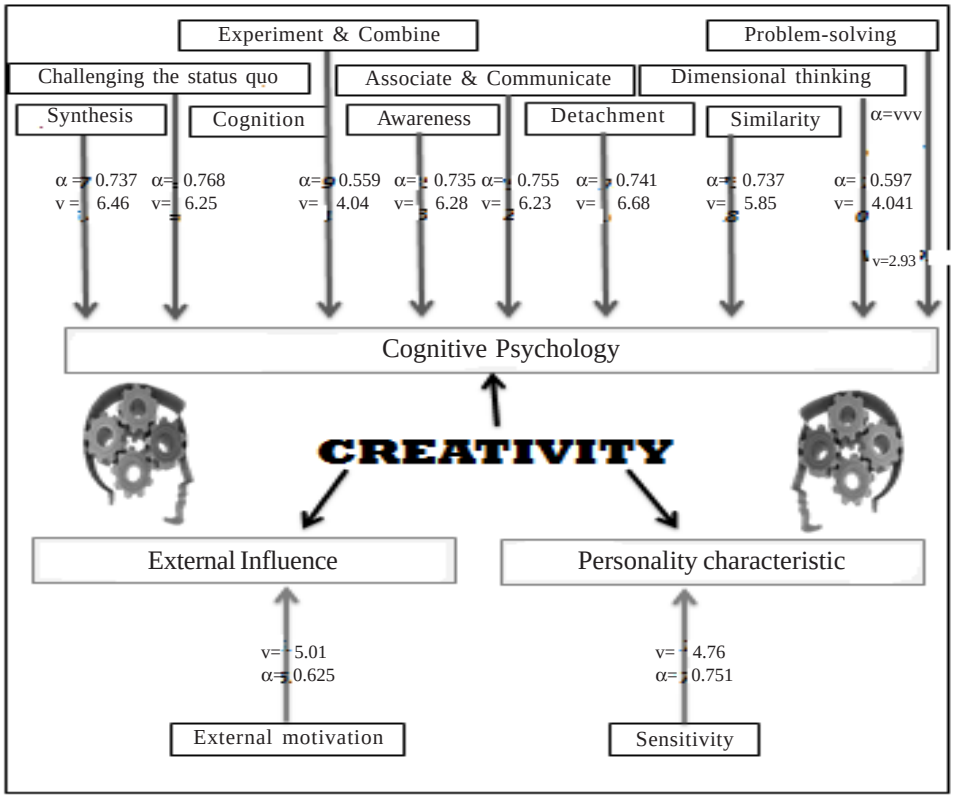

Fig. 1. A model to measure creativity at a university

Table 2: Influences considered

	Influence	*Description*	*Researchers*
1	*Eight Dimensional Thinking*	The ability to consider the dimensionality (i.e. space, time, cost, colour) of an issue to create ideas and combine objects, concep ts 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	*Fluency*	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)
3	*Motivation*	The drive to solve problems inter-ally 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	*Cognition*	The ability to understand a variety of information easily, to discover different links (obvious and not so obvious) and to identify con tradictions 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	*Communication*	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: 11); Cropley (2008: 258); Forex (2010: 1); Bergh and Theron (2009: 115; 124); Runco (2007: 396)
6	*Originality*	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	*Synthesis*	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	*Sensitivity*	The ability to display keen perception, being observant in recog-nising difficulties within a task and having insight into various aspects of a problem	Pérez Alonso-Geta (2009: 311); Runco (2007: 315); Creative Creativity (2007: 1); Forex (2010: 1)
9	*Four-Dimensional Thinking* of space and time.	The ability to consider consequences of ones actions holistically, in terms (2009: 311)	Whole Brain Thinking Pty Ltd (2005: 6); Neethling (2010: 15); Pérez Alonso-Geta
10	*Development*	The ability to gradually elaborate and explore ideas to find the best solution Zusmanand Zlotin (1998: 1)	Plsek (1996: 6); Bergh and Theron (2009: 124); Pérez Alonso-Geta (2009: 311);
11	*Imagination*	The ability to make associations and form a mental image of some-hing not present to the senses or never before wholly perceived in reality	Plsek (1996: 6); Bergh and Theron (2009: 115; 414); Runco (2007: 95); Jackson and Shaw (2005) in Kleiman (2008: 210); Hermann International (2010: 1)

creativity, the influences in Table 1 were reduced to 11 influences represented in Table 2 and defined. The process of elimination involved exploring creativity models and influences that received support from five or more sources.

The 11 identified influences were then used to construct the questionnaire.

Step 3: Operationalisation of influences

The 11 influences were operationalised to reflect the understanding of the concepts in the context of the present study. The operationalised influences appear in Table 3.

