

Creative thinking in prospective teachers: the *status quo* and the impact of contextual factors

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To create unique and appropriate learning opportunities and environments and to nurture the development of creative thinking abilities among learners are some of the demands for creative thinking currently expected of teachers globally and also in South Africa. Creative thinking in academic context assumes, among other things, the ability to generate a variety of original ideas, to see different viewpoints and elaborate on ideas. We report on the findings of a quantitative pilot investigation by means of experimental research utilizing an ex post facto design to determine the status quo regarding the creative thinking abilities of a heterogeneous group of 207 pre-service teachers studying at a South African university, using the Abbreviated Torrance Test for Adults (ATTA) and a Partial Least Squares (PLS) exploration into the relationship between contextual factors and the students' creative thinking abilities. Strong correlations were found among a variety of contextual factors such as the type of school model and culture and creative thinking abilities and also between specific contextual factors such as the choice of role model and socio economic and acculturation factors and certain creative thinking abilities. This research explores a largely unknown field, namely, the creative thinking abilities of a group of South African pre-service teachers of different cultural groups and creates an awareness of the need for the development of creative thinking abilities among these prospective teachers.

Keywords: contextual factors; creativity and culture, creativity; creative thinking; creative thinking abilities; teacher training

Introduction and orientation

The South African Norms and Standards for Teacher Education (Department of Education, (2000:15-16), Curriculum 2005, the Outcomes-Based curriculum that was implemented in South African schools from 1997 and its revisions since then, place emphasis on creative thinking within an academic milieu. The Norms and Standards for Educators (SA, 27 / 1996), requires that teachers must be fluent (“*consider a range of possibilities for action*”), encourage and model creative thinking (“*create a learning environment in which critical and creative thinking is encouraged*”) and “*adapt to change and unforeseen circumstances*”), be original (“*design original learning programmes*”) and flexible and able to elaborate (“*adapting learning programmes so that they are appropriate for the context in which teaching will occur*”). Compared to what literature reveals regarding creative thinking in an academic milieu, the policy requirements augur well with the views of Hunter, Bedell and Mumford (2007: 69-90), Craft (2005:20), Pink (2005:23) and Gyskiewicz (in Isaksen, Dorval & Treffinger, 2000:2) who are of the opinion that novelty, originality and imagination are important features of creative thinking. Furthermore, these authors link creative thinking to fluency of ideas, flexibility and fluidity of in-

formation and adding details to information already produced.

In the context of the article, creative thinking should not be confused with artistic talent. We focus on creativity as a cognitive function which refers to the ability to generate new ideas and concepts, and the ability to think divergently and productively in an academic domain (Arends, 2009:61; Papalia, Wendkos Olds & Duskin Feldman, 2008:378-379; Nolan, 2004:1). In this regard we support the viewpoint of McWilliam and Dawson (2008:635) who argue that creative thinking involves solving problems in ways that show initiative as well as developing, implementing and leading new ideas. In the context of the article in which the focus is on prospective teachers, we argue that creative thinking refers *inter alia* to the ability of teachers to produce a variety of new and original possibilities and ideas, and thinking which reflects insight, curiosity, flexibility, originality and the ability to identify relationships among concepts or ideas that are often overlooked during the design of learning programmes (cf. Lombard & Grosser, 2004:212-216; Lombard & Grosser, 2008:561-579).

In addition to the cited outcomes in the Norms and Standards for Educators, the National Curriculum Statement (NCS) (currently used in Grades 0 to 12 at schools) stipulates as a Critical Outcome that learners must be able to “*identify and solve problems using critical and creative thinking*” in all the different learning areas (Department of Education 2002:1). In addition to being a creative designer of learning programmes, teachers are also challenged to nurture the creative thinking abilities of learners.

From the NCS document one can gather that the creativity mentioned here is similar to what Grysiewicz (in Isaksen *et al.*, 2000:2) calls “*novel associations that are useful*” or a thinking process that transforms existing products into unique products (like learning programmes, learning environments and assessment opportunities) meeting “*the criteria of purpose and value established by the creator*” (Welsch quoted by Isaksen *et al.*, 2000:2).

Creative thinking is sometimes described as the ability to remould reality to meet human requirements and aspirations (Bronfenbrenner, 1979:9-10). Anderson and Krathwohl (2001) and Wilson (2006) see synthesis (the ability to put elements together or reorganize elements into a new pattern, structure or coherent or functional whole through generating, planning or producing) as the most difficult mental function in Bloom’s taxonomy of the cognitive domain (Wilson, 2006). Craft (2005:20) asserts that a distinction can be made between “high” creative thinking and “little” creative thinking. “High” creative thinking refers to something new and remarkable which has transformed something in a significant way. In contrast, “little” creativity is seen as ordinary thinking. McWilliam and Dawson (2008:634) argue that the shift in education is away from the first generation (high) creativity of single “towering historical figures” to second generation (little) creativity of the population. Furthermore, Nolan (2004:1) also distinguishes between creative behaviour and creative action. Creative behaviour involves relevant behavioural characteristics such as attitudes and dispositions that facilitate the creative thinking

process. Creative action is the physical action of doing new things for the first time.

This emphasis on creative thinking and the demand for creativity relate to a change in the perception of teachers' and learners' respective roles in the educational situation stemming from insights gained through psychological research. In order to develop critical thinking, it is now assumed that the most effective learning takes place when learners are challenged (Slavin, 2003:257-258; Hüther, 2006:332-338); actively involved (Schunk, 2004:313; McGonigal, 2005; Beck & Kosnik, 2006:9); learning is mediated (Vygotsky, 1978:125-128; Feuerstein in Kozulin, Feuerstein & Feuerstein, 2001:2) and mentored (Bronfenbrenner, 1979:5-6); and role-models (such as teachers) modelling higher order thinking processes such as creativity are available (Anderson & Krathwohl, 2001; Cox 1997:51).

Based on the above discussion we argue that teachers themselves need to be creative thinkers in order to design appropriate learning programmes and to nurture creative thinking abilities among learners. Teachers are responsible for designing and constructing relevant, challenging, learner-centred learning environments. They must construct experiences and assessment tools to assist learning in learners with diverse needs and interests and/or adapt existing experiences to suit the needs of their specific learners and situation. They must further mediate, mentor, model, and finally "deliver" creative learners.

This growing demand for creative thinking in teachers is linked to the value placed on creative thinking in the global world outside the school. Wonacott (2002) calls intelligent, creative, autonomous, problem-solvers with interdisciplinary knowledge "gold collar workers". With all the demands and opportunities for creative thinking presented by the new perspectives on the educational situation and the NCS in South Africa, a context demanding and encouraging creative work was created. Opportunities existed for the individual teacher or teams of teachers to develop unique learning programmes and stimulate relevant lessons with input from local cultures. In order to foster creative thinking in pedagogical contexts, McWilliam and Dawson (2008:639) argue that teachers need to create learning environments and activities in which learners are allowed to contribute to information acquisition, collaborative learning efforts exist between learners, learners share collective responsibility for learning, the learning environment minimizes command and control and learning from errors is fostered. This, however, did not materialize in the South African context. Taylor and Vinjevold (1999:105-130) report that despite the willingness of teachers to design learning programmes, and time, money and effort spent on training in this regard, most teachers remain unable to develop quality learning-programmes. Our own experience and our observation of teachers, at schools, confirm the apparent inability of teachers to utilize opportunities for creative thinking provided by the curriculum and new paradigms. Ten years after Taylor and Vinjevold reported their findings, the task team for the review of the National Curriculum Statement to the

Minister of Education (Department of Education, 2009:52-54) advised that the idea of encouraging teachers to develop their own learning programmes must be given up in favour of professionally developed materials such as textbooks. The task team states poor quality of learning materials, teacher workload and time constraints leading to frustration among teachers as reasons for their advice (Department of Education, 2009:52). Many other reasons, such as contextual factors, may however also be involved in this situation. It may be that nurturing and encouraging creative thinking were aspects that were disregarded during the education and training of teachers in the past. It may also be that creative thinking is not encouraged in the South African context in general. In this regard we explore the role of the context in developing creative thinking abilities as reported in different sources.

