Original Research Article

Relationship between Creative Thinking and Mathematics and English Language Performance of Students: The Moderating Role of Gender

ABSTRACT

Aims: This study sought to explore the moderating role of gender in the relationship between creative thinking and academic performance in English Language and Mathematics among Junior High School students in the Aboom Circuit, Cape Coast.

Study Design: The design for the study is correlational espousing the quantitative approach. The study was guided by two research hypotheses, which were tested using Pearson Product-Moment Correlation and Andrew F. Hayes Moderation Process. The instruments for the data collection were Kumar, Kemmler and Holman (1997) Creativity Styles Questionnaire-Revised (CSQ-R) and standardised-type test developed by experts in the various subject areas.

Results: The study revealed significant relationship between creative thinking and academic performance of students (English Language: r=.432, n=140, p=0.05, p=.003, 2-tailed; Mathematics: r=.401, n=140 p=0.05, p=0.000, 2-talied). The study further revealed that gender moderatedsignificantly in the relationship between creativity and academic performance (English Language: b=-.276, t=-2.398, CI= -.485, -.088; Mathematics: b=-.300, t=-2.198, CI= -.564, -.070). As such, male respondents had higher creative thinking effect in English Language and Mathematics than female respondents (b=.371, t=4.608, CI [.212, .530; b=.219, t=2.286, CI [.030, .407]).

Conclusion: Creative thinking indeed relates to performance, as such, it was recommended that creative thinking should be nurtured among all students in J.H.S. In addition, stakeholders in

education should consider including creative thinking in the curriculum and pay special attention to nurturing creative think in female students so that they could match up with their male counterparts.

Key Words: Creative Thinking, Gender,Students and Academic Performance

1. INTRODUCTION

Being creative in life is indispensable as it is believed to be part and parcel of everyday activities of people [1]. Creativity is diverse,which includes suchfields as business, manufacturing, technology, medicine, administration, education, even defense rather than confined to fine art, literature, performing arts, music, and similar artistic domains [1]. Reid and Petocz [2] mentioned that creativity is viewed in different ways in different disciplines; in education it is called “innovation”; in business “entrepreneurship”; in mathematics it is sometimes equated with “problem-solving”, and in music it is “performance”.According to Cropley [1], creativity results in tangible objects such as artworks, books or music, as well as buildings, machines, or devices, but go beyond these to encompass ideas, processes, services, or systems of operation, production and delivery. It encompasses doing these things in ways that are, on the one hand novel and on the other effective in achieving a desired result. The result may range from abstract actions such as communication of a feeling, arousal of esthetic admiration, provocation of a new way of looking at something, development of new understandings of experience or existence, to concrete results [1].Creativity is an active process necessarily involved in innovation. It is a learning habit that requires skill as well as specific understanding of the contexts in which creativity is being applied. The creative process is at the heart of innovation and often the words are used interchangeably [3].Creativity is the intellectual ability to reason differently and find unique answers to problems ([4]; [5]; [6]).

Cannatella [7] indicated that the need for creativity is naturally, tangibly, and mentally an indispensable part of human nature, and that, it is necessary for human-reproduction, growth and cultural striving. Clarkson [8] has stated that there are many qualities which have been

associated with creativity, such as divergent thinking, introversion, self-esteem, tolerance for ambiguity, willingness to take risks, behavioural flexibility, emotional variability, ability to absorb imagery, and even the tendency to neurosis and psychosis. Literature on creativity seem to be scanty but then, it is believed that there may be several kinds of creativity [9]. For instance, MacKinnon [10] has outlined three different kinds of creativity used as a basis for research at the Institute of Personality Assessment and Research Laboratory (IPAR), Berkeley, California. The first is artistic creativity, which reflects the creator's inner needs, perceptions and motivations. The second type is scientific and technological creativity, which deals with some problem of the environment and results in novel solutions but exhibits little of the inventor's personality. The third type is hybrid creativity, found in such fields as architecture that exhibits both a novel problem solution and the personality of the creator.

According to Kampylis and Berki [3], creative thinking enables students to apply their imagination to generating ideas, questions and hypotheses, experimenting with alternatives and to evaluating their own and their peers' ideas, final products and processes.