Table 3: Operationalisation of influences

	Influence	*Description*	*Source*	*Operationalisation*
1	*Eight Dimensional Thinking*	The ability to consider the dimensionality (i.e. 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	*Fluency*	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	*Motivation*	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	*Cognition*	The ability to understand a variety of information easily, to discover different links (obvious and not so obvious) and to identify contradicions 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	*Communication*	The ability to persuade others that creative ideas are valuable and reveal creative ideas to knowledgeable others	Jackson and Shaw: (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	*Originality*	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	*Synthesis*	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

Table 3: Contd...

Influence	*Description*	*Source*	*Operationalisation*
8 Sensitivity	The ability to display keen perception, being observant in recognising difficulties within a task and having insight into various aspects of a problem	Pérez Alonso-Geta (2009: 311); Runco (2007: 315); Creative Creativity (2007: 1); Forex (2010: 1)	The capacity to observe shortcomings due to the capability to look at problems thoughtfully
9 Four-Dimensional Thinking	The ability to consider consequences of ones actions holistically, in terms of space and time.	Whole Brain Thinking Pty Ltd (2005: 6); Neethling (2010: 15); Pérez Alonso-Geta (2009: 311)	The ability to consider consequences of actions from a broad perspective
10 Development	The ability to gradually elaborate and explore ideas to find the best solution	Plsek (1996: 6); Bergh and Theron (2009: 124); Pérez Alonso-Geta (2009: 311); Zusmanand Zlotin (1998: 1)	The ability to find solutions by using step-by-step procedures
11 Imagination	The ability to make associations and form a mental image of something not present to the senses or never before wholly perceived in reality	Plsek (1996: 6); Bergh and Theron (2009: 115; 414); Runco (2007: 95); Jackson and Shaw (2005) in Kleiman (2008: 210); Hermann International 2010: 1)	The skill to visualise something that is mysterious or unfamiliar due to unique associations with concepts that are known

Table 4: Origins of questionnaire items

Dimension	*Code*	*Item*	*Source*
Eight Dimensional Thinking	A1N1	To help me find solutions or generate ideas I look for the uniqueness in processes	Berne andRaviv (2004: 237-238),Bergh and Theron (2009: 124, 414-415), Forex (2010: 1), Creative Creativity (2007: 1), Plsek (1996: 3-4), Runco (2007: 395)
	A1N2	To help me find solutions or generate ideas I look for the uniqueness in processes objects	
	A1N3	To help me find solutions or generate ideas I look for the uniqueness in processes features	
	A1N4	To help me find solutions or generate ideas I look for the uniqueness in processes situations	
	A2N1	I consider the dimensionality of an issue to create ideas in terms of space	
	A2N2	I consider the dimensionality of an issue to create ideas in terms of time	
	A2N3	I consider the dimensionality of an issue to create ideas in terms of cost	
	A2N4	I consider the dimensionality of an issue to create ideas in terms of colour	
	AQ3	I determine if things can be done from different points of view	
	A4N1	To find creative solutions, I combine objects	

Table 4: Contd...

Dimension	*Code*	*Item*	*Source*
A4N3	To find creative solutions, I combine processes		
	A5N1	To find creative solutions, I separate concepts	
	A5N2	To find creative solutions, I separate processes	
	A5N3	To find creative solutions, I separate resources	
	A5N4	To find creative solutions, I separate objects	
	A5N5	To find creative solutions, I separate dimensions	
	AQ6	I like to modify my creative solutions	
	A7N1	I look for similarity in concepts	
	A7N2	I look for similarity in problems	
	A7N3	I look for similarity in solutions	
	A7N4	I look for similarity in patterns	
	A7N5	I look for similarity in processes	
	A8N1	To find the best creative solution, Iestimate	
	A8M2	To find the best creative solution, Isimulate	
	A8N3	To find the best creative solution, Iexperiment	
Fluency	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 andTheron (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	
Motivation	CN1	I am driven by external pressures (including other people) to solve problems	Pérez Alonso-Geta (2009:311), Unsworth (2001: 289-297), Bergh andTheron (2009: 415), Runco (2007: 403), Zusman and Zlotin (1998: 1)
	CN2	I am driven by external pressures (including other people) to solve self-discovered problems	
	CN3	I am self-motivated to resolve externally defined problems	
	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	
Cognition	DN1	I attain understanding from a variety of information sources without difficulty	Baer and Kaufman (2005: 4-6), Bergh andTheron (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	
	DN5	I can easily see different aspects of a problem	
	DN6	I can recognise gaps in my existing knowledge	

Table 4: contd...

