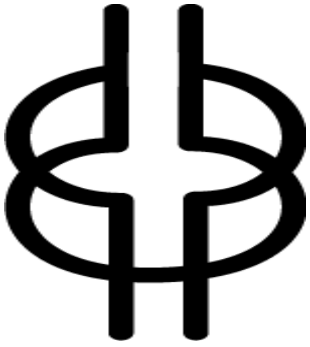
Ghana Journal of Education: Issues and Practice (*GJE*)



NYANSAPO – "Wisdom Knot"

Symbol of wisdom, ingenuity, intelligence and patience

Ghana Journal of Education: Issues and Practice (*GJE*)

ISSN 2579 - 0382

Published By

COLLEGE OF EDUCATION STUDIES, UNIVERSITY OF CAPE COAST, CAPE COAST, GHANA, WEST AFRICA

Ghana Journal of Education: Issues and Practices (*GJE*)

Ghana Journal of Education: Issues and Practices (*GJE*)

VOLUME 4 DECEMBER 2018

Editorial Comment

The Ghana Journal of Education: Issues and Practice (*GJE*) is a peer reviewed journal which focuses on classroom practice and policy issues that affect teaching and learning. In this volume, researchers and authors have contributed a wealth of high quality and informative material to the journal. This volume contains seven articles that have gone through peer review process at three levels by independent reviewers.

Charity Chikodi Iriobe and Canice Enuma Okoli investigate the impact of classroom motivational climates on attitude to and achievement in Visual Arts among junior secondary school students in Lagos, Nigeria. A total of 120 junior secondary three students drawn from three junior secondary schools in Lagos Education District 6 participated in the study. The authors conducted experiments which entailed teaching lessons in Visual Arts within a specified motivational climate spanned over four weeks to as their data source. The findings showed among others that the classroom motivational climates produced differential effects on the participants' post-test scores on attitude to Visual Arts.

Godwin Kwame Aboagye and Emmanuel Osuae Graham explore procedural problem-solving approaches students employ when solving computational problems that involve extensive and intensive quantities of change of state, using 240 Form 3 science students from five senior high schools in the Cape Coast Metropolis. The authors observed, among other things, that students employ the structured procedural approach when solving change of state computational questions that involve extensive quantities instead of the scientific approach and recommended the need for teachers to teach concepts using the scientific approach to effectively encourage learners to analyse problems based on their conceptual understanding before they proceed with computations.

Emmanuel Adu-tutu Bofah and Forster D. Ntow examine the theoretical and methodological issues underpinning the Internal/External (I/E) frame of reference model, which posits a paradoxical relation between "distinct" school subjects to explore the paradoxical relations between mathematics and self-concept across 29 countries using the TIMSS–2011 data set. The authors make an interesting observation about a negative achievement effect on non-

corresponding self-concepts (internal) and positive effects achievement on the corresponding self-concepts (external).

Samuel Olufemi Adeniyi and Olaotan Oladele Kuku examine study habits, locus of control and gender as determinants of academic achievement in English Language among students with hearing impairment in Lagos and Oyo States, Nigeria at the Senior High School level. The authors assert from their research that study habits and locus of control have influence on the academic achievement of students with hearing impairment. In addition, locus of control contributes mostly to the academic achievement of students with hearing impairment.

Andrews Cobbinah explores the comparative effects of critical thinking and peer-assessment skills training on Ghanaian senior high school students' achievement in mathematics in the Central Region of Ghana, using experimental group and control group design. The author makes two interesting observations namely; there was no significant comparative effect of critical thinking and peer-assessment skills training on students' achievement in mathematics, and there was no significant interaction effect of gender, age and treatment groups (critical thinking and peer-assessment) on students' achievement in mathematics. Based on the findings, the author suggests the use of either peer-assessment or critical thinking strategies in teaching mathematics lessons.

Charles Adabo Oppong examines the alignment between the History syllabus and its official textbook used in senior high schools in Ghana in the post-2007 reform era. The author uses a combination of in-depth interviews and content analysis to elicit the needed responses from the research participants. The author highlights what appears to be a disconnect between the History syllabus and the official History textbook. The author also observed that the official History textbook was perceived as not containing detailed information on the selected topics in the syllabus and discusses implications of the findings for policy on curriculum delivery in History at the high school level.

Olutomi Ade Ariyibi, Bakari Yusuf Dramanu and Joshua Adebisi Omotosho investigate the influence of three personality/ psychological factors (creativity, locus of control and risk tolerance) on the entrepreneurial inclinations of public university students in Nigeria, using a multi-sage sample procedure to select 2,930 participants for a questionnaire survey. The authors found that the three predictor

variables had significant influence on entrepreneurial inclinations of students and recommend the need to reposition the economy towards entrepreneurial drive for job creation, wealth creation and global competitiveness of the Nigerian youths in general and the graduate in particular.

The editorial team is grateful to all reviewers for the useful feedback they offered on the papers they reviewed and the level of professionalism they exhibited through the review process. To the Provost of the College of Education Studies, University of Cape Coast, the team would like to say a big thank you for the continual financial and logistical support which has made the publication of *GJE* possible.

Ernest Kofi Davis, PhD
(Editor-in-Chief)

Ghana Journal of Education: Issues and Practices (GJE)
Vol. 4, December 2018, pp. 1 - 18

Impact of Classroom Motivational Climates on Attitude to and Achievement in Visual Arts among Junior Secondary School Students in Lagos, Nigeria

Charity Chikodi Iriobe & Canice Enuma Okoli *

Department of Educational Foundations, University of Lagos, Nigeria

Corresponding author's email: caniceokoli@yahoo.com*

Abstract

The study investigated the impact of classroom motivational climates on attitude to and achievement in Visual Arts among junior secondary school students in Lagos, Nigeria. A total of 120 junior secondary three students drawn from three junior secondary schools in Lagos Education District 6 served as participants. Each of the three schools was randomly assigned either the task-involved, ego-involved or the control condition. The experiments which entailed teaching lessons in Visual Arts within a specified motivational climate spanned over four weeks. Each lesson lasted for 80 minutes per week. Three research instruments were used for data collection. These comprised the Students' Attitude to Visual Arts, Visual Arts Achievement Test, and Students' Perception of Motivational Climate. Three null hypotheses were formulated in the study. The hypotheses were tested using the Analysis of Covariance (ANCOVA). The findings showed that the classroom motivational climates produced differential effects on the participants' post-test scores on attitude to Visual Arts. The task-involved and ego-involved motivational climates were more effective than the control condition in bringing about greater positive feelings about Visual Arts class. The study also revealed that task-oriented and ego-involved motivational conditions recorded significant post-test mean gains in visual arts achievement.

Key words: Motivational climate, visual arts, attitude to visual arts, achievement in visual arts.

Introduction

Any nation that seeks relevance and competitiveness in the age of globalization must make every effort to give its citizens the best education possible. Visual arts education is an instrument par excellence that a nation can rely upon to bring about self-reliance. In

stating the inextricable role of arts in education and specifically in the modern concept of education, Ajayi (1985) posited that art should be given an important place, since it deals with the development of the whole child.

The purpose of art education is for the child to grow to live happily, creatively and also productively, with a growing sense of self-worth and personal dignity. The arts provide ample opportunities to the child for individual learning and self activity and subsequently, assume a great deal of importance in the all-round development of the child. Ajayi (1985) posited further that interaction with the environment and the medium of expression provides man with the necessary content for his learning. An art activity provides the child with the opportunity to freely interact with his environment, a variety of materials and media of artistic expression. Consequently, the role of arts in any educational system is fundamental for the creative growth and development of the child.

More importantly, Nigerian government recognizes the importance of art in the preservation of culture and as such, the National Policy on Education (Federal Republic of Nigeria, 2004) stipulates that measures shall be taken to ensure that culture of the nation is kept alive through art. This policy statement reveals the emphasis placed on visual arts, especially, in the preservation of Nigeria's cultural heritage. Uzoagba (2000) asserted that a society is judged by its artistic potentialities and such artistic potentials cut across different areas of human endeavour in general - education, technology, commerce, religion, transportation and communication among others. Moreover, the role of art as the medium for unity and instruction for all subjects in our educational system cannot be over-emphasized. Ironically, it has not been given adequate attention as some schools are yet to teach Art, and even when it is taught in some schools, Art teachers are not readily available.

The quality of education in any society to a great extent depends on the quality of teachers in the schools. According to Mamza (2007), most of the problems of training art teachers centre around: (i) recognition and policy making; and (ii) curriculum planning and development, plus the fact that, there are not enough art schools and art educators to cope with the increase in demand for art teachers. Additionally, he notes that teacher training programme at the Nigerian

Certificate in Education (N.C.E) level is not extensive and long enough to adequately prepare students for effective Art teaching because they are not properly groomed in the pedagogy and psychology of the child.

Uzoagba (2000) further asserts that the manner in which visual art is taught in our schools and colleges has been found to be unscientific, poor and improperly organized. This scenario is quite discouraging considering the fact that across the continent and among developed and developing countries; there are renewed drives at restructuring and improvising existing educational structures to meet global challenges. The introduction of various programmes and reforms are apparent strategies to realign existing educational structures with the present realities. These efforts are made to properly position education as a crucial means of national development. Moreover, at this time of rapid change in education, there is an increasing need for the education system to make use of skilled manpower and available relevant materials.

Talabi (2001) asserts that the importance of motivating students towards developing a positive attitude to arts cannot be overemphasized. Motivation has been defined as an approach by the teacher that arouses the students' interest in achieving a certain goal. To do this, the teacher creates an atmosphere capable of involving the children in an exciting situation. Subsequently, the type of motivational climate a teacher adopts and implements in a teaching/learning environment either enhances or hinders learning (Epstein, 1989).

Motivational climate, according to Weiss (2000), refers to how the learning environment is structured, what behaviours are valued and how individuals are evaluated. The learning environment could be task- or mastery-involved. A task- or mastery-involved motivational climate is one in which success and valued behaviours are defined in self-referenced terms such as: learning, effort, and improvement and mistakes are viewed as part of the learning process. On the other hand, an ego- or performance involved motivational climate is one in which the individual is evaluated in comparison to the performance of peers, as improved skill or mastery of a task is not sufficient to produce feelings of competence. One must therefore outperform others to evoke a sense of achievement. The ability of the teacher to arouse pupils' interest to participate actively in class is the key to eliciting behaviours either desirable or undesirable.

Teachers should pay close attention to the type of instructional environment they implement, because it will convey what they value and it will have motivational consequences for their students (Boyce, 2009). According to Ames (1992c), there are two distinct types of motivational climates-mastery (task-involving) and performance (ego-involving) and teachers can organize classroom activities to reflect one or both of these climate types.

An arrangement of the classroom teaching environment (or motivational climate) that emphasizes effort, improvement, cooperation, and self-referenced comparisons constitutes a task-involving or mastery climate. In this type of setting, students adopt positive achievement strategies, which include hard work, persistence at tasks, and the pursuit of challenging tasks (Ames & Archer, 1988). In contrast, when a classroom teaching environment stresses social comparison among competing students then this setting is referred to as ego-involving or a performance climate. This type of setting produces students who have lower motivation levels, attribute failure to lack of ability, and choose to work only on tasks at which they can be successful (Ames & Archer, 1988).

When the motivational climate was studied in physical education settings (Papaioannou, 1995; Solmon, 1996), findings indicated that students' perceptions of a mastery climate led to greater feelings of satisfaction, less boredom, higher perceived ability, increased intrinsic motivation, and increased persistence, especially at higher levels of task difficulty. Further, students in the mastery climate believed that both effort and ability contributed to success, as well as a positive attitude about physical education (Morgan, Sproule, Weigand, & Carpenter, 2005; Roberts, Treasure, & Conroy, 2007). In contrast, perceptions of a performance climate produced less enjoyment, greater boredom, belief that success was linked to ability and not to effort and less positive attitudes about physical education.

The traditional method of teaching currently in vogue negates the more scientific teaching pedagogy based on motivation and individual differences. The scientific methods which are basically learner-centred focus on what would motivate the student to perform optimally. This is where the adoption of motivational climate strategy aimed at deleting the apathy to Visual arts becomes urgent. The findings reported above were mostly from empirical studies conducted in

Physical Education classes. Since not much work has been done in applying the Epstein's TARGET strategy (Epstein, 1989) in Visual arts classes, it is therefore imperative to investigate the extent to which motivational climates created by Visual arts teachers can influence students' perception, attitudes and achievement in Visual Arts.

Purpose of the Study

The main objective of this study was to investigate the impact of classroom motivational climates on students' attitude towards and achievement in Visual Arts in Lagos State, Nigeria. Specifically, the study sought to investigate whether:

1. There is a difference in post-test scores on attitude to Visual Arts among participants in the three experimental groups.
2. There is a difference in the post-test scores in Visual Arts achievement test among participants in the three experimental groups.
3. There is a difference in the post-test scores on perception of motivational climate in Visual Arts class among participants in the three experimental groups.

Research Hypotheses

The following hypotheses were tested in this study:

1. There is no significant difference in the post-test scores in attitude to Visual Arts among participants in the three experimental groups.
2. There is no significant difference in the post-test scores in Visual Arts achievement test among participants in the three experimental groups (task-involved, ego-involved and control).
3. There is no significant difference in the post-test scores in perception of motivational climates among participants in the three experimental groups.

Method

Research Design

The research design used for the study was the quasi-experimental pre-test and post-test, control group design. The quasi-experimental design was appropriate for this study because it involved

human behaviour and did not permit complete randomization of subjects and control of all variables.

This type of design requires that participants be tested with the same instruments before and after treatment. To determine the effects of the treatment, the result of the participants in the treatment groups were compared with the scores of participants in the control group. The design comprised of two independent variables: experimental conditions (two treatments and one control) and gender (male and female). The dependent variables were attitude to visual arts, visual arts achievement and students' perception of motivational climate.

Participants

The participants for the study comprised 120 junior secondary school three (JSS 3) students. The students were selected from three Junior Secondary Schools (40 students per school) in Lagos Education District 6. The sampling procedure was simple random. Firstly, the Educational District 6 was chosen from the six Educational Districts through simple random sampling (hat and draw method). Secondly, three Junior Secondary Schools were randomly selected through *hat and draw* method from a total of 319 Junior Secondary Schools in Lagos Educational District 6. Finally, one arm of JSS 3 class was randomly selected from each school. From each arm a total of 40 students were randomly selected as participants for the study. The mean age of the participants was 14.73 years with a standard deviation of 1.23 years. A total of 56 males and 64 female students took part in the study.

Research Instruments

Three research instruments were used to obtain relevant data in the study.

Scale of Attitude to Visual Arts (SAVA)

The Scale of Attitude to Visual Arts was developed by the researchers to assess the extent to which students' attitude towards Visual Arts is favourable or unfavourable. It is a 12-item instrument scored on a 4-point Likert-type. The responses ranged from Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The instrument had a test-retest reliability coefficient of 0.67 at four weeks' interval. The SAVA was found to correlate significantly with Scale of Achievement Motivation, Students' Perception of Motivational

Climate and Visual Arts Achievement Test scores with coefficients of .48, .49 and .19 respectively ($p<0.05$).

Visual Arts Achievement Test (VAAT)

This is a 10-item achievement test in Visual Arts developed by the researchers based on essay format. There were parallel forms of the test (Form A and Form B). The questions in the two tests were based on the topics covered during the experimental period. A parallel form reliability test was carried out and a coefficient of 0.82 was obtained.

Students' Perception of Motivational Climate (Spmc)

This is a 10-item instrument adapted from the Perceived Motivational Climate in Sports Questionnaire (PMSCQ) developed by Walling, Duda and Chi (1993). It was designed to assess students' perception of the motivational climate created by the teacher during Visual Arts lessons. The items cover teacher's ability to make the lesson interesting, reward correct responses, be creative, encourage student participation in classroom and express beliefs in students' ability to succeed in Visual Arts. Examples of the items include "trying hard was rewarded", "students tried to improve based on their own score", "outperforming classmates was important", and "only the top students got noticed". The SPMC recorded a test-retest reliability coefficient of 0.76 at four weeks' interval. It correlated significantly with Scale of Attitude to Visual Arts and Visual Arts Achievement Test with coefficients of .49 and .23 respectively ($p<0.05$).

Administration of the instruments

One week before the commencement of the treatments, the researchers visited the schools to carry out pre-tests to the two treatments and control group. One week after the treatments were concluded, the researchers conducted the post-tests using the same assessment measures previously used for pre-tests, with the exception of Visual Arts Achievement Test in which a parallel form of the test was used.

Treatments

The three JSS 3 classes randomly selected from each of the three schools were assigned the task-involved climate, ego-involved climate or control condition. The experiment consisted of teaching four lessons

of Visual Arts within a specified motivational climate created by the teacher. Each experiment lasted for four weeks of 80 minutes contact per week. The lead researcher, a specialist in Visual Arts, carried out the experiments. The researcher obtained the scheme of work for JSS 3 Visual Arts from teachers in the schools. The researcher subsequently prepared four lesson plans based on topics in Visual Arts slated for the second term. The participants in each of the three experimental groups (task-involved, ego-involved or control condition) were taught similar topics using the same lesson plans. However, the groups differed on the unique motivational climate created by the teacher while teaching the topics. Each lesson covered the duration of two school periods (80 minutes).

Task-Involved Motivational Climate: The task-involved goal perspective is defined with self-referenced criterion for success, with an emphasis on learning a skill and improving individual performance. This goal perspective is associated with adaptive motivational patterns such as exerting effort, seeking challenging tasks, persisting in the face of difficulty, and attributing success to efforts. This goal dimension is based on the view that competence or ability can be increased through effort.

For the task-involved climate, the researcher implemented the TARGET strategies outlined by Morgan as cited in Solmon (1996). The TARGET strategies for fostering the task-involved motivational climate stresses individual challenge, short term goals, improvement and self-referenced criterion for success. The class environment focussed on rewarding efforts, improvement and persistence. The researcher encouraged the participants to work at their own pace, to work together, and to seek to do better than on previous exercises. In the course of teaching the four lessons, the researcher used statements that reflected task-involved motivational climate. The statement that pertains to task-involved climate which were used included:

a) references to individual challenges;
b) self-referenced goals;
c) recognition of individual progress;
d) encouragement of students to work in groups and help each other ;
e) to persist when task get to a difficult level; and
f) work at their own paces at an appropriate level of difficulty.

Ego-Involved Motivational Climate: The ego-involved climate was based on ego-involved goal perspective of achievement motivation (Nicholls, 1984) which stresses the evaluation of success in comparison with the performance of others. Individuals in this group attribute success in comparison to the performance of peers, as improved skill or mastery of a task is not sufficient to produce feelings of competence. One must therefore outperform others to evoke a sense of achievement. If the student perceives himself or herself to lack the ability to success (beat others), he or she finds little or no reason to exert effort.

The ego-involved motivational climate was created through the use of competition ladder. The focus of performance was on moving up the ladder and demonstrating superiority in comparison with one's classmate. The class members were encouraged to win contests and be the best visual artist. Poster colour packets and paint brushes were prices for best performance. In implementing the ego-involved climate, the researcher created ego-involved statements and placed prices for winners. These statements included all references to moving up the Visual Arts achievement ladder as well as trying to be the best in class or to outperform others in order to win coveted prices of art materials. The researcher taught four Visual Arts lessons within the context of the ego-involved motivational climate created. The lesson notes were the same used for task-involved motivational climate.

Control Condition: The researcher taught four Visual Arts lessons within the context of traditional teaching method. In other words, the teaching of Visual Arts lessons in the control condition followed the traditional teaching method. Researcher-participants' interactions were limited to asking questions, providing feedback, and reinforcing correct answers. There was no introduction of statements associated with task-involved or ego-involved motivational climates.

Method of Data Analysis

The three hypotheses formulated in the study were tested using a factorial (2 x 3) Analysis of Covariance (ANCOVA). The level of significance was determined at 0.05 level. Post-hoc pair wise comparisons was done using the Scheffe's test.

Results

Hypothesis one:

There is no significant difference in the post-test scores in attitude to Visual Arts among participants in the three experimental groups.

The results of testing this hypothesis are presented in Tables 1 and 2.

Table 1: Post-test and Pre-test Means on Students Attitude to Visual Arts for Participants across Experimental Groups

Experimental Group	Post-test		Pre-test		Mean
	Mean	*N*	*Mean*	*N*	Difference
Task-involved	36.38	40	35.83	40	0.55
Ego-involved	37.28	40	38.33	40	-1.05
Control	39.03	40	39.38	40	-0.35

Table 1 shows that the participants in the task-involved group recorded mean gain in attitudes to Visual Arts. On the other hand, the ego-involved and the control group did not record any positive change in attitudes to Visual Arts.

Table 2: 2 X 3 Analysis of Covariance (ANCOVA) Summary Data for Post-test Scores on Students' Attitude to Visual Arts (SAVA) Using the Pre-test Scores on SAVA as Covariate

Source of Variation	Sum of squares	df	Mean square	F- cal	Sig. of F
Main effects with covariates (combined)	601.29	4	150.32	6.10	*
Experimental Group	284.81	2	142.40	5.78	*
Gender	47.31	1	47.31	1.92	n.s.
Covariate (SAVA Pre-test)	419.22	1	419.22	17.02	*
2 – Way Interactions					
Experimental Group Vs Gender	135.31	2	67.65	2.74	n.s
Model	736.60	6	122.76	4.98	*
Residual	2783.32	113	24.63		
Total	3519.92	119	29.57		

* Significant $p < 0.05$ n.s. = not significant

The calculated F ratio of 5.78 for the experimental group was larger than the critical F ratio of 3.07. This suggests that there is a

significant difference in the post-test scores on Attitude to Visual Arts, among participants in the three experimental groups. Consequently, hypothesis one is rejected; $F(2, 113) = 5.78$, $p<0.05$. In terms of gender comparison, the calculated F value (1.92) was less than the critical F value (3.92). This implies that there is no significant difference in post-test scores on Attitude to Visual Arts between male and female participants.

Hypothesis two:

There is no significant difference in the post-test scores in Visual Arts achievement test among participants in the three experimental groups (task-involved, ego-involved and control).

The results of testing hypothesis two are presented in Tables 3 and 4.

Table 3: Post-test and Pre-test Means on Visual Arts Achievement Test (vaat) for Participants across Experimental Groups

Experimental Group	Post-test		Pre-test		Mean Difference
	Mean	*N*	*Mean*	*N*	
Task oriented	7.92	40	4.95	40	2.97
Ego involved	6.42	40	4.31	40	2.11
Control	5.41	40	4.30	40	1.11

Table 3 shows that the participants in the task-involved condition made the greatest mean gain in Visual Arts Achievement Test and were followed by those in the ego-involved motivational condition. On the other hand, the control group made the least mean gain.

Table 4: 2 X 3 Analysis of Covariance (ANCOVA) Summary Data for Post-test Scores on Visual Arts Achievement (VAAT) Using the Pre-test Scores on VAAT as Covariate

Source of Variation	Sum of squares	df	Mean square	f –cal	Sig. of F
Main effects with covariates (combined)	57.31	4	14.32	7.85	*
Experimental Group	19.82	2	9.91	5.43	*
Gender	3.92	1	3.92	2.15	n.s.
Covariate (VAAT Pre-test)	29.63	1	29.63	16.25	*

2 – Way Interactions					
Experimental Group Vs Gender	4.03	2	2.01	1.10	n.s
Model	61.33	6	10.22	5.06	*
Residual	206.06	113	1.82		
Total	267.39	119	2.24		

* Significant p< 0.05 n.s. = not significant

According to the results in Table 4, calculated value of F (5.43) was larger than the critical value (3.07). This signified that either one or both factors that make up the effects must be significant. Closer examination shows that there is a significant difference in the post-test scores in Visual Arts Achievement Test (VAAT) among the three groups. Hypothesis two is therefore rejected; (F2, 113) = 5.43, p<0.05. However, there is no significant difference in the post-test scores in VAAT due to gender difference of the participants (F=2.15). In the same vein, the interaction of gender and experimental conditions did not record any significant effect on the Visual Arts Achievement Test score. This means that whatever treatment effects evidenced by the experimental groups was without regards to their gender composition.

Hypothesis three:

There is no significant difference in the post-test scores in perception of motivational climates among participants in the three experimental groups.

The results of testing this hypothesis are presented in Tables 5 and 6

Table 5: Post-test and Pre-test Means on Students Perception of Motivational Climate for Participants across Experimental Groups

Experimental Group	Post-test		Pre-test		Mean Difference
	Mean	*N*	*Mean*	*N*	
Task-involved	33.80	40	32.03	40	1.77
Ego-involved	32.43	40	30.80	40	1.63
Control	28.75	40	29.20	40	-0.45

Table 5 shows that the task-involved group recorded the greatest improvement in the perception of motivational climate created in a

Visual Arts class and was closely followed by the participants in the ego-involved and control group respectively.

Table 6: 2 X 3 Analysis of Covariance Summary Data for Post-test Scores on Students' Perception of Motivational Climate (SPMC) Using the Pre-test Scores on SPMC as Covariate

Source of Variation	Sum of squares	df	Mean square	F – cal	Sig. of F
Main effects with covariates (combined)	902.61	4	225.65	12.83	*
Experimental Group	311.88	2	155.94	8.87	*
Gender	33.58	1	33.58	1.91	n.s.
Covariate (SPMC Pre-test)	348.54	1	348.54	19.82	*
2 – Way Interactions					
Experimental Group Vs Gender	55.51	2	27.75	1.57	n.s
Model	958.12	6	159.68	9.08	*
Residual	1986.67	113	17.58		
Total	2944.80	119	24.74		

* Significant $p < 0.05$ n.s. = not significant

In Table 6, the F calculated value (8.87) is greater than the critical value (3.07). This suggests that there is a significant difference in the post-test scores in students perception of motivational climate among the three experimental groups. Hypothesis three is therefore rejected; $(F2, 113) = 8.87$, $p<0.05$. On the other hand, there is no significant difference in the post-test scores on SPMC due to gender ($F = 1.91$). The interaction of gender and experimental conditions had no significant effect on SPMC ($F = 1.57$).

Discussion

Hypothesis One which states that there is no significant difference in the post-test scores on Scale Attitude to Visual Arts was rejected. This implies that the experimental conditions produced differential effects on the participants' post-test scores on attitude to Visual Arts. The post-hoc pair wise comparisons revealed that only the participants in task-involved motivational conditions evidenced significant mean gains in attitude to visual arts than the control group.

