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CORRELATE AND NON-CORRELATE OF POSTGRADUATES' CRITICAL THINKING ABILITIES AND ACADEMIC ACHIEVEMENT IN SCIENCE EDUCATION

By

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Abstract:

Science education is critical in helping learners acquire problem-solving and decision-making skills, which are capable of paving ways for critical thinking abilities and inquiry, that could help them respond adequately to widespread and radical changes in life. It is against this background that the paper examined graduates of science education extent of acquisition of critical thinking abilities in relation to their academic achievements. Descriptive survey research design was adopted and a sample of 56 purposively selected graduates of science education were employed for the study. Two instruments: An adopted version of the California Critical Thinking Disposition Inventory (CCTDI) of 1992 and students' cumulative grade point average (CGPA) entry schedule were used for the study. Mean and standard deviation statistics were used to describe the extent of the acquisition of critical thinking skills, t-test and Pearson product-moment correlation coefficient (PPMC) statistics were used to test the null hypotheses at a 0.05 level of significance.

Findings of the study revealed that there is high acquisition of critical thinking abilities among graduates of science education, and there is also a significant relationship between postgraduate science education students' critical thinking abilities and their corresponding academic achievements (p-value < α). However, there is a significant difference between postgraduate science education students' academic achievement and their critical thinking abilities (p<α). Critical thinking abilities were also found to be independent of gender. It was recommended that science teaching should integrate various science skills so as to enhance graduates of science education achievements.

Keywords: Critical thinking abilities, Academic Achievement, and Education.

Introduction

Education, in whatever form is meant to satisfy certain basic needs of man. No doubt that the early man went into it straight on his own with the unseen master teacher – experience, which guided him through trial and error (Majasan, 1998). Though slow and painful, it was effective because it aided man into meeting three of his basic needs: Food, Clothing and Shelter. Man by his initiatives, creative thinking, hard work and careful observations had applied himself so tenaciously to "his education" to attain standard. In other words, the attainment of certain standard depends to a very large extent on the standard of education acquired or provided to the learner.

Education has been defined differently by different scholars. In this paper, however, the writer sees education as that act of careful but articulate construction and re-construction of practical knowledge and experiences to meet human needs. These needs can only be met when education is geared towards skills acquisition for the purpose of production of goods and services that would satisfy human needs and consequently leads to job creation and wealth generation. To achieve this, there is the need to determine the critical thinking ability of our postgraduates Science Education Students in relation to their Achievements to see if meaningful Critical Thinking Skills have been acquired for possible job creation and wealth generation in future.

Research studies by Halpern (2014) have shown that critical thinking (CT) involves the ability to carry out certain scientific processes such as: the ability to draw valid inferences, identify relationships, analyze probabilities, make predictions and logical decisions as well as solve complex problems. All these processes are associated with postgraduate science education programs, which enable them to make well-informed decisions about real-life challenges and thereby become active citizens. This is evident to the fact that the school as an institution is among others meant to accomplish certain basic functions of society through the adequate transmission of needed skills for life.

Critical thinking skills requires students to apply information in new situations and in solving problems (Valentino, 2000). According to Ibe (2010), critical thinking involves the ability to identify a problem, raise questions about it, seek for information, analyze them and make inferences logically. Table 1 provides a description of skills associated with critical thinking skills.

Table 1: Critical Thinking Skills

S/N	Skill	Description
1.	Analyzing	Studying something to identify constituent elements or relationships among elements.
2.	Synthesizing	Using deductive reasoning to pull together key elements.
3.	Evaluating	Reviewing and responding critically to materials, procedures or ideas, and judging them by purposes, standards or other criteria.
4.	Applying	Using ideas, processes, or skills in new situations.
5.	Generating ideas	Expressing thoughts that reveal originality, speculation, imagination, a personal perspective, flexibility in thinking, invention or creativity.
6.	Expressing ideas	Presenting ideas clearly and in logical order while using language that is appropriate for the audience and occasion.
7.	Solving problems	Using critical thinking skills to find solutions.

Critical thinking skills enable pupils to be more critically minded, thereby expressing thoughts that reveal originality and inventions in an attempt to solve human problems for sustainable life-styles and global citizenship.

Academic achievement refers to the level of schooling one has successfully completed and the ability to attain success in one's studies. A high cumulative grade point average (CGPA) is an example of academic achievement, and awards are also significant accomplishments.

