

African Research Review

An International Multi-disciplinary Journal, Ethiopia

Vol. 10(2), Serial No.41, April, 2016: 266-274

ISSN 1994-9057 (Print)

ISSN 2070-0083 (Online)

Doi: <http://dx.doi.org/10.4314/afrrrev.v10i2.17>

Facilitating Creativity in Science Students' through Teacher Professional Development

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Abstract

The study ascertained how teachers facilitate the creativity skills of the Pupils as an outcome of professional development. 450 primary school pupils and 50 Basic science teachers in the primary schools were sampled. The study adopted the Solomon four group design. The Torrance Test for Creative thinking (TTCT) and the creativity checklist (CCh) was the instrument used to collect data. The reliability of the instrument was 0.78 established using Kuder-Richardson (K-R 21). The research questions were answered using mean while the hypotheses were tested using Two-Way ANOVA. Findings shows the experimental groups –A and B were significantly higher in creativity as assessed by TTCT scores in comparison to the control groups. Students in the experimental groups (A and B) scored significantly higher with group A out-performing group B on th post-test creativity checklist. The researcher recommended

that a programme of continuing education for teachers in relation to creativity at all levels of the education system especially at the primary school level be utilized.

Introduction

Academic creativity is a way of thinking about learning and producing information in school subjects such as science, mathematics, Arts and Business courses. Creative thinking and learning involve such abilities as evaluation: divergent production: and redefinition. Creative learning is a natural and healthy human process that takes place when people become curious and excited (Newton and Newton, 2009: 45).

Within the domain of student learning, teachers can serve as facilitators or inhibitors of creativity. Therefore, they play an important role in the development of creative skills in the educational system (Sternberg, 2003). At the classroom level, the incorporation of teaching practices that promote creativity can lead to positive changes in student behaviour, social skills, self-esteem, motivation and academic achievement. To maximize student outcomes in relation to creative endeavour, it is important that teacher receive appropriate knowledge and training in relation to appropriate classroom techniques.

Sternberg (2003:337) states that: "Teachers who reward all kinds of creativity are those who are likely to find among their students those who have made one of the most important decisions a person can make in his or her life: the decision to be creative". In the light of this, a number of studies (Torrance, 1972, Hosseini, 2002: Kampylis, Beki and Saariluoma, 2009) have been undertaken with a focus on assessing teachers' knowledge of creativity and the effect of teaching characteristics on student creativity. Previous findings (Kampylis, Beki and Saariluoma, 2009) have shown that teachers have limited understanding of creativity. A study by Hosseini, (2002) showed that the provision of information to teachers regarding alternative educational structures focusing on creativity promoted changes in knowledge and attitude that resulted in the incorporation of new skills suited to the development of student creativity. Furthermore, 70 Iranian teachers indicated that 90% of the sample believed that undertaking a creativity-oriented professional development programme had a positive outcome. Their knowledge, attitudes and skills changed their view of creativity and prompted changes in their work practices. Teaching and learning was perceived to be more successfully accomplished and contributed to an improvement in the educational progress of their students. Park, Young, Oliver & Cramond (2006) collected interview data from 35 Korean science teachers' regarding their perceptions of creativity and science teaching after participating in an overseas professional development programme. Their findings indicated that the teachers developed a stronger awareness that creativity can be expressed by every student and that creativity

can be enhanced. Research by Park (2006) showed that teachers who maintain positive relationships, a genuine interest in and respectful acceptance of student skill levels, are effective in the development of creativity (Sternberg and Williams, 1996).

Teachers are more capable of promoting creativity in their students if they acquire an improved understanding of the concept of creativity. (Mudrock 2003, Seo, Lee and Kim, 2006). Knowledge of creative thinking assists in the establishment of a creative atmosphere in the classroom, improving learning and formulation of positive attitudes towards students.

Mack (1987) survey 62 teacher educators and 388 student teachers from ten teaching institutions regarding their opinions in relation to the importance of using creative approaches. Mack reported that both groups supported the inclusion of creativity education methods in teacher preparation programmes. However, more than half of the respondents reported that they had not participated in any creativity oriented training programme. Mack concluded that in many teacher education programmes there is no emphasis on knowledge associated with methods to increase creativity.

According to Blumen-Pardo (2002), skilled teachers who have had opportunities to undertake a broad educational programme tend to be effective in the promotion of moral development, educational progress and cognitive growth within students who demonstrate high or low learning capacities. Several studies (Downing, Lamont and Newby, 2007) have shown that as an outcome of professional development, teachers are capable of facilitating change in the creativity skills of their students. Laius and Rannikmae (2004) found a significant difference in the creativity subscale scores of the instrument Package User's Guide (1997) of the Iowa Chautauqua programme for a sample of 447 students assessed at pre- and post-test points separated by an 8-week interval. The intervention involved 13 teachers completing a training programme designed to develop their science teaching skills in which an important focus was on fostering student creativity. Blumen-Pardo (2002) used the test for creative Thinking-drawing production (TCTDP) to evaluate changes in the creativity scores of a sample of 231 second graders. From this sample, 130 Peruvian children were involved in the experimental group and 101 in the control group. The first element of the intervention constituted 40 second-grade teachers completing an in-service training workshop on student giftedness in which creativity skills were of particular emphasis. Students in the experimental groups then completed a 10-week programme involving four lessons specifically devoted to developing skills such as comprehension, convergent problem solving and memory. Results clearly indicated a significant difference in figural –creative performance between the groups. This study is guided by the constructivist theory. Creativity reflects the firm belief in the constructivist philosophy of education. Constructivists reject the assumption that teachers provide