On the other hand, the task-involved motivational condition was not superior to the ego-involved motivational condition in changing the participants' attitude to Visual Arts. Similarly, the ego-involved condition was not significantly better than the control.

The results obtained from testing Hypothesis One showed that it is possible to change the attitudes of students towards skills-oriented activity. This confirms the findings of Digelidis, Papaioannou, Laparidis and Christodoulidis (2003) who assessed the effects of year long intervention in Greek junior high school physical education on motivational climate, goal orientations and attitudes towards exercise and healthy diet. They found that students who took part in the intervention, compared with the control had more positive attitudes towards exercise and healthy eating; had lower ego and higher task orientation scores, and perceived that their teacher gave more emphasis on task-involvement and less emphasis on ego-involvement. Even though the intervention reported involved physical education, it has implications for visual arts education. It is possible, based on their conclusion, for visual arts educators to create a positive motivational climate facilitating students' task orientation and attitudes towards learning tasks in visual arts.

The above findings are quite instructive. It goes to support Harrel's (2010) assertion concerning the setting of either performance or mastery learning goals. According to her, performance goals (associated with ego involved conditions) can be great in short term, but they also have some downsides. Performance goals by their nature are rather shallow. They tend to undermine long-term performance. For example, if a student achieves a goal of obtaining high mark in a competitive visual arts task, he/she may become less motivated to continue towards excellence. On the other hand, Harrel (2010) have found that mastery goals (associated with task-involved condition) are more effective because one's satisfaction is not related to external indicators. Consequently, one is less apt to give up in difficult circumstances, and may persevere through setbacks. Because mastery goals are always just beyond reach, it makes motivation to last over a long term.

According to Perlman and Karp (2007), individuals possess two types of orientations for demonstrating competence: mastery (task) and performance (ego). The students who possess a mastery-orientation

demonstrate competence or success through the achievement of personal goals and individual growth. On the other hand, performance oriented students judge success through social comparison, like winning or losing. The achievement theory suggests that goal orientations and the perceived motivational climate may influence one another and other motivational variables over time. Encompassed within this motivational pursuit is the idea that students will become actively involved in the learning process and engage in achievement, strategies skills acquisition and development. It becomes imperative for visual arts educators to understand how to enhance all students' motivation levels and influence their development of adaptive achievement strategies.

The second hypothesis states that there is no significant difference in the post-test scores in visual arts achievement test among participants in three experimental groups. This hypothesis was rejected. The findings indicate that participants in task-involved and ego-involved motivational conditions recorded significant post-test mean gains in Visual Arts achievement than participants in the control group. In the same vein, the task-involved condition appeared more efficacious than the ego-involved condition in enhancing achievement in Visual Arts. The findings obtained from testing Hypothesis Two confirms those by Treasure and Roberts (2001) who examined the relationship between students' perceptions of the motivational climate and beliefs about the causes of success, preference for challenging tasks, and satisfaction in physical education. Their results showed that perceptions of a mastery-oriented motivational climate were related to the belief that motivation or effort caused success and satisfaction. In contrast, perceptions of a performance climate were related to the belief that deception caused success and related negatively to the students' preference for challenging tasks. Results of hierarchical regression analyses revealed that perceptions of the motivational climate explained a significant amount of unique variance in the students' responses after controlling for dispositional goal orientations. The results suggest that the teacher can influence the salience of a mastery-oriented climate and, in so doing, optimize a child's motivation in visual arts.

Hypothesis Three states that there is no significant difference in the post-test scores in perception of motivational climate among

participants in three experimental groups. The hypothesis was rejected. This suggests that the participants in the three experimental groups differed significantly in the way they perceived the motivational climates created in Visual Arts classroom. The post hoc pair wise comparison indicates that post-test mean scores of participants in task-oriented and ego-involved groups were significantly greater than that of the control. It is evident from the findings obtained from testing Hypothesis Three that the two motivational conditions (task-involved or ego-involved condition) were positively perceived by the participants. Several factors may have contributed to this observation. Firstly, Visual Arts teachers do not have high morale due to poor motivation and dearth of teaching materials. Secondly, Visual Arts is activity-oriented. Many young people enjoy working with their hands especially those that appeal to their interests. Consequently, the motivational conditions created (task-oriented or ego involved) would naturally appeal to the needs of students – the need to achieve mastery and the need to outperform others in a competitive learning environment.

Recommendations

The following recommendations are proffered to create the right attitude to and achievement in Visual Arts as well as increase significantly the enrolment figure from its present dismal low rate to what would compete with the other courses at the Senior Secondary level.

1. There is need to retrain Visual Arts teachers in order to enable them understand the various approaches to create motivational climates in any classroom teaching-learning interaction.
2. The work of the art teacher should be supplemented by employing the services of resource persons such as local craftsmen and women with demonstrated ability in specific crafts to demonstrate such crafts to students.
3. Relevant conferences, seminars and workshops on the promotion of art teaching should be organised frequently by relevant government agencies.
4. Government should provide adequate financial assistance to schools for the procurements of the basic art materials, textbooks and other related facilities.

5. Visual Arts teachers should encourage their students to join art clubs and to participate in art competitions and exhibitions.

References

Ajayi, F. (1985). *Handbook on art methodology*. Ipetu- Ijesha, Nigeria: Oyoyo Press.

Ames, C. (1992c). Achievement goals, motivational climate and motivational process. In G.C. Roberts (Ed.)*Motivations In sports and exercise*. Champaign, Il: Human Kinetics.

Ames, C. & Archer, j. (1988). Achievement goals in the classroom: Students learning strategies and motivational processes. *Journal of Educational Psychology, 80*, 260-267.

Boyce, B.A. (2009). Creating instructional environments that keep students on TARGET: Does your class encourage a performance climate or a mastery climate? *Journal of Physical Education, Recreation and Dance*. Retrieved from http//:www.accessmylibrary.com.

Digelidis, N., Papaioannou, A., Laparidis, K., & Christodoulidis, T. (2003). A one-year intervention in 7th grade physical education classes aiming to change motivational climate and attitudes towards exercise. *Psychology of Sport and Exercise, 4*(3), 195-210.

Epstein, J. (1989). Family structures and student motivation: A developmental perspective. In C. Ames & R. Ames (Eds.). *Research on motivation in education*. New York: Academic Press.

Federal Republic of Nigeria (2004). *National policy on education*, (*4th ed.)*. Lagos, Nigeria: NERDC Press.

Harrel, A. (2010). Mastery vs. performance goals: why the type of goal you set matters. Retrieved from http://www.neboweb.com/ blog/types-goals-set-important-goals/.

Mamza, M. P. (2007). Contemporary issues in fine and applied arts education in Nigeria. *Multidisciplinary Journal of Research Development, 8(4)*, 1-5.

Morgan, K., Sproule, J., Weigand, D. & Carpenter, P.J. (2005). A computer-based observational assessment of the teaching behaviours that influence motivational climate in physical education. Physical Education and Sport Pedagogy, 10(1), 83-105.

Nicholls, G.J. (1984). Conceptions of ability and achievement motivation. In R. Ames & C. Ames (Eds). *Research on motivation in education.* New York: Academic Press.

Papaionnou, A. (1995). Differential perceptual and motivational patterns when different goals are adopted. *Jourrnal of Sports and Exercise Psychology*, *17*, 18-34.

Perlman, D.J. & Karp, G.C. (2007). Using TARGET to enhance preservice classroom teachers ability to identify and develop motivational climate. *Physical Educator*, *64*(2), 102-108.

Roberts, G.C., Treasure, D.C., & Conroy, D.E. (2007). The dynamics of motivation in sport: The influence of achievemtn goals on motivational process. In G. Tenenbaum & R.C. Eklund, (Eds.).*Handbook of Sport Psychology (3rd ed.)*. New York: Wiley.

Solmon, M.A. (1996). Impact of motivational climate on students' achievements and perception in a physical education setting. *Journal of Educational Psychology 88*(4), 713-738.

Talabi, G. (2001). *Art teaching in secondary schools.* Ibadan, Nigeria: Heinemann Educational Books Nigeria Plc.

Treasure, D.C. & Roberts, G.C. (2001). Students' percpetions of the motivational climate, achievement beliefs and satisfaction in physical education. *Reseach Quarterly for Exercise and Sport*, *72*, 165-175.

Uzoagba I. N (2000). *Understanding art in general education*. Owerri, Nigeria: Africana FEP Publishers Ltd.

Walling, M.D., Duda, J.L. & Chi, L. (1993). The perceived motivational climate in sports questionnaire: Construct and predictive validity. *Journal of Sport and Exercise Psychology*, *15*, 172-183.

Weiss, M. R. (2000) Motivating kids in physical activity. *Presidential Council on Fitness and Sports Digest*, *3*(11), 1-8.

Ghana Journal of Education: Issues and Practices (GJE)
Vol. 4, December 2018, pp. 19 - 43

Procedural Problem-Solving Approaches Employed by Students in Learning Extensive and Intensive Quantities of Change of State

Godwin Kwame Aboagye[1]* & Emmanuel Osuae Graham[2]

1. University of Cape Coast, Cape Coast, Ghana
2. University Practice Senior High School, Cape Coast, Ghana

*Corresponding author's email address: *aduaboagye@ucc.edu.gh*

Abstract

The purpose of the study was to investigate the procedural problem-solving approaches students employ when solving computational problems that involve extensive and intensive quantities of change of state. A sample of 240 Form 3 science students randomly selected from five senior high schools in the Cape Coast Metropolis participated in this study. An achievement test on change of state of matter comprising of five items was used for data collection. The results showed, among other things, that students employ the structured procedural approach when solving change of state computational questions that involve extensive quantities instead of the scientific approach. The study also found that no clear procedural approach was employed by majority of the students in solving change of state computational questions that involved intensive quantities. The study further revealed that among the five problem-solving approaches, the scientific approach was the most effective in revealing students' correct conceptions of intensive quantities. These findings suggest that for students to be good problem solvers, teachers must teach concepts using the scientific approach to effectively compel learners to analyse problems based on their conceptual understanding before they proceed with computations.

Key words: Problem solving**,** procedural approach, extensive quantity, intensive quantity, correct conception.

Introduction

Physics is a science which engages students with hands-on and minds-on activities that require them to perform computational tasks.

Computational questions in physics usually seek verifiable answers to physical quantities like distance, mass, time, latent heat of fusion, latent heat of vaporisation, temperature and density (Ostdiek & Bord, 2013). Physical quantities are usually identified by a number, or a combination of a number and a unit, which makes them unique and easy to interpret (Duncan & Kennett, 2009). For instance, the relative density of aluminium is 2.7 and it is a typical example of the use of a number to quantify the physical quantity and on the other hand, the mass of a bag of cement is 50 kg is the use of the combination of a number and a unit. Practically, industries communicate with their partners and clients in terms of physical quantities. Water manufacturing industries, for instance, communicate to consumers using physical quantities (e.g., a volume of voltic water is 750 ml). The Ghana Highway Authority erects sign posts to communicate to road users about speed limit (e.g., the speed limit for urban driving is 50 km/h) and the air traffic controllers of the Civil Aviation Authority also communicate to pilots in terms of physical quantities (e.g., you are 500 miles away from Kotoka International Airport).

Physical quantities can be combined by employing either addition or averaging. A physical quantity that can be combined using addition is known as an extensive quantity and a physical quantity that can be combined by using averaging is known as an intensive quantity (Howe, Nunes, Bryant, Bell, & Desli, 2010). Extensive quantities such as length, mass, area, or volume can be measured directly or can be counted, whereas, intensive quantities such as speed or concentration cannot be measured directly or counted (Simon & Placa, 2012). Howe et al. (2010) further explained that an extensive quantity relies on fractional relationships. For example, 1 kg of ice block depicts an extensive quantity because it consists of the sum of the masses of the individual constituents of the ice block. Contrary, the use of averaging for a particular physical quantity produces an answer which is neither greater than nor less than that physical quantity. Thus, an intensive quantity is a constant parameter for a particular substance. For instance, when an ice cube at its melting point is divided into several pieces, each piece will have a temperature of 0 ^{o}C. With this explanations and examples in mind, Howe, Nunes and Bryant (2011) indicated that an intensive quantity establishes a proportional relationship between variables of a formula. It is important to state that when an extensive

quantity divides another extensive quantity, the quotient is an intensive quantity. Therefore, intensive quantities express the relationship between two quantities which can either be intensive or extensive. For instance, density is a magnitude that predicts the strength of a relationship between the mass and volume for a particular substance at a specific temperature.

Change of state is a topic in physics that provides explanations to the phase transition of substances at melting and boiling points (Serway & Beichner, 2000; Cutnell & Johnson, 2007). At melting and boiling points, the heat energy transferred to a substance does not change the substance's temperature, rather it changes the state of the substance. For example, an ice cube at 0 ^{o}C absorbs energy in the form of heat to change its physical state to water at 0 ^{o}C. The treatment of change of state focuses on five major physical quantities (Cutnell, & Johnson, 2007; Walker, 2008), out of which two of them are intensive quantities and three are extensive quantities. Importantly, specific latent heat of fusion and specific latent heat of vaporisation are intensive quantities whereas mass, latent heat of fusion and latent heat of vaporisation are extensive quantities. The latent heat (Q) removed or supplied to a substance of mass (m) at a constant temperature is given as Q = mL. The variable *L* is an intensive quantity which represents the amount of heat per unit mass. Being an intensive quantity means that specific latent heat is a constant parameter for every substance that depends on proportional relation between variables and can be combined by using average. Also, specific latent heat of fusion or vaporisation is an intensive quantity because, it is a quotient of two extensive quantities. Further, the extensive quantity latent heat (latent heat of fusion or latent heat of vaporisation) varies directly with only the extensive quantity, mass, for a particular substance. This means that the greater the mass of a substance, the greater the amount of latent heat required to cause a phase transition at a constant temperature. In relation to the latter, a fractional increase in mass is equal to a fractional increase in only latent heat. For example, if 2 kg of ice require 672000 J of heat to change its state to water at a constant temperature, then doubling the mass of the ice (2 × 2 kg = 4 kg) will also double the quantity of heat (2 × 672000 J = 1344000 J) required to change its state to water without a temperature change. From this example, specific latent heat of fusion remains unaffected

because it is independent of mass and latent heat of fusion. Thus, the only mathematical tool to maintain specific latent heat as a constant parameter is average. In terms of averaging, the specific latent heat of fusion of ice for the question above is $\frac{336000\ J\ +336000\ J}{2}$ = 336000 J. It is crystal clear that such analyses require high level of critical thinking and should, therefore, not be undermined in physics education.

However, in Ghana, as in other developing countries in Sub-Saharan Africa, the elective physics syllabus only emphasises the treatment of physical quantities in terms of fundamental, derived, scalar and vector quantities (Ministry of Education Science and Sports, 2010). For this reason, many high school physics textbooks and classroom instructions have neglected the treatment of physical quantities in terms of intensive and extensive quantities. Due to this lack of recognition, many students find it difficult to distinguish between intensive and extensive quantities (Howe et al., 2010; Simon & Placa, 2012). For instance, Alwan (2010) complained that the neglect of the extensive-intensive framework in many curricula has made it difficult for students to distinguish between heat (extensive quantity) and temperature (intensive quantity); heat capacity (extensive quantity and specific heat capacity (intensive quantity). Available researches with extensive quantities (Correa, Nunes & Bryant, 1998; Stavy & Tirosh, 2000; Squire & Bryant, 2003) indicate that despite the successful computations of additive problems, many students face challenges with questions that involve inverse relation variables. Additionally, literature on intensive quantity (Howe et al., 2010) suggests that students encounter challenges while solving combination and single variable problems. Lastly, Howe et al. (2010) complained that there is limited research that explicitly explores the procedures students employ while solving computational problems on intensive quantities.

One of the factors that influence the type of procedural approach students employ when solving computational problems in physics is the type of question (Walsh, Howard & Bowe, 2007). Problems in physics may either seek answers to an extensive quantity or intensive quantity. Howe et al. (2010) examined some primary school learner's reasoning with intensive quantities and found that learners face more challenges when working with intensive quantities than extensive quantities. Howe et al. reported that 11 % of the learners

arrived at the correct answer when the variable, distance, directly proportional to speed, was manipulated. However, they detected that majority of the learners (81 %) arrived at the correct answer when the variable, time, inversely proportional to speed, was manipulated. The vast difference in percentage might possibly suggest that either the learners approached each problem differently or an approach used in one problem failed when applied to another problem. Alwan (2010) also showed that learners faced challenges when dealing with intensive quantities. Alwan stated that most of the learners were unable to determine the final temperature when two substances at different temperatures were mixed together. Perhaps, their participants were just adding temperatures; an approach common amongst learners. Conversely, Alwan reported that the students were successful in using the formula $Q = mc\Delta t$ (Q represents amount of heat, m represents mass of substance, c represents specific heat capacity and Δt represents temperature change) to solve for the amount of heat. This led to the conclusion that students are successful in manipulating formulae to arrive at an answer without a good understanding of the concepts that underpin the formulae. Lastly, Alwan concluded that the absence of treating physical quantities using the intensive-extensive framework poses challenges to learners.

Simon and Placa (2012) explored the possibility of getting a model to enhance reasoning about intensive quantities in relation to whole number multiplication and division problems. Based on their results, they concluded that it is impossible to develop a teaching model that will enhance learners' reasoning with intensive quantities with respect to whole number multiplication and division problems. The latter seem to be inconsistent with the effectiveness of the scientific approach as a problem-solving tool, as concluded by Walsh et al. (2007), which could also possibly be developed into a teaching model. Abrahamson (2012) probed the effectiveness of guided mediated abduction as a tool that can enhance learners' understanding of intensive quantities. The study revealed that guided mediated abduction is a tool that stimulates the central concept on which a mathematical notion hinges on and enculturates learners to be part of such a framework. Hill et al. (2014) investigated learners reasoning about concentration of sugar solution in the context of intensive quantities. Drawing samples from United Kingdom and Japan, they

realised that challenges encountered by learners when reasoning with intensive quantities depend on cultural experience.

Several researches (Walsh et al., 2007; Snetinova & Koupilova, 2012; Kuo, Hull, Gupta & Elby, 2013; Zewdie, 2014) show that learners adopt different procedures when solving computational questions in physics. As a consequence, problem-solving classifications are commonly used as a way of describing the different set of procedures learners employ while solving computational problems in physics. For instance, Walsh et al. (2007) grouped learners problem-solving into four major categories. According to Walsh et al., learners' problem-solving can be categorised as scientific approach, plug and chug approach, memory-based approach and no clear approach. It must be noted that the plug and chug approach was sub-divided into structured manner and unstructured manner. The results from their research indicate that many higher level students do not approach physics problems in a planned manner. Another finding that emerged from their study was that students used different approaches to solve different questions. Snetinova and Koupilova (2012) also proposed nine procedural approaches to problem solving. The authors categorised the approaches students employed into rolodex equation matching, rational thought, listing known and unknown quantities, prior examples in text or lectures, prior experiments in lecture, sub-problems, diagrams, concept first and real situation. They further divided these categories into limiting strategy and expansive strategy. According to them, limiting strategies are successful when applied to well-structured end of chapter exercises but are ineffective when applied to complex problems. However, expansive strategies are very effective when applied to complex problems. They stated that expert problem-solvers favour this strategy.

Additionally, Hegde and Meera (2012) probed learners' approach to the mechanism of physics problem-solving by the using multiple choice questions and questions of semi-structured interview to examine students' thought processes in physics problem-solving. It was found that terms employed in a physics task compelled student to search for an equation. Based on this, they realised that a problem solver's inability to locate an equation impedes the problem-solving process. They further stated that having access to an equation does not guarantee success in arriving at an answer. This was grounded in the

fact that learners do not appreciate the relationships amongst physical quantities in physics equations. Also, lack of mathematical manipulation skills was identified as an obstacle that hinders learners' problem-solving ability. Finally, their study added that a lack of conceptual understanding also hinders learners' success when guided during problem-solving. Kuo et al. (2013) in a study, on the other hand, focused on how learners combine conceptual and formal mathematical reasoning in solving mechanics problems. Through an interview, Kuo et al. tasked learners to provide an explanation to an equation and solve a mechanics problem with that equation. The results of the study indicated that some students blended mathematical operations with conceptual reasoning to solve real-life problems and they described this approach as symbolic form. They added that such learners employ a non-computational means of solving physics computational problems. Kuo et al. further reported that other students' description of the equation were more mathematical. Additionally, they stated that such students depended on only computations when solving physics problems. Inferring from the latter, it could be concluded that such students did not pay attention to the concepts that underscored the problem.

Cruz (2014) also investigated the effect of structured problem-solving strategy on the performance of 152 undergraduate students and concluded that the structured problem-solving strategy is an effective problem-solving technique that improves the learning of students. According to Polya (1957), structured problem-solving involves description, planning, implementation and checking. The description stage involves providing information and using diagrams to summarise the situation at hand. Further, the planning stage focuses on the basic relations that underscore the situation. Additionally, the implementation stage touches on computations. The final stage emphasises on checking whether the answer is right or wrong. Admittedly, this approach is similar to the scientific approach of Walsh, et al. (2007). Zewdie (2014) also employed the approaches proposed by Walsh et al. (2007) to explore some learners' procedural approach to problem solving but did not divide the plug-and-chug approach into its subcategories. In contrast to Walsh et al., Zewdie noted that none of his subjects followed the scientific approach in solving the tasks.

While studies on learners' knowledge of intensive and extensive quantities have received considerable attention by science educators (Howe et al., 2011; Hill et al., 2014), little evidence is available on studies to ascertain the procedural approaches learners employ while solving computational problems on extensive and intensive quantities. Additionally, since intensive and extensive quantities are not emphasized in the Ghanaian and many other West African countries' Senior High School (SHS) syllabi, there appear to be a gap in literature on the procedural approaches students adopt in solving problems involving extensive and intensive quantities. There is, therefore, a need to explore the procedural approaches of learners when they solve computational questions involving intensive and extensive quantities. Based on this recognition, the purpose of this study was in three-fold. First, this study explored the procedural approaches senior high school science students employ while solving computational questions that seek answers to extensive quantities. Second, the study investigated the procedural approaches senior high school science students employ when solving computational problems that seek answers to intensive quantities. Third, the study investigated the procedural approach that is most robust in unveiling students' conceptions about intensive quantities. This study attempted to answer the following research questions:

1. What procedural approaches do students employ while solving change of state computational questions that involve extensive quantities?
2. What procedural approaches do students employ while solving change of state computational questions that involve intensive quantities?
3. Which procedural approach is robust in revealing students' conceptions about intensive quantities?

Methodology

Since the primary focus of this study was to explore the procedural problem-solving approaches students employ in solving change of state computational tasks involving extensive and intensive quantities, the qualitative survey design, which is less a structured methodology, was employed to help gain an in-depth understanding of how students use procedural problem-solving approaches to solve

computational tasks (Cohen, Manion, & Morrison, 2007; Creswell, 2012). This design asks open-ended questions that yield responses that are used to uncover trends in thought and probe deeper into the problem at hand. In all, 240 Form 3 students randomly sampled using the computer-generated random numbers from five out of the 10 senior high schools in the Cape Coast Metropolis, offering the General Science programme, participated in the study. An achievement test comprising of five open-ended test items was used to collect data (See Table 5 and Table 6 for the five items). Students were also asked to describe how they approached each item in a brief statement. Each item on the test fell into one of the three levels of reasoning. These levels of reasoning include: Level A, Level B and Level C as adapted from Noelting's (1980) levels of reasoning. Table 2 summarises the features of each level.

Table 2: Features of Level of Reasoning

Level of Reasoning	Feature
Level A	Question requires mere substitution into formula.
Level B	Question requires averaging to determine an intensive quantity.
Level C	Question requires manipulation of directly proportional variables.

The other features such as type of computation and quantity required of each item is also displayed in Table 3.

Table 3: Features of Each Item

Item Number	Level of Reasoning	Computation required	Quantity
1	A	Latent heat of fusion	Extensive
2	A	Mass	Extensive
3	C	Latent heat of vaporisation	Extensive
4	B	Specific latent heat of fusion	Intensive
5	A	Amount of heat per unit mass	Intensive

From Tables 2 and Table 3, Level A reasoning means a question requires mere substitution. Thus, numbers can easily be plugged into a formula to arrive at an answer. By contrast, Level B reasoning suggests that a question requires finding average to maintain a particular intensive quantity. Lastly, Level C reasoning suggests that learners must reason with how one variable varies directly with another. Table 4 provides a detailed description of each approach.

Table 4: A Description of Walsh et al. (2007) Procedural Approaches to Problem-Solving

Approaches	Description
Scientific	Begin by qualitatively describing the concept on paper. Proceed by discussing in a coherent manner. Employ an equation and conclude by evaluating the answer.
Structured manner	Identify the concepts that are involved but do not begin by qualitatively analyzing the problem on paper. Recognize the variables needed to solve the question and seek appropriate formula.
Unstructured manner	Students depend only on variables that are stated in the question to employ an equation.
Memory-based	Learners who employ this approach rely on past experiences such as remembering a method used in class and recalling procedures employed in textbooks and past questions. Learners in this category usually recall a formula and substitute the given variables into it.
No clear	Learners do not approach computational tasks in a well-defined way. Their solution and knowledge are not organized in a coherent way. Centered on the variables given, they haphazardly seek for equations that will facilitate the use of the variables stated in a question. They also change their strategy as they proceed through a solution.

The content validity of the concept test was determined by two physics educators from the Department of Science Education and two experienced physics tutors who have taught physics for more than 15 years. The data for the first two research questions, were analysed using frequencies and percentages. Since these two research questions were aimed at categorising the approaches students employed in solving computational tasks on change of state, frequencies and percentages were, therefore, reported for each problem-solving approach. The categorisation of the problem solving approaches used by students in this study was based on the previous categorisations used by Walsh et al. (2007) where students' solutions were categorised as scientific approach, plug-and-chug approach (structured manner and unstructured manner), memory-based approach and no clear approach.

The third research question was analysed based on an argument that a good problem-solving activity does not focus on just following a set of procedures but involves relating the task at hand to the concepts that underscore it. Therefore, the robust approach was selected based on the potency of an approach in revealing both correct and wrong conception a learner holds about the intensive quantities.

