Playing Dice With Students' Creativity?

Abstract

Should students' creativity be nurtured or squashed on account of a creative or uncreative teacher one gets allocated in school? Rhodes (1961) articulated four aspects of creativity, namely: the creative person, creative thinking processes, creative environment and the creative product. The purposes of this paper are two-folds: it presents how the development of students' creativity can be left to the luck of the draw if action is not taken about teachers' creativity education and proposes creativity education to be a compulsory strand in student teachers' education as a matter of urgency. This paper also suggests an approach to creativity education based on an ecological framework of creativity (Rhodes, 1961; Isaksen, Puccio & Treffinger, 1993) which should take into account of the local culture or context.

A survey was conducted with 128 undergraduate students from a teachers training college of a large private university in Indonesia. What do these future teachers think creativity is? Do these future teachers believe they are creative? What blocks their creative thinking? Do they think it's important for their students to be creative? If so, how would they teach their students to be creative? Results indicate that these teachers-to-be will not be ready to support or develop students' creativity and insufficiently equipped to implement their ideas of developing creative potential without further creativity education. In short, there is an 'interface gap' (Tan, 2004, p.278) between what is desired or deemed important by the teachers-in-training and their knowledge and know-how in helping future students tap into their individual creative potential.

As a matter of urgency, policy makers and administrators of teacher training organizations should consider creativity education to be made compulsory for student teachers. Arguably, this is a better option than leaving the development of creative potential to chance.

Introduction

For the purpose of this paper, creativity is defined to be the ability to solve new problems effectively and ethically. The premise of this paper is that creativity is important and necessary for a progressive workforce and that teachers need to play a role in igniting and flaming students' creativity, lest it dies out to become cinders.

Given that increasing attention and importance are given to creativity as an essential skill for a progressive workforce, the lack of attention given to the creativity education of student teachers indicates either the lagging of policy making to address the need for creativity education or the assumption that teachers are ready and equipped to teach creativity in the absence of deliberate efforts to prepare them to do so. However, creative development is complex and non-linear as has been documented by Torrance's (1963) research[1] and influenced by personal and environmental factors (Amabile, 1996; Cropley, 2001; Davis, 2004; Houtz, 2003; MacKinnon, 1978; Miller, 2002). The author would like to argue that continuing such a laissez-faire approach in the development of creative potential during the school years is neglectful on the part of policy makers.

Research has shown that creativity can be taught (Firestien & Lunken, 1993; Parnes & Noller, 1972; Rose & Lin, 1984; Scott, Leritz & Mumford, 2004), and that creativity training can be effective (Parnes & Noller, 1972; Rose & Lin,1984). However, research in the teaching and learning of creativity conducted in the Indonesian environment is limited. Man, Susanti and Indrajaya (2007) investigated the effectiveness of teaching Creative Problem Solving to design students in higher education in Indonesia and found that a majority of the students had blocks to creativity before attending creativity training and most students benefitted from the training. The study suggested that there was the need for students to identify their blocks to creativity, equip students with strategies to overcome their blocks, and address the issues of students' self-confidence and fear to make decisions in addition to the need for sustained enforcement and encouragement in their creative thinking.

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[1] 'dips' in creative thinking ability in students have been found at the ages of five, nine, thirteen and seventeen; the delicne in creative thinking ability at age nine being better known as the *fourth grade slump.*

In the absence of creativity education in teacher preparation courses, a study was undertaken with two aims: (a) to investigate the readiness of student teachers to teach creativity and (b) to initiate a discourse on how the issue of teacher readiness to teach creativity can be addressed in the short and long term. It is only by settling and addressing this issue that policy makers begin to take control of the situation and not leave the development of students' creativity to chance.

Method

The study involved a group of 128 undergraduate students who had just completed the first year of their bachelors degree course from a teacher training college (the "student teachers") affiliated to a large private university in the suburbs of Jakarta, Indonesia. The students were being trained to teach a range of subjects (see Appendix A).

The student teachers were divided into 3 groups by the college's administration department and each group was led by one experienced instructor external to the university. A 3 hour training session was designed which included 3 parts, namely: pre-training survey, teaching of creative thinking, post-training survey (see Appendix B).

To investigate teacher readiness in teaching creativity, pre and post-training surveys were administered to examine participants' (a) perceptions about creativity, (b) their attitude towards it as teachers, intended teaching strategies to teach creativity (if any), (c) their awareness and beliefs about their own creativtiy and (d) blocks to their creativity and (e) the presence of basic knowledge about creative thinking principles.

To investigate whether individual or stand-alone creativity workshops might have a role as a stop-gap measure to address the issue of a lack of teacher readiness to teach creativity while, a post-training survey included questions about the influence of training and the benefits gained by the student teachers from the training, the learning that was deemed to be most important and further ideas for teaching strategies to teach creativity to future students. The Creative Problem Solving (CPS) method (Isaksen, Dorval & Treffinger, 1994; Osborn, 2001) was chosen as a method to teach creative thinking (see Appendix C).

