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EFFECTS OF COGNITIVE STYLE AND ANTICIPATORY REWARD ON STUDENTS CREATIVITY

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Abstract

The study examined the roles of cognitive style and anticipatory reward on creativity using one hundred and twelve (112) participants drawn from Capital City Secondary School Awka, Nigeria. Participant's responses from Group Embedded Figure Test (GEFT) and Divergent Thinking Task (DTT) used in measuring cognitive style and creativity respectively were subjected to 2-way-ANOVA statistical test. The results of the analysis shows that a significant main effect was observed for cognitive style, $F(1, 108) = 7.16$, $p < .05$ with the field-independent ($M = 13.63$, $SD = 3.50$) performing better on creativity task than the field-dependent ($M = 11.75$, $SD = 3.69$), which confirmed hypothesis I. And, no significant main effect was observed for reward, $F(1, 108) = 0.04$, $p < .05$ with the anticipatory reward condition ($M = 12.89$, $SD = 3.93$) not performing better on creativity task than no reward condition ($M = 12.48$, $SD = 3.49$), which rejects hypothesis II. The implications of the findings have shown that field-independent and field-dependent students perform differently to the anticipatory reward and no reward conditions on creativity tasks. Suggestions were made for further study.

Keywords: *cognitive style, reward, student creativity, and field-independent teachers.*

Introduction

The environment at large is frequently changing and becoming increasingly more competitive. However, it is critical to prepare students to live, to work and to be successful in this setting (Ford & Gioia, 2000). The ability to recognize and creatively exploit opportunities has become an essential skill (Florida, 2002). This brings creativity to the center of the focus when preparing future citizens to deal with uncertainty and to adapt to continuous changes.

Creativity is that characteristic of human behavior that seems the most mysterious, and yet most critical to human advancement. The capacity to solve problems in new ways and

to produce works that are novel, appropriate, and socially valued is an ability that has fascinated people for centuries. Most creativity research concerns the nature of creative thinking, the distinctive characteristics of the creative person, and the development of creativity across the individual life span, and the social environments most strongly associated with creative activity (Simonton, 2000).

Basically, there is no simple definition of creativity but several emphases have been made in the past that highlight various aspects of the creative effort, both with respect to its process as well as to its product (Hans, 2006). However, the most defining characteristic of creativity is that of novelty. It means producing or thinking something new and useful (Bean, 1992; Mumford, 2003; and Andreasen, 2005). Moreover, Runco (2007) calls these authors definition as "products bias definitions" of creativity. For him, product bias consists on assuming that all creativity requires a tangible product: "It would be more parsimonious to view creative products as inventions and the process leading up to them as creative or innovative". In this study, creativity is referred to as an individual's divergent ways of creative thinking, reasoning and imagination of novel ideas.

Essentially, creativity study can also be seen as a cognitive style (Wissink, 2001). It proposes the interpretation of creativity as a way of approaching the environment cognitively and of resolving and dealing with problems. However, cognitive style has been extensively studied in diverse research domains (Grigorenko & Sternberg, 1995; Rayner & Riding, 1997). It refers to an individual's creativity and style of problem solving. Style, in this case, refers to whether a person attempts to solve problems within the existing context (adapter) or whether a person seeks to find new ways to approach problems (innovator) (Kirton, 2003). According to Ozioko (1990), cognitive style is reported as the consistent way an individual

looks at, evaluates and responds to a variety of situations; and that it is also, the characteristic self-consistent modes of functioning found pervasively throughout an individual's perceptual and intellectual activities. Also, this study sees cognitive style as the individuals preferred way of information processing which can be either field-independent or field-dependent.

However, the study of Kush (1996) reported that; regardless of students' cognitive style, those with field-independent teachers show greater achievement than those with field-dependent teachers. Also, Amazue (2006) and Ndukaihe (2010) also found that; field-independent subjects performed significantly better than field-dependent subjects. But, this is contrary to the work of Roach (1988) who found that; the degree of students' field-dependence did not affect their ability to gain problem solving skills by either method.

Essentially, the great majority of empirical studies concerning the effects of reward on creativity here evaluated divergent thinking, an important component of creative performance involving the production of varied responses to a problem or question that has multiple alternative solutions (Runco, 1991). Reward is an external agent administered when a desired act or task is performed, that has controlling and informational properties (Wilson, 2007). Evidence suggests that enhanced reward promotes learning, performance, enjoyment, and persistence in sport, among other benefits (McCullough, 2005; Wilson, 2005).