Results

Students' procedural approaches to tasks involving extensive quantities

Research question one sought to investigate the procedural approaches students employ in solving change of state computational questions that involve extensive quantities. As shown in Table 5, no student approached Item 1 and Item 2 in a scientific manner. However, as shown in Table 5, .4 % of the 240 students used the scientific approach while solving Item 3. Further, half of the students (50 %) used the structured manner while solving Item 1. Interestingly, Item 2 closely followed Item 1 with a percentage of 47.9 %. For Item 3, only 11.7 % of the students employed the structured manner. Comparatively, one of the least popular approaches used was the unstructured manner of the plug and chug approach. Out of 240 students, as shown in Table 5, 13.8 % and 7.9 % employed the unstructured manner while solving Item 1 and Item 2 respectively. In terms of memory-based approach, for Item 1 and Item 2, as shown in Table 3, recorded close percentages of 20.4 % and 21.3 % respectively.

However, 10 % of these students used this approach while solving Item 3. For the no clear approach, Item 1 and Item 2 recorded 15.8 % and 22.9 % respectively. However, about three-fourth of the students (77.1 %) employed the no clear approach while solving Item 3. Only .8 % of the students did not attempt Item 3.

Students' procedural approaches to tasks involving intensive quantities

Research question two was intended to investigate the procedural approaches students employ in solving change of state computational questions that involve intensive quantities. As shown in Table 6, 0.8 % and 0.4 % (of 240) students employed the scientific approach while solving Item 4 and Item 5 respectively. In relation to structured manner, only 0.8 % of the students used this approach while solving Item 4 whereas 32.9 % of the students employed this approach while solving Item 5.

Table 5: Results of Students who employed each Approach for Items 1, 2 and 3

Items	Scientific	Structured manner	Unstructured manner	Memory-based	No clear	No Attempt
1. What heat is required to change 0.002 kg of ice at 0 ^{o}C to water at 0 ^{o}C? (Specific latent heat of fusion = 336000 J/kg)	0 (0)	120 (50.0)	33 (13.8)	49 (20.4)	38 (15.8)	0 (0)
2. The amount of heat supplied to water at 100 ^{o}C to change it to steam at 100 ^{o}C is 90400 J. Calculate the mass of the water. Specific latent heat of vaporisation of water is 2260000 J/kg.	0 (0)	115 (47.9)	19 (7.9)	51 (21.3)	55 (22.9)	0 (0)
3. A liquid containing x kg of water at 100 ^{o}C required y J of heat to completely boil. If the mass of the water is tripled, how much heat is required to completely boil at 100 ^{o}C	1 (.4)	28 (11.7)	0 (0)	24 (10.0)	185 (77.1)	2 (.8)

Numbers in brackets represent percentage

Table 6: Results of Students who employed each Approach for Items 4 and 5

Items	Scientific	Structured manner	Unstructured manner	Memory-based	No clear	No Attempt
4. A vessel contains 2 kg of water at 0 ºC. 3 kg of water at that same temperature is later added to the water in the vessel. If specific latent heat of fusion is 336000 J/kg, calculate the specific latent heat of fusion of the water in the vessel?	2 (0.8)	2 (0.8)	0 (0)	6 (20.4)	231 (96.3)	3 (1.3)
5. The amount of heat supplied to water at 100 ºC to change it to steam at 100 ºC is 90400 J. Calculate the mass of the water. Specific latent heat of vaporisation of water is 2260000 J/kg	1 (0.4)	7.9 (32.9)	29 (12.1)	48 (20.0)	83 (34.6)	0 (0)

Numbers in brackets represent percentages

For the unstructured manner, no student used this approach while solving Item 4. However, the unstructured manner recorded 12.1 % students for Item 5. Table 6 further displays that 2.5 % of the students used the memory-based approach in solving Item 4. However, 20 % of these students employed this approach while solving Item 5. Finally, an overwhelming majority of students' (96.3%) solutions to Item 4 was described as no clear approach. Conversely, 34.6 % of the students' solutions to Item 5 was categorised as no clear approach. Only 1.3 % of the students did not attempt Item 4.

Revealing students' conceptions about intensive quantities

Research question three sought to investigate the robust procedural approach used in revealing students' conceptions about intensive quantities. Table 7 displays findings of the robust approach which was successful in revealing the students' conceptions of intensive quantities. Robust approach, in this context, means a problem-solving procedure that has the tendency of revealing correct conceptions, alternative conceptions, correct mathematical algorithm and wrong mathematical algorithm.

Table 7: Robust procedural approaches for revealing students' conceptions of intensive quantities

Approach	Correct conceptions	Alternative conceptions	Correct mathematical algorithm	Wrong mathematical algorithm
Scientific	1	1	1	1
Structured manner	0	0	1	1
Unstructured manner	0	0	1	1
Memory-based	0	0	1	1
No clear	0	0	0	1

Keys: 1 = Yes, 0 = No

As shown in Table 7, the scientific approach is the most robust in revealing the conceptions of students about intensive quantities. This implies that structured manner, unstructured manner, memory-based approach and no clear approach are ineffective in revealing the conceptions of students about intensive quantities. Hence, there is a good reason to conclude that the scientific approach is very effective in revealing the lines of reasoning of students, when solving a

computational physics problem, in addition to uncovering correct and wrong computational algorithm. Two solutions, to Item 4, that highlights the robustness of the scientific approach are displayed below.

Example 1

''The specific latent heat of fusion of a substance is the amount of energy (in joules) needed to melt a solid of 1 kg to liquid of the same mass without changing its temperature. So, if 3 kg of water at 0 ^oC is added to 2 kg of water at the same temperature. The specific latent heat of fusion remains the same but the mass of the water changes to 5 kg. From mathematics $\frac{336000 + 336000}{2}$

= 336000 J/kg, Since the specific latent heat of fusion is a constant value, this confirms my value''.

This student commented on his steps as follows: *''I first provided an explanation of what specific latent heat of fusion is about and after I determined the average''*. A thorough examination of the above example indicates that the accurate understanding held by the respondent about specific latent heat of fusion (as an intensive quantity) resulted in the correct answer. Thus, this example shows that an accurate understanding of specific latent heat as an intensive quantity has a higher probability of producing a correct answer.

Example 2

''Since the 3 kg mass of water is at the temperature that is 0 ^oC as the one in the vessel; the quantity of heat energy produced after the addition of the 3 kg mass of water will be latent heat. Therefore, the quantity of latent heat in the 2 kg mass of water (Q_1) will be the same as the quantity of latent heat in the 3 kg mass of water (Q_2) that is $Q_1 = Q_2$. Q_1 is the product of mass of water in the vessel and its specific latent heat of fusion. Also, Q_2 is equal to the product of the mass of water added and its specific latent heat of fusion.

$Q_1 = Q_2$, $m_1 l_{f1} = m_2 l_{f2}$

$m_1 = 2$ kg, $l_{f1} = ?$, $m_2 = 3$ kg and $l_{f2} = 336000$ J/kg

$l_{f1} = \frac{3 \times 336000}{2}$

$= 504000$ J/kg

The specific latent heat of fusion of the water in the vessel is 504000 J/kg''.

This student commented that *''I first described my understanding of the question in terms of change of state. Then I deduced a mathematical expression after I calculated to get my answer''*. An evaluation of this solution suggests that this student did not conceptualise specific latent heat of fusion as a constant parameter for water. Therefore, this solution indicates that the student arrived at a wrong answer because of an alternative view about the question.

In order to highlight the contrast between an approach which is robust and that which is not robust, there is the need to present a solution that exemplifies a non-robust approach. An example of such an approach to Item 10 is presented below.

''$Q = ml_v$

$\frac{Q}{m} = \frac{mlv}{m}$

$l_v = \frac{Q}{m}$

$l_v = \frac{4520000\ J}{2\ kg} = 2260000\ J/kg$*''*

The presentation of this student does not show his line of reasoning and, thus, it becomes difficult to unravel any correct or alternative conception. Evidently, a follow up question showed that the student's solution concealed his understanding of the question. The student described the steps involved in the above solution as follows: *''Heat per unit mass is like mass per unit volume in density, so I applied the way I solve mass per unit volume''.* In relation to the student's comment, there is a good reason to conclude that students sometimes relate a problem in a particular area of physics to previous solutions of problems in other areas of physics.

Discussion

The first results of this study revealed that students employ mostly the structured followed by the no clear procedural approaches when solving change of state computational questions that involve extensive quantities. The findings of this study showed that students did not use the scientific approach category in solving questions on Item 1 and Item 2. This suggests that when problems on extensive quantities involve mere substitution of numbers into a formula, students do not begin by merging verbal and diagrammatic description of the task with a formula on paper. The latter possibly means that

students do not use the scientific approach when they encounter questions (on extensive quantities) that require Level A reasoning. This result confirms the assertion that many leaners do not analyse the concepts that underscore physics computational task on paper by making a diagrammatical analysis of the problem (Walsh et al., 2007; Zwedie, 2014). However, for Item 3, only one student used the scientific approach in solving the problem. This means that when a question (on extensive quantity) requires the manipulation of only a directly proportional variable, few students begin by analysing the problem qualitatively first on paper in terms of the concepts that underscore it. This finding hinges on Zwedie's (2014) assertion that few learners make an effort to express their understanding about a physics computational task on paper before solving.

Recall that about half of the students' solutions to Items 1 and 2 fell into the structured manner of the plug and chug approach. Since there are five problem-solving categories, the latter means that majority of the students prefer to create a mental picture of the question first, write down variables from the question, recognise that some variables are stated but not needed, identify variables that are not stated but needed, substitute variables into an equation and compute the variables to arrive at an answer when solving extensive quantity questions that require mere substitution into a formula. This result contradicts the findings of Zewdie's (2014) who reported that more than half of the respondents in a study preferred the memory-based approach. Thus, it is possible that the type of physical quantity and the level of reasoning a question require influences the type of problem-solving approach a student will employ. However, since close to one-eighth of the students employed the structured manner while solving Item 3, there is a possibility that many students do not think about a concept first before proceeding with an extensive quantity problem that involves the manipulation of only a directly proportional variable. The latter could possibly explain why Snetinova and Koupilova's (2012) asserted that many students do not make an effort to understand a problem before proceeding with computation. The large disparity in fraction, according to the former and latter submissions, shows that many students employ structured manner when a question requires mere substitution of variables into a formula (Level A reasoning) when compared with a

question that requires the manipulation of a directly proportional variable (Level C reasoning).

A unique feature of the unstructured manner is that students whose solutions fall in this category depend solely on variables which are stated in a problem. As stated earlier, a little over one-eighth of the students employed this approach while solving Item 1 whereas a little over one-sixteenth employed this approach while solving Item 2. The disparity in fraction is quite surprising since both items require Level A reasoning. This could possibly be attributed to the nature of the two questions. Item 1 requires the use of $Q = mL_f$ while Item 2 requires the use of $m = \frac{Q}{Lf}$. Interestingly, none of the students' solutions to Item 3 fell into the unstructured manner category. Note that Item 3, which required Level C reasoning, left out an intensive quantity that could possibly play a role in computations. Thus, it just needed an understanding of manipulating a directly proportional variable (i.e., $m \propto Q$). These findings about unstructured manner category raise questions about the viability of Zewdie's (2014) results which state that many students rush to do computations when given a physics task. Additionally, the results contradict Oglive's (2009) observation that many learners search for equations based on the known variables a task employ.

Surprisingly, about one-fifth of the students relied on past experiences while solving Items 1 and 2. Such consistency in the number of students for these two items suggests that when extensive quantity questions require Level A reasoning (see Table 2), all questions will record almost the same number of students for the memory-based approach. For Item 3, the number of students whose solution fell into this approach possibly means that when a question on extensive quantity requires the manipulation of a directly proportional variable (Level C reasoning) students will adopt memory-based approach. These findings imply that the memory-based approach is not the most preferred approach amongst the students which confirms the findings of Snetinova and Koupilova's (2012). According to Snetinova and Koupilova, learners rarely rely on past examples when solving physics computational tasks. However, the results are inconsistent with Zewdie's (2014) observation that majority of learners rely on previous experiences to solve physics computational task. The absence

of the no clear approach for Items 1 and 2 is not surprising since both items require Level A reasoning. In relation to Item 3, the overwhelming majority of students whose solutions fell into this category suggest that many students are inconsistent in their presentations when solving extensive quantity questions that require the manipulation of a directly proportional variable. These results are inconsistent with the findings of Zewdie (2014) who is of the view that the no clear approach is one of the least preferred approaches learners employ in solving problems.

The second result of this study revealed that students employ mostly the no clear procedural approach when solving change of state computational questions that involve intensive quantities. Recall that Items 4 and 5 recorded one of the least numbers of students who employed the scientific approach category. The latter means that for every 240 students who answer Item 4, only two of them use the scientific approach. On the other hand, for every 240 students who answer Item 5, one uses the scientific approach. Comparatively, this difference, though small, suggests that some students provide a detailed description of their solution when a question probes an intensive quantity as a constant parameter. With respect to the latter, it is possible that when students are given tasks that require Level B reasoning, they are compelled to interpret their steps in order to provide understanding on the part of examiners. Further, few students employed the scientific approach when a question on an intensive quantity requires Level A reasoning. The latter statement contradicts earlier findings of extensive quantities. Therefore, in the lens of Level A reasoning, the type of quantity which a computational task seeks could possibly influence a learner's decision to use the scientific approach. These facts possibly explain why Howe et al. (2010) claim that learners face more challenges when working with intensive quantities than extensive quantities. Though some students used the scientific approach in the study by Walsh et al. (2007), no learner used the scientific approach in the study conducted by Zewdie's (2014).

The study also found that a number of students employed the structured manner while solving Item 5 (32.9 %) compared to Item 4 (.8 %). Comparably, this means that many students easily construct a mental picture of the concept that underlie the question, write down variables from the question, recognise that some variables are stated

but not needed, identify variables that are not stated but needed, substitute variables into an equation and compute the variables to arrive at an answer when solving questions that require Level A reasoning. Thus, the structured manner is not commonly used by learners when a question explores intensive quantity as a constant parameter (Level B reasoning). Additionally, examining these statistics indicate that structured manner is not the preferred choice when intensive quantities are considered but the most preferred choice when extensive quantities are considered. Additionally, no student employed the unstructured manner while solving Item 4. This suggests that when a task on intensive quantity requires Level B reasoning, no learner depends solely on the variables that are stated in the question. Similarly, the unstructured manner is one of the least preferred approaches by the students when Item 5 is considered. Thus, when an intensive quantity question requires Level A reasoning, only few learners depend solely on the variables that are stated in the question. This raises questions about the viability of Hegde and Meera's (2012) finding that terms employed in a physics task compels students to search for an equation.

Although the memory-based approach was one of the preferred approaches used by students in solving Items 4 and 5, the number of students who employed it were very small. Thus, few of the students relied on past experiences when solving intensive quantity questions that require Level B reasoning. These results confirm those obtained for the extensive quantities. There is, therefore, a good reason to conclude that, though the memory-based approach is one of the most preferred approaches used by students as reported in the work of Zewdie (2014), it is, however, not the case in this study. This result confirms Oglive (2009) and Snetinova and Koupilova's (2012) observations that many learners do not rely on past experiences when solving computational task in physics. Since more than 75 % of the students' solutions to Item 4 fall into the no clear approach, it suggests that majority of them are not consistent when presenting a solution to a question that seeks the constancy of an intensive quantity. This finding seems to corroborate Abrahamson's (2012) conjecture that learners have the tendency of switching their line of reasoning when dealing with intensive quantities. It also confirms the findings of Howe et al. (2010) which states that many learners are unable to solve tasks which explore an intensive quantity as a constant parameter. Thus, a

problem-solver's inability to locate an equation impedes the problem-solving process (Hedge & Meera, 2012). Again, majority (34.6 %) of the students' solution to Item 5 also fall into the no clear approach. The latter results seem to be closer to the statistics quoted by Walsh et al. (2007) and Zewdie (2014) who quoted 27.3 % and 18.2 % respectively. These imply that when a question on intensive quantity requires mere substitution into a formula, few learners encounter challenges while solving such problems. A similar result was reported by Howe et al. (2010).

The third result of this study found that the scientific approach is the most robust in revealing students' correct conceptions, alternative conceptions, correct mathematical algorithm and wrong mathematical algorithm when solving change of state computational questions that involve intensive quantities. This finding confirms the study by Snetinova and Koupilova (2012) who are of the view that the use of an expansive strategy (i.e., scientific approach) is very effective for solving complex physics questions and has the capability of revealing the reasoning behind what informed the solution students present. Though the scientific approach was able to reveal students' conceptions, it also, however, showed alternatives ways students use in solving questions. These alternative views that students generate about questions presented, in many cases, lead them to provide wrong answers. These revelations agree with Walsh et al. (2007) that a scientific approach results in a wrong answer when the problem solver holds inaccurate conceptions of the concepts that underscore the problem. Further, the findings confirm that learners sometimes approach questions on intensive quantities using their knowledge of how extensive quantities are solved (Howe et al., 2011; Alwan, 2010; Simon & Placa, 2012). Additionally, the findings of this study clearly showed that some learners do not understand latent heat as an extensive quantity and specific latent heat as an intensive quantity.

Conclusions and Recommendations

The study found that majority of the students employ the structured procedural approach when solving change of state computational questions that involve extensive quantities instead of the scientific approach. This implies that there is a deficiency in the type of problem-solving approach students' use in solving computational

problems. The findings of this study also confirmed existing body of literature that students' problem-solving approaches fell into scientific, structured manner, unstructured manner, memory-based and no clear.

Secondly, the results of this study showed that the no clear procedural approach was employed by majority of the students when solving change of state computational questions that involve intensive quantities. Though few of the students employed the scientific approach irrespective of the demands of a question, it showed clearly that students have difficulties dealing with computational tasks that involved intensive quantities. To help students become adept problem solvers, physics teachers should aim at providing learners with questions which involve intensive quantities and questions which require the application of variation in extensive quantities. Again, rubric to computational questions should be structured to meet the standards of scientific approach. Further, multifaceted tasks must be part of learners' assignment.

Finally, this study unveiled that among the five problem-solving approaches, the scientific approach is very effective in revealing students' correct conceptions and alternative conceptions about intensive quantities. It is, therefore, recommended that teachers should develop the scientific approach into a teaching model to enhance the understanding of intensive quantities since this will also help reveal the lines of reasoning of students.

References

Abrahamson, D. (2012). Rethinking intensive quantities via guided mediated abduction. *The Journal of the Learning Sciences, 21*, 626–649.

Alwan, A. A. (2010). Misconception of heat and temperature among physics students. *Procedia Social Science and Behavioural Sciences, 12*, 600 - 614.

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6th ed.). London: Routledge.

Correa, J., Nunes, T., & Bryant, P. (1998). Young children's understanding of division: The relationship between division terms in a non-computational task. *Journal of Educational Psychology, 61*, 300–309.

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Boston: Pearson.

Cruz, D. S. T. (2014). The effect of structured problem-solving strategy on performance in physics among students who are enrolled in the University of Rizal System. *International Journal of Scientific and Research Publications, 4*(12), 1-7.

Cutnell, J. D., & Johnson, K. W. (2007). *Physics* (7th ed.). New Jersey: John Wiley & Sons, Inc.

Duncan, T., & Kennett, H. (2009). *IGCSE Physics* (2nd ed.). London: Hodder Education.

Hegde, B., & Meera, B. N. (2012). How do they solve it? An insight into the learner's approach to the mechanism of physics problem solving. *Physical Review Special Topics - Physics Education Research, 8*(1), 1-9.

Hill, J. L., Schlottmann, A., Ellefson, M. R., Taber, K. S., Tse, V. W. S., & Yung, T. S. W. (2014). *Early understanding of intensive properties of matter: Developmental and cultural differences*. Poster presented at the 36th Annual Conference of the Cognitive Science Society, Qubec City, Quebec, Canada. Published in P. Bellow, M. Guarini, M. McShane, & B. Scassellati (Eds.), Proceedings of the 36th Annual Conference of the Cognitive Science Society (p. 1240-1245) Austin, TX: Cognitive Science Society.

Howe, C., Nunes, T., & Bryant, P. (2011). Rational number and proportional reasoning: Using intensive quantities to promote achievement in mathematics and science. *International Journal of Science and Mathematics Education, 9*, 391–417.

Howe, C., Nunes, T., Bryant, P., Bell, D., & Desli, D. (2010). Intensive quantities: Towards their recognition at primary school level. *British Journal of Educational Psychology, II, Understanding Number Development and Difficulties, 7*, 101-118.

Krejcie, R.V., & Morgan, D.W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*, 607-610

Kuo, E., Hull, M. M., Gupta, A., & Elby, A. (2013). How students blend conceptual and formal mathematical reasoning in solving physics problems. *Science Education, 97*(1), 32–57.

Ministry of Education, Science and Sports. (2010). *Teaching syllabus for physics*. Accra: Author.

Noelting, G. (1980). The development of proportional reasoning and the ratio concept: Part I differentiation of stages. *Educational Studies in Mathematics, 11*, 217–253.

Ogilvie, C. A. (2009). Changes in students' problem-solving strategies in a course that includes context-rich, multifaceted problems: Physical Review of Special Topics. *Physics Education Research, 5*(2), 1-14.

Ostdick, V. J., & Bord, D. J. (2013). *Inquiry into physics* (7th ed.). Boston: Brook/Cole Cengage Learning.

Polya, G. (1957). *How to solve it* (2nd ed.). New Jersey: Princeton University Press.

Serway, R. A., & Beichner, R. J. (2000). *Physics for Scientist and Engineers* (5th ed.). New York: Saunders College Publishing.

Simon, M. A., & Placa, N. (2012). Reasoning about intensive quantities in whole-number multiplication? A possible basis for ratio understanding. *For the Learning of Mathematics, 32*(2), 35-41.

Snetinova, M., & Koupilova, Z. (2012). Students' difficulties in solving physics problems. *WDS'12 Proceedings of Contributed Papers, Part III*, 93-97. Retrieved on March 4, 2015, from https://www.mff.cuni.cz/veda/konference/wds/proc/pdf12/WDS12_317_f12_Snetinova.pdf.

Squire, S., & Bryant, P. (2003). Children's understanding and misunderstanding of the inverse relation in division. *British Journal of Developmental Psychology, 21*, 507–526.

Stavy, R., & Tirosh, D. (2000). *How students (mis-) understand science and mathematics*. New York: Teachers College Press.

Walker, J. (2008). *Fundamentals of physics* (8th ed.). New Jersey: John Wiley & Sons, Inc.

Walsh, L. N., Howard, R. G., & Bowe, B. (2007). An investigation of introductory physics students' approaches to problem solving. *Level 3, 5*, 1-16. Retrieved on March 4, 2015, from http://level3.dit.ie/html/issues5/lau rawalsh/Walsh Laura.pdf.

Zewdie, Z. M. (2014). An investigation of students' approaches to problem solving in physics courses. *International Journal of Chemical and Natural Science, 2*(1), 77 – 89.

Ghana Journal of Education: Issues and Practices (GJE)
Vol. 4, December 2018, pp. 44 – 59

Internal/External Frame of Reference: Exploring the Paradoxical relations between Mathematics and Self-Concept across 29 Countries

Emmanuel Adu-tutu Bofah & Forster D. Ntow *

College of Education Studies, University of Cape Coast, Ghana

*Corresponding author's email address: *fntow@ucc.edu.gh*

Abstract

Students' self-concept is an important construct in explaining achievement-related outcomes. The study examined the theoretical and methodological issues underpinning the Internal/External (I/E) frame of reference model. This model posits a paradoxical relation between "distinct" school subjects, for example, mathematics and verbal. Also, achievement in each domain is deemed to positively affect self-concept in the matching domain but negatively in the nonmatching domain. The investigation is based on 29 countries (N= 181,745) using the TIMSS–2011 data set. The data supported the assumptions associated with the I/E model. Result indicates a negative achievement effect on non-corresponding self-concepts (internal) and positive effects achievement on the corresponding self-concepts (external). The findings contribute to a better understanding of how students form self-concept across domains cross-culturally.

Key words: Internal/external frame of reference effect, mathematics self-concept, mathematics achievement, cross-cultural comparison.

Introduction

Self-concept theories extend across several branches (Wang & Lin, 2008). One such branch concerns the frame of reference effect - the context or standards against which people judge their own accomplishments and failures (Marsh, 2007). More often than not, individuals evaluate their own performance in comparison with the performances of others through social comparison processes (Marsh &

Hau, 2004, p. 57). In most cases, these comparisons are made within individual's immediate context (social comparisons; e.g., classmates in our school or class: external frame of reference (E)), or between domains— one school subject can serve as a frame of reference for another school subject (internal frame of reference (I)) (Marsh, 2007; Marsh et al., 2015; Möller, Helm, Muller-Kalthoff, Nagy, & Marsh, 2015). As Parker, et al. (2014) argue, " for self-concept, students use normative judgments about their ability and social comparison processes with reference to their peers, but also internal comparisons of their performance in one academic domain relative to other academic domains" (Marsh, 2007; Parker et al. 2014, p. 32;). Marsh et al. (2015) emphasized "… perceptions of the self cannot be adequately understood if the role of frames of reference is ignored" (p. 425). Moreover, evidence suggests that self-concept operates differently across cultures (Bofah, 2015; Bofah & Hannula, 2015; Chiu & Klassen, 2010; Marsh & Hau, 2004).

The theoretical rationale for I/E model

The Internal/External (I/E) model was postulated by Marsh (1986) to explain why extremely distinct school subjects, for example, mathematics and verbal (native language) self-concepts are nearly uncorrelated whereas their corresponding areas of achievement correlate substantially. The model posits that academic self-concept in a particular domain (e.g., mathematics or verbal self-concepts) is formed in relation to two comparison processes or frames of reference (Marsh, 2007; Marsh et al., 2015; Marsh & Hau, 2004; Möller et al., 2015); the internal and external frames of reference at the individual level. External comparison is a psychological process in which students compare their own achievement with other students (e.g., school, class) in a particular school domain (e.g., mathematics). The Internal frame of reference is a comparison process in which students compare their own achievements in one particular domain (e.g., mathematics) with that in other domain (e.g., science). Tests of the I/E model are normally examined when mathematics and verbal achievements are regressed on mathematics self-concept (MSC) and verbal self-concept (VSC). The model used to test the external comparison is a horizontal path leading from mathematics achievement (MAch) to MSC and from verbal achievement (VAch) to VSC, and are predicted to be substantial and positive. The model used to examine the internal comparison is cross

paths leading from mathematics achievement to verbal self-concept and from verbal achievement to mathematics self-concept and is predicted to be negative (see Figure 1A).