The role of the context in developing creative thinking abilities

We argue that inhibitors to creative thinking in an academic milieu due to a lack of tacit and explicit encouragement for thinking and acting creatively may also be partially responsible for the inability of the majority of teachers to grasp fully the opportunities for creative work that was created by Curriculum 2005 and the NCS. Furthermore, based on studies reported in the literature which indicate that, although creative thinking is partially hereditary, the context in which an individual grows up and in which he/she works, plays a major role in whether his/her latent potential will be expressed. Contextual factors may thus lead to inhibitors of creative thinking. Jones (in Isaksen *et al.*, 2000:14) mentions factors such as self-image problems, strong desire to conform to pre-existing patterns, being rigidly custom-bound, resistance to using imagination, inability to tolerate uncertainty, difficulty seeing a problem from different viewpoints and inability to see a variety of possibilities as inhibitors in this regard. Contextual factors that may be inhibitors of creative thinking within an academic milieu include lack of creative role-models, mediators and mentors, culture, habit, isolation, intellectual inability, illiteracy or low literacy, lack of explicit attention to productive thinking at school and tertiary level or even inhibition of creative thinking during teacher training or at schools (Memmi, 1991:90-141; Mwamwenda, 1995:109;112;116; Chisholm, 2000; Tshikuku, 2001; Kirsten & Viljoen, 2004:9; Lombard & Grosser, 2004: 215; Shi, 2004).

Figure 1 shows Shi's (2004:178) view of a context for creative behaviour and indicates how the interaction between an individual and contextual factors shapes the development of creative behaviour (creative thinking, creative habits and action) and leads to creative production. It shows the contextual factors (education, social environment, family, economic and physical conditions) interacting with person factors (personality, intelligence, knowledge and experience).

Most people accept that the context of an individual or group of individuals, seen as the background, environment or framework, plays an important role in determining human behaviour. It is impossible to provide a

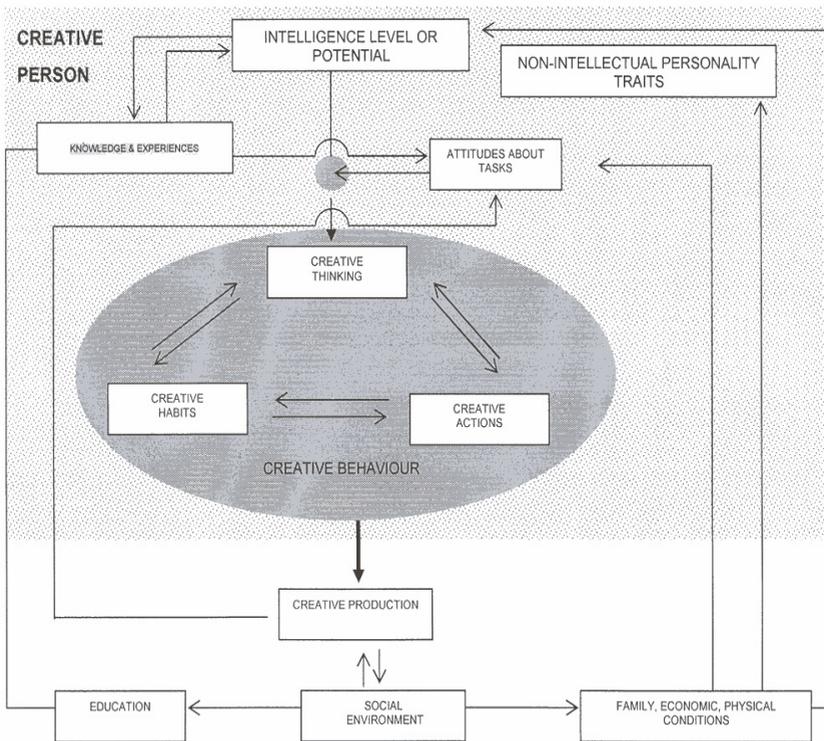


Figure 1 A context for creative behaviour (Shi, 2004)

picture of the complete context and all the forces acting on an individual regarding creative thinking abilities. To make it manageable we selected a small number of contextual factors that link with the above educational, social and family/economic fields, and examined their influence on the development of creative thinking abilities in an academic domain, namely, culture, type of school model attended, socio-economic factors, parental education, family factors, and choice of role models. They are discussed here.

The culture in which individuals grow up influences their thinking (cognition) and behaviour. The cardinal values or worldview of a society determines their creations (Tshikuku, 2001; Rudowicz, 2003:4). According to Nisbett, Peng, Choi and Norenzayan (2001:291) and Nisbett and Norenzayan (2002:3) the cultural differences that exist among different cultures affect not only their beliefs about specific aspects of the world but also impact on the nature of their cognitive processes. The result is that a given cognitive process may be equally available in principle, but differentially accessible in different cultures (Nisbett & Norenzayan, 2002:28). This implies that people may

habitually rely on qualitatively different thinking strategies to solve the same problems of everyday life. Different levels of knowledge about a domain may also lead to the use of different thinking strategies to solve the same problem. In this regard Lassiter (1999:4) concludes that he believes that the African culture has a unique identity and cognitive processes which are uncritical, uni-linear and lack initiative. This according to Nyasani (in Lassiter, 1999:4) has been “extremely negative for Africa, especially in terms of the African individual’s creativity and ability to innovate”.

The above clearly highlights the link between culture and the development of creative thinking abilities. In the context of the article, the research participants were representative of both western and African cultures. A literature study regarding the impact of these two cultures on cognitive processes revealed distinct differences. Nisbett *et al.* (2001:293) are of the opinion that individuals raised in a society focusing on personal freedom, choice, criticism, debate, curiosity and diversity will be characterised by analytic and divergent thought processes (e.g. western culture).

On the other hand, there are many African people who still enjoy the traditional African culture/lifestyle in which the philosophy of “*ubuntu*” is emphasized (Thorpe, 1996:32). *Ubuntu* is a literal translation for collective personhood, collective morality and not individual self-sufficiency (Mbigi, 1997:2;30). Some of the these principles relevant to teaching and cognitive development are: unconditional collective contribution, unconditional collective solidarity, unconditional collective acceptance, consensus and the totality principle (Mbigi, 1997:11; Tshikuku, 2001:7-24; Van der Walt, 2003:70-71, 136-158; Mpofu, Myambo, Mogaji, Mashego & Khaleefa, 2006:463). Former South African president, Nelson Mandela, bears testimony to this when indicating in his memoirs that, as a child, he was expected to “learn through imitation” : not by questioning, but by observing and following the practices of older peers and adults in the community (Rothstein, 2000).

We argue therefore that creative thinking and innovation could be seen as too individualistic for complying with the principles of *Ubuntu*. If high priority is given to individuality in a society, higher levels of creative thinking abilities will emerge. On the other hand, placing solidarity (collectivism) above individuality will contribute to lower levels of creative thinking.

Based on the above we are of the opinion that divergent, independent, creative and productive thinking abilities are latent in the African culture and need to be nurtured among prospective teachers who, in turn, need to nurture creative abilities among learners at school.

In this regard, we acknowledge and support the argument of Boughey (2006:138-144) that problems related to teaching and learning should not only be viewed from an individual, but also from a contextual, perspective. This implies that, instead of depicting students as inadequate with regard to the development of creative thinking abilities, one also acknowledges that the social context from which students come, could impact on the development of their creative thinking abilities. We therefore argue that it is possible to

equip students with creative thinking skills. Our argument links well with the notion of “frame switching” or “dynamic cultural approach” as coined by Hong, Morris, Chiu and Benet-Martinez (2000:710;718) according to which students can acquire creative thinking skills although these skills might not be operative in their internalized (home) culture.