Many studies by behaviourally oriented researchers have reported incremental effects of reward on novel performance and creativity. For example, Glover and Gary (1976) found that the variety of uses school children gave for common objects was increased by repeated reward for novelty. Also, Ikwuagwu (2010) found that participants performance improved significantly when reward was present (reward condition), but deteriorates when no reward is present (no reward condition). However, Eisenberger and Rhoades (2001) compared the

creativity of movie and short story titles developed by two groups of preadolescent students: a group that was rewarded during a prior training task (generating creative uses for common objects) and a group that was trained but received money during the initial training task subsequently developed more creative titles than individuals who received no money.

Moreover, Hennessey (1989) examined the creativity of children completing two computer tasks. Students were assigned to one of the three conditions: reward – experimenter (they were rewarded with a certificate for participation by the experimenter), reward – computer (they received a certificate controlled by the computer), or control (no reward contingency). Results showed no statistically significant differences in creativity between the three conditions. Similar decremental effects of expected reward for unspecified performance on creativity have been reported in many studies, leading cognitive researchers to the conclusion that expected reward reduces creativity (e.g. Tegano, Moran & Sawyers, 1991; Collins & Amabile, 1999).

This study will however attempt to answer the following questions: would there be any significant difference in the performance of field-independent and field-dependent cognitive styles in a creativity task? Would there be any significant difference in the performance of anticipatory reward and no reward conditions in a creativity task? Answers to these questions will help to a greater extent in proper conceptualization and appreciation of the effects of cognitive style and reward on students' creativity.

Basically, cognitive style and reward issues seem to be an influential variable in students' creativity. Hence, the overall purpose of the study is to explore and explain the effects of cognitive style and reward in relation to students' creativity. It is hypothesized in this study that; field-independent participants will perform better in creativity task than the

field-dependent cognitive styles. And, anticipatory reward participants will perform better in creativity task than no reward participants.

METHOD

Participants

Participants for the study were one hundred and twelve (112) Junior Secondary School 3 (JSS3) students of Capital City Secondary School, Awka, located in the capital city of Anambra State, Nigeria, consisting of fifty six (56) males and fifty six (56) females.

The participants were selected through simple random sampling method from the total population of one hundred and twenty eight (128) JSS3 students. The age of the participants ranged from 12-16 years with the mean age of 13.87 years and a standard deviation of 1.42.

Instruments

Two test materials were used. The first test material was the Oltman, Raskin, Herman, and Witkin (1971) Group Embedded Figures Test (GEFT). Oltman and colleagues (1971) Group Embedded Figures Test is a group form of a scale for assessing field-independence and field-dependence cognitive style. The test is a perceptual test that requires a person to locate a simple figure when it is embedded within a large complex figure that has been organized in order to obscure the location of the simple forms. The test contains three (3) sections. The first section, with seven (7) items, was used for practice, while the last two sections, with nine (9) items each, were scored. Any figure that was correctly located within the given geometric design was scored 1, and 0 when it was not located correctly. Upon completion of the GEFT's, individual scores were categorized by field-independent or field-dependent orientations. Possible scores on the GEFT ranged from 0 to 18. In this study, the

division between field-independent and field-dependent was set at a score of 12, as recommended by Witkin, Ottman, Raskin, and Karp (1971). Students scoring 12 or above on the GEFT were classified as field-independent, as they could more easily complete the task of finding the "hidden" figures. Students scoring 11 or below were classified as field-dependent, as they could less easily disemble the "hidden" figure from the surrounding pattern. So, the higher the score, the greater the field-independent; while the lower the score, the greater the field-dependent.

This instrument has been used by researchers in Nigeria (e.g. Amazue, 2006; Ndukaihe, 2010). However, because the GEFT was a speed test, internal consistency was measured by treating each scored section (sections two and three) as split-halves. Witkin et al., (1971) reported a corrected Spearman-Brown reliability coefficient of .82 on the GEFT. While, the data generated from a pilot study conducted with fifty five (55) JSS3 students of Community High School, Amorka, yielded a corrected Spearman-Brown reliability coefficient of .80 on the GEFT.