Extant literature have provided evidence supporting the I/E model across cultures (M.-S. Chiu, 2008; Marsh & Hau, 2004). Most studies on the I/E model focus on the two distinctly different domains; mathematics and verbal skills (native language) (e.g., Dickhäuser, 2005; Marsh & Hau, 2004). Additionally, cross-cultural generalisability of the l/E model in domains such as mathematics and verbal skills (Marsh & Hau, 2004) and between science and mathematics (M.-S. Chiu, 2008) have also been examined. Möller, Pohlmann, Koller and Marsh, (2009) also established the I/E through a meta-analysis study for the domains of mathematics and verbal skills across different age groups, gender, and country.

Extension of the I/E model: Mathematics and Science

Marsh and Yeung (2001) argue that limiting the I/E model to one numerical domain (usually mathematics) and verbal (native language) domains is not inherent to the logic of the I/E model. Extending the logic of the original I/E model to other domains will help construct stronger measures of these internal and external comparison processes (Marsh & Yeung, 2001; Möller, Streblow, Pohlmann, & Köller, 2006). The present study takes up this challenge using the mathematics and science constructs of the TIMSS 2011 cross-national study for 29 countries. The purpose of this study is to explore whether the I/E model can be extended to science and mathematics, two school subjects perceived to be highly related. The present study, therefore, extends previous research on the I/E models based almost completely on two distinct school domains (verbal and mathematics) to mathematics and science. Such an approach has the potential to help in the generalization of the I/E model. Moreover, this study will help clarify the suggestion that mathematics and science are either two distinct domains that are complementary or supplementary to each other in terms of national curricula, knowledge types, and student perceptions (M.-S. Chiu, 2008, 2012). The research questions are:

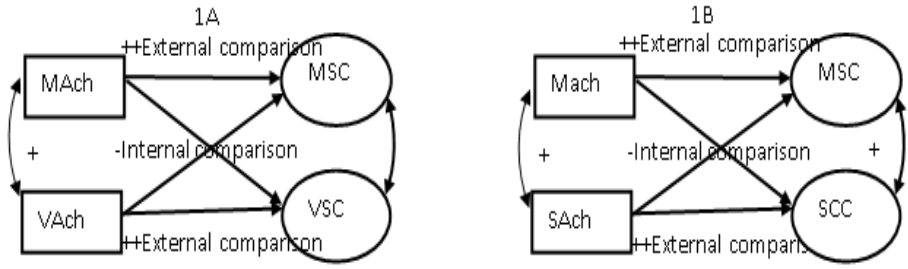
1. is the internal/external (I/E) frame of reference model supported when extended to other school subjects such as mathematics and science?

2. how does the I/E model perform cross-culturally?

Methodology

The present study hypothesized that there will be support for the I/E model across the general sample. More specifically, each of mathematics and science achievements will have a positive effect on the matching self-concept domain (external frame of reference: the horizontal paths in Figure 1B), but negative effects on nonmatching domains—mathematics achievement will have a negative effect on science self-concept and science achievement having a negative effect on mathematics self-concept (internal frame of reference: the cross-paths in Figure 1B). Moreover, mathematics and science achievement is expected to be positively correlated as well as mathematics and science self-concepts. The expected pattern of results is depicted in Figure 1B.

Figure 1. The original internal/external frame of reference (I/E) model relating verbal and math achievements to verbal and math self-concepts (1A).



In the present investigation, we evaluated the generalizability of this model to science domain, relating science and math achievements to science and math self-concepts (1B). Coefficients indicated to be "++", "-" are predicted to be positively high and negatively low. To avoid cluttering, only paths are shown.

Data Source

Data were obtained from students who participated in the Trends in International Mathematics and Science Study (TIMSS) 2011 study. For the present study, participants were eighth-graders from 29 countries (N = 181,745 see Table 2). See Martin and Mullis (2012) for detailed TIMSS sampling and method procedures.

TIMSS - 2011 students' self-concept in mathematics (MSC) and science (SCC) scales were created based on students' degree of agreement to each of five statements. Each scale was measured on a 4-point Likert response format: Agree a lot (1), Agree a little (2), Disagree a little (3), Disagree a lot (4). In the present study, the scores on two of the items were reverse-coded so that a higher value corresponds to a higher response. The items on the MSC/SCC are the following: 1) I usually do well in mathematics/Science, 2) I learn things quickly in mathematics/Science, 3) I am good at working out difficult mathematics/Science problems, 4) Mathematics/Science is more difficult for me than for many of my classmates [reverse coded], and 5) Mathematics/Science is not one of my strengths [reverse coded].

TIMSS - 2011 reported students' achievement in terms of five plausible values—random numbers drawn from the distribution of scores that could be reasonably assigned to each individual (Martin & Mullis, 2012). All reported five plausible achievement measures in mathematics and science were used in this study (See Martin and Mullis (2012) for discussion on the use of plausible values).

Data Analysis - Model evaluation and estimation criteria

Data analyses were conducted by means of structural equation modelling (SEM) with Mplus 7.4. SEM analyses were applied to conduct confirmatory factor analyses (CFAs), path analyses with plausible and latent variables and multiple-groups analyses. Missing data were addressed with the Mplus feature of multiple imputations with five imputed data sets (e.g., Asparouhov & Muthén, 2010). To ascertain the model fit, emphasis was placed on the comparative fit index (CFI; normed along a 0-to-1 continuum with values over .90 representing an adequate fit), the root-mean-square error of approximation (RMSEA; values less than .08 are indicative of a reasonable fit) (West, Taylor, & Wu, 2012) and the chi-square test statistic (χ^2: for informative purposes only because of its sensitivity to large sample size). These cut-off standards may be specific to particular models (complex models with large sample size) and data sets and using fit indices for interpreting acceptable model fits are only rough guidelines (West, Taylor, & Wu, 2012). The complex design associated with TIMSS data was accounted for by incorporating the clustering

variable, and students' sampling weights (weighting variable supplied with the data) in the analysis.

Moreover, following work on method effects associated with parallel and negatively worded items by Marsh et al. (2013) (see also Bofah & Hannula, 2015; M.-S. Chiu, 2008; Marsh et al., 2014), correlated uniqueness accounting for method effects relating to parallel and negative item wording was incorporated into all the models.

Cultural equivalence test of the I/E model

Establishing measurement invariance is regarded as an important condition for any construct validity or theoretical generalisation in cross-cultural research. In fact, most research on cross-cultural comparison advocate the use of measurement invariance to ease cross-cultural generalisability of the measured models (e.g., Vandenberg & Lance, 2000). There are several levels of measurement invariance. Three levels are of significance in cross-cultural comparison: configural (all the parameters are freely estimated across the groups), metric (the factor loadings are equally held across the group), and scalar (invariance constraints are placed on the measurement intercepts and the factor loadings) invariance. However, if mean comparisons are not the objective, as in the present study, then configural and metric are of merit.

Multigroup CFAs were used to examine if the measurement and structural models (I/E model) are invariant across the 29 educational systems/cultures. For the measurement model the configural (MG1) and metric (MG2) invariance were examined across the groups. To ascertain whether the I/E is invariant across the 29 educational systems, models whereby all estimates of the I/E model were constrained to be equal across the educational systems were compared to a model with all constraints freely estimated. Due to restrictions of space, detailed analyses are not presented in this paper.

Results

Using the overall sample (TG in Table 1 and overall data in Table 2), the I/E model was supported. The path estimates were consistent with the I/E framework (Figure 1B) that is, negative path from mathematics achievement to science self-concept ($\beta = -.564$) and from science achievement to mathematics self-concept ($\beta = -.197$), a positive path from mathematics achievement and science achievement

to mathematics self-concept (β = .310) and science self-concept (β = .539) respectively. There was a positive correlation between mathematics and science achievement (r = .880) and between science and mathematics self-concept (r = .426).

Multigroup CFA was used to examine if the I/E model is invariant across the 29 countries. The results of the country equivalence tests of the I/E model were acceptable. The RMSEA indicated a reasonable fit, whereas CFI and TLI indicated a slightly below reasonable fit model (see Table 1). The results of the country invariance test indicated a less adequate fit with increasing constraints on parameter estimates. For cultural invariance of the I/E model, comparison was made between two nested models (see Table 1), MG3 (freely estimating all parameter estimates) and MG6 (constraining all estimated parameter estimates to be equal across group). There was support for the invariance of the I/E model across countries because of the small change in the fit indices of the compared models (ΔCFI = .014, ΔTLI = .002, ΔRMSEA = .000; though $\Delta\chi^2_{188} = 5867.536$, $p < .05$). Other model comparisons, MG4 vs. MG5 and MG4 vs. MG6 also indicated a similar outcome. Moreover, there were variations in parameter estimates with respect to each country. A thorough look at each country's parameters indicated that a fit to the I/E model occurred in 24 out of the 29 countries. Five countries deviated from the I/E model (Table 2). Four partially supported and one contrasted the I/E model. Since there were no significant changes in model indices when constraints were imposed on the parameter estimates for the cultural equivalent test, separate analysis was done for each country in verifying the I/E model (Table 2).

Confirmatory factor analysis (CFA) with a two-factor model (M1: Table 1), with each domain representing a unique dimension did not fit the data. However, controlling for method effects associated with parallel and negatively worded items (M3) indicated a substantial improvement in goodness-of-fit. Moreover, there was support for configural (MG1) - reasonable to think that the factor structure is applicable across all 29 countries, and metric invariance (MG2) - one could conclude that the constructs are manifested in the same way in each of the groups - across the 29 country. All analyses subsequently reported are based on metric invariance model. All estimates of the factor loadings are constrained to be equal across the 29 countries.

Models MG1-MG6 examined whether the I/E model fit the 29 countries by setting certain combinations of invariants and freely estimating some parameters across the countries (See Table 1).

Composite reliabilities estimates for the MSC and SCC scales reached the acceptable value of .80, but in few cases fell below the acceptable value of .60. These are average results over five data sets due to the use of plausible values in the computations (See Table 2). Reliabilities were generally lower for the SCC construct than for the MSC. The lower reliabilities may attenuate the validity of the interpretations of the results and weaken the statistical power as well as the effect sizes (Schmidt & Hunter 1996). This necessitated the use of latent-variable models that accounted for unreliability, bias, and measurement errors (Cole & Preacher, 2014).

Table 1: Model TG examines whether the I/E model fit the total group

Model	χ^2	*df*	CFI	TLI	RMSEA	Model description
TG	19168.672	41	.936	.899	.051	Total group
M1	68909.136	34	.770	.695	.106	Two factor model
M2	13813.936	28	.954	.926	.052	includes CUs for negative item effect
M3	4268.378	25	.986	.974	.031	CUs for both negative and matching item effect
Multigroup CFA						
MG1	6264.252	725	.984	.971	.035	Inv =none
MG2	15487.215	949	.957	.941	.050	Inv =FL
Multigroup I/E model						
MG3	51351.300	1637	.872	.853	.070	Inv =none
MG4	51351.298	1637	.872	.853	.070	Inv = FL
MG5	56900.881	1749	.858	.847	.071	Inv = FL, PC
MG6	57218.836	1805	.858	.851	.070	Inv =FL, PC, FC, AC

Note. TG = total group; MG = multiple group (or multigroup); CFA = confirmatory factor analysis; Inv = invariant; FL = factor loadings; FC = factor covariance; AC = correlation between mathematics and science achievement; PC = path coefficients, CU=Corrected uniqueness.

Table 2: Composite reliabilities estimates for the MSC and SCC scales for 29 Countries

		Reliabilities		Path coefficient				Correlation	
Country	N	MSC ω	SCC ω	MAch to MSC	MAch to SCC	SAch to MSC	SAch to SSC	MSC - SSC	MAch - SAch
Australia	7556	.858	.836	.752	-.271	-.200	.661	.342	.851
Bahrain	4640	.654	.548	.636	-.302	-.260	.570	.371	.878
Botswana	5400	.648	.614	.989	-.226	-.953	.360	.330	.874
Chile	5835	.773	.711	.744	-.589	-.336	.699	.087	.846
Chinese Taipei	5042	.880	.850	.761	-.281	-.175	.708	.457	.877
Palestinian National Authority	7812	.601	.595	.649	-.**069**	-.295	.407	.450	.891
Ghana	7323	.515	.457	.397	-.118	-.254	.326	.369	.804
Honduras, Republic of	4418	.616	.536	.370	-.**056**	-.214	.**116**	.362	.824
Hong Kong, SAR	4015	.805	.751	.614	-.388	-.229	.577	.223	.831
Iran, Islamic Republic of	6029	.714	.671	.646	-.**061**	-.267	.329	.413	.859
Israel	4699	.773	.792	.659	-.345	-.239	.665	.116	.861
Italy	3979	.876	.804	.692	-.283	-.165	.542	.293	.827
Japan	4414	.824	.806	.691	-.098	-.123	.569	.478	.838
Jordan	7694	.543	.459	.788	-.161	-.457	.452	.487	.892
Korea, Republic of	5166	.861	.859	.814	-.**044**	-.150	.622	.524	.841
Malaysia	5733	.600	.599	.385	-.445	-.170	.589	.482	.803
Oman	9542	.470	.462	.665	-.**043**	-.326	.398	.465	.888

Table 2 Cont'd: Composite reliabilities estimates for the MSC and SCC scales for 29 Countries

		Reliabilities		Path coefficient				Correlation	
Country	N	MSC ω	SCC ω	MAch to MSC	MAch to SCC	SAch to MSC	SAch to SSC	MSC - SSC	MAch - SAch
New Zealand	5336	.821	.790	.797	-.379	-.331	.651	.287	.839
Norway	3862	.871	.814	.841	-.119	-.230	.488	.430	.821
Qatar	4422	.622	.614	.481	-.304	-.217	.590	.323	.873
Saudi Arabia	4344	.652	.587	.602	-.214	-.151	.520	.398	.845
Singapore	5927	.845	.837	.918	-.491	-.557	.719	.166	.877
South Africa	11969	.570	.533	.540	-.194	-.546	.199	.349	.856
Thailand	6124	.604	.574	.415	-.182	-.384	.182	.512	.827
United Arab Emirates	14089	.659	.622	.671	-.298	-.362	.518	.274	.869
Tunisia	5128	.626	.550	.621	-.201	-.276	.451	.141	.824
Turkey	6928	.779	.709	.850	-.166	-.364	.551	.412	.896
United States	10477	.824	.791	.738	-.225	-.319	.556	.134	.835
England	3842	.815	.823	.848	-.145	-.438	.433	.342	.846
Overall data	181745	.775	.757	.310	-.564	-.197	.539	.426	.880

Note: MAch = math achievement, SAch = science achievement, SCC = science self-concept, MSC = mathematics self-concept, ω = composite reliability. The estimates underlined are not significant at the .05 leve

Discussion

The purpose of this study was to examine the I/E frame of reference model on students' self-concept in mathematics and science. The use of science and mathematics in exploring the I/E has helped broaden the generalisability of the I/E model across other school domains. The findings of this study clearly support as well as challenge the foundations of the I/E theories, and provide new ways of looking at the theory. As such, the present study results are consistent with findings of Marsh and Hau's (2004) PISA study, Möller et al.'s (2009) meta-analysis, and Marsh et al.'s (2014) provide the strongest support for the generalisability of the I/E frame of reference effect model. That is, the internal/external frame of reference (I/E) model posits a paradoxical relation between "distinct" school subjects, for example, mathematics and verbal (native language). Also, achievement in each domain positively affects self-concept in the matching domain but negatively in the nonmatching domain. Furthermore, the choice of mathematics and science as the subjects of choice in this paper helped test the generalisability of the I/E model beyond mathematics and verbal skills used to be the norm in a number of the papers that were reviewed.

Additionally, the measurement nature of self-concepts model and the I/E model was supported by the overall data. A series of confirmatory factor analyses (CFAs) revealed the need to control for the method effects associated with such items. Although, composite reliability estimates were very low for some countries, these reliability estimates emphasize the need for latent variable models, such as those used in the present investigation (Marsh et al., 2014).

In this study, 24 out of the 29 countries supported the I/E model. This indicates that students in the 24 countries have a clear distinction between their mathematics and science self-concepts, and their mathematics and science abilities, although there was low to medium correlation between their mathematics and science self-concept and a high correlation between their mathematics and science achievement. However, five countries did not fully support the I/E model. Out of the five countries, four partially supported the I/E model and one contrasted it. For these four countries, the internal frame of reference path from mathematics achievement to science self-concept was not statistically significant. In the case of the fifth country, the internal frame of reference estimate between mathematics achievement and science self-

concept as well as the external frame of reference estimate between science achievement and self-concept were not statically significant. Interestingly, three out of the five countries partially supporting the I/E model were countries in the Middle East. The five countries that did not conform to the I/E model may give an indication of the influence of local school systems or culture on self-concept and achievement. With the 24 countries supporting the I/E model, students' self-perception as to whether mathematics and science are supplementary or different domain are clear. In these countries, mathematics and science are two distinct domains. The other five countries reported partial support for mathematics and science being two distinctive domains. Similar outcomes were reported in M.-S. Chiu (2008) and Marsh et al. (2014) in their study. The fact that countries differ to some extent on the I/E model suggests that research and theorizing that integrate cross-cultural perspectives are crucial to the establishment of more useful and universal theories (e.g., van de Vijver & Leung, 2000). This finding gives some indication of possible variations in how students from different cultures form self-concepts and add to the literature on cross-cultural studies and the validity of studies carried across multiple nations.

One important finding of this study is that social comparison processes influence internal and external self-concepts. Students with good grades in mathematics are less likely to think that they are good in science and vice versa. Students are more likely to perceive themselves to be more talented in mathematics than science when they perceive their mathematics achievement to be better than those of their classmates (Dickhäuser, 2005).

A limitation of the study is that the model could not account for the reciprocal determinism between mathematics and self-concept. This is because cross-sectional data used in modelling a reciprocal analysis is very problematic (Bofah, 2015). Moreover, the indices for the final model and some of the reliability estimates of the self-concept constructs were below acceptable scores. Although, method effect associated with negatively phrased and parallel items were controlled, the factor loadings of the negatively phrased items were very low and varied across all models tested. This supports the notion that responses to negatively phrased items are culture-specific (see Bofah & Hannula, 2015). Notwithstanding this challenge, a strength of the present study is that the TIMSS data used here are nationally representative samples

of students carefully constructed, and was consistently measured for a diverse set of countries (Marsh et al., 2014). Thus, the conclusion is that support for the I/E model can be generalised cross-culturally through the use of a more robust approach and stronger data set as reported in this paper. Another advantage in the approach adopted in this study as compared to other similar studies (e.g., Chiu, 2012) is that we included both latent variables that controlled for method factors and measurement error and all five achievement plausible values as discussed in TIMSS documentation.

References

Asparouhov, T., & Muthén, B. O. (2010). *Multiple imputation with Mplus: Mplus technical appendices.* Los Angeles, CA: Muthen & Muthen. Retrieved from http://statmodel2.com/download/Imputations7.pdf.

Bofah, E. A. (2015). Reciprocal determinism between students' mathematics self-concept and achievement in an African context. In K. Krainer & N. Vondrová (Eds.), *CERME 9-Ninth Congress of the European Society for Research in Mathematics Education* (pp. 1688–1694). Prague, Czech Republic. Retrieved from https://hal.archives-ouvertes.fr/hal-01287995.

Bofah, E. A., & Hannula, M. S. (2015). TIMSS data in an African comparative perspective: investigating the factors influencing achievement in mathematics and their psychometric properties. *Large-Scale Assessments in Education, 3*(1), 4.

Chiu, M.-S. (2008). Achievements and self-concepts in a comparison of math and science: exploring the internal/external frame of reference model across 28 countries. *Educational Research and Evaluation, 14*(3), 235–254.

Chiu, M.-S. (2012). The internal/external frame of reference model, big-fish-little-pond effect, and combined model for mathematics and science. *Journal of Educational Psychology, 104*(1), 87–107.

Chiu, M. M., & Klassen, R. M. (2010). Relations of mathematics self-concept and its calibration with mathematics achievement: Cultural differences among fifteen-year-olds in 34 countries. *Learning and Instruction, 20*(1), 2–17.

Cole, D. a, & Preacher, K. J. (2014). Manifest variable path analysis: Potentially serious and misleading consequences due to uncorrected measurement error. *Psychological Methods*, *19*(2), 300–15.

Dickhäuser, O. (2005). A fresh look: Testing the internal/external frame of reference model with frame-specific academic self-concepts. *Educational Research*, *47*(3), 279–290.

Marsh, H. W. (1986). Verbal and math self-concepts: An internal/external frame of reference model. *American Educational Research Journal*, *23*(1), 129–149.

Marsh, H. W. (2007). *Self-concept theory, measurement and research into practice: The role of self-concept in educational psychology*. Leicester, UK: British Psychological Society.

Marsh, H. W., Abduljabbar, A. S., Abu-Hilal, M. M., Morin, A. J. S., Abdelfattah, F., Leung, K. C., … Parker, P. (2013). Factorial, convergent, and discriminant validity of TIMSS math and science motivation measures: A comparison of Arab and Anglo-Saxon countries. *Journal of Educational Psychology*, *105*(1), 108–128.

Marsh, H. W., Abduljabbar, A. S., Parker, P. D., Morin, A. J. S., Abdelfattah, F., Nagengast, B., … Abu-Hilal, M. M. (2014). The internal/external frame of reference model of self-concept and achievement relations: Age-Cohort and cross-cultural differences. *American Educational Research Journal*, *52*(1), 168–202.

Marsh, H. W., & Hau, K.-T. (2004). Explaining paradoxical relations between academic self-concepts and achievements: Cross-cultural generalizability of the internal/external frame of reference predictions across 26 countries. *Journal of Educational Psychology*, *96*(1), 56–67.

Marsh, H. W., Möller, J., Parker, P., Xu, M. K., Nagengast, B., & Pekrun, R. (2015). Internal/External frame of reference model. In J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences* (2nd ed., Vol. 12, pp. 425–432). Amsterdam, Netherlands: Elsevier.

Marsh, H. W., & Yeung, A. S. (2001). An extension of the internal/external frame of reference model: A response to Bong (1998). *Multivariate Behavioral Research*, *36*(3), 389–420.

Martin, M. O., & Mullis, I. V. S. (Eds.). (2012). *Methods and procedures in TIMSS and PIRLS 2011*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. Retrieved from http://pirls.bc.edu/methods/index.html

Möller, J., Helm, F., Muller-Kalthoff, H., Nagy, N., & Marsh, H. W. (2015). Dimensional comparisons and their consequences for self-concept, motivation, and emotion. In J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences* (2nd ed., Vol. 6, p. ¨430-436). Amsterdam, Netherlands: Elsevier.

Möller, J., Pohlmann, B., Koller, O., & Marsh, H. W. (2009). A meta-analytic path analysis of the internal/external frame of reference model of academic achievement and academic self-concept. *Review of Educational Research*, *79*(3), 1129–1167.

Moller, J., Streblow, L., Pohlmann, B., & Köller, O. (2006). An extension to the internal/external frame of reference model to two verbal and numerical domains. *European Journal of Psychology of Education*, *XXI* (4), 467–487.

Parker, P. D., Marsh, H. W., Ciarrochi, J., Marshall, S., & Abduljabbar, A. S. (2014). Juxtaposing math self-efficacy and self-concept as predictors of long-term achievement outcomes. *Educational Psychology*, *34*(1), 29–48.

Schmidt, F. L., & Hunter, J. E. (1996). Measurement error in psychological research: Lessons from 26 research scenarios. *Psychological Methods*, *1*(2), 199–223.

van de Vijver, F. J. R., & Leung, K. L. (2000). Methodological issues in psychological research on culture. *Journal of Cross-Cultural Psychology*, *31*(1), 33–51.

Vandenberg, R. J., & Lance, C. E. (2000). A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods, 3*, 4–70.

Wang, J., & Lin, E. (2008). An alternative interpretation of the relationship between self-concept and mathematics achievement: Comparison of Chinese and US Students as a context. *Evaluation & Research in Education*, *21*(3), 154–174.

West, S. G., Taylor, A. B., & Wu, W. (2012). Model fit and model selection in structural equation modeling. In R. H. Hoyle (Ed.), *Handbook of structural equation modeling* (pp. 209–231). New York, NY: The Guilford Press.

Ghana Journal of Education: Issues and Practices (GJE)
Vol. 4, December 2018, pp. 60 – 76

Study Habits, Locus of Control and Gender as determinants of Academic Achievement of Students with Hearing Impairment in Two South-Western States, Nigeria

Samuel Olufemi Adeniyi [1*] & Olaotan Oladele Kuku [2]

1. Department of Educational Foundations, University of Lagos, Nigeria.
2. Federal College of Education (Technical), Akoka, Lagos State, Nigeria

[*]Corresponding author's email address: *soadeniyi@unilag.edu.ng*

Abstract

The study examined study habits, locus of control and gender as determinants of academic achievement in English Language among students with hearing impairment in Lagos and Oyo States, Nigeria. Senior secondary students with hearing impairment in inclusive and integrated schools in the two states constituted the population of the study. The sample size of 258 participants was selected through multistage technique. The study adopted a descriptive survey research design. Study Habit Inventory, English Language Achievement Test and Locus of Control Scale with reliability of 0.73, 0.81 and 0.79 respectively were the instruments used to gather data for the study. The three research hypotheses raised were tested at 0.05 level of significance. Data gathered were analyzed using mean, standard deviation, t-test, Analysis of Variance and multiple regression analysis. The study revealed that study habits and locus of control have influence on the academic achievement of students with hearing impairment. In addition, locus of control contributed mostly to the academic achievement of students with hearing impairment. It was recommended that students with hearing impairment should be helped to develop good study habits and locus of control.

Key words: Study Habits, Locus of Control, Gender, Academic Achievement, Hearing Impairment.