Literacy, which refers *inter alia* to the ability to read and write, to identify, understand, interpret, create, communicate, compute and use printed and written materials associated with varying contexts (Coiro, Knobel, Lankshear & Leu, 2008:1-22), is identified as a further factor involved in the stimulation and/or inhibition of domain specific creative thinking (Mwamwenda, 1995: 109-116) since illiteracy limits access to the domain (field of expertise) (Csikszentmihalyi, 1994:131-136). Literacy usually brings better employment opportunities, a better income and an improved **socio-economic situation**. In turn the socio-economic situation may determine the access to educational facilities and thereby, specifically in the South African context, exposure to **schools** where learners are exposed to either mainly African or mainly non-African teachers as models modelling thinking processes. The socio-economic situation further relates to the available time and stimulating resources needed for creative thinking (Ekvall, 1996). In the context of our study the socio-economic situation of the students and the level of education of their parents were considered as inhibitors of the development of creative thinking abilities. The type of school the students attended (Ex-Model C schools versus Township schools) and the role models with which the students identified, as inhibitors of creative thinking abilities were also considered. Khaleefa (in Mpofu *et al.*, 2006:474) indicates that the quality of education impacts on students' divergent thinking abilities.

Family factors such as the absence of a parent and trauma like death of a parent or sibling may also be involved in creative thinking. Peterson, Carson and Higgins (2003) and Simonton (2005) report that many highly creative individuals report traumatic childhood incidents enforcing autonomy, but with the stimulating presence of a mentor, such as a relative or family friend. Absence of one parent may, on the other hand, lead to lower socio-economic status of the family that may lead to a cascade of factors as described in the paragraph above. A large family limits the availability of resources that may inhibit creative thinking, but on the other hand the presence of siblings may be a stimulating and supporting factor. Literature highlights the importance of parents to support, organize and direct the cognitive growth of their children by modelling strategic cognitive processes (Gauvain, 2001:11-19; Kozulin, Gindis, Ageyev & Miller, 2004:17). For the purposes of our study, family trauma, family size and the absence of both or one of the parental figures were considered as inhibitors of creative thinking abilities.

That there is a demand for creative thinking within an academic milieu and that teachers must be competent in this regard are clear. We are of the opinion that a base-line assessment of the *status quo* regarding creative thinking in prospective South African teachers may indicate whether there is

reason for concern, single out certain areas for special and focused attention and encouragement and identify possible contextual factors contributing to problems in creative thinking, which may help in finding ways to address inhibition of latent potential.

Problem statement

South Africa, with its unique mix of cultures, embarked on a curriculum that embraces to a large degree, global knowledge and ways of thinking and doing. Jordan (2007) explains that African communities experienced the “*immense power at the command of the industrialised nations of Europe*” and “*had come to realise that it was only by acquiring these same skills and knowledge that Africans could hope to compete on an equal basis with western nations*”. South African teachers can, to a large degree, be seen as instruments of acculturation in the global culture. For a South African individual from an African cultural background, schooling is therefore equal to acculturation in a second culture, namely, the global culture. A contradiction arises: On the one hand all teachers are expected to be creative and act as models and mediators of creative thinking. On the other hand many teachers in South Africa come from cultures that may view creative thinking differently from the way it is described and expected in the curriculum. They may even, through an upbringing that taught them to conform, perceive creative behaviour as wrong. The teachers in the schools that they attended may have modelled creative thinking as negative behaviour. They may also have a history of only first- or second-generation literacy, a lingering colonial mentality (Memmi, 1991:90-14; Mwamwenda, 1995:109-116; Chisholm, 2000; Tshikuku, 2001) and socio-economic factors that do not provide adequate time and resources. Based on the aforementioned, which highlights the importance of creative thinking abilities and the possible impact of a number of contextual factors on the development of creative thinking abilities, the problem we wish to address seems to be vested in the following question: to what extent do contextual factors impact on the creative thinking abilities of pre-service teachers?

The following problem questions are within this central question:

- What is the *status quo* regarding the creative thinking abilities of pre-service teachers?
- What impact do contextual factors have on the creative thinking abilities of pre-service teachers?

Research framework, method and design

We set out to understand the development of creative thinking abilities in prospective teachers from an external, objective and positivistic stance (Cohen *et al.* in Maree & Van der Westhuizen, 2007:31).

Our positivistic stance guided us to a quantitative study with an *ex post facto* design to establish the creative thinking abilities of a group of South African prospective teachers and to determine the contextual factors that may

be involved in the development of their creative thinking abilities. Although a qualitative study would have contributed to a richer description of the situation, exploration and the establishment of possible relationships were the main focus points of this study, making the quantitative study appropriate.

The study involved no direct manipulation of the independent, contextual variables (Leedy & Ormrod, 2004:232). We set out to identify conditions that were already present, collect data and then investigate possible relationships among these factors and possible relationships between these factors and the dependent, outcome variables, namely creative thinking abilities.

The research complied with internal validity criteria as there was sufficient control of the biographic variables in order to allow the researchers to draw accurate conclusions. We are convinced that the conclusions drawn can be justified from the data collected (Leedy & Ormrod, 2005:97).

Although the sample used in the study was small and geographically bound and results could not be generalized to the population, the external validity of the study was enhanced by the fact that the study was conducted in a real-life setting (Leedy & Ormrod, 2005:99).

As this study was an initial investigation, we are convinced that the use of a test, to determine the research participants' levels of creative thinking, and a questionnaire, to establish biographical information from the participants, was appropriate.

The statistical procedure (Partial Least Squares (PLS) exploration) utilized in this study was appropriate for determining the relationships between creative thinking and contextual factors, and therefore the research complied with statistical conclusion validity (McMillan & Schumacher, 2006:35).

Participants

All first year pre-service teachers enrolled for a BEd degree at a South African University in 2004, 2005 and in 2006, preparing to teach in the Intermediate and Senior phase of the General Education and Training (GET) and Further Education and Training (FET) education bands, participated in the study. After removal of students whose creativity-data were incomplete, 207 participants remained.

All of the participants had passed the national matriculation examination on a sufficient level to gain entrance to the university. The total group consisted of 108 students of non-African cultures (Afrikaans and English mother tongue) and 99 (48%) of African cultures (Sesotho, Tswana, Pedi, Venda, Zulu, and Xhosa). The average age of the students was 20.6 years ranging from 18 years to 39 years of age with a median of 20 years, and 63% were female.

In the second part of this investigation, where the effect of choice of role models on creative thinking abilities was investigated in more detail, 99 of the original 207 students (see Table 1) who chose their father, teacher, celebrity or public leader as role model were used. The average age of this selection of students was 20.7 years ranging between 18 and 32 years; 47.5% were female and 43% were from African cultures.

Table 1 Descriptive statistics regarding the creativity indexes of students

Gr	Mode	Max.	Min.	Range	Median	Mean	SD	N
All	61	82	11	71	62	59.66	12.45	207
African	61	68	11	57	56	53.1	12.2	99
Non-African	65	82	24	58	67	66.7	8.81	108

Data-collection instruments

Two instruments were used to obtain data: the ATTA (Abbreviated Torrance Test for Adults) (Goff & Torrance, 2002) to assess creative thinking, namely, creative indexes and creative thinking abilities, and a self-constructed questionnaire to determine personal and contextual factors.

The ATTA, which is a pen and paper creativity test, was confirmed in a variety of studies as a valid, reliable and unbiased instrument (McCracken, 1997; McCann, 2005:127; Kim, 2006:10; Runco, Dow & Smith, 2006:274; Wechsler, 2006:24).

Reliability for the ATTA is evidenced by a Kuder-Richardson reliability coefficient (KR21) (Goff & Torrance, 2002:33) of 0.90 for Creativity Index (CI= total abilities plus the scores for the creativity indicators) and ranging from 0.38 for flexibility and originality to 0.84 for elaboration. All these values are between 0 and +1, indicating high reliability. The Mean, Sigma, and SEM for Creativity Index (69.43, 10.98, and 4.76.) and for creative thinking abilities (0.78 for elaboration to 1.69 for originality) are given with a total of 8.23 for total creativity indicators.

Based on information in the literature, a questionnaire aimed to gather biographical data about the participants, for example, personal (such as age, gender) and contextual data (such as parental education, socio-economic status of family, trauma in family, status of family, type of school model attended) was compiled. These factors could be measured with little error and numerical values were assigned to them.

The Torrance Tests of Creative Thinking (Torrance, 1974), based on the ideas of Guilford was utilized in the context of this research to determine the creative thinking abilities of the students. The test consists of several simple verbal and figural tasks involving divergent thinking plus other problem-solving skills. They are scored for the under-mentioned creative thinking abilities and creative indexes as identified by Guilford (1958) and Torrance (1974).

