

## Effect of Creative-Teaching on Creative-Thinking-Originality Among Different-Ability Upper-Basic Science Students in Gboko Township

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### Abstract

Effect of Creative-Teaching (CT) on Creative-Thinking-Originality (CTO) among different-ability upper-basic science students in Gboko Township was studied using pre-test post-test quasi-experimental design. Two research questions and two null hypotheses guided the study. From the population of 674, a multistage sample of 70 students in two schools was drawn from all the government grant aided upper-basic schools in Gboko Township. Torrance Test of Creative Thinking with reliability coefficient of 0.83 determined using a test-retest method with Pearson Product Moment Correlation statistics was used for data collection. Data were analysed using mean and Analysis of Covariance (ANCOVA). Findings showed no significant difference in the CTO among different-ability students within the teaching methods,  $F(2, 63) = 0.123, p(0.885) > 0.05$ . However, those taught Basic Science using CT exhibited significantly higher CTO than those in the Lecture Method.  $F(1, 63) = 54.773, p(0.000) < 0.05$ . Moreso, no significant difference existed in the students' CTO based on gender  $F(2, 63) = 0.252, p(0.778) > 0.05$ . Thus, CT was recommended for teaching science at basic schools.

**Keywords:** Creative-Teaching (CT), Creative-Thinking-Originality (CTO), Different-Ability and Gender.

### Introduction

In the global education, scholars, practitioners and other stakeholders have long recognized the necessity of creativity development in children and for functional and meaningful living in the 21st century. In light of the potential benefits of accessing and using creativity both in the learning process and in daily life, some efforts and funding have supported the incorporation of creativity into curricula, policies, and experimental learning projects, with the expectation that, this will reinforce educational reforms (Tsai, 2013a; Handayani, Rahayu & Agustini, 2020). Moreso, Shaheen (as cited in Ayua, Terhemba & Ikyernum, 2022) asserted that policy documents on education of many countries, such as Australia, Canada, United Kingdom, China, Singapore and Nigeria have demonstrated the need to nurture students' creativity through science education. Dumas and Dunbar (2014) confirmed that, creative thinking has been truly touted in scholarly literature as a critical capacity of the human mind.

Creative thinking is one's cognitive process to generate effective ideas in solving problems under certain aims and conditions Young and Balli (as cited in Handayani, Rahayu & Agustini, 2021). It also means a positive action in stimulating brain function that can create proper learning style (Lince, 2016). The valuable characteristics of creative thinking skills include imagination description, independence, experimentation, holism, expression, self-transcendence, surprise, and creativity McGregor

(as cited in Handayani, Rahayu & Agustini, 2021). Thus, creative thinking skills are essential cognitive aspects that must be included in the science teaching and learning process. Creative thinking skills have five characteristics namely fluency, originality, elaboration, abstractness to title and resistance to premature closure. Fluency refers to one's ability to produce many ideas, ways, suggestions, questions, ideas. Originality is an ability to generate ideas to solve problems and create unique and distinctive thoughts. Elaboration refers to one's ability to develop ideas along with the details. Abstractness to titles refers to the degree beyond labelling; based on the idea that creativity requires an abstraction of thought. While resistance to premature closure is the degree of psychological openness; based on the belief that creative behaviour requires a person to consider a variety of information when processing information and to keep an "open mind" (Handayani, Rahayu & Agustini, 2021). For the purpose of this study, creative teaching on creative-thinking-originality will be focused on, because of its suitability to Upper Basic 2 (UB2) students' age.