Results

Perceptions About Creativity

Participants defined and associated creativity with a range of reponses, (product process, personality traits, well-being, social acceptance). To note is that 22% of the respondents associated creativity with talent, eminence, wisdom or a God given gift. Furthermore, 59% of the respondents agreed with the statement 'Creativity requires talent'. [2]

Attitude Towards Creativity as Teachers and Intended Strategies to Teach Creativity

98% of the participants believed that it was important for their students to be creative or more creative and this high level attached to the importance of students' creativity was similar before and after training. The teaching strategies that the student teachers intended to employ became more specific after the workshop with the strategies mentioned highly related to what they themselves had learnt about creative thinking from the workshop (see Figures 1 and 2 below and Appendix D).
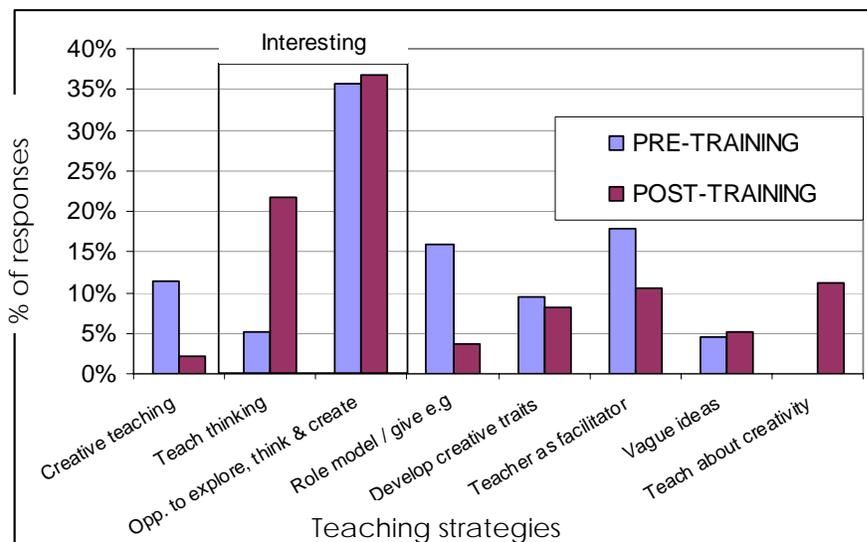

Figure 1. Comparison of pre and post-training responses to teaching strategies to teach creativity. Details of *Teaching thinking* can be found in Figure 2.

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[2]   9% highly agreed with the statement, 29% agreed with the statement, 21% somewhat agreed with the statement.
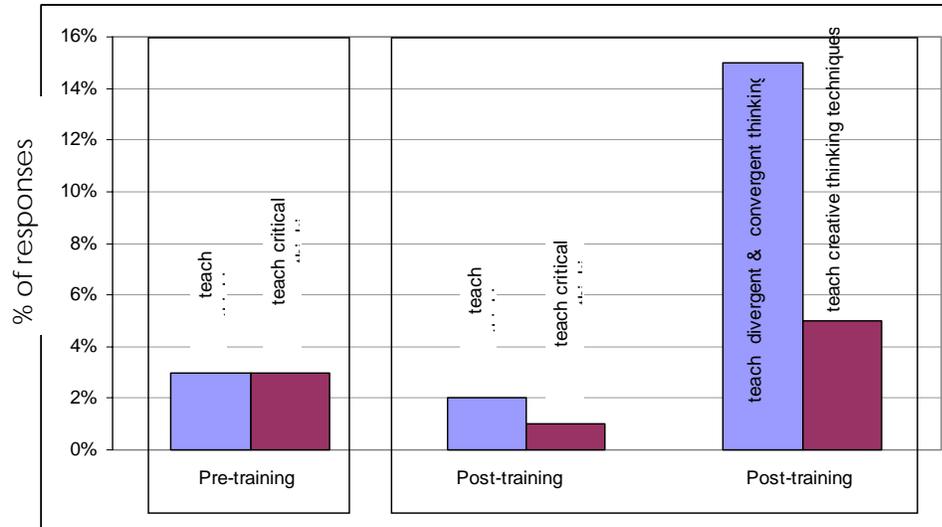
Figure 2 . Comparison of pre and post-training responses in how to teach thinking as a teaching strategy to teach creativity.

Awareness and Beliefs About Personal Creativity

Pre-training, 59% of the 128 participants believed they were creative. 31% of the participants believed they were not creative with a further 9% unsure of their own creativeness. 91% of all participants thought they can be more creative. When asked post-training whether they believed they could be more creative, 95% of those who already thought they were creative responded positively.