Creative thinking abilities refer directly to the divergent-productive abilities identified by Guilford (1958:5-18) who describes a number of meaningful, unique factors that are relevant in creative thinking, namely:

- Fluency (number of ideas);
- Flexibility (number of different categories of relevant, shifts in approaches, fluidity of information, lack of rigidity);

- Elaboration (amount of detail in responses, adding a variety of details to information that has already been produced); and
- Originality (unusualness, statistical rarity of the responses)

These factors correspond well with the views of Craft (2005:20) and Pink (2005:12) who are of the opinion that novelty, originality and imagination are important features of creativity in an academic domain.

The Torrance Tests of Creative Thinking (Torrance, 1974); based on the ideas of Guilford, consist of several simple verbal and figural tasks involving divergent thinking plus other problem-solving skills. They are scored for the above-named creative thinking abilities. This research focused on these factors identified by Guilford and Torrance.

The **creativity index** is compiled by adding the sum of the scaled scores of the creative thinking abilities to verbal and figural creativity indicators (like openness; resisting premature closure; unusual visualization and different perspectives; richness and/or colourfulness of imagery, movement and/or sound; abstractness of titles, context, combination, internal visual perspective, feeling, emotions and fantasy). These indicators reflect approximately 13% to 14% of the creativity index.

Models and variables

Models linking the independent, contextual variables in an integrated whole with one another and with the dependent, outcome variables, namely, creativity index or creative thinking abilities, were proposed, based on the literature study.

An outer model and an inner model were distinguished (Figure 2). In the outer model, measured variables or indicators may reflect latent variables (arrows pointing outwards) or form/cause (with arrows pointing inwards) emergent variables (both unobserved) (Chin, 2000:36). Culture and family factors such as family trauma, family status and number of children per family, represent measured independent (exogenous) variables. In the inner model, arrows point from these latent and/or observed variables towards the latent and observed variables affected by them.

Intermediate variables (endogenous) depend on the independent variables, but are independent relative to the outcome dependent variable. Arrows feed into them, but also out of them in the inner model. Contextual variables such as parental education, socio-economic factors, school model attended and people chosen as role models may therefore be seen as intermediate variables since they are dependent on factors such as those listed in the previous paragraph.

The dependent variables in this study, namely, the creative indexes and creative thinking abilities (such as fluency, originality, flexibility and elaboration), are influenced directly or indirectly by exogenous variables and also by the other endogenous variables. Arrows point into them in the inner model, but not out of them.

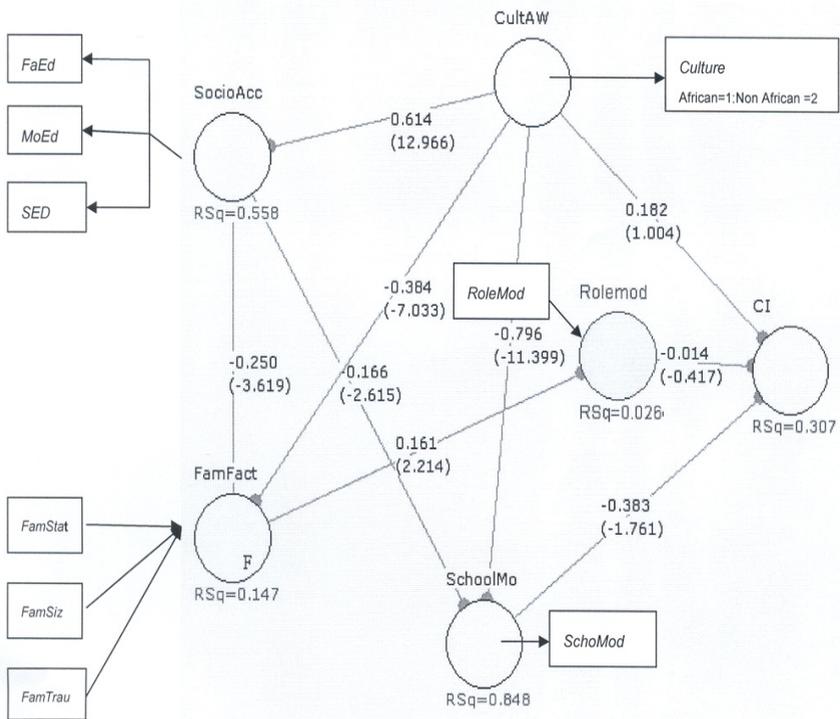


Figure 2 Model 1: Contextual factors and Creativity Index

Hypotheses

The following null and alternative hypotheses were formulated for this study:

- H₀¹ There are no relationships (direct or indirect) between contextual factors and creativity index in the participants in this study.
- H₀² There are no direct or indirect relationships between the variance in contextual factors and the different creative thinking abilities used in the creative process in the participants in this study.
- H_a¹ There are direct and/or indirect relationships between the contextual factors and creativity indexes.
- H_a² Not all creative thinking abilities, influencing the creative processes, are influenced to the same extent by the differences in contextual factors.

Procedures

Administering the instruments

The instruments were group-administered at the beginning of the semester. The students were informed about their right to abstain from the research. A consent form was signed by each participant. The biographical data were collected and then the ATTA was administered. The ATTA took nine minutes to administer with three minutes given for each of the three activities. The instructions for each activity were read out aloud from the manual before the timing of the activity began.

Data handling and analysis

Linear relationships between variables were assumed in this study. It was argued that the following three non-linear relationships between creative thinking and some personal factors reported in the literature did not apply in the current research: "Peaks and slumps as a function of age" in children (Sak & Maker, 2006) (all the participants in this study were over the age of 18 years); a curvilinear or inverted U-shaped relationship between educational level and creative thinking suggested by Simonton (in Weisberg, 1999:229) (all participants passed Grade 12); and the relationship between intelligence and creative thinking (intelligence was not used as a variable).

List-wise deletion was used to clean up the data. Where the data about the ATTA test were incomplete, all data were removed. Imputation of means was used in the few cases where students left out single items of biographical data.

A data matrix was compiled and the data were analysed using a component-based Structural Equation Modelling (SEM) technique, namely, Partial Least Squares (PLS) multiple regression (Tobias, 1997; Chin, 2000; Howie, 2002; Temme, Kreis & Hildebrandt 2006; Fu, 2006). The programme used, namely, Visual-PLS 1.04b, automatically generates Cronbach-Alpha, composite reliability, average variance extracted (AVE) and factor structure matrix of loadings and cross-loadings to help the researcher to check the convergent and discriminant validity of constructs.

To determine the significance of the data and confidence intervals, bootstrapping, a re-sampling technique with replacement of the sample was used. A hundred re-samplings were chosen.

Ethical considerations

No students were marginalized or disempowered through this research. The purpose of the research was explained to the participants and written consent was obtained from the participants. The research posed no risks to students as no manipulation of variables took place. Participants were informed that they could withdraw at any stage and that the data obtained would be kept confidential. Only the researchers and the Statistical Consultation Services of the University had access to the data. Tests and questionnaires were completed anonymously in order to disassociate names from responses. Data were checked for accuracy before reporting the findings.

Data analysis and discussion

The ATTA test gave the results given in Table 1. As can be seen, the mean of this group of 207 students was 59.66, with the non-African students testing on 66.7 and the African students on 53.1. The ATTA gives an average of 69.43 for the norm population. A number of reasons can be given to explain the difference: It may be argued that the ATTA is culturally biased and that the work of the researchers that found the test to be reliable across cultures, did not consider South African cultures. Fact is that the creative thinking expected of teachers in the workplace is the same for everyone and these results show that the South African students need some extra input to help them in this regard.

The creativity indexes for the African students ranged between 11 and 68 with a median of 56 (slightly higher than the mean, on 53) and those of the non-African students between 24 and 82 with a median of 67 (the same as the mean). The ranges of the scores were about the same (on 57 and 58, respectively). The standard deviation for the African group was smaller (8.8) than that of the non-African group (12.2) showing less variability around the mean in the scores of the former group. The mode (61) in the African group was higher than the mean (53.1) and in the non-African group it was slightly lower (on 65) than the mean (on 66.7).