Creative-thinking-originality is an interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel, useful and original as defined within a social context. Creative-thinking-originality breeds creativity. Originality is often highlighted as one of the most widely recognized facets of creativity (Fontenot, 2021). Originality can be seen in something as small as a unique idea produced in

everyday life to something as big as unconventional scientific progress. According to Scholastic Testing Service (as cited in Terhemba, 2022), originality can be viewed as thoughts that are unlikely to be formed by other individuals. Originality “is based on the statistical infrequency and unusualness of the response” Torrance, Ball and Safter, (as cited in Cummings & Blatherwick, 2017). Original thinking helps both male and female students with different ability (high, average and low) to combine existing ideas and create new and unusual ideas if taught with teaching method that can harness creative-thinking-originality. Although many teaching pedagogy impact creative-thinking-originality, several embodied theorists have noted that much of our originality output is based within sensorimotor experiences and comes to possess real novelty through creative teaching Hostetter and Alibali (as cited in Fontenot, 2021). Thus, the study of creative and original works would benefit from the examination of the cognitive approach such as creative teaching in producing original thoughts and ideas to yield original, unique and novelty products for future visions.

Creative Teaching (CT) is tending to create classroom instruction excellently and in a novel fashion. According to Ayua (2019), it involves teaching creatively and teaching for creative-thinking-originality to male and female students with different-ability. The need for creative-thinking-originality to survive the harsh economy among other challenges of the 21st century and the responsibility laid on schools to foster this skill necessitates a refocus on creative teaching. There are several creative teaching models. Thus: Misutova (2003) Creative-Teaching Model which is developed for mathematics and technical courses of basic study at the university level; and Schnapp (2018) Creativity Pedagogical Model which is targeted for teachers and education institutions. Others Include: 3eT Instructional Model and Model Numbered Heads Together. However, Torrance Incubation Model (TIM) of creative teaching and learning which can be applied at any level of education was adopted for this study. Torrance Incubation Model (TIM) of creative teaching and learning is a 3-stage (heightening anticipation, deepening expectations and keeping it going) model for delivering both subject (Basic Science) content and creative-thinking-originality. According to Torrance and Safter (as cited in Ayua, Terhemba, Ikyernum, 2022), the model was designed to make teaching more effective in any subject at any age. TIM foundation was laid at the International Centre for Studies in Creativity, University of Buffalo, New York. TIM of creative teaching and learning can be

applied to a lesson unit or project in any subject including Basic Science at the upper-basic school level and different ability students. Torrance (as cited in Ayua, Terhemba, Ikyernum, 2022) believed that people are inquisitive, exploring and searching kind of beings. Hence, Bruner’s (1960) theory of intellectual development states that learning is best through discovery and interaction with mental development advancing from non-abstract to abstract alongside age. It holds that knowledge via discovery is fundamental to learning and emphasizes that learning is by doing and thinking creatively. So, when given a choice, they would choose to learn creatively. They would continue to find problems and cannot keep from digging into things, turning ideas over in their minds, trying out new combinations, searching for new relationships and struggling for new, unique and original insights. Therefore, the link between this theory and creative teaching seems promising to investigate if creative teaching will affect creative-thinking-originality of different ability students in Basic Science.

Different-ability levels in this study refers to students’ high, average and low educational performance based on past academic scores in Basic Science. Ayua (2021); Ayua, Terhemba and Ikyernum (2022) stated that students vary in their academic abilities due to one reason or the other; which could be learner, teacher or environmental based. Hostetter (2013) explained that different academic ability grouping as placing students of differing ability levels in the same class or group. Maikano (2016) also held that ability grouping is based on educators’ judgments of students’ abilities; and that when assigning students’ to tracks, prior test scores or other performance measures provided from other grades or schools are used to determine the ability levels even in gender difference. Empirically, Peng (2019) and Lince (2016) found significant differences among groups on all the three dependent variables (fluency, flexibility, and originality) using 3eT Instructional Model and Model Numbered Heads Together respectively. Fontenot (2021) using Alternative Uses Tasks (AUTs), found no significant difference in originality thinking task. However, these studies did not use TIM of creative teaching, the studies failed to consider upper basic two students with different ability and was geographically limited to Nigeria. To bridge the yawning gap, the study bid to examine the mean difference in the Creative-Thinking-Originality among different ability students taught Basic Science using creative teaching and lecture method.