Introduction

Most often, academic achievement of students with hearing impairment is a thing of concern to stakeholders in education. There are many reports showing that the academic performance of children and adults often who are deaf lag behind their hearing counterparts (Lang, 2003). The poor academic achievement may not necessarily be related to level of intelligence as many students with hearing impairment possess average intelligence and sometimes few of them are above average or with superior intellectual capacity. This is because most children with hearing impairment have repeatedly demonstrated the same intellectual score on non-verbal intelligence test (Ogundiran & Olaosun, 2013). The major problem of many students with hearing impairment is academic adjustment which emanates from communication barrier, lack of societal understanding and degree or severity of their hearing losses. Hearing loss places a great barrier on the affected individuals. The barrier starts from inability to properly receive auditory signal which later culminates into communication difficulty in the form of verbal expression because the world around them is a language rich environment in the form of reasonable speech. The inability to speak creates gap between students with hearing impairment and their hearing counterparts, teachers and parents. This problem together with others could create academic difficulty for students with hearing impairment in regular, inclusive and integrated settings.

According to Crede and Kuncel (2008), study habit is the degree to which student engages in regular acts of studying that are characterized by appropriate studying routine occurring in an environment that is conducive for studying. This includes the management of time and resources to meet the demands of academic tasks. In a study conducted by Sulman and Naz (2012) on relationship between study habits of deaf students and their academic performance, the result revealed positive correlation between academic performance and study habit of these category of students. In relation to the finding above, Tamilarasi and Ushalayaraj (2017) noted that study habits are essential for students' academic achievement and in the acquisition of general knowledge. If good study habits are inculcated at the earlier stage of a child, he will be able to face a competitive society positively. This submission aligns with the study conducted by Carbonel (2013) on learning style, study habits and academic performance of college

students at Kalinga-Apayo State College in Philippine. The researcher found that study habits influence the performance of the students. Earlier studies by Davenport (1988), Stockey (1986), and Culler and Holahan (1980) on study habits and academic performance revealed strong relationship between study habits, skills, attitudes and academic performance. It therefore means that study habits present considerable influence on achievement of students be it hearing and hearing impaired.

Furthermore, locus of control is another important variable that affects students' academic achievement. Locus of control is a belief system regarding causes of person's experiences and factors affecting success or failure (Barzegar, 2011). Locus of control is seen as a predictor of much behaviour (Dilmac, Hamarta & Arslan, 2009; Tella, Tella, & Adeniyi, 2009). Locus of control structure showed distributions of internal and external locus of control and those with internal locus of control believed that their success or failure is reason of their efforts and abilities. On the other hand, the external locus of control count successes or failures on luck or some external forces (Saricam & Duran, 2012). A study by Barzegar (2011) on the relationship between learning style, locus of control and academic achievement of Iranian students using internal locus of control scale developed by Rotter (1966) revealed that locus of control contributed greatly to students' academic performance. Another study by Knowles and Kerman (2007) investigated students' attitude and motivation towards online learning. The result revealed that students with internal locus of control tend to perform better in academic courses compared to those with external locus of control. The above implied that children with internal locus of control are very lively with academic pursuit and likely to achieve higher compared with children with external locus of control. Other studies have also reported the contribution of locus of control to academic achievement (Hassan & Khalid, 2014; Nejati, Abedi, Agbaci & Mohammadi, 2012; Anakwe, 2003; Biggs, 1997). Hence, locus of control whether internal or external can influence academic achievement of students with or without hearing impairment.

Studies have documented a lot of reasons for students' academic achievement whether with or without disabilities. Variables like academic self-efficacy, locus of control, motivation, social support, study habit, students attitudes have been linked to academic achievement among non-disable students (Alade & Kuku, 2017;

Ogunmakin & Akomolafe, 2013; Abid, Kanwal, Nasir, Iqbal, 2016; Aladenusi, 2015; Cerna & Pavliushchenko, 2015; Oriakhi & Igbudu, 2015; Hassan & Khalid, 2014; Akinleke, 2012; Osa-Edo & Alutu, 2012; Crede & Kuncel, 2008; Tella, 2007). Unfortunately, few studies on reason for academic difficulties of students with hearing impairment may not be easily accessible as many as their hearing counterparts in Nigeria. The reasons stakeholders who are not special educators believed that students with hearing impairment are not capable of achieving like others because of their auditory deprivation and as such will not be affected by general factors influencing academic successes of individuals without disabilities. It must be noted that this group of individuals with hearing impairment are part of the society and are affected by what happens around them whether in the school or at home.

In addition, gender is among the determinants of students' academic achievement. Different studies have been conducted to investigate the impacts of gender on academic achievement at different levels, that is, elementary, high school, college and University on core subjects. The findings seem inconclusive. However, studies by Voyer and Voyer (2014), Farooq, Chaudhury, Shafiq and Berham (2011), Gibb, Fergusson and Horwood (2008), Erdem, Şentürk and Arslan (2007), and Abu-Hola (2005) all reported that females performed better than their male counterparts and their different results were statistically significant. In line with the findings above, studies by Tamilarasi and Ushalayaraj (2017) on comparative study habits of male and female hearing impaired students revealed that female students with hearing impairment have better learning habits than their male counterparts. This of course is an indication that female students with hearing impairment performed better than their male counterparts. On the contrary, Oluwagbohunmi (2014), Udida, Ukwayi, and Ogodo (2012), O'Neill and Sweetman (2012) and Awofala (2011) found that male students with hearing impairment performed better than females. Interestingly, studies by Alade and Kuku (2017), Abubakar and Adegboyega (2012), Abdul-Raheem (2012), Kang'ahi, Indoshi, Okwach and Osodo (2012) and Mlambo (2011) all reported no gender-based statistical significance in their different studies.

With the current concern on the academic achievement of students with hearing impairment and various indicators influencing academic performance of students as found in some studies discussed

above. This study becomes imperative in view of the fact that few studies have been done locally to actually ascertain factors that will aid better performance of students with hearing impairment. This study therefore, is on study habits, locus of control and gender as determinants of academic achievement of students with hearing impairment.

Hypotheses

The following research hypotheses were tested in the study.

1. Study habits have no significant effect on academic achievement of students with hearing impairment.
2. Locus of control has no significant effect on academic achievement of students with hearing impairment.
3. There is no significant joint effect of study habits, locus of control and gender on academic achievement of students with hearing impairment.

Methodology

This study adopted a descriptive survey research design because it allows the researcher to collect data regarding the opinion of the participants on a particular subject. The targeted population of this study consisted of all secondary school students with hearing impairment in senior categories (SS 2 and 3) in inclusive and integrated schools in Lagos and Oyo State, Nigeria respectively. The two levels of classes (SS 2 and 3) were selected in the inclusive and integrated schools because they would have adequately covered the curriculum contents and would have imbibed a particular learning construct. There are 283 students with hearing impairment that constituted the targeted population across the four schools in the two states. The four schools were two integrated schools in Oyo State and two inclusive schools in Lagos States. The participants were selected through multistage sampling technique. The initial stage of the technique involved using purposive sampling. This was aimed at selecting the inclusive and integrated schools in Lagos and Oyo State, Nigeria respectively. The next stage involved the use of purposive sampling technique to select the students with hearing impairments in each of the four schools. The students with hearing impairment selected were based on their availability for the study. Subsequently, students with hearing impairment in each of the four schools in SS 2 and 3 were selected as

participants in the study. Table 1 shows the distribution of participants based on schools and gender.

Table 1: Distribution of Participants based on State, School and Gender

State	*School*	*Gender*		*Total*	*Gender*		*Total*	*Total per State*
		Male	*Female*		*Male*	*Female*		
Lagos	A	32	37	69	29	33	62	131
	B	36	38	74	34	35	69	
Oyo	C	31	34	65	28	29	57	127
	D	38	37	75	36	34	70	
Total		*137*	*146*	283	127	131	258	

Figures from Table 1 show that 131 participants were selected from Lagos State, which comprised 63 male and 68 female; while Oyo State had 127 participants consisting of 64 male and 63 female. Thus, the sample size consisted of 258 participants. Three research instruments were used to gather relevant data for the study. The instruments were

- Study Habit Inventory (SHI)
- English Language Achievement Test (ELAT) and
- Locus of Control Scale

The researchers adapted Bakare's (1977) Study Habit Inventory. The SHI has 25 statements, which boarder around Home Homework and Assignment, Time Allocation, Reading and Note Taking, Study Period Procedures/Test Preparation and Examinations/Test taking. The SHI has a reliability coefficient of 0.73 while the adapted instrument has a reliability coefficient of 0.76 using the test-retest reliability to test the stability. The SHI has two sections, namely, sections A and B. Section A dealt with background information of the participants such as name of school, class, sex and gender. Section B had 25 statements with the following options: *Almost Never, Less than Half of the Time, More than Half of the Time* and *Almost Always* which is represented with 1, 2, 3 and 4 respectively.

English Language Achievement Test (ELAT) was constructed and refined by the researchers to determine the achievement of participants in English Language. The ELAT has 100 multiple choice test items with options A, B, C and D. The instrument has an obtainable score of 100 with emphasis placed on several aspects of English Language as displayed in the Test Blueprint.

Table 2: Blueprint for the English Language Achievement Test

Contents	Weight	Behavioural Objectives			Total (100%)
		Knowledge (30%)	Comprehension (50%)	Application (20%)	
Grammar	20%	6	10	4	20
Comprehension	20%	6	10	4	20
Lexis and Structure	30%	9	15	6	30
Letter and Sound	30%	9	15	6	30
Total	100%	30	50	20	100

The Test Blueprint displayed in Table 2 was used to ensure the content validity of the ELAT. The items in the ELAT were developed to meet a discrimination index range from 0.4 to 0.6 and difficulty index range from 0.30 to 0.70. Test retest reliability was used to determine the stability of the instrument. The ELAT was administered twice within an interval of three weeks and the scores were collated for 30 students and Pearson's' Product Moment correlation was used to determine the correlation coefficient. The process yielded 0.81.

Locus of Control Scale (LOCS) was adapted from Rotter (1966) locus of control questionnaire. LOCS was used to assess that participants' tendency to internalize or externalize responsibility for events or circumstances in their lives. The LOCS has a reliability coefficient of 0.79, with a total score ranging from 0 to 40. The respondents were grouped into three based on their respective obtained scores in LOCS. The highest range of scores 26-40 reflect external locus of control, followed by 16-25 reflecting internal-external locus of control, while the lowest range of scores between 01-15 reflect internal locus of control.

The instruments were personally administered to the participants by the researchers in order to reduce undue errors due to extraneous variables. The researchers collected the filled instruments immediately. Data gathered were analysed using descriptive and inferential statistics. The descriptive statistics used for analyses were mean and standard deviation, while the inferential statistics used were the t-test, Analysis of Variance (ANOVA) and multiple regression analysis. The hypotheses were tested at 0.05 level of significance.

Results of the Findings

Hypothesis One: Study habits have no significant effect on academic achievement of students with hearing impairment. The t-test was used to calculate students' study habit on their academic achievement. The result of the analysis is presented in Table 3.

Table 3: Analysis of Students' Study Habits on Academic Achievement.

Variables	N	Mean	SD	Df	t-cal	t-tab	Sig	Decision
Study Habit	258	65.47	5.34	257	7.96	1.97	0.000	H_0 is Rejected
English Achievement Test	258	45.58	10.34					

*Significant at $p < 0.05$

Data from Table 3 revealed that the mean score of 65.47 was derived for study habit, while the mean score of 45.58 was derived for English Language Achievement Test. The table also indicated that the t-calculated value of 7.96 resulted in the influence of study habit on academic achievement. The t-calculated value of 7.96 is greater than the critical value of 1.97, at 257 degree of freedom and 0.05 level of significance. As a result, the null hypothesis was rejected and it was concluded that there is significant influence of students' study habit on academic achievement in English Language.

Hypothesis Two: Locus of control has no significant effect on academic achievement of students with hearing impairment. Locus of control will not have significant influence on academic achievement of students with hearing impairment. The t-test was used to calculate students' locus of control on their academic achievement. The result of the analysis is presented in Table 4.

Table 4: Analysis of Students' Locus of Control and Academic Achievement.

Groups	N	Mean	Standard Deviation
Internal LOC	46	55.37	5.82
Internal-External LOC	77	45.80	11.63
External LOC	135	42.12	8.48
Total	258	45.58	10.34

Figures from Table 4 show that learners with Internal Locus of Control had the highest mean performance of 55.37. Their counterparts Internal-External Locus of Control and External Locus of Control had mean achievements of 45.8 and 42.12 respectively. In order to

determine the significance of the group mean, the Analysis of Variance (ANOVA) was computed and the result displayed in Table 5.

Table 5: ANOVA of Students' Locus of Control and Academic Achievement

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6029.453	2	3014.727	35.880	.000
Within Groups	21425.496	255	84.022		
Total	27454.950	257			

Table 5 shows that a calculated F – value of 35.88 resulted as the influence of locus of control on academic achievement of students with hearing impairment in English Language. This calculated F – value of 35.88 is significant since it is higher than the critical F-value of 3.03 given 2 and 255 degrees of freedom at 0.05 level of significance. Consequently, the null hypothesis was rejected. Further analysis of data was done due to the significant F-value obtained as shown in Table 5. To determine the degree of academic achievement difference in the Locus of Control groups, the Fisher's Least Squares Difference (LSD) post hoc multiple comparison was carried out and the result of the analysis is presented in Table 6.

Table 6: Multiple Comparison Analysis of Students' Locus of Control and Academic Achievement

(I) Locus of Control	(J) Locus of Control	Mean Difference (I-J)	Sig.
Internal LOC	Internal-External LOC	9.58*	.000
	External LOC	13.25*	.000
Internal-External LOC	Internal LOC	-9.58*	.000
	External LOC	3.67*	.005
External LOC	Internal LOC	-13.25*	.000
	Internal-External LOC	-3.67*	.005

*. The mean difference is significant at the 0.05 level.

The analysis shows that students with hearing impairment with Internal Locus of Control have significantly higher mean achievement in English Language than those with Internal-External Locus of Control

(t = 9.58; p < 0.05). Similarly, students with hearing impairment with Internal Locus of Control have significant higher mean achievement in English Language than those with External Locus of Control (t = 13.25; p < 0.05). Besides, students with hearing impairment who possess Internal-External Locus of Control have significantly higher mean achievement in English Language than those with External Locus of Control (t = 3.67; p < 0.05).

Hypothesis Three: There is no significant joint effect of study habit, locus of control and gender on academic achievement of students. The Multiple Regression Analysis was employed to analyse the data. The results of the analysis are presented in Table 7, 8 and 9.

Table 7: Model Summary of Regression Analysis

Model	R	R Square	Adjusted R Square
1	.455[a]	.207	.198

a. Predictors: (Constant), Locus of Control, Gender, Study Habits

Figures from Table 7 shows that R value of 45.5% resulted as a measure of the quality of the prediction of the dependent variable. The coefficient of determination (that is R^2) value of 20.7% resulted as the proportion of variance in the dependent variable (Academic Achievement) that can be explained by the independent variables (Locus of Control, Gender and Study Habits).

Table 8: Analysis of Variance (ANOVA) of Regression Model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5691.171	3	1897.057	22.140	.000[b]
	Residual	21763.779	254	85.684		
	Total	27454.950	257			

a. Dependent Variable: English Language Achievement Test

b. Predictors: (Constant), Locus of Control, Gender, Study Habit Inventory

Figures from Table 8 show that F-calculated value of 22.14 resulted as the overall regression model. The F-calculated value of 22.14 is greater than the critical value of 2.63, given 3 and 254 degrees of freedom at 0.05 level of significance. Thus, the null hypothesis was rejected. This implies that there is significant joint effect of locus of control, study habits and gender on the academic achievement of students with hearing impairment in English Language.

Table 9: Analysis of Variance (ANOVA) of Regression Model - Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	57.684	7.550		7.640	.000
	Gender	-1.029	1.153	-.050	-.893	.373
	Study Habits	.057	.108	.030	.530	.596
	Locus of Control	-6.102	.755	-.451	-8.078	.000

a. Dependent Variable: English Language Achievement Test

Figures from Table 9 shows how much the English Language Achievement Test of students with learning impairment varies with the Gender (-0.050), Study Habit (0.030) and Locus of Control (-0.451) when other variable are held constant. Gender and Locus of Control shows an inverse relationship with academic achievement students with hearing impairment in English Language. Besides, Study Habits of students with hearing impairment varies positively with their achievement in English Language. However, only Locus of Control was found to be significant with the achievement of students in English Language.

Discussion

The result of hypothesis 1 revealed that study habits could influence academic achievement of students with hearing impairment. This is because the t-calculated is greater than the t-value. This finding corroborated Sulman and Naz (2012) study on relationship between study habits of deaf students and their academic performance, the finding revealed that there was positive correlation between study habits academic performance of students with deafness. The result is also in line with the position of Tamilarasi and Ushalayaraj (2017) that study habits are essential in students' academic achievement and acquisition of general knowledge. This means that for students to progress academically, good study habit must be developed. In the same vein, students with hearing impairment must be helped to develop good study habit to enable excel academically.

The result of hypothesis 2 revealed that locus of control has significantly influence on academic achievement of students with hearing impairment. The result of the study is in line with Dilmac, Hamarta and Arslan (2009) and Tella, Tella and Adeniyi (2009) who reported that locus of control predicted academic behavior. Also, this result is in line with the study of Barzegar (2011) on relationship between learning style, locus of control and academic achievement of Iranian students. The study revealed that the locus of control contributed greatly to students' academic performance. It can then be inferred that locus of control whether internal or external exerts great influence on academic achievement of students generally.

The result of hypothesis 3 revealed that the independent variables (locus of control, study habits and gender) jointly contributed to academic achievement of students with hearing impairment. However, from Table 4, it is evident that locus of control contributed significantly to academic achievement of students with hearing impairment. The relative contribution of each independent variable further corroborated the findings of studies on study habits, locus of control and gender as possible predictors of academic achievement at any level of education. This result is therefore in line with Tarnilarasi and Ushalayaraj (2017), Carbonel (2013) and Davenport (1988) who reported strong relationship between study habits and academic achievement of students, Aladenusi (2015), Dilmac, Hamarta and Arslan (2009) and Tella, Tella and Adeniyi (2009) whose finding revealed strong relationship between locus of control and academic achievement of their participants and Voyer and Voyer (2014), Farooq, Chaudhury, Shafiq and Berham (2011) Tamilarasi and Ushalayaraj (2017), Oluwagbohunmi (2014) and Awofala (2011) that reported gender implications and academic achievement of students that have been investigated at different time.

Conclusion

This study examined the influence of locus of control, study habits and gender on academic achievement of students with hearing impairment. The results of this study have established that, locus of control, study habits and gender could predict academic achievement. However, locus of control contributed mostly to academic achievement of students with hearing impairment.

Recommendations

It is recommended that teachers, counselors, parents and other stakeholders in the education of students with hearing impairment should help in the development of good study habits and locus of control be it internal and external locus of control to change the consistent poor academic achievement of students with hearing impairment in Nigeria.

References

Abdul-Raheem, B. O. (2012). Gender differences and students' academic achievement and retention in social studies among Junior Secondary Schools in Ekiti State, Nigeria. *European Journal of Educational Studies, 4*(1), 155-161.

Abid, M. A., Kanwal, S., Nasir, M. A. T., & Iqbal, S. (2016). The effect of locus of control on academic performance of the students at tertiary level. *International Review of Management and Business Research, 5*(3), 860-869.

Abubakar, R. B., & Adegboyega, B. I. (2012). Age and gender as determinants of academic achievement in Colllege Mathematics. *Asian Journal of Natural and Applied Science, 1*(2), 121-127.

Abu-Hola, I. (2005). Uncovering gender differences in cience achievement and attitudes towards Science for Jordanian Primary Pupils. *Demescus University Journal, 21*(1), 19-53.

Akinleke, O. W. (2012). An investigation of the relationship between test anxiety, self-esteem and academic performance among Polytechnic students in Nigeria. *International Journal of Computer Applications, 51*(1), 47-50.

Alade, O. M., & Kuku, O. O. (2017). Impact of frequency of testing on study habits and achievement in mathematics among secondary school students in Ogun State, Nigeria. *Journal of Educational Research and Practice, 7*(1), 1-18.

Aladenusi, O. (2015). Academic locus of control and social support as predictors of research help-seeking behavior among Nigerian undergraduates. *American Journal of Psychology and Cognitive studies, 1*(2), 29-36.

Anakwe, A. I. (2003). *The relationship among locus of control, academic performance and school adjustment of Senior Secondary School in Plateau State. Unpublished MED dissertation University of Jos.*

Awofala, A. O. (2011). Is gender a factor in Mathematics performance among Nigerian Senior Secondary School students with varying school organization and location? *International Journal of Mathematics trends technology, 2*(3), 17-21.

Bakare, A. (1977). *Study habits inventory*. (SHI) Manual Psycho-educational Research Production. Ibadan: University Press.

Barzegar, M. (2011). *The relationship between learning style, locus of control and academic achievement in Iranian Students*. 2011 2nd International Conference on Education and Management Technology.

Biggs, J. B. (1997). Locus of control and college students' approaches to learning: A comment. *Psychology Reports, 80,* 993-994.

Carbonel, L. G. (2013). Learning styles, study habits, and academic performance of college students at Kalinga-Apayao State College, Phlippines. *International Journal of Advanced Research in Management and Social Sciences, 2*(8), 245-258.

Cerna, M. A., & Pavliushchenko, K. (2015). Influence of study habits on academic performance of International College Students in Shanghai. *Higher Education Studies, 5*(4), 42-55.

Crede, M., & Kuncel, N. R. (2008) Study habits, skills and attitudes: The third pillar supporting collegiate academic performance. *Perspectives on Psychological Science, 3*(6), 425-453.

Culler, R.W., & Holahan, C. J. (1980). Test anxiety and academic performance: The effects of study-related behaviours. *Journal of Educational Psychology, 72,* 16-20.

Davenport, R. C. (1988). *Using attitudinal (non-intellective) measures, independently and in conjunction with intellective measures to predict college freshmen grade point ratio.* Unpublished Doctoral dissertation, Clemson University, SC.

Dilmac, B., Hamarta, E., & Arslan, C. (2009). Analysing the trait anxiety and locus of control of undergraduates in terms of attachment styles. *Educational Sciences: Theory and Practice, 9*(1), 143-159.

Erdem, C., Şentürk, I., & Arslan, C. K. (2007). Factors affecting grade point average of university students. *The Empirical Economics Letters, 6*(5), 360-368.

Farooq, M. S., Chaudhry, A. H., Shafiq, M., & Berhanu, G. (2011). Factors affecting students' quality of academic performance. A case study of secondary school level. *J.Q. Technol. Manage, 7*(2), 1-14.

Gibb, S. J., Fergusson, D. M., & Horwood, L. J. (1997). Gender differences in educational achievement in a New Zealand birth cohort. *New Zealand Journal of Educational Studies, 32*(1), 83-96.

Hassan, S. S., & Khalid, R. (2014). Academic locus of control of high and low achieving students. *Journal of Research and Reflections in Education, 8*(1), 22-33.

Kang'ahi, M., Indoshi, F. C., Okwach, T. O., & Osodo, J. (2012). Gender and students' academic achievement in Kiswahili language. *Journal of Emerging Trends in Educational Research and Policy Studies, 3*(5), 716-720.

Knowles, E. & Kerman, D. (2007). An investigation of students' attitude and motivation toward online learning. *Students Motivation, 2*, 70-80.

Lang, H. G. (2003). Perspectives on the history of deaf education. In M. Mashark and P. Spencer (Eds.): *Oxford hand of deaf studies, language and education*. New York: Oxford University Press.

Mlambo, V. (2011). An analysis of some factors affecting student academic performance in an introductory biochemistry course at the University of the West Indies. *The Caribbean Teaching Scholar, 1*(2), 79-92.

Nejati, M., Abedi, A., Agbaci, A., & Mohammadu, A. (2012). The relationship between locus of control with the academic performance of M.A students by considering the role of life quality and satisfaction with life. *Inter-disciplinary Journal of Contemporary Research in Business, 4*(5), 254-263.

O'Neill, D. A., & Sweetman, O. (2012). *Gender, single sex, schooling and Mathematics achievement*. ZA discussion paper No 6917; Bonisuan Germany. EACEA/Eurydice 2010. "Gender in educational outcomes: Study in the measure taken and the current situation in Europe". Education, Audiovisual and Culture Executive Agency (EACEA) 92.

Ogundiran, O., & Olaosun, O. (2013) Comparison of academic achievement between students with congenital and acquire

deafness in Nigerian College. *Journal of Education and Practice, 4*(23), 42-47.

Ogunmakin, A. O., & Akomolafe, M. J. (2013). Academic Self-efficacy, locus of control and academic achievement of Secondary School Students in Ondo State, Nigeria. *Mediterranean Journal of Social Sciences, 4*(11), 570-576.

Oluwagbohunmi, M. F. (2004). Gender issues in classroom interaction and students' achievement in social studies. *International Journal of Innovative Research Development, 5*, 742-745.

Oriakhi, U., & Igbudu, U. (2015). Influence of gender on students' academic achievement in government subject in public secondary schools in Oredo Local Government area of Edo State, Nigeria. *Journal of Educational and Social Research, 5*(2), 101-106.

Osa-Edo, G. I., & Alutu, N. N. G. (2012). A survey of students study habits in selected secondary schools: implication for counseling. *Current Research of Social Sciences, 4*(3), 228-234.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of Reinforcement. *Psychological Monographs, 80*(1, 609), 1-28.

Saricam, H., & Duran, A. (2012). *The investigation of the Education Faculty students' academic locus of control levels*. 15th Balkan international conference, Bureast, 28th-30th June, 2012.

Stockey, A. A. (1986). *Reading and study habits as predictors of performance at a two-year college*. Unpublished Ph.D. thesis, University of Wisconsin.

Sulman, N., & Naz, S. (2012). Relationship between study habits of deaf students and their performance in general Science. *International Journal of Contemporary Research in Business, 3*(12), 489-496.

Tamilarasi, B., & Ushalayaraj, D. (2017). Study habits of male and female hearing impaired students: A comparative study. *Indian Journal of Applied Research, 7*(3), 651-653.

Tella, A. (2007). The impact of motivation on students' academic achievement. *Eurasia Journal of Mathematics, Science and Technology Education, 3*(2), 149-156.

Tella, A., Tella, A., & Adeniyi, S. O. (2009). Locus of control, interest in schooling, self-efficacy and academic achievement. *Cypriot Journal of Educational Sciences, 4*, 168-182.

Udida, L. A., Ukwayi, J. K., & Ogodo, F. A. (2012). Parental Socioeconomic background as a determinant of students' academic performance in selected public schools in Calabar Municipal local government area, Cross River State, Nigeria. *Journal of Education and Practice, 3*(16), 129-135.