According to Tsai and Shirley [11], several theories and empirical studies such as those of Baer and Garrett [12]; Hennessey [13];Piirto [14]have offered various perspectives that brighten creativity development. The major findings of those studies arrived at two conclusions about creativity: (a) everyone has creativity and (b) creativity can be taught and developed. Therefore, teachers can be imperative resource in facilitating students learning experience and reveal their potential in the classroom. As a result, one of the key responsibilities of teachers is to inculcate the habit of creativity in students' minds. In education, creative problem solving serves as an important platform to promote creative thinking among students [15]. Chia-Yi and Seokhee [16] investigated the effects of creative problem solving ability among 409 Taiwanese fifth and sixth grades students in terms of mathematics and concluded that different thinking and domain specific knowledge could predict the mathematics problem-solving ability. Conversely, Nickerson [17] has recognized that how to improve creativity is not well implicit, but there are

options that worth consideration. For instance, Mednick and Andrews [18] investigated the relationship between creativity and Intelligent Quotient by using the Remote Associates Test (RAT; [19] to measure creative thinking, and the Scholastic Aptitude Test (SAT) of verbal and mathematical ability (SAT-V & SAT-M) as the indicators of IQ. The results from scores of high school students and college freshman showed a moderate relationship between intelligence and creative thinking.

1.2 Relationship between Creative Thinking and Students' Academic Performance

In terms of creative thinking and academic performance, Ai (as cited in [20]) studied the relation between creativity and academic achievement. In the study, the students were randomly selected from 68 schools (2,264 students, 38% were boys and 62% were girls). Three creativity scales, the Torrance Test of Creative Thinking (TTCT), the Abedi-Schumacher Creativity Test (CT), and the Villa and Auzmendi Creativity Test (VAT), were used. The academic achievement of the students' was assessed using a self-reported achievement in four subject areas English, Science, Mathematics and Social Studies. A canonical correlation analysis found that when operationalized by their grades, creativity was related to academic achievement for both boys and girls. For girls, related to two of the academic subject areas (Social Studies and English) and fluencyrelated to natural science and mathematics. In a similar study conducted by Nami, Marsooli, and Ashouri[20] among 242 randomly sampled students, the study revealed a positive strong correlation between these two variables (creative thinking and students' academic performance). The researchers concluded they had 99 percent confidence that there is positive significance between creativity and academic achievement and higher levels of creativity for students increase their academic achievement. Ogunsanya,Akintunde and Olatoye[21]investigated the relationship between students' creativity and academic achievement using their CGPA scores among 235 students. The study found low negative significant relationship between Creativity and CGPA scores and found that higher the students creativity, the lower the CGPA scores. A creative person may not necessarily be a high achiever in the

school. Muhammad,Naseer, Khizar, Aness, and Anwar[22]explored the relationship between creative thinking and academic achievements of the secondary school students using randomly selected 256 participants. The study revealed a significant relationship between Creative thinking and academic achievement and found a significant relationship between creative thinking and students' academic achievements on different aspects of test of creative thinking. In a study among 306 randomly selected students, it revealed that there was a weak but negative correlation between creativity thinking and academic performance of the students. The value of r = - .090 was indicated and it showed a negative correlation value. The researchers concluded that a creative person might not necessarily be a high achiever in education [23].

1.3 Gender Difference relationship between creative thinking academic performances of students

Research on academic success of students has provided no reliable and consistent indication concerning the extent of creativity, age and gender on academic achievement [24]. A search on academic achievement studies revealed that various variables had been identified as correlates of academic achievement. In spite of the biological differences, there has been a consensus that there are no significant sex differences in intelligence generally ([25]; [26]). Even though there are no sex differences in general intelligence and divergent thinking ability, females remain significantly under-represented in creative fields related to design, science and technology. Females less often study physical sciences, engineering, computer studies and related fields at every level of education from elementary school to graduate school [27]. Helson [28] maintained that, the understanding of creativity in women involves paying attention to the social world, individual differences in motivation and to changes in society over time. According to Jackson and Rushton [29], findings of "no sex difference in intelligence" have since been replicated many times on different standardization samples with different test batteries. Halpern [30] in a study indicated that males are frequently observed to obtain average higher scores on some tests of spatial ability, mathematical reasoning, and targeting, while females are often