Blocks to Creativity

Almost half of the participants (48%) experienced blocks to creativity and were aware of them before training. In total, training helped 64% of the participants gain heightened awareness of their blocks to creativity. The biggest blocks to creativity among this group of student teachers were affective in nature (lack of self-confidence and courage to take risk, laziness, lack of patience, persistence and curiosity, lack of open-mindedness) followed by cognitive blocks e.g. narrowness of thinking (details in Appendix E).
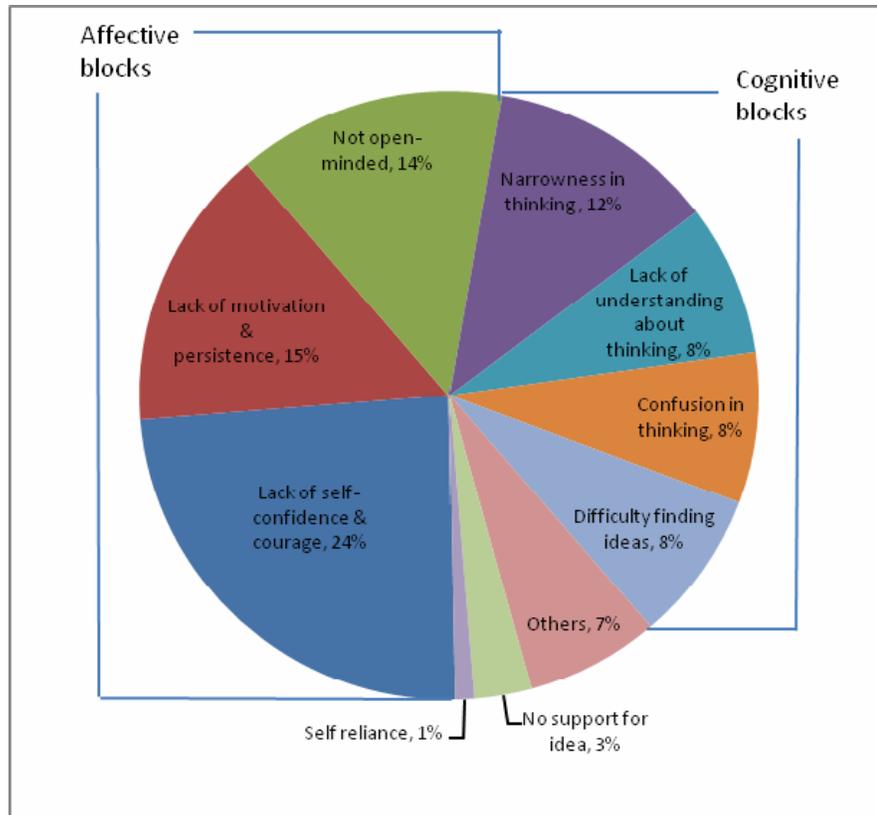
Figure 3. Nature of blocks to creativity among student teachers.

Presence of Basic Knowledge About Creative Thinking

Divergent and convergent thinking can be considered to be the fundamentals of creative thinking[3] (Isaken, 1987). Only 9% of the participants knew about divergent and convergent thinking.

Influence of Training and Benefits Gained

Almost all participants benefitted from the training (91%). 50% of the benefits was related to thinking and 33% related to attitude change.

Most Important Learning from Training

Of the 88% who responded to the question of what the most important learning from training were, 66% indicated learning about thinking as the most important learning and 16%

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[3] Guilford distinguished between divergent thinking and convergent thinking in the 1950s (Runco, 1999) and a balance of the two types of thinking have been argued to form the crux of creative thinking (Guilford, 1977) and indeed the UK's National Advisory Committee on Creative and Cultural Education Report (1999) stated that: "Helping young people to understand and manage the interaction between generative and evaluative thinking is a pivotal task of creative education." (p.33).

in attitude change. A small proportion thought they became more creative due to training and mentioned this to be most important learning from the workshop.

Discussion

Readiness to Teach Creativity

Perception and attitude about creativity.

Concerning factors are the association of creativity with talent, eminence, wisdom or a God given gift and the belief that *Creativity requires talent*. Implicit in these perceptions is that creativity cannot be taught or learned and that these future teachers may not see a role in themselves in teaching creativity to their 'untalented' students.

Teachers as creative individuals.

Teachers need to believe that they are creative and to be creative in order to be positive creative role models to their students and to be creative in their teaching. Given that 40% of the total participants did not have a positive perception of themselves as creative individuals coupled with the high proportion of affective blocks to creativity with a seemingly under-awareness of them, it would benefit these student teachers to establish a positive perception of themselves as creative individuals by first helping them become aware of their blocks to creativity and then to help them overcome their blocks.