Voyer, D., & Voyer, S. D. (2014). Gender differences in scholastic achievement: A meta-analysis. *Psychology Bulletin, 140*(4), 1174-1204.

Ghana Journal of Education: Issues and Practices (GJE)
Vol. 4, December 2018, pp. 77 – 88

Comparative Effects of Critical Thinking and Peer-Assessment Skills Training on Ghanaian Senior High School Students' Achievement in Mathematics

Andrews Cobbinah

Department of Education and Psychology, University of Cape Coast, Cape Coast, Ghana

Email: *andrews.cobbinah@ucc.edu.gh*

Abstract

The study determined the comparative effects of critical thinking and peer-assessment skills training on Ghanaian senior high school students' achievement in mathematics. The non-equivalent pre-test and post-test control group 3x2x2 factorial quasi-experimental design was adopted for the study. Three public senior high schools were randomly sampled to participate in the study and a total of one hundred and thirty-seven (137) students made up of ninety-five (95) in the experimental groups and forty-two (42) in the control group from three intact classes were selected from schools in the Central Region of Ghana. Two mathematics achievement tests, with reliability coefficients of 0.79 and 0.83 were employed by the researcher for data collection. Critical thinking and peer-assessment modules were also developed and used by the researcher for the intervention. The peer-assessment and critical thinking modules were content validated by three experts using percentage of agreement method which yielded 79% and 80% respectively. ANCOVA was used to test the hypotheses at 0.05 level of significance. The findings of the study were that: there was no significant comparative effect of critical thinking and peer-assessment skills training on students' achievement in mathematics. Furthermore, there was no significant interaction effect of gender, age and treatment groups (critical thinking and peer-assessment) on students' achievement in mathematics. Based on the findings, it was recommended that teachers can make use of either peer-assessment or critical thinking strategies in teaching mathematics lessons to bring about the much-needed improvement in students' performance in Mathematics.

Key words: Critical thinking, Peer-assessment, Students achievement, Gender, Age and Core Mathematics

Introduction

Mathematics is a vital tool for the understanding and application of science and technology. The discipline plays the vital role of a precursor and harbinger to the much needed technological and national development, which has become an imperative in the developing nations of the world (Kang'ahi, Indoshi, Okwach & Osodo, 2012). In today's high and ever-increasing technological world, it is important that students, right from childhood, should develop their knowledge and skills in mathematics so that when they grow up they will not have fears about the subject. According to Chen, Liang, Lee and Liao (2011) the National Commission on Excellence in Education spent dollars to provide remedial education programmes for basic skills such as Reading, Writing, Spelling, and Computation. According to the report, many individuals felt that schools were over emphasising reading and computation and not spending adequate time on necessary skills such as comprehension, analysis, solving problems, and drawing conclusions. These skills (comprehension, analysis, solving problems and drawing conclusions) are critical thinking skills which are seemed to be neglected. Critical thinking involves skills by which the students recognise a wide range of subjective analyses and critically evaluate how well each of them might meet their needs and solve problems. Alwehaibi (2012), opined that critical thinking provides the tools for the mind; that people generally need to think through things for both studying and daily life. As thinking skills develop, students gain skills that can be used effectively to reason better through the thinking tasks implicit in future goals achievement.

Peer-assessment, on the hand, is the process by which students mark their colleagues work, critique it and offer suggestions in order to improve their works. The starting point for introducing peer-assessment is for teachers and learning support assistants to model the process that is, acting as role model and explaining and demonstrating how it should be done. For example, showing students how to give constructive feedback, i.e. detailed comments, objective focus, etc. in verbal and writing is necessary. A good way of doing this is to use examples of work from anonymous pupils (e.g. from a previous year or another school), modelling the type of constructive feedback that might be given or providing a list of questions that pupils might ask. The development of critical thinking and peer-assessment skills as desirable educational outcome requires teaching methods which help learners

improve their ability in critical thinking, peer-assessment skills and increase their tendency to use such skills (Karami, Pakmehr & Aghili, 2012). Therefore, the teachers' correct understanding of appropriate teaching methods and effective factors influence many motivational variables of learners such as tendency to think critically.

Today collaborative learning plays an important role between teaching methods. In this method, students cooperate with each other, share the learning experience and thereby, can improve many of their skills and abilities (Chan, 2013). Karami, Pakmehr and Aghili (2012), believed that the output of collaborative learning is far more than competition and individual activities. Alwehaibi (2012), considers fostering dialogue to be part of the method of critical thinking acquisition, because dialogue makes it possible to take the perspective of others into account, which is necessary for 'the assessment of truth claims. Instructional formats in which cooperative learning and dialogue feature are expected to promote the students' active learning and higher-order thinking skills simultaneously (Racionero & Padros, 2010). Garrison (2011) in his book titled 'philosophy for children' introduces an approach which is entirely focused on dialogue and he saw it as a dialogic teaching that improves thinking skills. This skill allows children to have more activity, receives more feedback and enables them to reason based on fact and logic.

Riswanto and Putra (2012), found that through peer-assessment, students enhance their sense of competence and self-worth. Evidence suggests that, when peer-assessment is used effectively it can foster higher-order levels of learning, such as those represented by the upper levels of Bloom's taxonomy and encourage students to develop professional behaviours that require the ability to reconcile multiple perspectives. It encourages students to develop the social skills needed to work in teams, including the ability to provide meaningful feedback and to accept peer critiques (Carlson, Berry & Voltmer, 2005). Zundert, Sluijsmans and Merrienboer (2010), also concluded that teachers and students found the peer-assessment exercise beneficial in terms of developing students' higher-level cognitive thinking and facilitating a deep approach to language learning. Results of several studies in the higher education system have shown the positive effect of collaborative learning method (peer-assessment) on learning skills and high cognitive levels of students (Ebiendele, 2012). According to Tiruneh, Verburgh

and Elen (2014) the kind of teaching method adopted is important for someone to construct correct understanding of critical thinking and learn how to think critically. It could be said that the more the teacher creates opportunities for interaction among learners, the better the opportunities for criticism in students' activities, hence provides a more suitable context for students' critical thinking disposition. Therefore, considering opportunities that collaborative learning compared with individual environment, provides, utilisation of this method by teachers in educational systems is suggested. Students' performances in core mathematics are poor and stakeholders have been wondering how this trend could be solved. As a result, several reasons have been assigned to this abysmal performance of students in the Central Region. Key among the reason's stakeholder attribute to this poor performance is the teaching methods (Cobbinah, 2016). Clearly, the effectiveness of either of the method cannot be doubted but the comparative advantage of one on the other has not been established. Again, an outstanding issue investigated by the researcher was whether gender and age have interaction effects on students' critical thinking and peer-assessment skills in their achievement in mathematics. The findings of most of these studies in the literature reviewed so far were indicative that individual factors were studied and their effects on students' achievement were established but no comparative study for the two skills were done. Therefore, the researcher looked at the comparative effects of critical thinking and peer-assessment skills training and their effects on students' achievement in mathematics as well as the interaction effect of critical thinking, peer-assessment, age and gender. It appears to the best of the researcher's knowledge that not much research of this nature has been done in Ghana. This therefore motivated the researcher to undertake the study to investigate the comparative effects of critical thinking and peer-assessment skills training on Ghanaian senior high school students' achievement in Mathematics.

Purpose of the study

The purposes of the study were to identify the comparative effects of critical thinking and peer-assessment skills training on Ghanaian senior high school students' in mathematics achievement as well as the interaction effect of critical thinking and peer-assessment

skills training on senior high school achievement in mathematics based on gender and age.

Research Hypothesis

1. There is no significant comparative effect of critical thinking skills training and peer assessment skills training on students' achievement in mathematics.
2. There is no significant interaction effect of critical thinking and peer-assessment skills training on students' achievement in mathematics based on age and gender.

Methodology

The research design for this study was a 3x2x2 factorial non-equivalent quasi-experimental design. The independent variables in the study were critical thinking and peer-assessment skills training, while age and gender were intervening variables and achievement in mathematics was the dependent variable. Three intact classes were used for the study. In this design, the dependent variable was measured both before and after the treatment or intervention as depicted below:

Assignment	Group	Pre-test	Treatment	Post-test
(Critical thinking)	1	O_1	X_1 (Gender) (Age)	O_4
(Peer-assessment)	2	O_2	X_2	O_5
(Control)	3	O_3	……	O_6

Figure 1: Diagrammatic Representation of the Experimental Design

Key:

Group 1 = critical thinking, 0_1 = first observation for CT, X_1 = Treatment for CT, 0_4 = second observation for CT.

Group 2 = Peer- assessment, 0_2 = first observation for PA, X_2 = treatment for PA 0_5 = second observation for PA

Group 3 = control, 0_3 = first observation for control, 0_6 = second observation for control

---------- = intact groups no randomization

Gender and age = intervening variables

The diagrammatic representation of the experimental design shown in Figure 1 indicates experimental levels which comprised three (3) groups. These groups were critical thinking skills training (1); Peer –Assessment skills training (2) and the Control (3).

The $O_1 = 0_2 = 0_3$ = pre-test, $O_4 = 0_5 = 0_6$ = Post-test, X_1 = treatment (Critical Thinking) and X_2 = (Peer-Assessment)

The diagrammatic expression of the treatment strategies shown in Figure 1 indicates that the experimental groups 1 and 2 were pretested, after which they underwent experimental treatment and the post-test was administered to them. For the control group, which was group 3, (they received the traditional method of teaching) no treatment was administered but subjects responded to pre-test and post-test instruments. The use of both pre-test and post-test helped to establish, the temporal precedence of the independent variable to the dependent. This gave the researcher more confidence when inferring that the independent variables were responsible for changes in the dependent variable. Secondly, the used of a pre-test allowed the researcher to measure between groups differences before exposure to the intervention. This substantially reduced the threat of selection bias by revealing whether the groups differed on the dependent variable prior to the intervention (Chan, 2013).

Two mathematics achievement tests, with reliability coefficients of 0.79 and 0.83 were developed and employed by the researcher for data collection. Critical thinking and peer-assessment modules were also developed and used by the researcher for the intervention. The modules were content validated by three experts using percentage of agreement method which yielded 79% and 80% for the peer assessment and the critical thinking modules respectively. The 3x2x2 factorial quasi experimental design was used because in a school or natural setting, it may not be possible to randomly assign students to groups since the headmasters/mistresses did not like their classes to be disorganised for the purpose of the research. This design helped in comparing groups against one another, hence it automatically ruled out selection-maturation interaction biases. The critical thinking, peer-assessment and the control group comprised 50, 45 and 42 students respectively. The average age of the critical thinking, peer-assessment and the control groups were respectively 16.8 years, 16.3 years and 16.9 years respectively, whereas the overall average age of students was 16.7 years.

Results and Discussions

Hypothesis one: *There is no significant comparative effect of critical thinking skills training and peer-assessment skills training on students' achievement in mathematics.*

A two-way ANCOVA was carried out to test the comparative effect of critical thinking and peer-assessment skills training of students' achievement in mathematics.

Table 1: ANCOVA Post-test ` Achievement in Mathematics Scores among the Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	16449.747[a]	12	1370.812	13.387	.000**	.564
Intercept	13680.523	1	13680.523	133.601	.000**	.519
Pretest	2413.279	1	2413.279	23.568	.000**	.160
Gender	42.084	1	42.084	.411	.523	.003
Age2	37.287	1	37.287	.364	.547	.003
Group	5169.596	2	2584.798	25.243	.000**	.289
Gender * Age2	1.581	1	1.581	.015	.901	.000
Gender * Group	189.917	2	94.958	.927	.398	.015
Age2 * Group	46.468	2	23.234	.227	.797	.004
Gender * Age2 * Group	233.100	2	116.550	1.138	.324	.018
Error*	12697.377	124	102.398			
Total	533813.000	137				
Corrected Total	29147.124	136				

a. R Squared = .564 (Adjusted R Squared = .522)

* =This means an interaction ** =This means is significant

The result as shown in the Table 1 and with mathematics Achievement Test, F (2,124) = 25.24, p = 0.000, (partial eta squared = 0.29). The result shows a significant difference in achievement in favour of the treatment groups. The eta value indicates that the two treatments contributed equally 29% to the students' achievement in mathematics.

Table 2: Result of Scheffe Post Hoc Test

Group	N	Subset	
		1	2
Control	42	46.40	
Peer Assessment	45		65.07
critical Thinking	50		68.76
Sig.		1.000	.272

The post hoc test results presented in Table 2 shows that though significant differences exist between treatment groups as a subcategory (CT and PA) against the control group, no significant difference was observed in the mean score achievement in the treatment groups (p =1). An indication is that, none of the skills training has a comparative advantage over the other. That is, there is no significant difference in achievement in mathematics between students exposed to critical thinking and those exposed to peer-assessment skills training. Though there was no statistically significant difference in achievement in mathematics in the treatment groups (peer-assessment and critical thinking groups), however, a closer look at the mean scores showed a critical thinking mean score of 68.76 which is higher than the mean score for the peer-assessment group with 65.07. There appears to be similarity between the two interventions, in that in peer-assessment, students were given the opportunity to assess their peers' work with the aid of scoring rubrics.

With these scoring rubrics, students identified the steps involved in the solution of the items and accordingly awarded marks for each step deemed correct and situations where the students had no mark in a step reasons were assigned for it. In awarding the marks students analysed and made inferences which are also skills used in critical thinking. This also supports the findings of Cevik, Haslaman and Cevik (2014) who studied the effect of peer-assessment on problem solving skills of prospective teachers supported by online learning. They found that, the groups involved in study mostly focused on the negative feedback which includes evaluation, explanation and analysis as well as suggestion type feedback (revision and detailed revision). To them the groups mostly ignored the positive evaluation, explanation and analysis. These groups one could say that they were making use of critical thinking skills in their learning. Evidence also suggests that, when peer-assessment is used effectively, it can foster higher order

levels of learning such as those represented by the upper levels of Bloom's taxonomy and encourage students to develop professional behaviours that require the ability to reconcile multiple perspectives (Carlson et al., 2005).Again Zundert et.al., (2010) concluded that teachers and students found peer-assessment exercise beneficial in terms of developing students higher level thinking. This implies that students critical thinking skills can be acquired through peer-assessment skills. However, Alwehaibi (2012) believed that fostering dialogue is a way of critical thinking acquisition, because dialogue makes it possible to take the perspective of others into account, which is necessary for 'the assessment of truth claims. Therefore, there seem to be a thin line between the two skills. Though research has indicated the effectiveness of the two skills training for improving students' performance no literature has reported their comparative effectiveness or advantage of either. However, this study has reported no comparative effects of the two interventions. Probably, the slight mean score increases in the critical thinking (CT) skills training as against the peer-assessment mean score was probably due to an increased in the knowledge in mathematics by students who received that training (CT).

Hypothesis 2*: There is no significant interaction effect of critical thinking and peer-assessment skills training on students' achievement in mathematics based on of age and gender*

The results form Table 1 again shows that, there was no significant interaction effect of Group and Gender F (2, 124) = .927, p = 0.398 with a minimum effect size (partial eta squared = 0.015). This indicates that there is no significant difference in the effect of gender on the achievement in mathematics in the treatment groups. This eta value means that the interaction effect of gender on group contributes 1.5% to the students' achievement in mathematics. On Group and Age there was no significant effect, F (2, 124) = .227, p = .797 with effect size of 0.004. This means that there is no significant difference in the effect of age on the achievement in mathematics in the treatment groups. On Gender and Age F (2, 124) = .015 p= .901 with effect size = .000). This also indicates that there is no significant difference in the effect of age on achievement in mathematics for both male and female.

Similarly, the interaction effect of gender and age contribute 0.0% and group and age contribute 0.4% respectively to students' achievement in mathematics. A multiple interaction effect of

Group, Gender and Age also showed no significant effect, F (2,124) = 1.138, p = 0.324 with effect size of 0. 018. This indicates that there is no significant difference in the effect of gender and age on achievement in mathematics in the treatment group. An eta value of 0.018 indicates the combine effect of, group, age and gender contributing 1.8% to students' achievement in mathematics. The results also indicate that for gender and age the two groups showed no significant difference in the two interventions and that designing such interventions one may not necessarily consider gender and age of the participants. The results in this study further suggest that for gender the two groups (male and female students) showed no significant interaction effect in the two interventions. Again, for age the result suggests that the two groups of ages (14- 16) years and 17- 19 years) showed no significant interaction effect on peer-assessment and critical thinking skills training of students. Hence there is no interaction effects on the treatments based on gender and age. The fact is that whether male or female and young or old students' responses to the two interventions indicated that they were probably not matters to consider. Thus, designing such interventions one may not necessarily consider gender and age differences of the participants. It suggests again that it is the intervention strategies which should be well packaged to bring about the needed academic achievement change in the students and probably not students being male or female and young or old. Even though critical thinking (CT) and peer- assessment (PA) as factors influencing students' academic achievement has been reported in the literature, the interaction effect of peer- assessment and critical thinking based on age and gender has not yet been reported in the literature was found in this study to have no interaction effects. This result probably might have arisen due to the enthusiasm exhibited by both groups of students to learn the skills being taught them.

Conclusion and Recommendations

The two skills training have a high- activity-based student's participation which brings effectiveness in teaching. The result also showed that critical thinking and peer-assessment could be used to improve senior high school students' achievement in mathematics irrespective of gender and age. Though age and gender difference could not be found to have an effect on students' achievement in this study, teachers should not ignore their importance in contributing to the

overall students' success. That teaching method could be at the root of students' failure in mathematics; however, their ages or gender may not be considered in choosing either critical thinking or peer-assessment training for their learning improvement. Based on the findings, the following recommendations were made: Critical thinking and peer-assessment skills training modules can be invaluable short-term tools which policy makers and implementers can make use of in the teacher education programme to improve the quality of teacher training and to enhance the teaching of critical thinking and peer-assessment skills in our schools irrespective of age and gender. Teachers should make use of any of the two teaching skills which they feel comfortable, knowledgeable and very effective in, during teaching to impact positively on students' performance.

References

Alwehaibi, H. U. (2012). Novel program to promote critical thinking among higher education students: Empirical study from Saudi Arabia. *Asian Social Science, 8*(11), 193-204

Carlson, P., Haslama, T. & Voltmer, D. (2005). Incorporating students' peer-review into an introduction to engineering design course. In W. G. Camp (Eds.), Formulating and evaluating theoretical frameworks for career and technical education. *Journal of Vocational Education Research, 26*(1), 4-25

Cevik, Y. D., Haslama, T. & Cevik, S. (2014). The effect of peer-assessment on problem solving skills of prospective teachers supported by online learning activities. *Studies in Education Evaluation. 44,* 23-35.

Chan, Z. C. Y. (2013). A systematic review of critical thinking in nursing education. *Nursing Education Today, 33,* 236-240.

Chen, S. L., Liang, T., Lee, M.L. & Liao, L. C. (2011). Effects of concept map teaching on students' critical thinking and approach to learning and studying. *Journal of Nursing Education 50(8), 466-469.*

Cobbinah, A. (2016). Perceived causes of low academic achievement in senior high schools in Ghana. *AL-Hikmah Journal of Interdisciplinary Studies, 9,* 55-62.

Ebiendele, E. P. (2012). Critical thinking: Essence for teaching mathematics and mathematics problem skills. *African Journal of Mathematics and Computer Science Research, 5(3), 39-43.*

Garison, D. R. (2011). E-learning in the 21st century: *A framework for Research and Practice* (2nd ed.). New York: Routledge.

Karami, M., Pakmehr, H. & Aghili, A. (2012). Another view to importance of teaching methods in curriculum collaborative learning and students' critical thinking disposition. *Social and Behavioral Science, 46*, 3266-3270.

Kang'ahi, M., Indoshi, F. C., Okwach, T. O. & Osodo, J. (2012). Gender and students' academic achievement in kiswahili language. *Journal of Emerging Trends in Education Research and Policy Studies, 3*(5), 716-720.

Kaufman, A. S. & Kaufman, N. L. (2005). *Essentials of Research Design and Methodology*. Hoboken, New Jersey: John Wiley & Son Inc.

Racionero, S. & Padros, M. (2010). The dialogic turn in education psychology. *Revista de Psicodidactica, 15*(2), 143-162.

Riswanto, & Putra, P.P. (2012). The use of mind mapping strategy in the teaching of writing of SMAN3 Bengkulu, Indonesia. *International Journal of Humanities and Social Science, 2*(21), 1-9

Tiruneh, D. T., Verburgh, A. & Elen, J. (2014). Effectiveness of critical thinking instruction in higher education: A systematic Review of Intervention Studies. *Higher Education Studies, 4(*1), 1 -17.

Zundert, M. V., Sluijsmans, D. & Merrienboer, J. V. (2010). Effective peer-assessment process: Research findings and future directions. *Learning and Instructions, 20*, 270-279.

Ghana Journal of Education: Issues and Practices (GJE)
Vol. 4, December 2018, pp. 89 – 110

Content Matching of the Syllabus and the Official History Textbook of Senior High Schools in Ghana

Charles Adabo Oppong

College of Education Studies, University of Cape Coast, Cape Coast, Ghana

Email*: coppong@ucc.edu.gh*

Abstract

The senior high school History syllabus was redesigned in 2010 to reflect the 2007 education reform in Ghana while the 1993 History textbook designed after 1987 education reform continue to be used to support the implementation of the 2010 History syllabus. Reasonably, it is important to investigate the alignment between the 2010 History syllabus and the 1993 official History textbook. This paper, therefore, examines the alignment between the History syllabus and its official textbook used in senior high schools in Ghana in the post-2007 reform era. The case study approach was employed, using a combination of in-depth interviews and content analysis to elicit the needed responses. It was found that there was a disconnect between the History syllabus and the official History textbook. The study also found that the official History textbook was perceived as not containing detailed information on the selected topics in the syllabus. The implications of the findings are discussed in the main text. It is recommended that curriculum developers must ensure both harmony between the two curriculum documents and a more comprehensive coverage of the selected topics in the official History textbook.

Key words: Senior High School, History textbook, history syllabus, reform, alignment

Introduction

Some misinterpretations exist over the distinction between syllabus and textbook, since the terms are used differently on either side of the Atlantic. Generally, 'syllabus' refers to that sub-part of curriculum which is concerned with the specification of the units to be taught in the classroom (Brumfit, 1984). In the Ghanaian education

system, the senior high school History syllabus is a document that specifies the rationale, aims and objectives, contents, teaching methods, teaching-learning resources and assessment instruments to be used for the teaching of the History subject (Oppong, 2009). Textbook, on the other hand, "is a book used as a standard source of information for formal study of a subject and an instrument for teaching and learning" (Graves 2000, p. 175). For instance, the History textbook in Ghana contains information on the History topics specified in the History syllabus. In spite of the different meanings of syllabus and textbook, they occupy significant space in any educational enterprise.

Syllabus and textbooks, in particular those designed for History teaching, provide both a space for the creation of a summarised knowledge which is considered to be germane to a specific society, and a means by which claims to social legitimacy may be made (Carrier, Fuchs, Eckert & Messinger, 2015). Through the History syllabus, classroom practices are connected to the larger goals of education of a particular jurisdiction. The connection enables teachers to create an appropriate 'engagement' between theory and practice, and between educational ideals and educational practices of a country (National Council of Educational Research and Training, 2006). Perhaps, the syllabus is the road map for the attainment of the national education goals.

More importantly, much of the 'discourse' between theory and classroom practice is enhanced through the History textbook because it provides extra information that may not be contained in the History syllabus. Arguably, the History textbook is developed on the basis of the written History syllabus (Mahmood, 2011) and expands the topics in the syllabus with detailed information. Berisha, Jashari and Thaqi (2015), for instance, note that the principal function of any school textbook is to provide accurate information on the respective subject syllabus for teachers and students. Within the instructional frame, History textbooks remain a significant source of content knowledge for both teachers and learners (Sewall, 2004). Therefore, the History textbook is developed in such a way that the content presented in it aligns with the syllabus document. If there is no alignment between the textbooks and syllabus, it may perhaps be difficult to achieve national education goals to the desired extent and this may affect the whole system of education (Saeed & Rashid, 2014).

The degree of alignment between syllabus guidelines and textbooks would, therefore, lead to educational accomplishment (Saeed & Rashid, 2014). As Ornstein (1994) argues, the History textbook is accepted as a suitable document for instruction as long as it is kept in proper perspective with the History syllabus. What is more important is for the textbook to reflect other aspects that the syllabus intends to achieve (Fan, 2010) in order to ensure effective implementation. In particular, the nexus between syllabus topics and textbook topics are supposed to be more coherent in countries where the education system is more centralized and the publishing of school textbooks is completely controlled by the government, as is the case in Ghana. Consequently, it is appropriate to examine the alignment between the History syllabus and the textbook. This study, therefore, seeks to examine the alignment between the History syllabus and its official History textbook used in high schools in Ghana. Such a study is based on two justifications.

First, the curriculum reform in Ghana in 2007 provides grounds for this study. The education reform of 2007 in Ghana led to modifications in the entire education system. Some aspects of curriculum documents witnessed significant changes while others remained the same. For instance, the History syllabus was redesigned in 2010 to reflect the 2007 reform while the 1993 History textbook designed after the 1987 education reform continues to be used to support the implementation of the 2010 History syllabus. Reasonably, it is important to investigate the alignment between the 2010 History syllabus and the 1993 History textbook.

Second, several studies have been conducted to establish the alignment between curriculum documents such as the syllabus and relevant textbooks (Hashmi, Hussain & Shoaib, 2018; Hutchins, 2016; Mahmood, 2010; Nakawa, 2012; Salehi & Zamanian, 2012; Saphir, 2001; Shah, 2012). For instance, Saphir's (2001) study on the teaching of History in Ghana, reports that the History textbook aligns with syllabus guidelines yet teachers find it necessary to give reading beyond the government recommended textbook since it is not detailed enough for most topics. Two perspectives become obvious from Saphir's study. The first perspective is the belief that topics in the History textbook align with the topics in the History syllabus. This observation may be related to the fact that the two curriculum documents analysed were all planned and designed based on the 1987 education reform in Ghana.

Therefore, the alignment between the syllabus and textbook is expected.