knowledge and students store it. They contend that instead, learners construct their own versions of reality by forming personal connections between new and existing knowledge. The researcher as an insider in the university system fears that creativity education methods are not being implemented. The study was guided by the following objectives:

- 1) Ascertain the mean scores of students in the experimental group on Torrance test of creativity Thinking (TTCT) at post-test;
- 2) Determine the mean scores of students who were rated by teachers who participated in a creativity programme and those students rated by teachers who did not participate on a creativity checklist at post-test.

These objectives were raised as questions.

- i) What are the mean scores of students in the experimental group on Torrance test of creativity Thinking (TTCT) at post-test?
- ii) What are the mean scores of students in the experimental group on Torrance test of creativity Thinking (TTCT) at post-test?

The following hypotheses guided the study

H01: The mean scores of students in the experimental group on Torrance test of creativity Thinking (TTCT) will not be significantly higher than that of the students in the control group.

H02: The mean scores will not be higher for students who were rated by teachers who participated in a creativity programme and implemented than those students rated by teachers who did not participate on a creativity checklist.

Method

The study adopted a quasi-experimental design based on the Solomon four-group design (Ogomaka, 2004 and Ibe, 2008). The study utilized random cluster sampling. There are 27 local government areas in Imo State from which 10 primary schools. 2 from each of the three zones of the state (Owerri, Orlu and Okigwe) were randomly selected. A sample of 120 teachers was randomly selected from the 10 schools. At the schools' level, these were divided evenly into 3 experimental groups. The number of teachers from each of the school varied depending on the size of the student population. A sample of 489 pupils, aged 7-11 years was drawn from the cohort of students that the teachers in the study were teaching. Thus a total of 30 teachers were involved in the experimental group- A (Creativity group), which also included a cohort of 150 students resulting from random selection of five students who worked with each teacher. The same procedure was followed in the formation of the Experimental group

-B (control). Finally, on the basis of the Solomon method, 150 students of the experimental group and 150 students of one control group received pre-test and post-test, whereas another 150 students of the treatment group and 150 students of the other control group received only the post-test.

The teachers in the experimental group A participated in a creativity focused professional development workshop. The 70h programme included 20h assigned to detailing theory, 15 h relating to teaching techniques and 35h associated with classroom, practices. The workshops required participant involvement for 5h per week for approximately two months. Each programme participant was provided with specific information and strategies examining: (a) the concept and nature of creativity (b) the methodology of teaching creativity (c) creativity and school education and (d) model of creativity development. Teachers linked their participation in the training with the implementation of the material covered in the workshops in their classroom. The instruments used for the study were the Torrance test of creative thinking (TTCT) and creativity checklist (Kim, 2006). The test includes figural and verbal subtest, of which the figural forms were used in the present study. These are preferable to use from primary school levels up to secondary school. The TTCT- figural consists of parallel A and B forms with three subtests: (a) compose a drawing (b) finish a drawing and (c) compose a different drawing parting from parallel lines (Torrance, 1972). Both forms are oriented to evaluate four main cognitive processes of creativity: (a) fluency or number of relevant responses (b) flexibility as referred to a variety of categories or shifts in responses (c) originality entails considering novelty responses, not familiar and unusual, but relevant and (d) elaboration as referred to the number of details used to extend a response. According to the TTCT-figural manual of 1998 (Torrance, 1972), the reliability estimates of each creative index from Kuder-Richardson 21 using 99th percentile scores as the estimates of the number of items ranged between 0.89 and 0.94. But for this study, the reliability coefficients of the instrument ranged between 0.72 and 0.81 when the instrument was adapted to the subjects of the study. The test retest reliability of TTCT figural B subscales were: fluency (0.71), elaboration (0.78), flexibility (0.71), originality (0.74) and overall test score (0.72). The Cronbach's alpha coefficient for the CCh was $r = 0.98$ and a positive correlation $r = 0.51$ was also found between the FFCT and CCh in the current study.

According to Solomon design methodology, the experimental group is involved in all phases of treatment and testing. The experimental group and one control group complete pre-testing and another pair of treatment and control groups is not pre-tested. Following pre-testing the experimental groups completed and implemented the creativity training programme. Finally, all student and teacher participants completed post-testing.