Knowledge about creativity and know-how in how to teach it.

In light of a seemingly lack of basic knowledge about creativity, there appears to be a need to deliberately teach creativity to student teachers to equip them with the vocabulary, knowledge and know-how to teach their students creativity. We can infer the benefit of doing this from how participants said they would teach creativity pre and post-training in the above Results section *Attitude Towards Creativity as Teachers and Intended Strategies to Teach Creativity.*

Conclusion: lack of readiness to teach creativity.

The group of student teachers is not ready to teach creativity with their existing beliefs about creativity, creative abilities and knowledge about creativity. In summary, there is an 'interface gap' (Tan, 2004, p.278) between what is desired or deemed important by the teachers-in-training and their knowledge and know-how in helping future students tap into their individual creative potential. On a positive note, almost of all the student teachers in this

group believe creativity is important and should be developed in their students and this forms a good basis to teach creativity to these student teachers.

Addressing the Lack of Readiness to Teach Creativity

Short term solution: stop-gap measures - creativity workshops.

Analysis of the post-training responses indicate that training helped a majority of participants to believe that they can be more creative, helped some of them become more aware of their blocks to creativity, and equipped them with specific strategies (both cognitive and affective) to be more creative[4]. Thus, the group of student teachers seemed to have related to their new knowledge and experiences from the workshop to develop their personal creativity, be more specific in their intended teaching strategies and raised some awareness to the importance and development of certain affective traits both in students and teachers.

Long term solution: creativity education - Reflective-Ecological Approach.

Teachers need to have a conceptual or theoretical grounding in their knowledge of creativity, so they are equipped with a framework to focus teaching that purposefully develops students' creativity. In addition, teachers need to be equipped with some know-how in the form of specific strategies, tools and techniques in teaching creativity. An ecological approach to framing such creativity education is proposed. An ecological model of creativity draws on the dimensions of person, process, product and press as described by Rhodes (1961) to provide a holistic basis for how creativity can be conceptualized. Furthermore, it is a structure with which teachers can explore their own creativity (and hence *reflective)* before drawing on such an ecological approach in framing and designing teaching that develops their students' creativity. Arguably, this is a better option than leaving the development of creative potential to chance.

In the absence of a universal definition of creativity, it is argued that it would be preferable that a view of the creative forest is taken as opposed to a limited examination of and working with just one creative tree in the whole forest. An interactionist model of creative behavior was proposed by Woodman and Schoenfeldt (1993) which suggested a complex person-situation interaction in creative behaviours. Isaksen and his colleagues (Isaken, Stein, Hills and Gryskiewicz, 1999) referred to such an interactionist approach as an

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[4]   35% related to the use of divergent and convergent thinking, the main training contents, as a way to be more creative, 28% were affective responses which included being more open-minded, self-confident, risk taking, curious and being more collaborative with others, a reflection of an awareness of their blocks and having the need to overcome them.

Ecological Approach and proposed an ecological view for creativity research. As pointed out by Isaksen et al (1999), "the absence of an integrating conceptual framework has promoted an exaggerated image of confusion and contradiction (in the field of creativity)." (p.440). In a similar vein to Woodman and Schoenfeldt's (1993) model, Amabile's (1996) revised componential model of creativity emphasized the role of the environment, creative processes and an individual's motivation in creative output. The push for unification of the various aspects of creativity in the research and understanding of creativity highlight the fact that creativity is multi-faceted and should not be understood in a reductionist approach only, as was apparent in the student teachers' responses.

Rhode's (1961) four Ps model of creativity provides an encompassing view of creativity by suggesting that true creativity is a result of the interaction of the creative person, creative thinking process, creative press (environment) and creative product. Although this is by no means the only way to think about creativity, the model has the potential to trigger thinking on a holistic view of creativity. To truly develop creativity in oneself and in students, affective skills need to be developed as well as cognitive abilities and vice versa – and all this can only take place in a psychological and physical environment that support it. The aim of taking an ecological approach to teach creativity is not to have everyone arrive at the same definition and association of creativity, but rather to address the need for synthesis or consideration of how the various aspects of creativity might interact to prevent a narrow focus on one aspect of creativity due to a lack of knowledge of others. This can be detrimental to the teaching of creativity.

Within the breadth of the four Ps of creativity, each of the P can also be taken to deeper levels of understanding. It is here that student teachers can explore pertinent issues discussed in the creativity literature such as individual creative styles, various models of creative process, creative classroom environments and evaluation of creative products. It is proposed that student teachers use a reflective approach to explore the depth of the four Ps of creativity by using the ecological approach to first explore their own creativity before applying it to their teaching. There are two reasons for the suggestion of a reflective approach: (a) to help student teachers understand and develop their own creativity and (b) to prepare student teachers to be effective teachers of creativity.