The second perspective is that Saphir's finding suggests that though there is an alignment between textbooks and syllabus in general, textbooks do not contain much detailed information therefore teachers make use of other supplementary materials. Ogah's (2017) study confirms Saphir's observation. Ogah (2017) examined the implementation of the History curriculum in senior high schools in the Asuogyaman District in Ghana. The author indicated that History teachers use supplementary textbooks as a result of the lack of details in the government prescribed History textbook in Ghana. It is important to note that the use of supplementary materials also has some disadvantages especially if such materials are not sanctioned by the appropriate authority.

Ghana is not alone in this experience. In Iran, Salehi and Zamanian (2012) indicated that most of the teachers did not like the idea of using supplementary materials at schools. However, the authors mentioned that the insipidness and the lack of enough information in the recommended textbooks compelled teachers to use supplementary textbooks. Perhaps, most teachers use supplementary textbooks to complement government recommended textbooks when such reasons, insipidness and lack of enough information in recommended textbook, exist in their context. This observation had been made by Lubben, Kasanda, Kapenda, Gaoseb & Kanjeo-Marenga (2003). These authors claimed that the prescribed textbook was not referred to during class activities, because there was lack of adequate information in prescribed textbooks.

In France, Hutchins (2016) stated that because teachers want to adhere to the curricula so that national education goals could be achieved, textbook publishers tend to follow the syllabus specifications very closely. Even so, the publishers have freedom in their approach to most topics, as the syllabus does not provide extensive explanations of the topics to be covered. It is, therefore, admitted that, in France, there is flexibility in textbooks development. However, because national education goals are concerned, textbooks are developed to suit the syllabus. This furthers the argument that for purposes of achieving national education goals, syllabus and textbooks ought to have a common ground of alignment. In Texas, however, different

arrangements exist. Hutchins notes that for textbook to be approved, technically, textbook publishers only need to include half of the material in the State's curriculum guidelines and they are free to include materials that are not required. This requirement suggests that all the issues in the curriculum may not be addressed in the textbook. Arguably, the textbook may not comprehensively align with the materials or topics in the curriculum. In the end, the State education goals may not be achieved as expected.

Similar observation has been made by Hashmi, Hussain and Shoaib (2018) that reflects Hutchins' (2016) finding in France. The authors reported in a study that investigated the alignment between Mathematics curriculum and textbook in Punjab that textbook was aligned with the curriculum. The congruence between the textbook and the curriculum in Punjab may perhaps ensure the accomplishment of educational objectives as Saeed and Rashid (2014) had argued. The match between the two documents may also reflect the educational system and its requirements in Punjab. Perhaps, it is the system requirement in Punjab that textbooks developed to support curriculum implementation should align with the curriculum. In such situation, the educational objectives may be easily achieved as envisaged in policy documents.

Nakawa (2012) examined the alignment between mathematics textbooks and its syllabus in Zambia and found that the ideal objectives in mathematics textbooks were not reflected in the syllabus. The study further established that the textbooks highlighted mathematical knowledge and skills but these were not reflected in the syllabus designed by the Zambian Education Ministry. Nakawa therefore concluded that while the objectives of Mathematics education syllabus advocated for the ability for communication, pupils' activities described in the textbooks were mostly restricted to the writing process. In Pakistan, similar observations have been made by Schmidt, McKnight, Houang, Wang, Wiley, Cogan, and Wolfe (2001) and Shah (2012). In the two studies, the authors indicated that English textbooks did not align with the curriculum. Mahmood (2010) also reported in a study on textbook evaluation that Mathematics textbook approved by the Ministry of Education did not align with the curriculum. Mahmood noted that the finding reflected inconsistency among the government approved textbooks with respect to required level of understanding demanded in the curriculum. This suggests a mismatch between

curriculum intent and provisions in the textbook. Thus, there is lack of compliance with objectives of the curriculum and the consistency with regard to the level of understanding demanded by the approved textbooks (Mahmood, 2010). In the same research report, Mahmood indicates that textbooks approved by the government of Pakistan for the subject of Science do not completely cover the scope of contents mentioned in the curriculum. This implies that curriculum content requirements are not met in approved textbooks. Arguably, Saphir (2001) and Ogah's (2017) observation may reflect the situation in Pakistan. That is, teachers are likely to use other supplementary textbooks to satisfy curriculum requirements. Jijji (1980) had also indicated that in Iraq the syllabus is not always in tune with the real needs of learners and that the textbooks' writers have not focused properly on the objective of the syllabus. This suggests that the textbook and the syllabus may have been prepared and designed in isolation, without a consideration of a possible alignment.

The studies discussed above have been carried out in different contexts largely outside Ghana. Thus, with the exception of Saphir's (2001) study, all the other studies on alignment have been carried out in different jurisdictions as well as on different subjects especially Mathematics and English – not on History. It seems obvious, therefore, that very limited efforts have been made on this issue in Ghana, particularly in History education. Thus, the conceptual field between the History syllabus and its official textbook has not been explored after the 2007 education reform in Ghana. It seems worthwhile, therefore, to examine the alignment between the History syllabus and the official History textbook used at the high school level. This article has taken a step further by adding another dimension to alignment research by investigating how the high school History textbook provide detailed information on the topics in the History syllabus. The study is, therefore, organised around two questions, namely:

1. How do the topics specified in the high school History syllabus align with those in the history textbook in Ghana?
2. Does the History textbook provide detailed information on the topics in the History syllabus?

In this paper, alignment is defined as the degree to which topics in the History textbook are in agreement with the topics outlined in the History syllabus in the Ghanaian context (Webb, 2002). The two

curriculum documents being examined are the government of Ghana developed documents for History education in high schools.

Analytical framework

Webb's (2007) Alignment Model is adapted as the analytical framework for the study. This Model provides strategies that are used to measure alignment between curriculum documents. It highlights the correspondence between curriculum documents such as syllabus, textbooks, teachers' guide, among others. In this model, Webb suggests that the sequential development of curriculum materials enable researchers to measure curriculum documents to support educational systems. The Model is appropriate to use if the documents being measured to determine the degree of alignment are developed in different time periods. This implies that the Model is appropriately applied when documents are developed in a sequence. That is, the first document developed is used as a blueprint to develop subsequent documents (Shah, 2012). In the Ghanaian education system, the syllabus of the various subjects are developed first, and are then used by textbook developers as a blueprint to determine the structure and content of the respective subject's textbooks (Case, Jorgensen, & Zucker, 2008). During the development process, textbook developers can identify the topics that correspond to each topic in the syllabus, thereby providing thorough evidence of alignment (Case, et. al., 2008). In his Alignment Model, Webb (2007) provides four aspects of the Model that can be used to assess different issues about curriculum documents. These include categorical concurrence, depth of knowledge consistency, range of knowledge correspondence, and balance of representation. Categorical concurrence evaluates the similarity between the topics in different documents. Depth of knowledge consistency compares the content complexity of related documents required by the curriculum. Range of knowledge criterion is used to judge whether a comparable span of knowledge expected in the textbook is the same as, or corresponds to, the span of knowledge in the syllabus (Webb, 2002). Balance of representation compares the emphasis given to certain topics and objectives in curriculum documents (Webb, 2007).

Two aspects of the Model have been adapted as the basis of analysis to address the two research questions formulated: *categorical concurrence* and *range of knowledge correspondence*. The categorical

concurrence would enable the determination of the general indication of alignment, if both the History syllabus and History textbook have the same topics or otherwise. Therefore, alignment is achieved when the History syllabus and the textbook have the same topics. The range of knowledge would also lead to the determination of the expected details in the History textbook to correspond to the span of knowledge in the History syllabus that students need in order to answer standardized assessment items in History.

Methodology

This is a qualitative case study conducted within the interpretivist paradigm. By making use of this paradigm, descriptive data in the context of the Ghana History syllabus and textbook were collected with the intention of developing an understanding about what is being studied (Nieuwenhuis, 2007). These two curriculum documents were purposively selected based on the fact that they are the officially prescribed materials for use in the teaching and learning of History in Ghana. It is important to state that the History syllabus in use was published in 2010 after the reforms in 2007 while the official textbook in use was published in 1993 after the 1987 reforms. Usually, once a new History syllabus is developed, as was the case in 2010, the expectation is that a new History textbook to support classroom implementation would be published. However, as indicated earlier, that was not the case.

Ten out of the 19 History teachers in the Accra Metropolis were selected for the in-depth interviews (IDIs). The use of 10 History teachers reflected Creswell's (1998) argument that "interviews with up to 10 people" is a recommended number to reach saturation (p. 65). The purposive sampling technique was used to select the sample because of the central phenomenon underlying the study (Creswell, 2008). The selection of History teachers took two factors into consideration: (a) years of teaching History, and (b) role in examining students. In terms of years of teaching, only teachers who have had 10 years and above of teaching experience were selected. In terms of role in examining students, History teachers who were examiners for the West African Examination Council were considered. These two factors guided the selection because it was assumed that teachers selected on such grounds would be in better position to provide information as to the extent to

which the History textbook contains detailed information to support the implementation of the syllabus. Also, it was assumed that teachers who serve as examiners are in a position to evaluate the details of the History textbook considering the fact that they are privy to marking scheme requirements.

The analysis of the documents took into consideration the view that qualitative researchers who use written texts such as syllabus, textbooks, teachers' guide and other curriculum documents as their materials do not try to follow any predefined protocol in executing their analysis (Denzin & Lincoln, 2008). Rather, such researchers try to write down their themes by reading and rereading the study materials thereby drawing a picture of the presuppositions and meanings that constitute the cultural world of which the textual material is a specimen. In line with this perspective, a bricolage of qualitative content analysis within the categorical concurrence aspect of Webb's model was used as means to explore the alignment between two curriculum documents. The approach to content analysis involved the following procedure: By reading the two documents, specific data were generated from the relevant sections of the History syllabus and the chapters in the History textbook that dealt with the topics in the syllabus. This analysis was done in a manner that the History textbook produced certain discourses on the topics in the syllabus in line with the purpose of the investigation. The content matching approach was adopted for the analysis. Under this approach, the relevant topics in the syllabus were matched with the specific topics in the textbook as required by the categorical concurrence. The units of analysis therefore comprised the topics in both documents.

In-depth interviews (IDIs) were conducted to elicit responses on how the History textbook provides detailed information on the topics in the History syllabus. The interviews were recorded and transcribed for analysis. As the interviews were transcribed, trends and statements that responded to research Question Two were noted within the range of knowledge of the Alignment Model. Before the analysis, a list of codes was created for the responses about the detailed information the History textbook provides, and the rationale for using other supplementary History textbooks. Codes were assigned to highlight some excerpts. After the initial analysis, narratives were written that described the respondents' responses. These narratives provided an overview of the respondents' responses and enabled the identification of patterns.

Findings and Discussion

Alignment between the History syllabus and the History textbook

The analysis revealed that the History textbook follows the structure of the syllabus. This was obvious as the two documents were both organised into three sections. The three sections in the two documents represent the various Grades or Forms in the high school system - Forms One, Two and Three. In the first sections of the documents, the textbook had ten topics for Form One students while the syllabus provided nine topics as indicated in Fig. 1. Civilisation of Nilotic Sudan from 3000 BC is not in the 2010 History syllabus. This means that a topic in the History textbook is not captured in the History syllabus. Therefore, in Form One the topics in the textbook, to an extent, do not conform to the latest syllabus guidelines implemented in 2010.

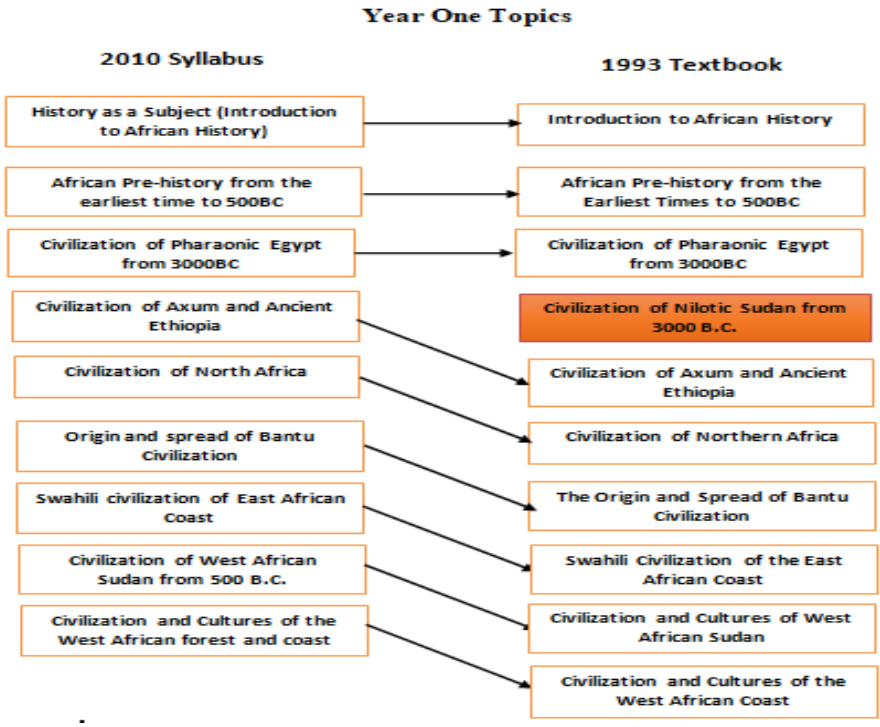


Fig. 1: Year One Topics

In Form Two, both documents contain nine topics. However, it was noticed that two separate topics in the textbook are combined in the

syllabus as: "The Peopling of Ghana and The Rise of States and Kingdoms". In this case, the topics in the syllabus should have been eight, but "Social and Political Developments: 1500-1900", Form Three topic has been added to Form Two topics making it nine topics in the syllabus as Fig. 2 provides. Notwithstanding the alteration in Form Two, there is no alignment between the topics in the textbook and the syllabus, as established in the Model. Thus, there is a topic in the syllabus which is not captured in the textbook.

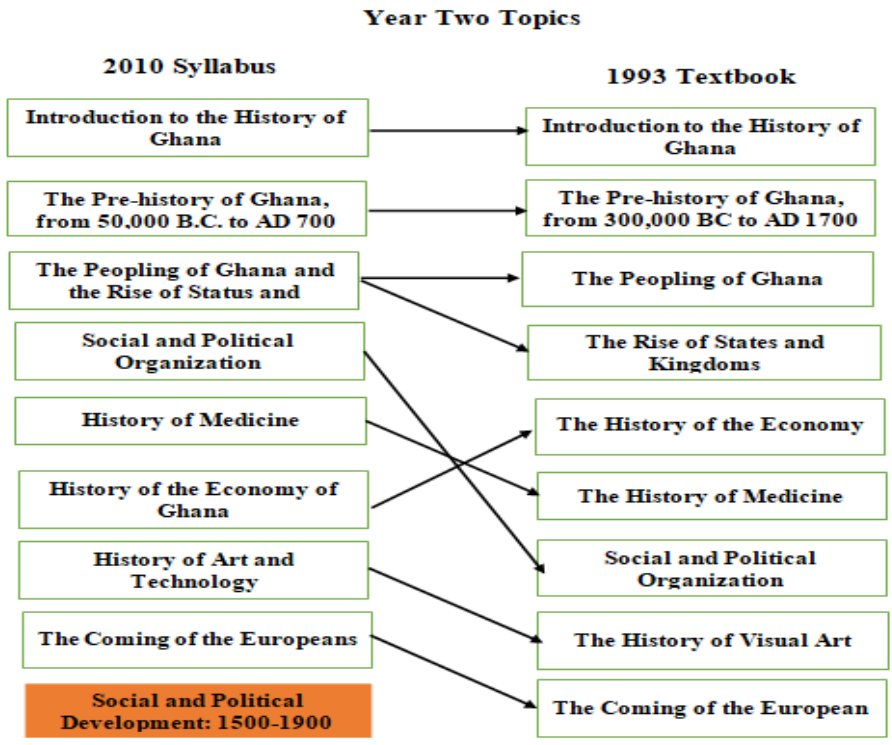


Fig. 2: Year Two Topics

In Form Three, there is a mismatch. While the textbook contains eight topics, the syllabus has four topics. Considering the addition done to Form Two topics in the syllabus, it would have been understandable if the topics in the syllabus are seven. However, this was not the case. The difference is that the textbook has three more topics that are not captured in the syllabus as Fig. 3 indicates. These are "The World Situation by AD 1500", "The Changing Patterns of Trade", and "The Partition of Africa". It is, therefore, obvious that in Form Three, there

is lack of alignment between the two curriculum documents in History education in Ghana. This finding corroborates the findings of some earlier studies (e.g. Schmidt, et al., 2001; Nakawa, 2012; Shah, 2012; Jijji, 1980). All of these studies found lack of alignment between subjects' textbooks and the respective syllabi. This lack of alignment could be related to the absence of a new History textbook to reflect the changes made in the 2007 reforms which informed the designing of the 2010 History syllabus. Consequently, History teachers are not likely to use the History textbook.

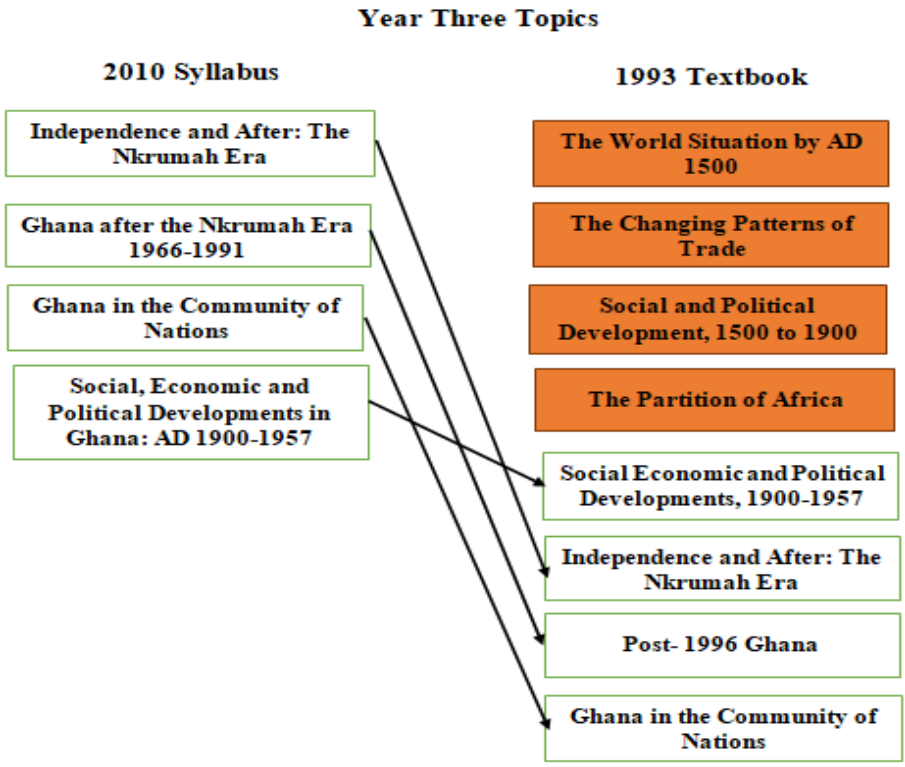


Fig. 3: Year Three Topics

Generally, the findings established that the topics in the History textbook did not adequately match the topics in the History syllabus. That is, the contents of the History textbook were not adequately congruent with the History syllabus. Reasonably, what appears as a lack of alignment between the textbook and the syllabus specifically in Form

Three may be attributed to the reforms carried out in 2007. These reforms made alterations in the content of the History syllabus. These alterations in the curriculum document may have led to the omission of topics and joining of topics in the 2010 History syllabus. However, the approved History textbook that ultimately provides detailed information on the topics in the syllabus, as noted earlier, has not been subjected to any changes since 1993 when it was published. It is obvious, therefore, that the History textbook that is currently in use continues to reflect the 1987 education reform. In the absence of a new History textbook to give effect to the 2007 reforms, the 1993 History textbook continues to be used in History classrooms in Ghana.

This practice needs attention, given the fact that when reforms are carried out, it is not only that all the related aspects of the reforms are planned and designed by only connecting each of the aspect. More importantly, what is required during education reforms is to match up all the related aspects with each other to identify possible alignment among them (Memoire, 2010). The finding has provided somewhat lack of alignment between the History textbook and the syllabus. This situation may have pedagogical implications. There is the likelihood that History teachers would use different materials produced by commercial publishers rather than the official History textbook. It is to be noted that materials produced by commercial publishers are not to be substitutes for government textbooks but are to be used as supplementary materials. Therefore, if teachers would only rely on supplementary textbooks because of the deficit in the government textbook, then the purpose of teaching History in schools may not achieve the ends for which History was introduced into the school curriculum in Ghana. Arguably, the perception that any material can be used to teach a subject is baseless. Textbooks have to be planned and designed in advance before classroom implementation of any reform or innovation. Textbooks are to fulfil certain requirements in order to achieve the goals set in the school curriculum.

The finding also suggests the existence of curriculum reform gap in History education in Ghana. At the global level, the reform gap may cast a '*slur'* on the education enterprise of Ghana. It is obvious that reforms should include all aspects that matter to a particular subject's curriculum. However, the finding has indicated that the History syllabus has been altered to reflect changes made in the 2007 education reform while the History textbook has not witnessed any modifications

in line with the new dimensions the reform brought. This may create an impression in international readers or audience that stakeholders lack understanding in curriculum reforms, innovation and change. It is accepted worldwide that textbooks influence classroom practices more than any other instructional material (Valverde, Bianchi, Wolfe, Schmidt & Houang, 2002). Textbooks are organised in a purposeful way, and consequently their content and structure are very important for the realisation of specific objectives of History education in any country (O'Keeffe & O'Donoghue, 2009). Therefore, the absence of a History textbook to reflect the current History syllabus in Ghana is not appropriate. Given the central role of textbooks in curriculum reform and change, it is prudent that care be taken at policy-making levels to see to the designing of new History textbooks that align with the syllabus' content embodied in the 2007 reforms, and is 'fit for purpose'.

The detailed nature of the History textbook

As noted in the methodology, 10 History teachers were interviewed to address this subheading. There was unanimity in the responses gathered. All the History teachers acknowledged the lack of detailed information in the official History textbook. Some of the comments are as follows:

> *the history textbook currently in use is not comprehensive enough to support classroom teaching. The information in the textbook is not adequate considering the marking schemes used over the years in marking final examination questions. I realised that a lot of the information required to answer examination questions are not found in the textbook* (History teacher B).

Similarly, History teacher D noted that:

> *I use supplementary textbook when teaching. The obvious reason is that the government recommended history textbook does not adequately provide detailed information on the topics in the syllabus. Most of the explanations in the textbook are very brief, therefore if I rely on it alone, students are likely to lose"*.

History teacher E also said that:

> *Explanations in the textbook are not comprehensive at all. I have been marking examination for 15 years for the exam council and the requirements of the marking scheme show that the government history textbook is not detailed enough. Though, I know that the history textbook cannot contain everything but some relevant little information that ought to be in the textbook are not there. And this is serious, because a lot of senior high schools in Ghana do not have school libraries let alone books and internet accessibility to supplement the teaching and learning of history*.

These findings suggest that the official History textbook is not detailed enough to achieve the desired expectations. The interviews uncovered the lack of depth of information in the textbook to support the implementation of the History syllabus. For that reason, History teachers make use of supplementary textbooks. Possibly, the absence of a corresponding History textbook to support the implementation of the 2010 History syllabus may also account for this practice.

The lack of detailed information in the official History textbook may provide assumption that the textbook is not 'fit for purpose', and that it is obsolete to the current History syllabus. This finding supports those of Saphir (2001), Hutchins (2016) and Ogah (2018). These studies acknowledged that textbooks do not provide extensive explanations of materials in subjects' syllabi. Though, it is admitted that textbooks cannot contain everything, it is important that certain required details are provided in the textbook; the practice should be the case for developing countries where there are a lot of rural schools that cannot readily access extra information through other alternatives. This makes the History textbook very essential for quality education in developing countries. An important conclusion of researchers on the relevance of textbooks is that the availability of required information in textbooks in schools in developing countries is associated with students' achievement: students do better on tests when there are textbooks to support classroom instruction (Heyneman, Farrell & Sepulveda-Suardo, 1978; Fuller, 1987; Fuller and Clarke, 1993). Therefore, if the government History textbook is not comprehensive enough to serve its purpose, students' academic achievement could be effected.

The use of other supplementary History textbooks as claimed by the respondents was a concern. It was noted that these supplementary

History textbooks used by History teachers were not submitted for approval at the District Education Directorate as required by the Ghana Education Service. The following comments are worth noting. For instance, History teacher A said that:

> *The supplementary textbooks I have been using have not received any approval from the Education Directorate. I just bought them from the bookshop. Ideally, such books should have a seal from Ghana Education Service as an indication of approval. Again, preferably textbooks that are brought to the schools for sale, the publishers should come with approved letters from either the District Office or the headquarters. But in my case, these publishers do not have such approval letters because they [publishers] say they do not go for any approval. However, after perusing those textbooks, I realise they are good to support my lessons so I buy them.*

History teacher G stated that:

> *Those who bring supplementary textbooks to sell in the school do not have approval from the Education office because they say they do not go for such approval. So for me, I only go through the materials they bring and, if I am convinced that they are good materials, I buy one and recommend students to also buy them. This is all because the recommended history textbook does not contain adequate information on the topics in the history syllabus. More importantly, the supplementary textbooks help us to prepare students for their exams*

The findings imply that supplementary History textbooks used by these respondents do not have any official approval as required by policy. This calls for action, given the fact that the established procedure for using other supplementary textbooks in schools is not followed. Regardless of the benefits that may be derived from the use of supplementary textbooks in schools, requirements for the use of supplementary textbooks ought to be adhered to. It is possible that not all History teachers may possess the required competence to evaluate supplementary textbooks to determine their efficiency as noted. Even

those who claimed they assess the suitability of these materials do so in the light of examination questions. However, the government History textbook may have other educational values that students are expected to obtain apart from helping students to pass examinations.

It has been established in the findings of this study that the lack of comprehensive government History textbook makes teachers use other supplementary textbooks. These textbooks are produced by commercial publishers to augment government materials. The danger in this practice is that most supplementary textbooks are not developed in line with education policy and guidelines. For instance, in Ghana, it is a policy that all supplementary textbooks supplied by commercial publishers are approved by District Directorate of Education. The Education Directorate would ensure that these supplementary textbooks adhere to the government education policy, and also the content of the materials have a direct tie to the curriculum and supports the instructional programme. Similar arrangements also exist in the State of California. In California, teachers who intend to use other supplementary textbooks are expected to consult the District Superintendent or designee as necessary to determine the compliance of the material with District criteria (California Department of Education, 2000). The primary considerations should be the educational value, appropriateness, and relevance of the materials as well as the suitability of the material per the developmental stage of the students. However, as the finding suggests, the supplementary textbooks History teachers acknowledged they have been using were not approved by the established offices. Therefore, the current practice where publishers do not seek approval in line with policy ought to end for the purposes of ensuring quality History education.