Gender difference is the character of being male or female. Gender disparity according to Danjuma (2015) globally militates against equitable

participation of boys and girls in Science Education especially in Africa. Ali, Ozovehe and Dyaji (2014) submitted that females face a number of inequitable difficulties that limit their potentials in participation in the Sciences. This implies that gender peculiarities affect teaching, learning and creativity of students in Basic Science. Empirically, Marzieh and Nesa (2016) examined Comparison of Creativity Dimensions (Fluency, Flexibility, Elaboration, Originality) between Bilingual Elementary Students (Azari language-Kurdish language) in Urmia City – Iran and found that the fluency dimension from creativity was significant difference between the two groups of bilingual students. Also finding showed that there was significance difference between two groups of bilingual students' flexibility, but there were no significant differences in elaboration and originality dimensions. Also, there was significant difference in gender. Although, a gap still exists since this study did not ascertain the teaching strategy used to compare creative dimensions, did not include students with different ability levels and was geographically limited to Nigeria. That is why the current study seeks to find out the mean difference in the Creative-Thinking- Originality between male and female students with different ability taught Basic Science using creative teaching.

This study was necessitated by the low creativity level among upper basic science students orchestrated by usage of inappropriate teaching methods. As enshrined in the national policy on education (Federal Republic Nigeria - FRN, 2014), Moreso, the government emphasized basic education and spelt out its goals: part of which supports the teaching/learning of science for development of creativity. These include: laying of a sound basis for critical, reflective and independent thinking as well as manipulative skills. However, these goals cannot be achieved with teaching methods that are not hands and minds on. Naz and Murad (2017), Avwiri (2017) and Peng (2019) studies confirmed that Basic Science learners are rendered passive and lacking creativity, as a result of poor teaching methods. Therefore, creative-thinking-originality which is an aspect of creativity can be achieved if taught with innovative teaching methods. It is against this background that the study seeks to investigate the Creative-Teaching (CT) on Creative-Thinking-Originality (CTO) among different-ability upper-basic science students in Gboko Township with the following objectives:

- i. To examine the mean Creative-Thinking-Originality scores of the students with different ability levels taught Basic Science using creative teaching and lecture method.

- ii. To find out the mean Creative-Thinking-Originality scores between male and female students with different ability taught Basic Science using creative teaching.

### Research Questions

The following research questions guided the study:

- i. What is the mean Creative-Thinking- Originality scores of the students with different ability levels taught Basic Science using creative teaching and lecture method?
- ii. What is the mean Creative-Thinking-Originality scores between male and female students with different ability levels taught Basic Science using creative teaching?

### Research Hypotheses

The following hypotheses were formulated and tested at  $p \leq 0.05$   $\alpha$ -level:

- i. There is no significant difference in the Creative-Thinking- Originality scores of the students with different ability levels taught Basic Science using creative teaching and lecture method.
- ii. There is no significant difference in the Creative-Thinking- Originality between male and female students with different ability taught Basic Science using creative teaching.

### Methodology

A pre-test post-test quasi-experimental design was used for the study. After pre-test, the experimental group was taught the topic “chemicals” using Creative Teaching (CT); while the control group was taught the same concept using Lecture Method (LM) for six weeks before post-test. This was to harness creative-thinking-originality by producing unimaginable, novel, and unique product. A multistage (stratified, purposive & random) sample of 70 Upper-Basic II students in two schools was drawn from the population of 674 (356 males and 318 females) students in all the government grants aided schools in Gboko Township. Firstly, the schools were stratified into two (2-single schools with 290 students and 5-mixed schools with 384 students). Secondly, the five schools were purposively selected (4 in Gboko-North and 1 in Gboko South) and this was because, the schools were co-educational. Creativity equivalence test was administered to students in the five schools and Analysis of Variance (ANOVA) was used to determine students' creative-thinking-originality homogeneity and equivalence. Out of the five schools, four schools in Gboko North had homogeneity and equivalence. The researcher casted a lot (A= Experimental Group, B = Control Group, C = Not involved in any group and D = None of the

above) for the four schools. Thirdly, the two schools that had correct draw from the lot, students in each were randomly assigned into 35 experimental and 35 control groups respectively. This was for the purpose of honesty, objectivity, ensuring a bias-free sampling and assignment of subjects into groups.