found to have average higher score on some tests of memory, verbal ability, and motor coordination within personal space. A study conducted among 28 students in the 4th grade of an elementary school in Bandung City was aimed to establish whether there are differences in creative thinking skill between male and female students. The result of this research indicated no difference in creative thinking skill between male and female students after the application of Team Games Tournament (TGT) learning [31]. The issue of gender differences in creative thinking is a complex and controversial one. Although gender differences in creativity have been assessed in several studies, the results have been inconsistent. For instance, researchers such as Jaquish and Ripple [32]; Agarwal and Kumari [33] found no statistically significant gender differences whereas others like Coone [34]; Tegano and Moran [35] among others found gender differences, at times favouring women and sometimes favouring men [36].A study conducted among students concerning the role of gender in creative thinking and performance revealed that male students were high (M = 80.70) than female students M= 66.97). It means the male students were better in creative ideas than the female counterparts. It was concluded that there was a great impact of gender to the five components of creative thinking ability (37). Similarly, Naderi, Abdullah, Aizan, Sharir, and Kumar (38) in their study concerning creativity, age, and gender predicting academic achievement revealed that creativity, age and gender predicted academic achievement but such predictions were low (R=.378, R -Square= .143) despite existence of significance relationship (F= 8.294, sig=000, P<0.01) among the variables.

Having explored numerous studies on creative thinking and academic performance,it is clear that such studies are geographically different from that of the study area. Again, it can be observed that in such studies respondents were varied and could not account for general conclusion that creative thinking relates to performance or otherwise. With respect to observed variable like gender moderating the relationship between creative thinking and academic performance, least is known as research works focused on other psychological variables different from those under investigation.For instance, studies such as Semordzi, Odame-

Mensah, Hammond and Amoako [39], Zhang, Ren and Deng [40] and Ye, Posada, and Liu [41]used gender as moderator in relationship studies pairing personality traits against career choices and academic stress, gender difference in creativity and academic performance and academic self-efficacy. In terms of the Aboom Circuit located in the Cape Coast Metropolis, it is widely agreed that students' performance is usually appreciable for instance 50.21% of candidates who sat the BECE in 2015 passed their core subjects(English Language and Mathematics) (WAEC Chief Examiner's report as cited in [42]). In light of this, the researchers sought to ascertain if gender in anyway could moderate the relationship between creative thinking and academic performance of Junior High School students in the Aboom Circuit. Doing this will help improve instruction by providing course delivery strategies tailored differently for the promotion of creative thinking among male and female students.The purpose of the current study was to identify relationship between creative thinking and students' academic performance in English Language and Mathematics as they are moderated by gender. Specifically, the following hypotheses were tested:

1. **H0:** There will be no significant relationship between creative thinking and academic performance of students.

   H1: There will be a significant relationship between creative thinking and academic performance of students.

2. **H0:** Gender will not significantly moderate the relationship between creative thinking and academic performance of students.

   H1: Gender willsignificantly moderate therelationship between creative thinking and academic performance of students.

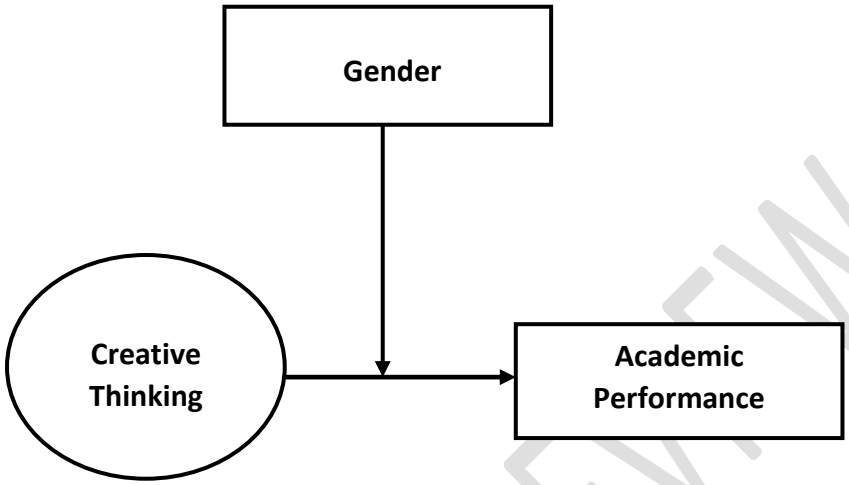

Figure 1: Authors' Construct

Comprehensive literature is available to accentuate the relationship between creativity and academic performance as indicated in the construct named Figure 1. However, it is scarcely document the influencing role that socio-demographic variable like gender play in the making the relationship possible or not. Therefore, the construct sought to find the moderating of gender as a third variable concerning the relationship between creative thinking and academic performance of students.