Table 2 Latent factors with their measured variables, Cronbach-Alphas, *convergent (composite) and *discriminant (AVE) reliability data

Variable	Latent factor	Item N	Measured variables	N of items	α	Comp. reliab.	Ave.
<i>SosioAcc</i>	Socio-economic and acculturation factors	1	Father's education (0-13 years of schooling)	3	0.80	0.88	0.71
		2	Mother's education (0-13 years of schooling)				
		3	Socio-economic status (1 = low → 10 high)				
<i>FamFact</i>	Family factors	1	Family trauma (none reported = 1; reported = 2)	3	0.51	0.67	0.48
		2	Family status (2 parents=1; other = 2)				
		3	Family size (number of children)				
<i>SchoMod</i>	School model	1	Former Model C = 1, Township = 2	1		Unity	
<i>RoleMod</i>	Role model	1	From most to least intimate: 0 - 5	1		Unity	
<i>Cult</i>	culture	1	African = 1; Non-African = 2	1		Unity	

The null hypothesis, H_0^1 , hypothesized that there are no relationships (direct or indirect) between contextual factors and creative thinking. Model 1 (Figure 2) was used to model these relationships with Visual PLS (Fu, 2006).

The latent constructs were composed of a number of measured variables (given in Table 2) and had fairly good construct reliabilities in this model: composite reliability for family factors (*FamFact*) was 0.730765 and for socio-economic factors and acculturation factors (*SocioAcc*) was 0.880651. Multi-collinearity problems manifested as sign changes at attempts to model parental education and socio-economic factors separately (Kennedy, 2002:1-13). The AVE values for these two constructs were 0.485176 and 0.711351 (with square roots well above 0.5, as recommended by Gefen and Straub (2005:94) on 0.6965 and 0.8434, respectively) and the Cronbach-Alphas were 0.510384 and 0.799203, respectively.

After running the model, insignificant paths (< 0.1) were trimmed away as well as constructs with low R^2 values (< 0.015). This necessitated the removal of paths from family factors (*Famfact*) and *SocioAcc* to Creativity Index (CI) from the model due to respectively a very low path coefficient and because of sign-changes (it was already represented in the other paths through the type of school model, role model and family factors) (Kennedy, 2002:8). The results obtained with the trimmed model are given in the model 1 (Figure 2). The very weak insignificant path between role model and CI (0.014) was retained because it was of specific interest to this study. The value of the coefficient was too weak to be definitely positive or negative (non-stationarity) and another model (model 2 in Figure 5) was used to explore the relationships of the choice of role models with contextual factors and creative thinking.

In model 1 (Figure 2), 30.70% of the variance of the construct Creativity index (CI) is explained by the contextual variables, namely, culture, role models, type of school model, *SocioAcc* and family factors. Similarly, the model explains 84.8% of the variance in the construct type of school model (*SchoMod*). 55.8% of the variance of the reflective latent endogenous construct *SocioAcc* is explained by the factors that contribute to it in the model, namely, family factors, culture and the measured exogenous factors, namely, SED (measured on a scale from 0–10) and mother and father's educational levels (*FaEd* and *MoEd*), (measured on a scale from 0 to 13).

Of the variance in the construct role model (*RoleMod*), 2.6 % is explained by the factors feeding into it, namely, *FamFact* and the choice of role model (0 indicated no or self as role model, 1 indicated mother or female relative, 2 father or male relative, 3 teacher, 4 celebrity and 5 public leader.) The sequence was chosen to represent concentric spheres circling out from the most intimate (proximal) relationships to further away (distant). The formative latent construct, family factors (*FamFact*), consisted of the measured factors family trauma (no major trauma = 1 and trauma present = 2), family size (*FamSiz* = number of children), and family status (*FamStat* with two parents living together = 1 and other situations = 2).

Strong relationships with values of 0.55 and above were found between culture and *SocioAcc* (–0.614) and culture and type of school model (–0.796). Significant paths (values > 0.30 , but < 0.50) were found from model-type of

school to creativity index ($PreCIAdj = -0.383$), Culture and Family Factors (-0.384) and with values > 0.20 , but < 0.30 from *FamiFact* to *SocioAcc* (-0.250). Culture and creativity index ($CI = -0.182$) were weakly and negatively related as was *Famfact* to the choice of role models ($RoleMod = -0.161$), which was in turn very weakly related to CI ($PreCIAd = 0.014$). Also *SocioAcc* and type of school model was weakly related ($SchoMod$) (-0.166).

The relationships found in this model are discussed here.

- *Culture to CI* (-0.182). In this study, the creativity indexes of the participants from non-African cultures (culture 2) tested higher than those of participants from African cultures (culture 1). This corroborates the arguments of Nisbett *et al.* (2001:291) and Nisbett and Norenzayan (2002:28) that culture impacts on the development of cognitive processes.

- *School model to CI* (-0.383): The school model 1 represented previous model C schools (teachers mainly from non-African culture), whereas school model 2 represented township schools (teachers mainly from African cultures). The negative relationship shown here between culture and CI , links with that of the cultural transfer through modelling and mediation as explained by Bandura (1986:48-50) and Amabile (1996:179-202). African participants in this study mostly attended township schools (90.9% (90/99)), whereas 2.7% (3/108) of the non-African students attended township schools. African teachers teaching at township schools would most likely model the African ways of thinking and behaviour which, as explained above, may emphasize conformity (Gauvain, 2001:11-19; Kozulin *et al.*, 2004:17; Mpofu *et al.*, 2006:463).

- *Culture to SocioAcc* (0.614) and *family factors to SocioAcc* (-0.250). Participants from culture 2 (non-African) came from more well-to-do families than those from culture 1, explaining the positive relationship between culture and socio-economic factors. The parents of participants from culture 2 were better schooled (Grade 11.9 and 11.4 for father and mother, respectively) than those from culture 1 whose parents had much lower schooling (Grade 7.5 and 8.3 for father and mother, respectively). School education in South Africa generally equals acculturation in a global (western) culture so that more years at school may be seen as a larger degree of acculturation in global culture. The participants, who were more well-to-do, were more likely to come from households with two parents. 79% (85/108) of culture 2 came from households with two parents and 47% (47/99) of the participants from African culture lived in a two-parent-household. Where parents had a higher education and where the household consisted of two parents, the family situation was generally less deprived. Isaksen *et al.* (2000) link availability of time, opportunities and resources to an atmosphere where creative thinking may be encouraged. This does not imply that rich people are more creative, simply that deprivation may be a limiting factor.

- *SocioAcc to type of school model* (-0.166). The better the socio-economic position (closer to 10) and the higher the parental education (closer to 13), the more likely it was that the participants attended previously model C schools (indicated with 1). (This relationship was much lower in the model than when regressed on independently probably due to the strong covariance between

culture, socioeconomic factors and acculturation and school model). The association between school model and creative thinking is discussed above.

- *FamFact to role model* (0.161). The less exposure there was to trauma such as loss of a parent, the more likely it was for the student to choose a role model closer to home (closer to 1). The general tendency shown by the trend line (in Figure 3) and indicated by the regression coefficients in the PLS model 1 (Figure 2) indicates that the closer to home the choice was, the higher the creativity indexes were. This relationship is more complex than that. As is shown in Table 3 and Figure 3, the participants who chose their father as role model had the highest creativity indexes, whereas those who chose political and other leaders as role models had the lowest creativity indexes. This finding supports the views of Gauvain (2001:11-19), Peterson *et al.* (2003), Kozulin *et al.* (2004:17) and Simonton (2005) who argue that the stimulating presence of a relative can have a positive effect on creative thinking.

In Table 3, the relationship between choice of role model and creativity index is shown and Figure 3 represents these data graphically.