The second test material consisted of the Silvia, Winterstein, Willse, Barona, Cram, Hess, Martinez, and Richard (2008) divergent thinking tasks: an unusual uses task. The Silvia's and colleagues (2008) divergent thinking task is a test for assessing individual creativity level. This can be administered in a group, and was designed to elicit specific information about creativity. The test is a creative thinking test that requires people to generate unusual ways of object uses. For this task, participants were instructed to generate unusual creative uses for common objects like, bricks and knives which, was scored with subjective scoring method using 1-5 scale ranging from "not at all creative" to "highly creative". However, 4 judges rated the responses based on Top 2 scoring method after which

the responses are averaged to form each person's creativity score for the task. This Top 2 index evaluates people's best efforts, in their own judgement, and it thus, represents people's best level of performance when they are instructed to do their best.

The reliability of the test instrument was determined using an inter-rater reliability method. Silvia's et al., (2008) reported a Cronbach's Alpha reliability coefficient of .80 on the creativity tasks. While, the data generated from a pilot study conducted with fifty five (55) JSS3 students of Community High School, Amorka, yielded a Cronbach's Alpha reliability coefficient of .71.

Procedure

Before the administration of the test materials, the experimenters established some rapport with the participants. They were told that the test materials were not for examination but purely for research purposes. The tests were administered by the experimenters with the help of the research assistant in the school selected to carry out the study.

However, the experiment was carried out in two (2) consecutive days. The first day, the experimenters administered the first test material; the Group Embedded Figures Test (GEFT) to the entire 128 JSS3 students that are willing to participate in the study. The participants were given a tag bearing the same number written boldly on top of the test material which served as an identity to the participants. From their performance in the GEFT, a sample of 112 participants (56 males and 56 females) who were considered to be field-independent and field-dependent was randomly selected for the study.

The first section of the test material comprising seven (7) items was used for practice with the participants. Later on, they were given 40 minutes to solve the remaining two sections of nine (9) items each. Thus, the following instructions were given to the students:

This is the test of your ability to find a simple form when it is hidden within a complex pattern. Try to find the simple form in the complex figure. It is the SAME SIZE, in the SAME PROPORTIONS and FACES IN THE SAME DIRECTION within the complex figure as when it appeared alone. When you finish turn the page to check your solution.

At the end of the 40 minutes, the experimenters asked the participants to stop attending to the test material and collect them for scoring.

The second day, the experimenters gathered the selected participants with their tag identification into the same classroom where the first test material was administered and teach them for ten (10) minutes. During this period, the participants were given description of the concept of creativity and what is expected from them through examples.

Reward was manipulated by assigning participants randomly into two (2) treatment conditions (anticipatory reward condition and no reward condition). However, a verbal instruction was given to the participants in their different capacity. So, the instructions given to the anticipatory reward condition on administration of the test was as follows:

In this test, you will be required to generate unusual creative uses for a brick and a knife. For these tasks, you should write down all of the original and creative uses for a brick and knife that you can think of. If you are judged to be among the best in terms of originality and creativity, you will receive a reward for you to keep after the exercise. You will have three minutes in each of the task. If you have a question, show by a raise of hand.

The instructions for the no reward participants were the same except for the omission of the statement anticipatory reward. At the end of the test, the researchers instructed the participants to

stop writing, and to evaluate their responses. They were told to pick two of their most creative ideas. They were asked to circle the two responses that they thought were their best. The participants were given few moments to pick their Top 2 responses, after which they hand in the test materials for scoring.

Design / Statistics

A 2 x 2 completely randomized factorial design were employed for the study. The factors were Cognitive Style (Field-independent vs. Field-dependent) and Reward (Anticipatory reward vs. No reward).

A 2-Way Analysis of Variance (2-Way-ANOVA) was employed to test the hypotheses.

RESULTS

The results are stated in the order in which the hypotheses were presented.