Torrance Test of Creative Thinking (TTCT-Figural B) was used for data collection. Section ‘A’ collected students’ bio data; while section ‘B’ had three activities each lasting for 10 minutes with opportunity for multiple responses of ideas, to test students’ creative-thinking-originality in Basic Science. Students’ ability levels were based on previous term’s performance grades (high = A/B; average = C/D; low = E/F). TTCT-Figural B was validated by two experts: a senior lecturer in Mathematics Education and a Professor of Chemistry, both from the Department of Science and Mathematics Education,

Benue State University, Makurdi. The instrument was pilot tested on 15 Basic II students in one of the schools in Gboko other than the sample for the main study. A reliability coefficient of 0.83 was determined by a test-retest method with Pearson Product Moment Correlation. Extraneous variables like group initial difference, group interaction effect and priming were controlled by homogeneity test, distant locations and impromptu tests respectively. Both pre-test and post-test were administered under standard examination conditions. The research questions were answered using mean and standard deviation while hypotheses were tested at 0.05  $\alpha$ -level using two-way Analysis of Covariance due to normality of the distribution, homogeneity of variance, randomness of selection, measured based on interval scale and independence of samples.

## Result

**Table 1 Mean and Standard Deviation of Creative-Thinking-Originality Scores of students taught Basic Science using Lecture Method (LM) and those taught using Creative Teaching (CT).**

| Ability Level  | Sample (n) | Teaching Method | Originality-Pretest |       | Originality-Posttest |       | $\bar{x}$ Gain | $\bar{x}$ Gain Difference |
|----------------|------------|-----------------|---------------------|-------|----------------------|-------|----------------|---------------------------|
|                |            |                 | $\bar{x}$           | SD    | $\bar{x}$            | SD    |                |                           |
| High           | 14         | LM              | 4.30                | 2.088 | 2.67                 | 1.419 | <b>1.63</b>    | <b>0.74</b>               |
|                | 14         | CT              | 3.34                | 1.504 | 5.71                 | 1.858 | <b>2.37</b>    |                           |
| Average        | 9          | LM              | 3.32                | 1.525 | 2.14                 | 1.284 | <b>1.18</b>    | <b>0.69</b>               |
|                | 11         | CT              | 3.20                | 1.028 | 5.07                 | 2.054 | <b>1.87</b>    |                           |
| Low            | 12         | LM              | 3.12                | 1.781 | 2.23                 | 0.944 | <b>0.89</b>    | <b>0.17</b>               |
|                | 10         | CT              | 3.64                | 2.090 | 4.70                 | 1.413 | <b>1.06</b>    |                           |
| <b>Cluster</b> |            | <b>LM</b>       | <b>3.58</b>         |       | <b>2.35</b>          |       | <b>1.23</b>    | <b>0.54</b>               |
|                |            | <b>CT</b>       | <b>3.39</b>         |       | <b>5.16</b>          |       | <b>1.77</b>    |                           |

The result in Table 1 shows homogeneity in the pre-test creative-thinking-originality mean scores among different-ability students, between LM and CT with cluster means of 3.58 and 3.39. The Table also shows

that all the creative-thinking-originality mean scores among different-ability students in the CT were higher than those in the LM with cluster mean gain difference of 0.54.