Table 3 Choice of role model related to creativity index

Role model	Level of exposure and intimacy of relationship decreases → → →						N
	Self or No-one	Mother	Father	Teacher	Celebrity	Leader	
Numerical value	0	1	2	3	4	5	
Creativity index	59.7	59.7	63.3	59	59.5	57.8	
N	19	89	31	15	36	17	207

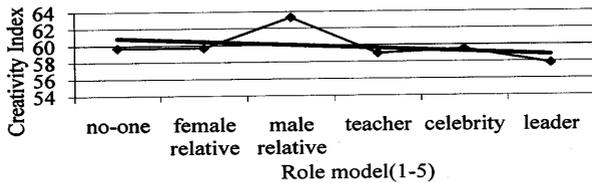


Figure 3 The relationship between choice of role model and creativity index

In Figure 4, the choices of participants who tested very low in the ATTA (creativity level 1) are compared with those of participants who obtained above average (4 and above).

	self/ no-one	female relative	male relative	teacher	celebrity	leader
Creativity level 1	10.7%	39.3%	7.1%	10.7%	21.4%	10.7%
Creativity level 4-7	11.9%	40.5%	23.8%	4.8%	14.3%	4.8%

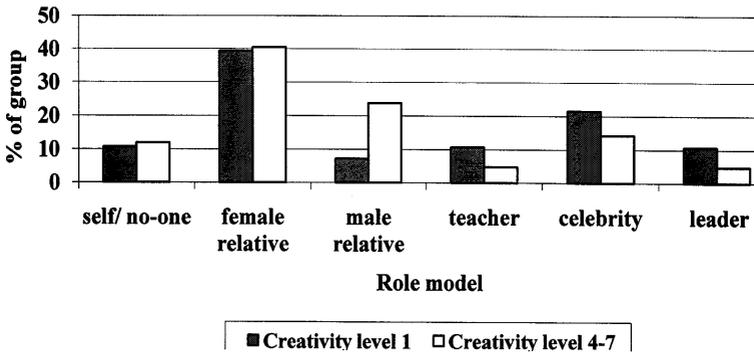


Figure 4 Comparison of choices for role models in participants who tested on creativity level 1 in the pre-programme ATTA with those who obtained 4 and above

Although these are weak relationships, both these graphs, Figure 3 and Figure 4, may point to the important role of the involvement of the parents as a contributor to the development of creative thinking (possibly through mediation and modelling of creative thinking patterns) (Gauvain, 2001: 11-19; Kozulin *et al.*, 2004:17).

After observing the relationships between role models and creative thinking as described above, we left the choice of female relative and no-one out of the model and select only the cases ($N = 99$) who chose male family members (2), teachers (3), celebrities (4) and public figures (5) for model 2 (Figure 4). With this selection of data the null hypothesis H_0^2 , namely, the relationships among the contextual factors and creativity indexes and creative thinking abilities were investigated. The contextual factors were school model (*SchoolMod*), role model (*RoleMod*) and the micro-contextual factors modelled as part of the construct family factors in model 1, namely, trauma (*FamTrau*), family size (*FamSize*) and a personal factor, position in family (*PosFamI*). The final model 2 (Figure 5), after heavy trimming of the original concept, explained

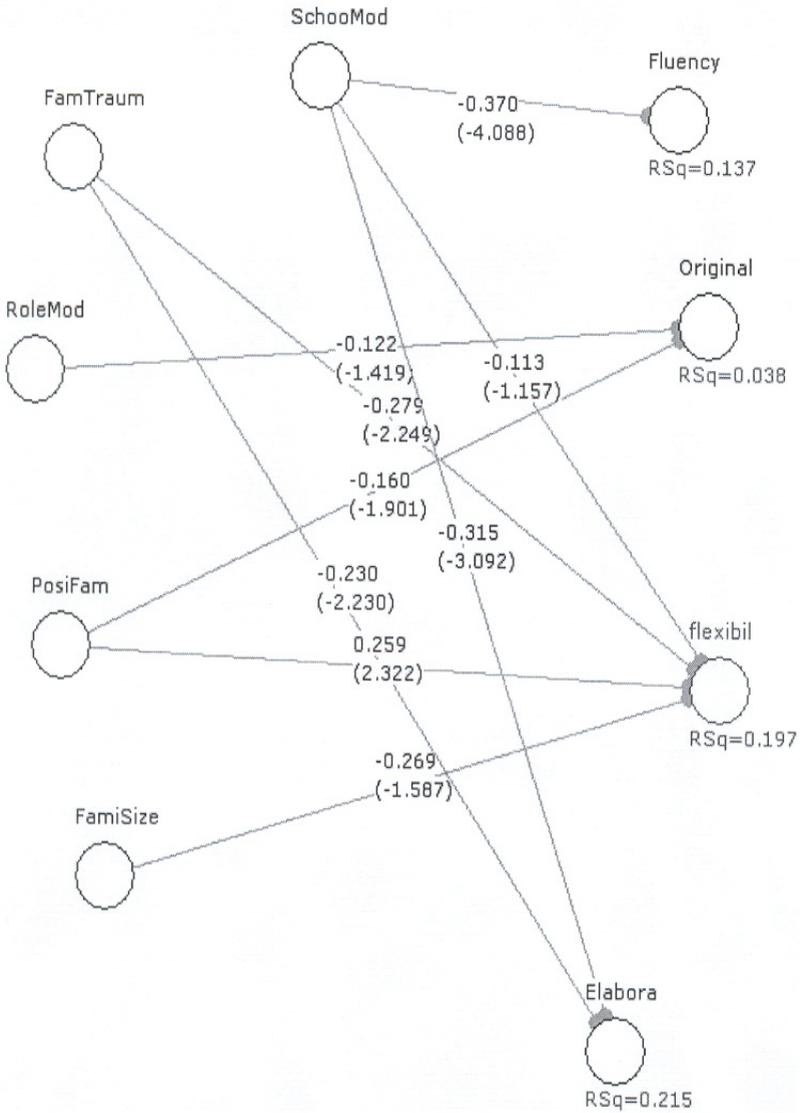


Figure 5 Model 2: Path model to explore the role of micro factors (like choice of role models, family trauma, family size, position in the family, and school model) in the development of creative abilities ($N = 99$)

13.7% ($R^2 = 0.137$) of the variance in fluency, 3.8% of the variance in originality, 21.5% of the variance in elaboration and 19.7% in the variance in flexibility.

Position in the family affected flexibility positively and significantly (0.259) with a medium effect (Cohen in Howie, 2002:99), meaning that the later-born children in the family showed greater flexibility than the older children. Earlier born children showed higher levels of originality ($-0.160 = \text{small}$). School model (*SchooMod*) had negative relationships with, respectively, flexibility ($-0.113 = \text{small}$), elaboration ($-0.315 = \text{medium}$) and, especially, fluency ($-0.370 = \text{medium}$) with participants from previously model-C schools showing higher competence. Family size related negatively ($-0.269 = \text{small}$) to flexibility. It means that children from smaller families were more competent in viewing situations from different perspectives. The absence of family trauma contributed significantly to flexibility ($-0.279 = \text{small}$) and elaboration ($-0.230 = \text{small}$). Originality was the only creative process skill that related with a path coefficient of more than 0.1 to role model, ($-0.122 = \text{small}$). Choosing a male relative, mainly the father, related weakly to originality.

Adequate exposure to creative role models, mentors or networks is seen as stimulating creativity (Amabile, 1996:179-202). Simonton (1988:412) distinguishes two roles for role models: impersonal "paragons" and personal mentors. Paragons (like celebrities and public leaders) are admired at a distance. One sees the result of their day-to-day thinking processes in the press and media, but not the intimate process in progress. Personal "mentors" are involved in a more direct fashion and their thinking and habits are closely observed. In the life of the developing child, these intimate interactions (like with a father) and support may be factors that make a difference.

t test values of larger than 1.68, obtained by the bootstrap method (with 100 re-samplings) and indicated in brackets below the path coefficients in model 2, showed that all the paths were significant on $p = 0.05$, except for the paths between role model and originality (-1.419 and family size and flexibility (-1.587) which were significant on $p = 0.1$ level (requiring a value of 1.281). The relationship between school model and originality (t value = 1.157) was significant only on a 0.25 level.

Were there then no relationships (direct or indirect) between contextual factors and creative thinking as proposed in the null hypothesis H_0^1 ? Strong relationships were shown between some contextual factors (such as school model and culture) and creativity index. Other contextual factors (role model, family factors and *SocioAcc*) seem to interact with one another in such a way that they also influence the creativity index. The null hypothesis H_0^1 , may therefore be rejected and the alternative hypothesis H_a^1 , accepted. Contextual factors do influence creative thinking directly and indirectly.