Dimension	*Code*	*Item*	*Source*
	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	
Communication	EN1	I am able to persuade others that my ideas are valuable	Jackson and Shaw (2005) in Kleiman (2008: 210), Pérez Alonso-Geta (2009: 311), Cropley (2008: 258), Forex (2010: 1), Bergh andTheron (2009: 115, 124), Runco (2007: 396)
	EN2	I use communication as a tool to reveal my creative ideas to knowledgeable others	
Originality	FN1	I propose new 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 andTheron (2009: 124, 414), Runco (2007: 95)
	FN2	I intentionally engage in unpopular ideas	
	FN3	I am able to redefine a known problem from a completely different perspective	
Synthesis	GN1	I can find the connection between items	Pérez Alonso-Geta (2009: 311), Vilalba (2008: 13), Forex (2010: 1), Runco (2007: 402), Bergh andTheron (2009: 414), Plsek (1996: 3-4), James, Gerard andVagt-Traore (2004: 3)
	GN2	I find new solutions by using associations between items	
	GN3	I like to combining various concepts to find solutions to problems	
	GN4	I am able to see problems in a novel way	Pérez Alonso-Geta (2009: 311), Runco (2007: 315), Creative Creativity (2007: 1), Forex (2010: 1)
Sensitivity	HN1	I am a sensitive person	
	HN2	I can recognise difficulties within a task easily	
	HN3	I am sensitive to the various aspects of a problem	
Four-Dimensional Thinking	IN1	I consider the consequences for humanity when I look for solutions to a problem	Whole Brain Thinking Pty Ltd (2005: 6), Neethling (2010: 15), Pérez Alonso-Geta (2009: 311)

Table 4: Contd...

Dimension	*Code*	*Item*	*Source*
	N2	I consider immediate personal gains when I look for solutions to a problem	
	IN3	I think about the consequences of my ideas	
	IN4	I can anticipate consequences	
Development	JN1	I do not prematurely judge ideas	Plsek (1996: 6), Bergh andTheron (2009: 124), Pérez Alonso-Geta (2009: 311), ZusmanandZlotin (1998: 1)
	JN2	I thinking ideas through carefully and developing on it	
	JN3	I developing ideas to find the best solutions for a given situation	
	JN4	I make random attempts to solve a difficult problem	
	JN5	I prefer to break away from preconceived perceptions to find solutions to problems	
Imagination	KN1	I generate new ideas by actively searching for associations among concepts	Plsek (1996: 6), Bergh andTheron (2009: 115, 414), Runco (2007: 95), Jackson and Shaw (2005) in Kleiman (2008: 210), Hermann International (2010: 1)
	KN2	I use brainstorming to make associations regarding a given concept.	
	KN3	I make the effort to actively search for associations	
	KN4	I generate ideas by finding as much alternatives as possible	
	KN5	I always look at the big picture	
	KN6	I like to take initiative and challenge assumptions	
	KN7	I like to challenge assumptions	

in the personality characteristics group as indicated in Table 1.

Step 2: Reduction of creativity influences from twenty-eight to eleven

In order to get a more parsimonious set of variables without losing the ability to measure

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: Identify the measuring criteria pertaining to the influences

Upon finalisation of the 11 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 three groups:

- Influences that fall into the cognitive psychology group. Tertiary education requires more cognitive processes therefore this is not surprising that more cognitive psychology factors were identified in the model.
- One influence falls into the external influences group. Motivation can be seen as a cognitive psychology influence as well, but the model focuses on external motivation specifically and therefore the impact of the external environment on the creativity needs to be considered and measured.
- Only one falls into the personality characteristics group, namely sensitivity.

The theoretical model to measure creativity is shown in Figure 1.

CONCLUSION

An exploratory perspective was taken to examine a broad range of creativity influences at educational level. Although 28 influences were identified, 11 were selected as the most frequent-

ly used to determine and measure creativity. The examination of literature models ensured that the influences along with questions for the measuring instrument were scientifically selected 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 eleven factors which were identified to measure creativity.

The use of a model to measure creativity will improve the explanatory potential for tertiary institutions, academics and companies focused on creative ability development. The model has the potential to be applied and tested in various settings, for example entrepreneurship (new venture creation) and innovation development. 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 development of individuals' creative abilities.

Finally, measuring creativity at tertiary educational level remains challenging because psychological factors play a role in fostering or inhibiting creativity at tertiary educational level, and social and cultural factors impact on the creative and teaching process in different academic areas. This necessitates the statistical validation of the newly developed theoretical model once the theoretical model is operationalised.

RECOMMENDATIONS

From the research it is recommended that:

·The model to measure creativity at tertiary level (specifically at a university) should be operationalised and employed to empirically evaluate creativity of university students. Preferably, this should be done at various universities.

·The theoretical model requires statistical validation to ensure that the models does measure what it was developed for, namely the creativity of tertiary university students. The validation may lead to further purification of the model by means of omitting or adding some measuring criteria to the model.

- The reliability of each of the data sets should be determined to ensure that the model has satisfactory levels of reliability. (The Cronbach Alpha is a recognised coefficient to employ in measuring reliability.)
- The model should also be subjected to various fitness measures to determine how all the model fits, for example the Comparative Fit Index (CFI), the Hoelter's Fit Index and the RMSEA measure.

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