**Table 2: Mean and Standard Deviation of Creative-thinking- Originality Scores of male and female students taught Basic Science using Creative Teaching.**

| Ability Level  | Sample (n) | Gender        | Originality-Pretest |       | Originality-Posttest |       | $\bar{x}$ Gain | $\bar{x}$ Gain Difference |
|----------------|------------|---------------|---------------------|-------|----------------------|-------|----------------|---------------------------|
|                |            |               | $\bar{x}$           | SD    | $\bar{x}$            | SD    |                |                           |
| High           | 9          | Male          | 3.48                | 1.282 | 4.42                 | 2.099 | <b>0.94</b>    | <b>0.89</b>               |
|                | 19         | Female        | 3.98                | 2.080 | 4.08                 | 2.352 | <b>0.1</b>     |                           |
| Average        | 10         | Male          | 3.65                | 1.485 | 3.38                 | 2.274 | <b>0.27</b>    | <b>1.0</b>                |
|                | 10         | Female        | 2.86                | 0.836 | 4.13                 | 2.321 | <b>1.27</b>    |                           |
| Low            | 12         | Male          | 3.98                | 2.275 | 3.29                 | 1.621 | <b>0.69</b>    | <b>0.13</b>               |
|                | 10         | Female        | 2.61                | 0.977 | 3.43                 | 1.884 | <b>0.82</b>    |                           |
| <b>Cluster</b> |            | <b>Male</b>   | <b>3.70</b>         |       | <b>3.70</b>          |       | <b>0.63</b>    | <b>0.1</b>                |
|                |            | <b>Female</b> | <b>3.15</b>         |       | <b>3.88</b>          |       | <b>0.73</b>    |                           |

The result in Table 2 shows homogeneity in the pre-test mean scores among different-ability levels between male and female students with cluster means

of 3.70 and 3.15. The table also shows that the creative-thinking-originality mean scores in the post test was homogeneous between male and female test



with cluster mean gains of 0.63 and 0.73 respectively.

**Table 3: Summary of Two-Way ANCOVA Analysis on Creative-Thinking-Originality among Different-Ability Levels Based on Teaching Methods.**

| Source                          | Type III Sum of Squares | Df | Mean Square | F      | P    | Partial Eta Squared | Noncent. Parameter | Observed Power <sup>b</sup> |
|---------------------------------|-------------------------|----|-------------|--------|------|---------------------|--------------------|-----------------------------|
| Corrected Model                 | 150.951 <sup>a</sup>    | 6  | 25.158      | 10.421 | .000 | .498                | 62.529             | 1.000                       |
| Intercept                       | 216.124                 | 1  | 216.124     | 89.526 | .000 | .587                | 89.526             | 1.000                       |
| Originality Pre-test            | 2.160                   | 1  | 2.160       | .895   | .348 | .014                | .895               | .154                        |
| Teaching Method (CT & LM)       | 132.228                 | 1  | 132.228     | 54.773 | .000 | .465                | 54.773             | 1.000                       |
| Ability Level                   | 8.396                   | 2  | 4.198       | 1.739  | .184 | .052                | 3.478              | .352                        |
| Teaching Method * Ability Level | .593                    | 2  | .297        | .123   | .885 | .004                | .246               | .068                        |
| Error                           | 152.089                 | 63 | 2.414       |        |      |                     |                    |                             |
| Total                           | 1315.360                | 70 |             |        |      |                     |                    |                             |
| Corrected Total                 | 303.039                 | 69 |             |        |      |                     |                    |                             |

a. R Squared = .498 (Adjusted R Squared = .450)

The result in Table 3 shows no significant difference in the creative-thinking-originality among different-ability students within those taught Basic Science using CT and those taught using LM,  $F(2, 63) = 0.123, p(0.885) > 0.05$ . Therefore, the null hypothesis was not rejected. However, the table showed that

student's creative-thinking-originality in the CT was better than those in the LM  $F(1, 63) = 54.773, p(0.000) < 0.05$ . The implication of this result is that, although creative teaching enhances creative-thinking-originality, it is not dependent on students' academic ability.