Table 1: Mean (m) and Standard Deviation (SD) of Cognitive Style and Reward on Creativity

Variable	**Level**	**Mean**	Std. D.	N
Cognitive style	field independent	13.63	3.50	56
	Field dependent	11.63	3.69	56
Reward	Anticipatory Reward	12.89	3.93	56
	No reward	12.48	3.49	56
	Total	12.69	3.70	123

Table 2: 2x2 analysis result Tests of Between-Subjects Effects (ANOVA Summary Table). Dependent Variable: CREATIVITY

Variables	SS	df	MS	F	sig
Cognitive style	94.30	1	94.30	7.16	*
Reward	0.58	1	0.58	0.04	ns
Cognitive style & reward	0.15	1	0.15	0.01	ns
Error	1422.90	108	13.18		
Total	1522.06	111			

*SS = sum of square, df = degree, MS = mean square, f = anova value, * = Significant, P < .05, ns = Not Significant*

In the summary tables above, a significant main effect for cognitive style was observed, F (1,108) = 7.16, p < .05 with field-independent (M = 13.63, SD = 3.50) performing better in creativity task than the field-dependent (M = 11.75, SD = 3.69). This result confirmed hypothesis one which stated that; "field-independent participants will perform better in creativity task than the field-dependent cognitive styles".

However, the tables above further showed no significant main effect for reward, F (1,108) = 0.04, p < .05 with anticipatory reward condition (M = 12.89, SD = 3.93) not performing better in creativity task than no reward condition (M = 12.48, SD = 3.49). The result rejects the second hypothesis which stated that; "anticipatory reward participants will perform better in creativity task than no reward participants".

Moreover, the tables above showed no significant interaction effects between cognitive style and reward on creativity.

Summary of the Findings:

- A statistically significant difference exists between field-independent and field-dependent cognitive styles in the performance of students' creativity tasks.
- No statistically significant difference exists between anticipatory reward condition and no reward condition in the performance of students' creativity tasks.
- No significant interaction effects were observed between cognitive style and reward on creativity.

Discussion

The results of the present study provide substantial evidence for the first hypothesis which stated that; field-independent participants will perform better in creativity task than the field-dependent cognitive styles. This finding is in agreement with Davis and Cochran (1989) who observed that; field-independent students typically demonstrate higher levels of achievement across some conceptual behaviour. The present result suggests that field-independent cognitive style is more positively related to creativity. Also, Schunk (2000), for example, points out that children tend to be more field-dependent in their preschool years with a subsequent increase in field-independence that extends into adolescence. Since most children are identified for placement into gifted programs early in their academic careers, it is quite possible that the use of cognitive style as an identification tool with that age group could be discriminatory toward children who are cognitively delayed.

In the same vein, the present study is consistent with Kush (1996) study who reported that; regardless of students' cognitive style, those with field-independent teachers show greater achievement than those with field-dependent teachers. Amazue (2006) and Ndukaihe (2010) also found that; field-independent subjects performed significantly better than field-

dependent subjects. However, the result of the present study contradicts the work of Roach (1988) who found that; the degree of students' field-dependence did not affect their ability to gain problem solving skills by either method.

Moreover, the result on reward revealed no statistically significant difference between anticipatory reward and no reward conditions in the performance of students' creativity task. Thus, the second hypothesis which stated that; anticipatory reward participants will perform better in creativity task than no reward participants was rejected. This study is in line with Hennessey (1989) study that examined the creativity of children completing two computer tasks. Results obtained showed no statistically significant differences in creativity between the conditions. However, similar decremental effects of expected reward for unspecified performance on creativity have been reported in many studies, leading cognitive researchers to the conclusion that expected reward reduces creativity (e.g. Tegano, Moran & Sawyers, 1991; Collins & Amabile, 1999).

This finding was contrary to Glover and Gary (1976) study that found the variety of uses school children gave for common objects was increased by repeated reward for novelty. Also, Ikwuagwu (2010) found that participants performance improved significantly when reward was present (reward condition), but deteriorates when no reward is present (no reward condition). However, Eisenberger and Rhoades (2001) compared the creativity of movie and short story titles developed by two groups of preadolescent students: a group that was rewarded during a prior training task (generating creative uses for common objects) and a group that was trained but received money during the initial training task subsequently developed more creative titles than individuals who received no money.

Having noted whatever might be the reason for the differences that exist between participants with field independent cognitive style and those with field dependent cognitive style; and the differences that do not exist between anticipatory reward condition and no reward condition. This study has however, contributed in the convergence of students creativity in recent times.

Moreover, the link between theory and practice as demonstrated in this study is a crucial implication of the study. The theoretical assertion that cognitive style and reward have effect on creativity has been tested and the findings have given practical support to the earliest proposition. Finally, the findings may stimulate further research and the work will therefore, serve as a reference source to researchers who will embark on a similar topic in the future.

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