The study conducted by Karagol and Bekmezi (2015) examined the relationship between academic achievements and critical thinking dispositions of teacher candidates in Faculty of Education and also find out whether critical thinking dispositions and academic achievements scores of teacher candidates differ according to different variables, revealed that critical thinking dispositions of teacher candidates do not differ according to gender, but academic achievement differs according to the gender. There was also positive and weak relationship between critical thinking dispositions and academic achievements of teacher candidates.

Azar (2010) conducted a study on the effect of critical thinking dispositions on students' achievement in selection and placement exam for university in Turkey. 121 students who were selected randomly form the sample for the study. The Critical Thinking Dispositions Scale (CTDS) and a pro forma were used to collect scores of students on test exams for OSS in 2008-2009 academic years. The findings of the study revealed that there is no statistically significant difference between students' academic achievement and critical thinking dispositions at 0.01 level of significant.

Taghva, Rezaei, Ghaderi and Taghva (2014) studied the Relationship between Critical Thinking Skills and Students' Educational Achievement, revealed that there was a significant relationship between teachers' critical thinking and students' educational achievement. Another part of the results indicated that there was no any significant difference between male and female students in terms of critical thinking.

The problem

The need to acquire high-order skills such as the critical thinking skills by every postgraduate science education student cannot be overemphasized. This is owing to the rapid but extreme complex challenges, which are working their way into the deepest structures of our live. These complex Global challenges according to Wilson cited in Karbalaei (2012) are eating deep into our economic, social and environmental realities. With these obvious realities in mind and the growing rate of unemployment in Nigeria, one would be quick to ask if our science education system has actually impacted the needed critical thinking skills capable of enabling our youth to be gainfully employed and be employers of labour in the near future? It is against this background that the paper seeks to find out the extent of acquisition of critical thinking abilities among postgraduate students of science education and the relationship or otherwise of the critical thinking skills they have acquired and their academic achievements. This study has become necessary because the observable consequences of these complex realities could greatly affect the future of the Nigerian State.

Objectives of the study

The main objective of this study is to determine the relationship or otherwise between postgraduates' critical thinking skills and their academic achievements in Science Education at the

Department of Science and Vocational Education, Usmanu Danfodiyo University, Sokoto. The study seeks to:

1. determine the extent of acquisition of critical thinking skills among postgraduate Students of Science Education,
2. find out the relationship between critical thinking skills and academic achievements of postgraduate Science Education Students,
3. establish the differences between critical thinking skills and academic achievements of postgraduate Science Education Students, and
4. find out if gender is a factor in critical thinking skills acquisition.

Research questions

The following research questions are proposed to guide the study:

1. What is the extent of the acquisition of critical thinking skills among postgraduate students of science education?
2. Is there any relationship between critical thinking skills and academic achievements of postgraduate science education students?
3. Is there any difference between critical thinking skills and academic achievements of postgraduate science education students?
4. Is the acquisition of critical thinking skills dependent on gender?

Hypotheses

The following research hypotheses shall be tested at a 0.05 level of significance.

1. There is no significant relationship between critical thinking abilities and the academic achievement of postgraduate science education students.
2. There is no significant difference between critical thinking abilities and academic achievement of postgraduate science education students.
3. There is no significant difference between male and female postgraduate science education students' critical thinking abilities.

The study would have both practical and theoretical significance. Practical in the sense that professional institutions and curriculum planners among others will find the results useful in

repositioning their objectives and mission statements to accommodate gaps in skill acquisition. Theoretically, also, the study will add significant support to already established theories of critical thinking, which draws on and synthesizes research on three separate topics: Theories of reasoning by Westaby, J. D., Probst, T. M., and Lee, B. C. (2010). As well as the theory of academic achievement, which posits that the psychological characteristics of individual students and their immediate psychological environments influence educational outcomes from cognitive, behavioral, and attitudinal perspectives (Reynolds & Walberg, 1992).

Method

The paper adopted a correlation research design of descriptive nature. This was employed to enable the researcher to establish both relationships and differences among critical thinking abilities and academic achievements of postgraduate science education students. The population of the study comprises all 56 postgraduate students of science education. A purposive sampling technique was used to select only postgraduate students who have completed their coursework and had their cumulative grade point average (CGPA) computed. An adopted version of the California Critical Thinking Disposition Inventory (CCTDI) of 1992 was used to ascertain students' critical thinking abilities in relation to their academic achievements computed in CGPA. As well as a CGPA entry schedule (CGPAES) designed by the researcher to obtain information on students' achievements, which ranges from 0.00 to 5.00 Points.

Results

Data obtained were analyzed using descriptive and inferential statistics. Descriptive statistic was used to answer the research questions raised, and the null hypotheses were tested using Pearson Product Moment Correlation Coefficient (PPMC) and t-test at 0.05 levels of significance.