Creative classrooms need creative teachers, so we need to ensure that student teachers' creativity is optimally developed. Ng (2004) proposed a model based on Rhode's (1961) four Ps of creativity to understand and hence create a creative climate for learning in the classroom (p.17). Ng's (2004) model positioned the teacher as the creative person in order to create a creative learning environment for students to engage in creative thinking (processes) that would result in creative products. The model assumes and rests on the following basis: teachers are already creative and therefore can immediately and confidently apply their knowledge of creativity to create a creative classroom environment for students and to engage students in creative thinking during learning.

Whilst the author agrees with Ng's model, there is a missing gap. Based on the findings from the study, it is clear that we cannot assume student teachers' creativeness and that they will be the creative teachers required in Ng's model. It is therefore proposed that the four Ps model is first used to teach student teachers about themselves as creative individuals: What are they like as creative people? (i.e. what are their areas of strengths and weaknesses, what are their blocks to creativity?) To what extent do the learning environments they are immersed in or have been immersed in support or discourage their creativity? What creative processes do they engage in when met with new problems and how can learning creative process models, tools and techniques augment their own creative processes? How would they rate their past and present outputs or achievements as creative? And more importantly: How has each of the four Ps interacted or influenced one another in their own creativity? Thus, an introspective approach by way of applying creativity knowledge for a thorough self-analysis and self-reflection not only deepens one's knowledge of creativity but also enables student teachers to apply their knowledge in creativity to develop themselves further as creative individuals - by gaining heightened awareness of their own creativity and what can be done to tap into it - in this way, student teachers are set on a path to independently draw upon their own creativity and, in doing so, they become positive creative role models to their future students.

To prepare student teachers to be effective teachers of creativity, we can help them extend their self-understanding of the implications of the 4Ps of creativity to others. Student teachers can further deepen their understanding of creativity by sharing the introspective thoughts of themselves as creative individuals with their fellow student teachers. This will

deepen their understanding of how individuals can differ in being creative. It is the author's opinion that once this level of understanding is gained, teachers become more adept at understanding their students as creative individuals and hence their learning needs.

Once student teachers are familiar with the ecological approach to creativity by self-reflection and application, and extending this understanding to others, they can then begin to think about how to base their future teaching of creativity on such an approach. That is, how to (a) develop creative traits in students (b) to set the creative environment and (c) to teach creative thinking processes within a school curriculum? Understanding the interaction of the four Ps at the classroom level and at the individual student level will enable teachers to make better teaching decisions especially when it comes to the unique demands of individual students. Thus, a *reflective-ecological* approach to creativity education (see Figure 4) in student teachers' education first introduces the various aspects of creativity to teachers, thus enabling students of creativity to explore the breadth of creativity and the synthesis of the various aspects. Secondly, it is used as a basis for student teachers to explore their own creativity and understand the creativity of others, thus exploring the depth of each aspect of the ecological framework of creativity and their synergetic effects on individuals. Having explored the breadth and depth of creativity, and gaining heightened awareness and understanding of themselves and others as creative beings, and how their own creative potential can be further developed, it is then that student teachers have a solid foundation to explore how to apply the ecological framework in their own teaching of creativity.

Teachers who are confident in their own creativity will be creative role models for their students, and be able to model and teach creative thinking processes to their students that could result in creative products within the context of specific school curricula. In doing so, they will also be able to deliberately build a creative learning environment for their students, especially one that meets the individual needs of students – and here is where we arrive at Ng's (2004) model - where we have creative teachers who are actually capable of building a creative climate for learning in the classroom.
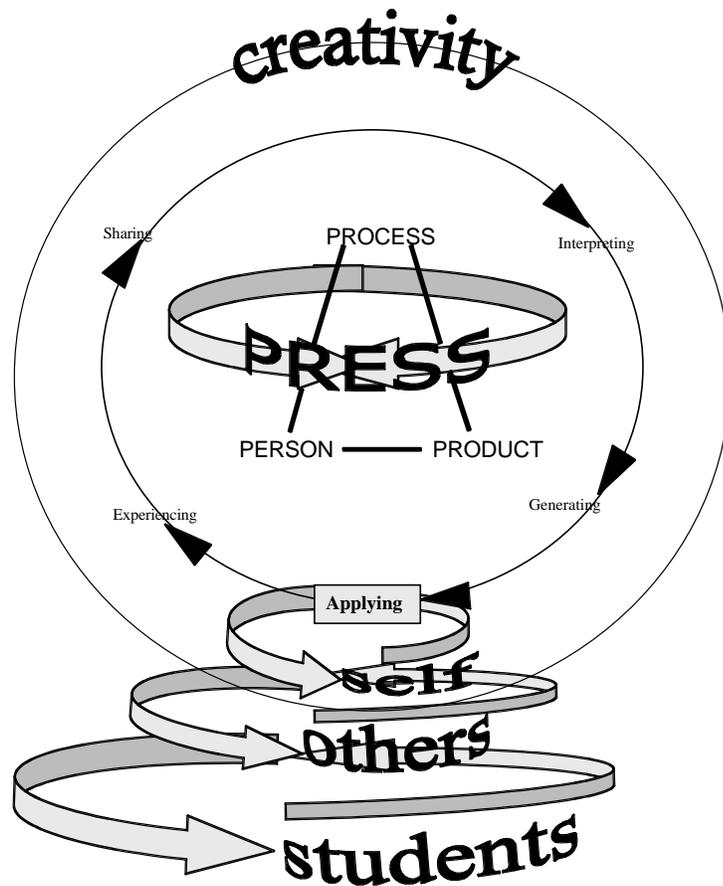
Note. Based on the Experiential Learning Cycle (Gaw, 1979).