2.0 RESEARCH METHODOLOGY

The study employed a non-experimental research design known as correlation design. The choice of the design was appropriate because the study investigated the relationship between variables and made no effort in manipulating variables as in causal-effect comparative studies. The population for the study was all Junior High School students in the selected schools within the Aboom Circuit, Cape Coast, with population estimate of 1345. It is this attribute that makes participants eligible as population members. The accessible population was all Junior High School Three (3) students with population estimate of 523 (365 males and 158 females). The J.H.S. Three (3) students were used for the study because they are those believed to have

covered greater part of the syllabi used in constructing the performance instrument. The sample size was 140 (81 males and 59 females) based on 25 percent of the accessible population as proposed by Nwana [43]. Multistage sampling procedures (Random sampling, stratified sampling and systematic sampling) were used in selecting participants for the study. Random sampling procedure was usedto select four (4) out of ten (10) junior high schools in the Aboom Circuit. Stratified sampling procedure was used to apportion samples to the various schools as it gave a fair representation of the population of the sampled schools. Lastly, systematic sampling procedure was used to select individual respondents from the sampled schools using a kth term of 4 as a decision number.Table 1 presents information about the sample for the selected schools:

Table 1: Sample of Junior High School 3 Students from the Circuits

Schools	Proportion	Sample	J.H.S 3 Boys	J.H.S 3 Girls
St Nicholas J.H.S.	38.0	53	30	23
Antem M/A J.H.S.	19.0	27	17	10
Aboom Methodist J.H.S	24.0	33	18	15
Aboom Zion J.H.S.	19.0	27	16	11
Total	**100.0**	**140**	**81**	**59**

Source: Field Data (2019)

The instruments for the data collection were adapted standardised Scale developed by Kumar, Kemmler and Holman [44]Creativity Styles Questionnaire-Revised (CSQ-R) with a reliability coefficient of .74. The reliability coefficientfor the tests were English Language (.74), Mathematics (.77), with a composite coefficient of .76, which lies within the normal range [45]. The test items were 40 each for a subject and were considered standardized because they were developed, reviewed and validated by a team of experts in the various subject areas. The activity time for the test was 30 minutes each for a subject. The data collected were analysed

using inferential statistical tools such as Pearson Product-Moment Correlation and Andrews F. Hayes Processing.

3.0 RESULTS AND DISCUSSION

In all, 140 questionnaires with equal number of test papers were administered to the students. There was a return rate of 100%. The resounding return rate occurred because of the fact that students were on the verge of writing their final examination in school and as such, all were always available for guidance from their teachers towards the examinations. No member of the research team involved in lobbying for all to be present at the period of data collection but it occurred naturally. The views of the respondents are presented in the sections that follow:

3.1 Gender distribution of the respondents

Table 2 presents that both male and female students participated in the study. It was indicative that male students were more than female students as the male participants had a frequency of 81 representing 57.8% while the female respondents were 59, representing 42.2%.

Table 2: Gender Distribution of the Respondents

Gender/Sex	Frequency	Percentage
Male	81	57.8
Female	59	42.2
Total	**140**	**100**

Source: Field Data (2019)

3.2 H1:There will be a significant relationship between creative thinking and academic performance of students.

Table 3a: Relationship between Creative Thinking and Academic Performance in English Language

Variable		Creative Thinking	English Performance
Creative Thinking	Pearson Correlation	1	.432**
	Sig. (2-tailed)		.003
	N	140	140
English	Pearson Correlation	.432**	1
Performance	Sig. (2-tailed)	.003	
	N	140	140

Source: Field Data (2019) **Correlation is significant at the 0.05 level

Table 3a offers the relationship between creative thinking and academic performance of students in terms of English Language. The results from the analysis revealed that creative thinking among students correlate positively with their performance. The correlation between the creative thinking and academic performance was moderate and the p-value shows a statistically significant relationship. This is evident after the two variables produced a results of (r=.432, n=140, p=0.05, p=.003, 2-tailed) which is less than p value of 0.05. This brings to the understanding that when students think creatively, they are likely to perform well academically. The findings corroborate that of Muhammad,Naseer, Khizar, Aness, and Anwar[22]study findings, whichrevealed a significant relationship between creative thinking and academic achievement and found a significant relationship between creative thinking and students' academic achievements on different subjects.