Table 2: Critical Thinking Abilities (CTA) and Academic Achievement in Cumulative Grade Point Average (CGPA) Ratings

Critical Thinking Abilities (CTA)		Academic Achievements in CGPA	
CTA	Range	CGPA	Range
High Critical Thinking Ability (HCTA)	2.50 – 5.00	High Achievement	2.50 – 5.00
Low Critical Thinking Ability (LCTA)	0.01 - 2.49	Low Achievement	0.01 – 2.49

Table 3: Mean and Std. Dev. between CTA and CGPA of postgraduate science education students.

variable	N	$\overline{x}$	Std. Dev.	Mean Difference
CTA	56	3.66	0.71	0.15
CGPA	56	3.81	0.47	

From table 3, postgraduate science education students had critical thinking abilities mean scores of ($\overline{x} = 3.66$) and a corresponding CGPA mean scores of ($\overline{x} = 3.81$) and a mean difference of 0.15. In other words, postgraduate science education students' extent of acquisition of critical thinking abilities also increases with academic achievement.

Table 4: Mean and Std. Dev. of CTS of Male and Female postgraduate science education students.

variable	N	$\overline{x}$	Std. Dev.	Mean Difference
Male	31	3.81	0.5198	0.39
Female	22	3.42	0.4264	

From table 4, Male postgraduate science education students had critical thinking abilities mean scores of ($\overline{x} = 3.81$) while the Female postgraduate science education students had critical thinking abilities mean scores of ($\overline{x} = 3.42$) and a mean difference of 0.39. In other words,

postgraduate science education students' extent of acquisition of critical thinking abilities is independent of gender.

Table 5: Relationship between CTA and Academic Achievement (CGPA) of Postgraduates Science Education Students.

Variables	N	$\overline{x}$	Std. Dev.	df	r	*p*-value	Decision
CTA	56	3.7594	0.7104	51	0.341	0.01	HO1
CGPA	56	3.8142	0.4789				rejected

α = 0.05

Table 5 indicate a significant relationship ($p < \alpha$) between HCTA and High academic achievement. Hence the null hypothesis is rejected.

Table 6: t-test of differences between CTA and Academic achievement (CGPA) of postgraduates' science education students.

Variables	N	$\overline{x}$	Std. Dev.	t	df	*p*-value	Decision
CTA	56	3.6563	0.8196	33.383	54	0.00	HO2
CGPA	56	3.8100	0.4882				rejected

α = 0.05

Table 6 show a significant difference between critical thinking abilities and academic achievement. Hypothesis HO2 is equally rejected because *p*-value is less than alpha value (0.00 < 0.05). This finding contradicts Azar (2010) who asserts that there is no statistically significant difference between students' academic achievement and critical thinking dispositions at 0.01 level of significance. This contradiction may be owing to the variations in the level of significance used.

Table 7: t-test statistics of difference between male and female postgraduate science education students' critical thinking abilities.

Variables	N	$\overline{x}$	Std. Dev.	t	df	*p*-value	Decision
Male	31	3.8158	0.5198	40.875	51	0.00	HO3
Female	22	3.8118	0.4264				rejected
Total	53						

α = 0.05

Table 7 presents a significant difference ($p < \alpha$) between male and female postgraduate science education students critical thinking abilities. Hence the null hypothesis is rejected. This finding is supported by the studies of Karagol and Bekmezi (2015) whose finding indicates significant difference in critical thinking acquisition across gender. However, it contradicts the work of Taghva, Rezaei, Ghaderi and Taghva (2014) who revealed that there was no significant difference between male and female students in terms of critical thinking.

Conclusion

Findings in this study which appear to be fully and adequately supported by similar research studies earlier reviewed is an indication that one of the major goals of science education is the development of critical thinking abilities among students. No doubt then that laboratory experimental method associated with science education was reported (Mulyono, 2018) to improve critical thinking abilities. If scientific reasoning clearly involves critical thinking, it should be expected that pupils with higher performance in science also have higher critical thinking abilities (Rodrigues & Oliveira, 2010), likewise, postgraduate science education students exposed to critical thinking skills should have higher critical thinking abilities as a correlate of their academic achievements.

Recommendations

1. Since it is found in this study that there is a strong positive correlation between critical thinking abilities and postgraduate science education students' academic achievements, science teaching should integrate various science skills so as to enhance students' achievements.
2. A similar study should be conducted at a 0.05 level of significance to ascertain the actual cause of the contradiction in the different findings on academic achievement and critical thinking abilities.

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