Figure 4. Reflective-Ecological Approach to Creativity Education for Teachers

Short term solution: stop-gap measures - creativity workshops.

Policies take time to make and implement. Curricula take time to change. In the meantime, while the longer term creativity education of student teachers are being debated and considered, should we leave students' creative development to the luck of the draw of whom one gets allocated as a teacher – remembering the 40% of the student teachers surveyed who did not believe they were creative?

Meanwhile, it is suggested that the gap in creativity education be filled by short term training in creativity using a reflective-ecological approach. Analysis of the post-training responses indicate that training helped a majority of participants to believe that they can be more creative, helped some of them become more aware of their blocks to creativity, and

equipped them with specific strategies (both cognitive and affective) to be more creative[5]. Thus, the group of student teachers seemed to have related to their new knowledge and experiences from the workshop to develop their personal creativity.

The same can also be said of the post-training responses to the question: How would you teach creativity to your students? Training appeared to have enabled the student teachers to be more specific in their intended teaching strategies and raised some awareness to the importance and development of certain affective traits both in students and teachers, as evidenced by the fact that 61% of the post-training responses to teaching strategies were new and almost a third of the responses generated were specific to workshop contents[6] (equivalent to half of the new responses). Another third of the responses appeared to be based on the participants' personal experiences from the activities of the workshop - such as giving students opportunities to ask questions, to play, to express their own ideas with a need to have a risk taking spirit and the self-confidence to do so, teaching students to be more open-minded and teachers themselves needing to be more open-minded to students' ideas.
As stated above, one can only teach what one knows. It is suggested here that in the absence of comprehensive creativity education for student teachers, the gap be filled by short term training in creativity using a similar reflective-ecological approach as proposed in the discussion section *Long term solution: creativity education - Reflective-Ecological Approach*. That is, short experiential workshops focused on specific aspects of creativity that enable participants to first understand how the contents relate to themselves as creative individuals before proceeding to consider how the contents might apply to their teaching, What may also be useful, as discussed in the section below Cultural / Contextual Issues in Teaching Creativity is a needs analaysis of student teachers by surveying the blocks to creativity and creative thinking needs so that such needs can be catered for in stand-alone training modules.

Cultural and Contextual Issues in Teaching Creativity

Affective blocks to creativity.

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[5]   35% related to the use of divergent and convergent thinking, the main training contents, as a way to be more creative, 28% were affective responses which included being more open-minded, self-confident, risk taking, curious and being more collaborative with others, a reflection of an awareness of their blocks and having the need to overcome them.
[6]   deliberately teaching about creativity, teaching divergent and convergent thinking and their related tools and techniques.

Affective blocks to creativity such as a lack of self-confidence and courage to take risks may be cultural or context specific and these should be further investigated. As shown, training had some impact on raising awareness of blocks. Although the training contents were cognitive, a high proportion of blocks discovered were affective. The author views a lack of self-confidence and courage to take risks (24% of the respondents) to be a concerning factor. Other affective blocks to creativity that also give rise to concern include laziness and the lack of some traits of the creative person (curiosity, persistence, open-mindedness) which occur in 29% of the respondents. For how can we expect these traits to be modeled to students if student teachers do not possess them themselves? If indeed, certain affective blocks are pinpointed as cultural or contextual issues, they need to taken into account when creativity courses are designed for student teachers within that context.

Higher value on the cognitive over the affective aspects of creativity.

The group of student teachers seemed to value the cognitive aspect of creativity more than the affective aspects. This possibility is illustrated below in Table 1.