The null hypothesis H_0^2 could also be rejected. Not all contextual factors affect the different creative thinking abilities equally. Some creative thinking abilities are related to the absence of trauma (elaboration and flexibility), the father or other male family member standing out as a role model rather than a paragon (originality), smaller family size and later position in the family (flexibility). Being a first or earlier born sibling gives a small but significant

advantage regarding originality. School model attended seems to affect fluency and elaboration skills significantly. The alternative hypothesis H_a^2 was therefore accepted.

Conclusions

Although this study was only a pilot study, restricted to a particular context and limited to a small number of prospective teachers, important findings can be derived that could be followed up in more extensive research projects. In answering the research question, the data revealed that contextual factors do impact on creative thinking abilities. Contextual factors such as culture, school-models attended; socio-economic factors and acculturation of parents had significant paths leading to creative thinking indexes. Culture may influence creative thinking because of the difference in emphasis on individuality or conformity. The type of school attended may affect creative thinking as a result of the degree of challenge that is provided, as well as the modelling of specific ways of thinking.

Contextual factors influence creative thinking abilities differently. Family factors such as trauma (that often leads to the absence of a father) and large family size (that may lead to lack of resources) may influence creative thinking. The absence of a father figure may remove the intimate father and child dyad and entice children rather to choose paragons as role models. With the presence of a father in the family comes exposure to a larger variety of models that could be observed closely. The father's presence also brings better socio-economic conditions that usually result in availability of experiences and stimulating resources. The flexibility observed in later-born children may be due to a stimulating effect of older siblings.

There is a definitive need and ample opportunities for developing creative thinking in teachers in South Africa specifically. This study indicated that contextual factors do impact on the development of creative thinking abilities of the prospective teachers who took part in the study and that creative thinking skills need to be developed to empower these teachers in order to comply with the Norms and Standards for Educators and the Critical Outcomes of the NCS.

Kozulin and Presseisen (1995) emphasize that not all cultures support all cognitive processes equally. This study supports this observation. The cognitive processes involve in creative thinking need to be developed and modelled intentionally and explicitly in all South African prospective teachers because of identified lower functioning in this regard. The need is most pressing in the case of cultural groups where creative thinking is not encouraged and/or even inhibited in their primary culture. The development of creative thinking skills should not only focus on teaching cognitive skills, but especially also deal with cultural biases linked to the development of creative thinking abilities. Feuerstein (in Kozulin & Presseisen, 1995:67-68) stresses the importance of intentional mediation in developing higher cognitive functions such as the development of creative thinking. Challenging learning environments with appropriate support are crucial in this regard (Hüther, 2006:332-338). Support can be given in the form of mentorship (implying an encouraging inter-

active relationship, actively promoting creative development and the exposure of the product to the world (Bronfenbrenner, 1979:5-6) and Guimera, Uzzi, Spiro and Amaral (2005:697-702)) and/or in the form of modelling, where cognitive processes of diverse “models” are observed and amalgamated in unique ways (Bandura, 1977:12-23; 48).

In supporting the development of creative thinking abilities within an academic domain, challenge, intentional mediation of and mentoring and modelling creative thinking abilities are essential elements. The context determines the available resources, and the type of education and through these, the models to which an individual will be exposed. We argue that creative thinking should not only be associated with a certain amount (high creativity) or group of people. Everyone has the potential to be a creative thinker. The key component to stimulate creative thinking lies in motivating the “inner spark” as indicated by Amabile (1996:14).

Creative thinking is universal and human and can be developed through formal education (McWilliam & Dawson, 2008:456; 635). Lecturers involved in teacher training must therefore be aware of the demands for creative thinking within the school curriculum and accept the challenge to nurture the creative thinking abilities of students. They must not assume that students will be able to meet these demands automatically. They must tacitly and explicitly encourage creative thinking through modelling, creating contexts in which creative expression is encouraged and by providing opportunities which require students to put elements together or reorganize elements into new patterns, structures or coherent or functional wholes (*cf.* Lombard & Grosser, 2008:576). This may be done by encouraging students to, for example, avoid premature closure by producing different possible ideas for solving problems (or compiling hypotheses, models and interpretations of information, and so forth), to value originality, to elaborate on their ideas and to look at situations from different viewpoints.

References

- Amabile TM 1996. *Creativity in context*. Boulder, Colorado: Westview Press.
- Anderson L & Krathwohl D (eds) 2001. *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Boston, MA: Longman <http://www.scribd.com/doc/933640/Bloom-Revised> Date of access December 2007.
- Arends RI 2009. *Learning to teach*, 8th edn. Boston: McGraw Hill.
- Bandura A 1977. *The social learning theory*. New Jersey: Prentice-Hall.
- Bandura A 1986. *Social Foundations of thought and action. A social cognitive theory*. New Jersey: Prentice-Hall.
- Beck C & Kosnik C 2006. *Innovations in teacher education*. Albany: State University of New York Press.
- Boughey C 2006. Academic study as a social practice. In: Sutherland P & Crowther J, *Lifelong learning*. London: Routledge.
- Bronfenbrenner U 1979. *The ecology of human development*. Massachusetts: Harvard University Press.
- Chin WW 2000. *Partial Least Squares for researchers: An overview and presentation of recent advances using the PLS approach*. <http://disc-nt.cba.uh.edu/chin/indx.html>. Date of access 11 January 2007.

- Chisholm L 2000. *A South African Curriculum for the 21st century: Report of the review committee on curriculum 2005*. Pretoria: Department of Education.
- Coiro J, Knober M, Lankshear C & Leu DJ 2008. Central issues in new literacy's and new literacy research. In: Coiro J, Knober M, Lankshear C & Leu DJ (eds). *Handbook of new literacy research*. New York: Lawrence Erlbaum Associates.
- Cox BD 1997. The rediscovery of the active learner in adaptive contexts: A developmental-historical analysis of transfer of training. *Educational psychologist*, 32:41-55.
- Craft A 2005. *Creativity in schools*. Oxon: Routledge Publishers.
- Csikszentmihalyi M 1988. *Society, culture, and person: a systems view of creativity. The nature of creativity*. Cambridge: Cambridge University Press.
- Csikszentmihalyi M 1994. *The evolving self*. New York: Harper Collins Publishers. Department of Education see South Africa. Department of South Africa.
- Ekvall G 1996. Organizational climate for creativity and innovation. In: Puccio GJ & Murdock MC. *Creativity assessment, readings and resources*. New York: Creative Education Foundation.
- Fu JL 2006. *Visual-PLS*. <http://www2.kuas.edu.tw/prof/fred/vpls> Date of access: January-February 2007.
- Gauvain M 2001. *The social context of cognitive development*. London: The Guilford Press.
- Gefen D & Straub D 2005. *A practical guide to factorial validity using PLS-graph: Tutorial and annotated example*. www.pubinfo.vcu.edu/carma/Documents/OCT1405/GefenStraub.hubona.pdf Date of access: 10 January 2007.
- Goff K & Torrance EP 2002. *Abbreviated Torrance Tests for Adults Manual*. Bensenville: Scholastic Testing Service.
- Lombard BJJ & Grosser MM 2008. Critical thinking: are the ideals of OBE failing us or are we failing OBE? *South African journal of education*, 28:561-579.
- Lombard BJJ & Grosser MM 2004. Critical thinking abilities among prospective educators: ideals versus realities. *South African journal of education*, 24:212-216.
- Guilford JP 1958. Can creativity be developed? *Art education*, 11:3-7.
- Guimera R, Uzzi B, Spiro J & Amaral LAN 2005. Team assembly mechanisms determine collaborative network structure and team performance. *Science*: 308. <http://amaral.northwestern.edu/Publications/Papers/Guimera-2005-Science-308-697.pdf> Date of access: 6 May 2007.
- Hong Y, Morris MW, Chiu C & Benet-Martinez V 2000. Multicultural minds: A dynamic constructivist approach to culture and cognition. *American psychologist*, 55:709-720.
- Howie S 2002. English language proficiency and contextual factors influencing Mathematics achievement of secondary school pupils in South Africa. PhD thesis. Enschede: University of Twente.
- Hunter ST, Bedell KE & Mumford MD 2007. Climate for creativity: A quantitative review. *Creativity research journal*, 19:69-90.
- Hüther G 2006. Neurobiological approaches to a better understanding of human nature and human values. *The journal for transdisciplinary research in Southern Africa*, 2:331-343.
- Isaksen SG, Dorval KB & Treffinger DJ 2000. *Creative approaches to problem-solving: a framework for change*. Creative Problem-solving Group, Buffalo.
- Jordan ZP 2007. Speech by the Minister of Arts and Culture Dr Pallo Jordan at a launch of African Literature Project at Adam's College Kwa Zulu Natal. <http://www.info.gov.za/speeches/2007/07110815451004.htm> Date of access 31 July 2008.
- Kennedy P 2002. *Oh no! I got the wrong sign! What should I do?*