**Table 4: Summary of Two-Way ANCOVA Analysis on Creative-Thinking-Originality among Different-Ability Levels Based on Gender.**

| Source                 | Type III Sum of Squares | Df | Mean Square | F     | P    | Partial Eta Squared | Noncent. Parameter | Observed Power <sup>b</sup> |
|------------------------|-------------------------|----|-------------|-------|------|---------------------|--------------------|-----------------------------|
| Corrected Model        | 17.346 <sup>a</sup>     | 6  | 2.891       | .638  | .700 | .057                | 3.825              | .236                        |
| Intercept              | 239.256                 | 1  | 239.25      | 52.76 | .000 | .456                | 52.760             | 1.000                       |
| Originality Pre-test   | 5.061                   | 1  | 5.061       | 1.116 | .295 | .017                | 1.116              | .180                        |
| Gender                 | .130                    | 1  | .130        | .029  | .866 | .000                | .029               | .053                        |
| Ability Level          | 10.724                  | 2  | 5.362       | 1.182 | .313 | .036                | 2.365              | .250                        |
| Gender * Ability Level | 2.283                   | 2  | 1.142       | .252  | .778 | .008                | .504               | .088                        |
| Error                  | 285.694                 | 63 | 4.535       |       |      |                     |                    |                             |
| Total                  | 1315.360                | 70 |             |       |      |                     |                    |                             |
| Corrected Total        | 303.039                 | 69 |             |       |      |                     |                    |                             |

a. R Squared = .057 (Adjusted R Squared = -.033)

The result in Table 4 reveals that no significant difference existed in the creative-thinking- originality among different-ability male and female students taught Basic Science using CT,  $F(2, 63) = 0.252, p(0.778) > 0.05$ . The null hypothesis was therefore, not rejected.

## Discussion

Creative-thinking-originality on lecture method and Creative teaching shows no significant difference in the creative-thinking-originality scores among different-ability students. However, student's

creative-thinking-originality in the creative teaching was higher than those in the lecture method. With regards to field experience, the finding is not odd because students in the creative teaching were engaged through heightening anticipation, deepening expectation and keeping it going to: tickle their imaginations, acquire and create ideas, look beyond the information on the surface to find what is beneath it all, construct their knowledge, and use resources for future visions. The study agrees with Fontenot (2021) who found no significant difference in originality thinking task though with different strategy used.

Moreso, the finding disagrees with Peng (2018) and Lince (2016) who found significant differences in the combined creative-thinking scores (fluency, flexibility, and originality) for the three TIPS items. This may be due to variations in curriculum content, teaching strategy, location. probably time and the combined TIPS.

Regarding students' Creative-thinking-originality based on gender, no significant difference existed in the creative-thinking-originality between male and female students with different-ability levels taught Basic Science using creative teaching. This implies that, creative teaching on creative-thinking-originality is without gender disparity among different ability levels in Basic Science students. Following field experience, the finding is not strange because both boys and girls explored their ideas, construct and use it for future visions through active involvement in creative teaching and learning processes. Thus, the finding disagrees with Marzieh and Nesa (2016) who found significant differences in creativity (fluency and originality) scores based on gender. This may also be due to variations in curriculum content, teaching strategy, location and probably time.

### Conclusion and Recommendations

Based on the findings, it was concluded that: creative-thinking-originality among different-ability students will certainly be enhanced without gender disparity if Basic Science is taught using Creative Teaching. To do this effectively, the following were recommended:

1. Teachers not only at the upper basic school level, should be trained by the Federal, State Ministries of Education and other stakeholders through seminars, workshops on how to effectively utilize Creative Teaching.
2. Government through the Ministries of Education and teacher training institutions in Nigeria should ensure in-service training and retraining of teachers to maximize Creative Teaching lesson delivery.
3. Teacher training institutions in Nigeria should include constructive teaching strategies such as creative teaching in the teacher training programmes.
4. School proprietors, head and parents' teachers' association should provide materials/funds needed by the teachers for creative teaching of Basic Science.

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