Table 1

Comparison of Affective and Cognitive Blocks and Strategies

	Blocks to creativity	Benefits of training	Strategies		
			To be more creative	To teach students to be creative	
			post-training	pre-training	post-training
Affective	53%	33%	23%	10%	8% (teach students) 5% (change self)
Cognitive	36%	50%	46%	41%	59%

Although it is not certain that participants thought they could be more creative due to the training alone, from the results of the survey, we can infer training has had some influence, especially in giving participants strategies or concrete ideas in how to be more

creative. If we put together the mentioned benefits, positive influence and most important learning from training and how participants thought they could be more creative (when asked after training), participants considered learning creative thinking principles to be the most important learning, followed by attitude change. 46% of the participants mentioned practicing what was taught in training and creative thinking to be strategies that could help them to be more creative and that 23% thought that a change in attitude (becoming more open-minded, self-confident, risk taking and curious) could help them be more creative. Although we see affect or attitude to be a block to creativity in more than half of the participants and 33% of the participants thought their attitude was influenced for the better from training, we see a higher proportion of student teachers considering learning the cognitive aspects or creative thinking to be the most important learning from the training. Furthermore, it doesn't seem that an increase in awareness of their own affective blocks have made student teachers realize that their future students may suffer from similar affective blocks and that for them to be effective role models, developing the creative personality traits (Davis, 2004) within one self are as essential as developing creative thinking skills. The possibility of a preference for the cognitive rather than the affective aspects of creativity may be due to the fact that the training content was mainly towards the cognitive with the affective aspects reflected upon individually only. Whether this preference is training induced or cultural or context specific needs further investigation but reminds us of the need to help student teachers see the ecology of creativity – both for their and their future students' benefit.

To summarize, the prevalence of affective blocks and the seemingly higher value placed on the cognitive aspects of creativity may be a cultural or context specific phenomenon. However, further investigation is needed before further conclusions can be drawn. What is highlighted here is the need for designers of creativity education for student teachers to take into account of cultural or context specific issues in order to have the issues addressed to create a platform for the training of student teachers to learn and teach creativity on an ecological basis – in long term and short term trainings.

Conclusion

Findings from the investigation indicate that:

1. Although nearly all of the student teachers believed it is important to teach creativity to their students, they were not ready to teach it. Many did not believe they were creative and some believed creativity to be a talent whilst some associated creativity with art. Basic knowledge of creative thinking was absent and specific strategies to teach creativity existed in only a small proportion of the student teachers.
2. Blocks to creativity were common in the group of student teachers and not of all them were aware of their blocks.
3. Workshops of short duration with limited and focused objectives can immediately equip teachers with creativity related vocabulary, change their perceptions of creativity, increase their motivation and confidence in their own creativity and equip them with specific strategies to teach creativity to future students.

Due to these findings, it is recommended that teacher training should, as a matter of urgency, include creativity education and a conceptual framework based on an ecological or interactionist model of creativity (Isaken, Puccio and Treffinger, 1999) is proposed for teaching creativity to teachers in training. Based on the findings, it is suggested that such a framework should take into account of the local context or culture to ensure the inclusion of contents that address contextual issues, one of which appears to be individual blocks to creativity. Before such changes can be introduced, it is helpful to address immediate issues facing teachers and equip them with specific creativity contents that will be useful to them to teach creativity to their future student by way of stand-alone workshops.

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Appendix A

Subject Specialization of Student Teachers

Table A1

Subject Specialization of Student Teachers

Subject	No. of teachers	%
English	7	5%
Sciences	55	36%
Maths	42	28%
Religion	5	3%
Social Sciences	30	20%
P.E	3	2%
Arts	8	5%
IT	1	1%
Total	**151**	**100%**

Note. Total number exceeds the group of participants of 128 as some participants were specializing in more than one subject.

Appendix B

Training Contents: Teaching Creative Thinking - An introduction

Pre-training survey, curiosity activity, various defintions of creativity, introduction to the four Ps model of creativity, divergent and convergent thinking, divergent thinking rule: defer judgment, rules of divergent thinking, guided practice of divergent and convergent thinking rules, rules of convergent thinking, independent application of divergent and convergent rules, debrief curiosity activity, explore application of learning, post-training survery assessment.

Research

In a meta-analysis of 70 studies, Scott et al (2004) showed that some approaches are more effective than others, specifically approaches that "focus on the development of cognitive skills and the heuristics involved in skill application" (Scott et al, 2004; p.361), of which CPS is an example.

CPS is a structured problem solving methodology that was introduced by Alex Osborn in his book "Applied Imagination" in 1953. CPS has since undergone refinements and developments based mainly on the work of the Creative Education Foundation and the International Center for Studies in Creativity at Buffalo State College.

Although CPS is found in varying models, two distinguishing features of CPS remain: (1) the three stages of problem definition, generation of ideas and formulating a plan of action, and (2) the balance between divergent and convergent thinking (Puccio, Firestien, Coyle & Masucci, 2006). Generally, CPS includes three stages and six steps, the overview of which is presented in Appendix C. Within the CPS process, there are a variety of techniques and tools.