- <http://www.stat.columbia.edu> Date of access 18 March 2007.
- Kim KH 2006. Can we trust creativity tests? A review of the Torrance Tests of Creative Testing (TTTC). *Creativity research journal*, 18:3-14.
- Kirsten T & Viljoen C 2004. Siek vir skool. *Beeld*, September, 9:14.
- Kottak CP 2005. *Windows on humanity*. New York: McGraw Hill.
- Kozulin A, Feuerstein R & Feuerstein R 2001. *Mediated learning experience paradigm in teacher training*. http://vcisrael.macam.ac.il/site/eng/show_file. Date of access 9 August 2006.
- Kozulin, A Gindis B, Ageyev VS & Miller SM 2004. *Vygotsky's Educational Theory in Cultural Context*. Cambridge: Cambridge University Press.
- Kozulin A & Presseisen BZ 1995. Mediated learning experience and psychological tools: Vygotsky's and Feuerstein's perspectives in a study of student learning. *Educational psychologist*, 30:67-75.
- Lassiter JE 1999. *African culture and personality: Bad social science, effective social activism, or a call to reinvent ethnology?* <http://web.africa.ufl.edu/asq/v3/v3i2a1> Date of access 19 September 2005.
- Leedy PD & Ormrod JE 2005. *Practical research, planning and design*. New Jersey: Pearson Educational International.
- Maree JG & Van der Westhuizen C 2007. Developing a research proposal. In: Maree JG (ed.). *First steps in research*. Pretoria: Van Schaik.
- Mbigi L 1997. *Ubuntu. The African Dream in Management*. Pretoria: Sigma Press.
- McCann M 2005. International perspectives on giftedness: experimental and cultural observations of IQ and creativity with implications for curriculum and policy design. *International education journal*, 6:125-135.
- McCracken JL 1997. Women who invent: examining the impact of formal and informal education on their creativity. PhD Thesis. Oklahoma: Oklahoma State University.
- McGonigal K 2005. *Teaching for transformation: from learning theory to teaching strategies*. <http://ctl.stanford.edu/Newsletter> Date of access 3 February 2010.
- McWilliam E & Dawson S 2008. Teaching for creativity: towards sustainable and replicable pedagogical practice. *Higher education*, 56:633-643.
- Memmi A 1991. *The colonizer and the colonized*. Boston: Beacon Press.
- Mpofu E, Myambo K, Mogaji AA, Mashego T-A & Khaleefa OH 2006. African perspectives on creativity. In: Kaufman JC & Sternberg RJ (eds). *The international handbook of creativity*. Cambridge: Cambridge University Press.
- Mwamwenda TS 1995. *Educational psychology: An African perspective*. Durban: Butterworths Publishers.
- Nisbett RE & Norenzayan A 2002. Culture and cognition. In: Medin DL (ed.). *Stevens' Handbook of experimental psychology*. 3rd edn. New York: Wiley & Sons Inc.
- Nisbett RE Peng K Choi I & Norenzayan A 2001. Culture and Systems of Thought: Holistic versus Analytic Cognition. *Psychological Review*, 108:291-310.
- Nolan V 2004. Creativity: the antidote to the argument culture. In: Fryer M (ed.). *Creativity and cultural diversity*. Leeds: The Creativity Centre Educational Trust.
- Papalia DE, Wendkos OD & Feldman R 2008. *A child's world. Infancy through adolescence*. 11th edn. Boston: McGraw Hill.
- Peterson J, Carson S & Higgins D 2003. *Biological basis for creativity linked to mental illness*. <http://www.sciencedaily.com/releases/2003/10/031001061055.htm> Date of access 1 November 2005.
- Pink DH 2005. *A Whole New Mind: Moving from the information age into the conceptual age*. New York: Allen & Unwin.
- Rothstein R 2000. *When culture affects how we learn*. <http://www.asianam.org>.

Date of access 18 June 2008.

- Rudowicz E 2003. Creativity and culture: A two-way interaction. *Scandinavian journal of educational research*, 47:4.
- Runco MA, Dow G & WR Smith WR 2006. Information, experience, and divergent thinking :an empirical test. *Creativity research journal*, 18:269-277.
- Sak U & Maker CJ 2006. Developmental variation in Children's creative mathematical thinking as a function of schooling, age and knowledge. *Creativity research journal*, 18:279-291.
- Schunk DH 2004. *Learning theories. An educational perspective*. Pearson: Merrill Prentice Hall.
- Shi J 2004. Intelligence current in creative activities. *High ability studies*, 15:173-187.
- Simonton DK 1988. Creativity, leadership and chance. In: Sternberg RJ (ed.). *The nature of creativity*. Cambridge: Cambridge University Press.
- Simonton DK 2005. Are genius and madness related? Contemporary answers to an ancient question. *Psychiatric times*, 22.
<http://www.psychiatrtimes.com/showArticle.jhtml> Date of access 15 June 2005.
- Slavin RE 2003. *Educational psychology: theory and practice*. Boston: Longmans.
- South Africa 1996. *National Education Policy Act 27 of 1996*. Pretoria: Government Printer.
- South Africa Department of Education 2000. *Norms and Standards for Teacher Education. Government Gazette*, 20844:15 -21. Pretoria: Government Printer.
- South Africa Department of Education 2002. *Revised National Curriculum Statement for Gr. R-9. Technology*. Pretoria: Department of Education.
- South Africa Department of Education 2009. *Report of the Task Team for the Review of the Implementation of the National Curriculum Statement*. Pretoria: Department of Education.
- Taylor N & Vinjevold P 1999. *Getting learning right. Report of the President's Initiative Project*. University of the Witwatersrand: The Joint Education Trust.
- Temme D, Kreis H & Hildebrandt L 2006. *PLS Path-modelling- A Software Review*.
<http://sfb649.wiwi.hu-berlin.de/papers/pdf/SFB649DP2006-084.pdf> Date of access 1 January 2007.
- Thorpe SA 1996. *African traditional religions. An introduction*. Pretoria: University of South Africa.
- Tobias RD 1997. *An introduction to partial least squares regression*. Cary, NC: SAS Institute. Explains PLS using a chemometric example. Appendices detail SAS PROC PLS commands and parameters. <http://ftp.sas.com/techsup/download/technote/ts509.pdf> Date of access 20 February 2007.
- Torrance EP 1974. *Norms-Technical manual: Torrance tests of creative thinking*. Bensenville, IL: Scholastic Testing Service.
- Tshikuku K 2001. Culture, entrepreneurship and development in Africa. *International conference on the cultural approach to development in Africa*. Dakar: Senegal University.
- Van der Walt BJ 2003. *Understanding and rebuilding Africa. From desperation today to expectation for tomorrow*. Potchefstroom: Institute for Contemporary Christianity in Africa. Potchefstroom.
- Vygotsky LS 1978. *Mind in society. The development of higher mental processes*. Cambridge, MA: Harvard University Press.
- Wechsler S 2006. Validity of the Torrance Tests of creative thinking to the Brazilian culture. *Creativity research journal*, 18:15-25.
- Weisberg RW 1999 . Creativity and Knowledge: A Challenge to Theories. In: Sternberg RJ (ed.). *Handbook of creativity*. Cambridge: Cambridge University

Press.

Wilson LO 2006. *Beyond Bloom - A new Version of the Cognitive Taxonomy*.

<http://www.uwsp.edu/education/lwilson/curric/newtaxonomy.htm> Date of access 1 February 2010.

Wonacott ME 2002. Gold collar workers. *ERIC Digest No. 234*.

<http://www.calpro-online.org/ERIC/docgen.asp?tbl=digests&ID=119> Date of access 12 December 2006.

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