Results

Table 1: Two-way ANOVA for post-test TTCT scores

Source	SS	Df	MS	F	Sig
Pre-test effect	3802.932	1	3602.932		
Creativity training	1897.498	1	180697.498	6.34	0.05
Pre-test x training effect	3938.631	1	3938.631	13.17	0.05
Error	5835.661	299	19.52		
Total	9638.053	300	32.12		

Data presented on table 1 shows the results of the two-way analysis of variance for the students' post-test TTCT scores. The main effect of the students' participation in post-test was significant ($F_{1,299} 6.34 p < 0.05$). There was also significant main effect for teacher involvement in creativity training in regards to the students. The interaction of student involvement in pre-testing and teacher involvement in creativity training in relation to the students TTCT post test scores was significant ($F_{1, 299} 13.17. p < .05$).

Table 2: Two-way ANOVA for Post-test Teacher checklist scores

Source	SS	Df	MS	F	Sig
Pre-test effect	54.377	1	54.377		
Creativity training	3479.534	1	3479.534	11.61	0.009
Pre-test x training effect	337.87	1	337.87	1.13	0.136
Error	3817.404	299	12.78		
Total	7634.404	300	25.45		

Data on table 2 shows the results of the two –way analysis of variance for the students' post-test CCh scores ($F_{1,299} 11.61 p < 0.05$) and the interaction of student involvement in pre-testing and teacher involvement in creativity training in relation to the students CCh post-test scores was not significant ($F_{1,299} 1.113.p < 0.05$). There is no significant main effect for teacher involvement in creativity training in regards to the students CCh post-test scores ($f_{1.482} 6.977.p 0.009$).

Discussion

The results of this study demonstrated that the students in the experimental groups were significantly higher in creativity than those in the control groups. The creativity training programme that the experimental and treatment groups of teachers completed could be considered as a contributing factor in the positive change in their students' creativity scores. The sample of students that completed TTCT pre-testing was also higher in post-test TTCT scores than the group of students that only completed post-testing. The result of this study corroborates to the students TTCT scores findings of Blumen-Pardo's (2002) study conducted with students in Peru. Blumen-Pardo reported that the creativity professional development programme for teachers facilitated an increase in students' creative capability and concluded that teacher training workshops were necessary to develop the creative performance of students. This result indicates that students may become familiar with the items of the TTCT as an outcome of completing the measure and that this experience may in turn have a positive effect on the student's post-test TTCT scores. A significant interaction effect of the students' completion of TTCT pre-testing and participation in the creativity intervention was also observed. Sternberg (1996), Newton, & Newton (2009) proposed the application of patterns of creativity education as an effective strategy to implement in order to develop students' creativity. Firstly, teachers have to educate students on how to function as a creative people and make them aware of the process of creativity. They should then guide students on a path through which they are able to build their own creativity. The professional development programme implemented in the current research clearly influenced the teachers' capacity to apply new knowledge and skills within their classroom practices that facilitates the development of student creativity.

Findings show that students in the experimental groups scores significantly higher on the post-test creativity checklist. No significant difference was found between the pre-test and non-pre-test groups in regard to their teacher creativity checklist scores. Results associated with the moderate correlation between the TTCT scores and the teacher's observational checklist indicates that teachers can generally evaluate the creativity skills of their students. The differences identified between the experimental and control groups in relation to the checklist scores also reinforces that the creativity training programme was effective in facilitating change in teacher practices and as a consequence students' creative skills.

The lack of difference in the checklist scores for the pre-test and no pre-test groups suggests that the pre-test experience involving the TTCT was not a contributing factor in the post-test scores based on the teachers' observations of student creative behaviours. The checklist scores may possibly relate to teacher knowledge and not directly to the scored creativity skills of the students. The teachers of the experimental

groups may have become familiar with the characteristics of the checklist questions as an outcome of their professional development. The results also support the proposition of Kampylis, Beki and Saariluoma (2009) who concludes that a creativity checklist based on teacher observation represents a valuable tool for monitoring students' real-world creativity characteristics applicable to the classroom situation.

Conclusion

The findings of this study provide an indication that student creative thinking skills are capable of being positively affected as an outcome of the participation of teachers in relevant training programmes. The study demonstrated that the students in the experimental groups (Group A that had pre-test, group B that had no pre-test but only post) were significantly higher in creativity as assessed by TTCT scores in comparison to the control groups (had pre-test and post-test). The sample of students that completed TTCT pre-testing was also higher in post-test TTCT scores than the group of students that only completed post-test TTCT scores. Students in the experimental groups scored significantly higher on the post-test creativity checklist. No significant difference was found between the pre-test and non-pre-test groups in regards to their teacher creativity checklist scores.

Recommendations

The researcher makes the following recommendations:

- A training programme for all teachers is very necessary. This is needed since the teachers need be updated in content and pedagogy so as to be able to lead the young learners successfully to the knowledge, skills and attitudes of the 21st century. The stakeholders in education are all involved in this such as the universal Basic Education Commission.
- Workshop for all pre-service teachers should be organized either quarterly or annually by experts in the area of methodology. This will enable the teachers interact with peers from other areas as well as with the experts on best practices to impart learning to the learners.

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