For the workshop designed and delivered for the purpose of this study, the two distinguishing features of CPS mentioned above, and the rules or guidelines for divergent and convergent thinking were taught to the student teachers.

Creative Problem Solving (CPS) – Overview

Adapted from Miller, Vehar & Firestien (2001)

Identify the Goal, Wish or Challenge
^ state a variety of goals, wishes or
   challenges
v choose a goal, wish or challenge
   where you have ownership, motivation
   and a need for imagination
Gather Data
^ explore all the data around the goal,
   wish or challenge
v identify all the relevant data
Clarify the Problem
^ state the problem in as many ways as
   possible
v choose a problem statement to work on

Explore the Challenge

Generate Ideas

Generate Ideas
^ think up a wide variety of ideas to
   solve the problem
v choose the most promising idea

Prepare for Action

Select & Strengthen Solutions
^ evaluate and refine the ideas
   you selected
v select the most promising
   solution(s)
Plan for Action
^ list assisters/resisters and actions
   for implementation
v form a specific plan of action

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^ diverge = **generate** variety of problem statements / ideas / actions
v converge = **select** from the variety of problem statements / ideas / actions generated

Appendix D

Details of Pre and Post Training Results (Teaching Strategies)

Before training, a total of 157 ideas were elicited from the participants for teaching strategies to teach creativity, such as: creative teaching methods (11% of total responses), give students opportunities to explore, think and create (36%), role model / give examples (16%), develop creative traits (10%), teacher as facilitator and motivator (18%), with only 5% of the responses specifically mentioning teaching students to think (with half of these responses mentioning only teaching critical thinking) and 4% giving vague ideas or none at all.

When asked the same question again after training of how they would teach creativity to students, the responses differed somewhat. A total of 133 ideas were elicited. 38% of these ideas were the same or similar to pre-training ideas but 62% of the teaching strategies ideas were new. Among the new ideas, deliberately teaching about creativity, divergent and convergent thinking and related tools and techniques amounted to 30% of the total post-training responses. 20% of the post-training responses included more specific strategies within the broad category of give students opportunities to explore, think and create, which included: giving opportunities to students to ask questions, problem solving, allowing students to give ideas and play, opportunities to practice being creative, and the widening of students' perspectives in thinking. These are specific in comparision to pre-training opportunities to explore, think and create which included: teachers asking students questions, giving students opportunities to think, to create freely and to explore. Where curiosity, persistence and being original were mentioned as personality traits that teachers should develop in students as part of their teaching strategies to develop creativity (pre-training), 7% of the new responses post-training added the following to the range: teach students to be open-minded, develop self-confidence and a risk taking spirit in students. In addition, 5% mentioned keeping open-minded to students' ideas as a teaching strategy.

61% of the post-training responses to teaching strategies were new and almost a third of the responses generated were specific to workshop contents[7] (equivalent to half of the new responses). Another third of the responses appeared to be based on the participants' personal experiences from the activities of the workshop - such as giving students opportunities to ask questions, to play, to express their own ideas with a need to have a risk taking spirit and the self-confidence to do so, teaching students to be more open-minded and teachers themselves needing to be more open-minded to students' ideas.

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[7]   deliberately teaching about creativity, teaching divergent and convergent thinking and their related tools and techniques.

Appendix E

Analysis of Nature of Blocks

Table E1

Nature of Blocks to Creativity – Pre-training

Pre-training - awareness of blocks - nature of blocks	No. / % of responses		Attitude	Thinking Skill	Environment	Others
Lack of self confidence / courage to take risk	22	24%	24%			
Not open-minded	13	14%	14%			
Lazy, no patience, easy to give up, lack of curiosity	12	13%	13%			
Narrowness in thinking	12	13%		13%		
Difficulty finding ideas	11	12%		12%		
Confusion in thinking / making decisions/ overwhelmed	10	11%		11%		
Others	7	8%				8%
Lack of understanding / practice in thinking	4	4%		4%		
No support for idea	2	2%			2%	
Total	93	100%	51%	40%	2%	8%

Table E2

Nature of Blocks to Creativity – Post-training

Post-training - NEW awareness of blocks - nature of blocks	No. / % of responses		Thinking Attitude	Skill	Environment	Others
Lack of self-confidence / courage to take risk	14	25%	25%			
Lazy, no patience, easy to give up, lack of curiosity	10	18%	18%			
Lack of understanding / practice in thinking	8	15%		15%		
Not open-minded	7	13%	13%			
Narrowness in thinking	6	11%		11%		
Others	4	7%				7%
Confusion in thinking / making decisions/ overwhelmed	2	4%		4%		
No support for idea	2	4%			4%	
Difficulty finding ideas	1	2%		2%		
Self reliance	1	2%	2%			
Total	55	100%	58%	31%	4%	7%