Table 3b: Relationship between Creative Thinking and Academic Performance in Mathematics

Variables		Creative Thinking	Mathematics Performance
Creative Thinking	Pearson Correlation	1	.401*
	Sig. (2-tailed)		.000
	N	140	140
Mathematics Performance	Pearson Correlation	.401*	1
	Sig. (2-tailed)	.000	
	N	140	140

Source: Field Data (2019) **Correlation is significant at the 0.05 level

The results in Table 3b revealed that there was a statistically significant moderate positive relationship between social curiosity and academic performance of students'. This manifested after the Pearson Product Moment correlation coefficient produce a result of (r=.401, n=140 p=0.05, p=0.000, 2-talied) implying that students creative thinking could have significant influence on the academic performance. The findings debunked results of a put out by Mishra and Garg [23] which showed a weak but negative correlation between creative thinking and academic performance of the students and as such, a creative person might not necessarily be a high achiever in education.

3.3 H2:Gender will significantly moderate the relationship between creative thinking and academic performance of students.

A moderation analysis was conducted to explore the role gender in mediating the relationship between creative thinking and students' academic performance. The predictor was creative thinking, the moderator was gender and the criterion was academic performance. However, the criterion was multifaceted in nature such that the composite of it could not be used. The academic performance comprised English Language and Mathematics. The moderation was done using 5,000 bootstrap samples. This bootstrap figure was used to the fact that the sample was not all that huge and as well, contained more than two distributions from the population. The use would allow for building not only on population parameters but estimation for confidence intervals of p-values.

English Language as Y

Table 4a: Gender Moderating the Relationship between Creative Thinking and English Language Performance

Variables	Coeff	BootSE	t-value	BootLLCI	BootULCI
Constant	-7.772	3.925	-1.804	-15.715	-.262
Creative Thinking (CT)	.647	.076	7.868	.503	.799
Gender (G)	9.918	4.925	1.721	.848	20.119
CT*G	-.276	.103	-2.398	-.485	-.088
Conditional effects of the focal predictor at values of the moderator(s):					
Male	.371	.081	4.608	.212	.530
Female	.095	.181	.526	-.262	.452

Model summary: R^2=.442; F (3, 152) =40.211, p<.001

CT*ELP: R^2 *change*=.021; F (1, 152) =5.749, p=.018

Criterion: English Language Performance

The result in Table 4a showed that gendermoderated significantly in the relationship between creative thinking and English Language Performance, b=-.276, t=-2.398, CI(-.485, -.088).

Further analysis revealed that the effect of creative thinking on English Performance was high for male respondents, b=.371, t=4.608, CI(.212, .530) than female respondents. The findings support that ofPiaw (37)which revealed that male students were high than female students in terms of male students been better in creative ideas than the female counterparts.

Mathematics as Y

Table 4b: Moderating Role of Gender in the Relationship between Creative Thinking and Mathematics Performance

Variables	Coeff	BootSE	t-value	BootLLCI	BootULCI
Constant	-2.187	4.880	-.427	-12.308	7.030
Creative Thinking (CT)	.519	.092	5.315	.348	.710
Gender (G)	7.474	6.252	1.092	-4.096	20.539
CT*G	-.300	.126	-2.198	-.564	-.070
Conditional effects of the focal predictor at values of the moderator(s):					
Male	.219	.096	2.286	.030	.407
Female	-.082	.215	-.381	-.506	.342

Model summary: R^2=.378; F(3, 152)=30.772, p<.001

CT*G: R^2 *change*=.020; F(1, 152)=4.829, p=.029

Criterion: Mathematics Performance

The result in Table 4b shows that gender significantly moderated the relationship between creative thinking and mathematics performance, b=-.300, t=-2.198, CI (-.564, -.070). Further analysis revealed that the effect of creative thinking on mathematics performancewas high for male respondents, b=.219, t=2.286, CI (.030, .407) than femalerespondents. The revelation debunked that of Naderi, Abdullah, Aizan, Sharir, and Kumar (38) as gender predicted

positively but low on academic achievement among students.

4.0 CONCLUSION AND RECOMMENDATIONS

It is concluded that creative thinking in no small way has a reflection in performance concerning scholastic work. The study revealed significant relationship between creative thinking and students' performance in English Language and Mathematics. Again, gender of students significantly moderated the relationship between creative thinking and academic performance. As such, teachers must make time to plant the seed of creativity in their students so that they can learn and achieve through their guidance. Again, it is important that stakeholders work out modalities in adding creative thinking to the curriculum at the basic level in order to put students in shape before they get to high school.

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