Arguably, textbooks are not only developed for examination purposes. They may have other expectations in the school system. Therefore, teachers' use of supplementary textbook materials for examination purpose would deprive students of other equally important outcomes that the government textbook could offer them. Kuhn (1970) suggests that a prescribed school textbook provides the contemporary paradigm of the subject and its pedagogy, and further introduces novice teachers into the body of knowledge and the processes specific to the subject that other supplementary textbooks would not offer. Stray (1994) also emphasises that government prescribed textbooks have additional socio-economic values apart from examinations. Thus,

textbooks play an essential role in the transmission of multiple values about the field of knowledge, about pedagogy, and other relevant aspects of society (Lubben, Kasanda, Kapenda, Gaoseb & Kanjeo-Marenga, 2003).

Therefore, the practice of teachers using supplementary textbook alone is completely unacceptable but admittedly excusable because, the evidence suggests that teachers' use of supplementary textbooks in class is due to the absence of a prescribed History textbook that comprehensively addresses topics in the 2010 History syllabus. The current situation of the non-existence of a new prescribed History textbook to support the implementation of the current reform provides a reasonable justification for the use of supplementary History textbook. This means that the decision of History teachers in using supplementary textbooks is a pedagogical decision made by the teachers and a decision determined by the unavailability of government History textbook that reflects 2010 History syllabus.

Conclusion and Recommendations

What the researcher considers the most significant finding of this study is the somewhat mismatch between the content of the History syllabus and its official History textbook which the framework helped to elicit. This deficiency in History education at the senior high school level could constitute a hurdle in achieving the aims of the History curriculum in Ghana. This obvious gap must be filled. In this context, there is a concern the Ghana Education Service must respond to immediately. The concern is that new History textbooks have to be published to meet the implementation needs of the 2007 education reforms. Thus, the finding provides an implication in the sense that it offers feedback to curriculum developers and textbook authors to consider alignment between the History syllabus and the History textbook. For instance, in Malaysia, the Curriculum Development Centre revised the English syllabus in 2002 and new textbooks were published in 2003 (Mustapha, 2008) to reflect the issues in the syllabus. Findings from the interview also lead to the conclusion that the History textbook does not contain detailed information on the topics in the History syllabus. It is for that reason that History teachers make use of supplementary textbooks. What makes this practice more disconcerting is that these materials are not approved for use in schools.

Supplementary textbook materials are usually examination focused and do not contain other essential resources in government textbooks (Ogah, 2017). Therefore, students are not likely to obtain other relevant values that a detailed government recommended History textbook would offer them. Though textbooks are not the only instructional resources required for attaining a country's educational goals, they are a major component of many curricula and education systems. The development of the History textbook can play a critical role in achieving and maintaining quality education. Delivering a quality, coherent and comprehensive History education to students does not happen in a vacuum. Therefore, to ensure that a quality History education is achieved, the History textbook to be developed must contain comprehensive and adequate information to support History teaching and learning in schools.

References

Berisha, V., Jashari, H., & Thaqi, X. (2015). A mismatch between curriculum intentions and textbook design: An assessment of mathematics textbooks for lower secondary school in Kosovo. *Journal on Education (JED), 2*(2), 31-35.

Brumfit, C.J. (1984). Function and structure of a state school syllabus for learners of second or foreign languages with heterogeneous needs. In British Council (1984) *General English Syllabus Design, ELT Documents 118.* Oxford, UK The British Council.

California Department of Education Publications (2000). *Standards for evaluation instructional materials for social content.* California. California Department of Education

Carrier, P., Fuchs, E., & Messinger, T. (2015). *The international status of education about The Holocaust: A global mapping of textbooks and curricula*. UNESCO/Georg Eckert Institute for international textbook research.

Case, B. J., Jorgensen, M. A., & Zucker, S. (2008). *Assessment report: Alignment in educational assessment*. San Antonio, TX: Pearson Education, Inc.

Cresswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five methods*. London: Sage

Cresswell, J. W. (2008). *Planning, conducting, and evaluating quantitative and qualitative research*. Boston: Pearson Inc

Denzin, N. K., & Licoln, Y. S. (Eds.) (2008). *Strategies of qualitative inquiry (Vol.2).* Thousand Oaks, CA: Sage

Fan, L. (2010). *Principles and processes for publishing textbooks and alignment with standards: A case in Singapore.* Paper presented at APEC Conference on Replicating Exemplary Practices in Mathematics Education, KohSamui, Thailand, 7-12 March.

Fuller, B. (1987). What school factors raise achievement in the Third World? *Review of Educational Research, 57*(3), 255-292.

Fuller, B., & Clarke, P. (1993). Rising school effects while ignoring culture? Local conditions and the influence of classroom tools, rules and pedagogy. *Review of Educational Research, 64, 119-157.*

Graves, K. (2000). *Designing language courses: A guide for teachers*. Boston, MA: Heinle Cengage

Hashmi, A., Hussain, T., & Shoaib, A. (2018). Alignment between Mathematics Curriculum and Textbook of Grade VIII in Punjab. *Bulletin of Education and Research, 40*(1), 57-76.

Heyneman, S. P., Farrell, M.A., & Sepulveda-Suardo, M. (1978). *Textbooks and achievement: What we know*. Washington, DC: The World Bank.

Hutchins, D. R. (2016). *Nationalism and history education: Curriculum and textbook in the United States and France*. New York; NY: Routledge Publishing.

Jijji, F. S. (1980). *A critical account of the TEFL in Iraq since 1950.* Unpublished M.Ed. Thesis, University of Hull.

Kuhn, T. (1970). *The structure of scientific revolutions.* Chicago, IL: University of Chicago Press.

Lubben, F., Kasanda, B., Kapenda, L.,Gaoseb, N., & Kanjeo-Marenga, U. (2003). Teachers' use of textbooks: Practice in Namibian science classroom. *Educational Studies, 29* (2/3), 109 – 125

Mahmood, K. (2011). Conformity to quality characteristics of textbooks: The illusion of textbook evaluation in Pakistan. *Journal of Research and Reflection in Education, 5*(2), 10-190

Mahmood, K. (2010). Textbook evaluation in Pakistan: Issue of conformity to the national curriculum guidelines. *Bulletin of Education and Research, 32* (1), 15-36

Memoire, A. (2010). *Curriculum, syllabus, textbooks and teaching learning material.* New Deihi, India: Ministry of Education

Mustapha, G. (2008). A reflection of the revised syllabus translated in textbooks. *Journal of International Management Studies,13,* 162-169.

Nakawa, N. (2012). Growth and challenges of two basic schools teachers under the practice of lesson development based on Substantial Learning Environment (SLE) in the Republic of Zambia. Journal of JASME Research in Mathematics Education, 18(2), 13-21

National Council of Educational Research and Training. (2006). *National focus group on curriculum, syllabus and textbooks.* New Delhi, India: Deekay Printers.

Nieuwenhuis, J. (2007). Qualitative research designs and data gathering techniques. In K. Maree (Ed.), *First steps in research* (pp. 70-79). Pretoria, South Africa: Van Schaik Publishers.

Ogah, M. (2017). *Implementation of senior high school History curriculum in the Eastern Region of Ghana*. Unpublished M. Phil Thesis, University of Cape Coast, Ghana.

O'Keeffe, L., & O'Donoghue, J. (2009). Assessing the effect of Mathematics textbook content structure on student comprehension and motivation. *Proceedings of Third National Conference on Research in Mathematics Education, Dublin.*

Oppong, C. A. (2009). *An evaluation of the teaching and learning of history in senior high schools in the central region of Ghana*. Unpublished M. Phil Thesis, University of Cape Coast, Ghana.

Ornstein, A. C. (1994). The textbook-driven curriculum. *Pedagogy Journal of Education, 29,* 70-85.

Saeed, M., & Rashid, S. (2014). Alignment between chemistry curriculum and textbooks at secondary level. *The Sindh University Journal of Education, 43,* 29-46.

Salehi, M., &Zamanian, M. (2012). The Use of Supplementary Materials by Iranian EFLTeachers at High Schools for Talented Students. *Journal of Studies in Learning and Teaching English, 1*(2),167-185

Saphir, K. (2001). *Sankofa: A study into the teaching of history in the Ghanaian education system.* African DiasporaISPsPaper56. Retrieved from http://digitalcollection.sit.edu/african-isp/56

Schmidt, W. H., McKnight, C. C., Houang, R. T., Wang, H., Wiley, D. E., Cogan, L. S., & Wolfe, R. G. (2001). *Why schools matter: A cross-national comparison of curriculum and learning.* San Francisco, CA: Jossey-Bass.

Sewall, G. T. (2004). *World history textbooks: A review*. Center for Education Studies dba American Textbook Council.

Shah, F. S. (2012). *An investigation into the alignment between the governments' dictated English language curriculum and the textbook mediated classroom practice at the secondary level in Pakistan*. Unpublished doctoral thesis submitted to Nottingham Trent University, University of Nottingham.

Stray, C. (1994). Paradigms regained: Towards a historical sociology of the textbook. *Journal of Curriculum Studies, 26* (1), 1-29.

Valderde, G. A., Bianchi, L. J., Wolfe, R. G., Schmidt, W. H., & Houang, R. T. (2002). *According to the book: Using TIMSS to investigate the translation of policy into practice through the world of textbooks.* Dordrecht, Netherlands: Kluwer Academic Publishers.

Webb, L. N. (2007). Issues related to judging& the alignment of curriculum standards and assessments. *Applied Measurement in Education, 20*(1), 7–25

Webb, N. (2002). Assessment literacy in a standards-based urban education setting. In *annual meeting of the American Educational Research Association, New Orleans*.

Ghana Journal of Education: Issues and Practices (GJE)
Vol. 4, December 2018, pp. 111 – 122

Influence of Creativity, Locus of Control and Risk Tolerance on Entrepreneurial Inclinations of Public University Students in Nigeria: Some Implications for Stakeholders

Olutomi Ade Ariyibi [1], Bakari Yusuf Dramanu[2*] & Joshua Adebisi Omotosho [2]

1. Nigerian Educational Research and Development Council, Abuja, Nigeria.
2. College of Education Studies, University of Cape Coast, Ghana.

[*]Corresponding author's email address: *bdramanu@ucc.edu.gh*

Abstract

This study was conducted to determine the influence of three personality/psychological factors (creativity, locus of control and risk tolerance) on the entrepreneurial inclinations of public university students in Nigeria. A multi-stage sampling procedure was used to reach 2,930 students in three public universities in locations across the country that positioned them as a representative sample of the entire student body of the country. The Creativity, Locus of Control and Risk Tolerance Questionnaire (CLOCRITQ) and the Entrepreneurial Inclination Questionnaire (EIQ) were the instruments used to gather data for the study. The main data obtained were analyzed by using a stepwise multiple regression analysis and analysis of variance (ANOVA). Results showed that the three predictor variables had significant influence on entrepreneurial inclinations of students. Among the recommendations made is the need to reposition the economy towards entrepreneurial drive for job creation, wealth creation and global competitiveness of the Nigerian youths in general and the graduate in particular.

Key words: Creativity, Locus of control, Risk tolerance, Entrepreneurial inclinations, University students, Nigeria.

Introduction

In order to establish a link between psychological and entrepreneurial research efforts, Kumbul-Guler and Tinar (2009) stated that several psychologists and researchers have tried to look at behavior and underlying human factors of entrepreneurship. Their line of argument is that though the subject of entrepreneurship has roots in economics, sociology and management, the psychological approach must not be ignored.

The personality approach to explaining entrepreneurial tendencies has a long tradition in entrepreneurship research. It can be traced to McClelland (1953) in the 1950's. However, this approach was neglected after a while until the late 1990's when Brandstatter (1997) argued that the individual should be the unit of analysis and interest when dealing with the subject of entrepreneurship. Most economists feel that in order to explain entrepreneurial behavior, one ought to take into account either the personality structure of entrepreneurs or their motives, and not only their general interest in maximizing profits. So it is imperative to find the distinctive personal characteristics of entrepreneurs who are more successful than others.

After Brandstatter (1997), other researchers have worked on the relationship among various personality characteristics and entrepreneurship. Of particular interest among such studies are those which investigated how these personality characteristics predict entrepreneurial performance. The studies in this category include those of Baron (2000), Chu (2000), Denga (2005), Gürol and Atsan (2006), Yusof, Sandhu and Jain (2007) and Kiadese (2008).

In a study, Kumbul-Guler and Tinar (2009) identified four dominant personality traits that explain entrepreneurial inclination. These are risk taking, achievement motivation (need for achievement), internal locus of control and innovativeness. In a similar vein, Yusof, Sandhu and Jain (2007) asserted that three entrepreneurial personality constructs - internal locus of control, need for achievement and a moderate risk-taking propensity - have emerged as "*classic*" characteristics associated with entrepreneurial personality.

Similarly, Shaver and Scott (1991) strongly argued that of all the personality/psychological constructs indicated in previous studies as having links with entrepreneurial inclination, creativity, need for achievement, locus of control, risk-taking propensity and innovativeness have received the most attention in entrepreneurship

literature. The current researchers, in their effort to contribute to the body of knowledge on this topical issue of entrepreneurship, have focused their attention on only three of these constructs, namely: creativity, locus of control and risk tolerance. Their choice was premised partly on their conviction that the probability of finding the envisaged relationship or link between these constructs and entrepreneurial inclination might be strong, and partly on the yawning scarcity of research combining the three constructs in one single study, especially as it relates to West Africa in particular and Africa in general.

On the basis of the above, the major objective of this study was to investigate the relationships between creativity, risk tolerance and locus of control on the one hand, and entrepreneurial inclinations on the other. This was undertaken among a representative sample of undergraduates in public universities in Nigeria.

Research Hypothesis

The null hypothesis that guided the conduct of the study was: *Creativity, locus of control and risk tolerance will not be significantly related to entrepreneurial inclinations of students in public universities in Nigeria.*

Methodology

Research Design

The correlational survey method was the research design used in this study. It was chosen because it is the type of design used to find relationships between two or more measured variables. According to Pallant (2010), correlation analysis is used to describe the strength and direction of the linear relationship between two variables. The goal of correlational studies is to find the correlations between a complex behavior pattern (in the current case, entrepreneurial inclination) and variables thought to be related to it. Stangor (2006) stated that correlational designs tend to measure complexities of the patterns of relationships that exist among measured variables.

In this study, three variables (creativity, risk tolerance and locus of control) which represent the predictor variables and their relationships with entrepreneurial inclinations were sought. In other words, through the use of a correlational design the researchers hoped to study how the predictor variables either singly or in combination

might affect the entrepreneurial inclination of students in public universities.

Sample and sampling procedure

The population for the study was all students in universities in Nigeria. The target population comprised all students in public universities in Nigeria. By means of a multi-stage sampling approach, a representative sample for the study was selected as indicated below:
At the first stage, cluster sampling technique was applied. The population was sub-divided into two clusters or groups: students in public universities and those in private universities, and the former cluster was selected because they have a broader spread of characteristics of the Nigerian student than the latter cluster. The evidence for this comes from two main sources. Firstly, public universities in Nigeria leave their admission doors wide open to applicants from all parts of the country, and for a wider spectrum of academic programmes. Secondly, private universities on the other hand, limit their student intake to a smaller number of students (the children and wards of rich parents and guardians) who can afford to pay the exorbitant school fees charged. This cluster (public universities) was further grouped into the six geo-political zones into which Nigeria is divided: North-East, North-West, North-Central, South-West, South-East and South-South. From these six zones, three zones were purposively selected so as to give the study a national spread. They were North Central, South-South and South-West.

The second stage was the selection of one university from each of the three zones obtained in Stage One. The criteria for these choices included age of the university, its rating, its population and its programmes.

- From North-Central, Ahmadu Bello University, Zaria, Kaduna State;
- From South-South, University of Port-Harcourt, Port Harcourt, Rivers State; and
- From South-West, University of Ibadan, Ibadan, Oyo State.

The third stage involved the selection of a representative sample from each of the three universities. To achieve this, the faculties were first classified into three categories, namely: (a) Arts and Humanities, (b) Social Sciences and Business, and (c) Science and Technology. At each university, the number of students in each of the three categories

of faculty was obtained. From these, five percent (5%) of the students was randomly selected as participants in the study. This is explained in detail in the data collection and analysis section later in the work. Thus, a total of 2,930 students were randomly selected as the sample for the study. Table 1 gives a summary of the distribution of respondents by Region, University and Faculty Grouping.

Finally, convenience sampling, as a nonprobability sampling method, was used to select the actual participants on the basis of their availability and voluntary consent to participate given at the beginning of the exercise.

Table 1: Distribution of Respondents by Region, University and Faculty Grouping

S/N	Region	University	Faculty Group	Population	Sample	%
1	North	Ahmadu Bello University, Zaria	Arts/Humanities	7,006	350	5
			Social Studies	6,489	324	5
			Science and Tech.	15,136	757	5
			Sub-Total I	**28,631**	**1,431**	**5**
2	South	University of Port Harcourt, Port Harcourt	Arts/Humanities	5,240	262	5
			Social Sciences	5,500	275	5
			Science and Tech.	6,260	313	5
			Sub-Total II	**17,000**	**850**	**5**
3	West	University of Ibadan, Ibadan	Arts/Humanities	4,349	217	5
			Social Sciences	1,930	96	5
			Science and Tech.	6,721	336	5
			Sub-Total III	**13,000**	**649**	**5**
			Grand total	**58,631**	**2,930**	**5**

Instrumentation

Two questionnaires were used for collecting data for the study. These were the "Creativity, Locus of Control and Risk Tolerance Questionnaire" (CLOCRITQ), and the "Entrepreneurial Inclination Questionnaire" (EIQ). Adequate steps were taken by the researchers to establish the appropriate psychometric properties of the two instruments (validity and reliability) as discussed below.

Validity: The CLOCRITQ was used to gather data on the three predictor variables: Creativity (C), Locus of Control (LoC) and Risk

Tolerance (RT). Hence, it was a battery of tests and consisted of three sections, A, B and C. Section A on creativity was an adopted form of the Ibadan Creativity Assessment Scale developed by Akinboye (1977). Section B was the adapted version of the Rotter's Locus of Control Scale by Rotter (1966). Section C was the Risk Tolerance Scale developed by the researchers. It was validated for face and content validity through vetting by three experts in the Department of Counsellor Education, University of Ilorin, Nigeria and two test experts from the Nigerian Educational Research and Development Council (NERDC), Abuja, Nigeria.

Reliability: Section A of CLOCRITQ on Creativity was an adopted version of the Ibadan Creativity Assessment Scale which was developed by Akinboye (1977). Its reliability was established by its author through the use of the test-retest method and has a reliability coefficient (r) of 0.72. Section B on Locus of Control was adapted form of Rotter's (1966) Locus of Control Scale which had a reliability coefficient r of 0.76. Section C on Risk Tolerance was developed by the researchers. The questionnaire had a total of 55 items comprising 20, 20 and 15 items for Creativity, Locus of Control and Risk Tolerance respectively. The EIQ was a 20-item questionnaire designed by the researchers to measure the entrepreneurial inclination and interest of the students.

In order to establish the reliabilities of the two instruments (CLOCRITQ and EIQ), they were administered to 300 students of the University of Lagos, Akoka, Nigeria, which was not one of the universities used for the study. The reliability coefficients obtained after the pilot test are shown in Table 2.

Table 2: Coefficient of Internal Consistency for CLOCRITQ and EIQ

Scale	No. of Items	Cronbach's Alpha
Creativity	20	0.768
Locus of control	20	0.631
Risk tolerance	15	0.715
Entrepreneurial inclination	20	0.794

Data Collection and Analysis

The questionnaires were administered by the researchers with the help of three research assistants who were given prior training in

order to acquaint them with the purpose, nature and the rules governing the conduct of the research. Data collection was carried out in the three universities concurrently. For each university, one research assistant was attached to one researcher for this purpose. Through prior arrangements with the faculty selected as indicated earlier, they were assigned specific lecture halls where they met the students to administer the required quota (5%, Table 1) of the questionnaires using convenience sampling method, a nonprobability sampling involving the selection of respondents primarily on the basis of their availability and willingness to participate (Zechmeister, Zechmeister & Shaughnessy, 2001). In this way a total of 2,930 copies of each questionnaire were distributed and retrieved on the spot after they were duly completed.

For Section A of each of the questionnaire, frequency counts, percentages, means and standard deviations were computed. For the main data from Section B of CLOCRITQ and EIQ, a stepwise multiple regression analysis and analysis of variance (ANOVA) were used.

Results

As stated earlier, the null hypothesis that guided the conduct of this study was: *Creativity, locus of control and risk tolerance will not be significantly related to entrepreneurial inclination of students in public universities in Nigeria.* To test the null hypothesis a step-wise multiple regression was used. The results are presented in Table 3.

Table 3: Regression output for Influence of Creativity, Locus of Control and Risk Tolerance on Entrepreneurial Inclination of Students.

Model	Variables	β	Standard error	Standardized βeta	p-value	R-square
1	(Constant)	21.79	1.43		.00	.187
	crt	0.61	0.02	.432	.00	
2	(Constant)	16.51	1.52		.00	.211
	crt	0.59	0.02	.422	.00	
	lc	0.64	0.07	.157		
3	(Constant)	8.99	2.03		.00	.220
	crt	0.60	0.02	.429	.00	
	lc	0.59	0.07	.138	.00	
	risk	0.22	0.04	.097	.00	

$\alpha = .05$

Key: crt = creativity, lc = locus of control, risk – risk tolerance

The results in Table 3 indicate that all three predictor variables (Creativity, Locus of Control and Risk Tolerance) are significantly related to the Entrepreneurial Inclination of students. The analysis shows three steps or models to the development of the model:

Step 1 (Model 1) identifies Creativity (*crt*) as the sole variable that is significantly related to Entrepreneurial Inclination with a coefficient of 0.61 which is significant at .05 alpha level ($p < .05$). At Step 1 Creativity, as the sole variable, accounts for about 18.7% of the variability of students' Entrepreneurial Inclination (*ei*).

The model at Step 1 is thus stated as:

$$\boldsymbol{ei = 21.79 + 0.60\ crt} \quad \text{.....(Equation 1).}$$

Step 2 (Model 2) shows Creativity (*crt*) and Locus of Control (*lc*) as the variables that are significantly related to Entrepreneurial Inclination (*ei*) with coefficients of 0.59 and 0.64 respectively, and *t*-values of 24.58 and 9.17 which are significant at .05 alpha level ($p < .05$). These two variables [Creativity (*crt*) and Locus of Control (*lc*)] in model 2 account for about 21.1% of the variability in students' Entrepreneurial Inclination (*ei*).

The model at step 2 is therefore stated as:

$$\boldsymbol{ei = 16.51 + 0.59crt + 0.64\ lc} \quad \text{.....(Equation 2).}$$

Finally, Step 3 (Model 3) shows that Creativity (*crt*), Locus of Control (*lc*) and Risk Tolerance (*risk*) are the variables that are significantly related to Entrepreneurial Inclination (*ei*) with coefficients of 0.60, 0.57 and 0.22 respectively, and *t*-values of 25.07 and 5.56 which are significant at .05 alpha level ($p < .05$). These three variables in model 3 [Creativity (*crt*), Locus of Control (*lc*) and Risk Tolerance (*risk*)] account for about 22.0% of the variability in students' Entrepreneurial Inclination (*ei*).

The model is stated as:

$$\boldsymbol{ei = 8.99 + 0.60crt + 0.57lc + 0.22\ risk} \text{.....(Equation 3).}$$

This implies that at this stage, i.e. equation 3, all three predictor variables are significantly related to Entrepreneurial inclination of the students. Hence, for every increase in the Creativity, Locus of control and Risk tolerance of the average student, the Entrepreneurial inclination will be affected by a factor of 0.60, 0.57 and 0.22 respectively.

Each of the models, namely equations 1, 2 and 3, were tested to know if their relationship to the entrepreneurial inclination of students is substantial. The sub-hypothesis that catered for these is:
The effect of the model is not significantly different from zero.
Table 4 shows the results of the analysis.

Table 4: ANOVA Results for Relationship of Creativity, Locus of Control and Risk Tolerance on Entrepreneurial Inclination of Students.

Model	Variable added	Group	Sum of square	*df*	Mean square	*F*	Sig
1	Creativity (*crt*)	Regression	74454.743	1	74454.743	673.31*	.000
		Residual	323777.220	2928	110.58		
		Total	398231.96	2929			
2	Locus of control (*loc*)	Regression	84287.529	2	42143.764 5	392.92*	.000
		Residual	313944.434	2927	107.26		
		Total	398321.963	2929			
3	Risk tolerance (*risk*)	Regression	87863.269	3	29287.756 3	276.11*	.000
		Residual	310368.694	2926	106.07		
		Total	398321.963	2929			

*Significant, p< .05

The results in Table 4 show that models 1, 2, and 3 yielded *F*-values of 673.31, 392.92, and 276.11 respectively, each of which is significant at the .05 level of significance. Therefore, the effect of models 1, 2, and 3 are significantly different from zero. This implies that the models provide credible platforms for determining the influence of Creativity (*crt*), Locus of control (*lc*) and Risk tolerance (*risk*) on the Entrepreneurial inclination (*ei*) of the average student.

Discussion

The results have revealed that the three variables – creativity, locus of control and risk tolerance – have a significant relationship with entrepreneurial inclination of students in public universities in Nigeria. This finding corroborates the results of Baron (2000), Chu (2000), Kiadese (2008), Zampetakis, Gotsi, Andriopolulos and Moustakis (2011) and Ngwoke, Oyeoku and Obikwelu (2013) that the personality/psychological traits such as creativity, locus of control, risk tolerance and the need for achievement affect people's aspiration towards entrepreneurship.

Entrepreneurship is necessary for economic growth and development. Hence, it is crucial to boost the creativity level and risk tolerance of today's students who will become the workforce of the future. Even though, from the results of this study, the three predictor variables do, in fact, predict entrepreneurial inclinations quite well, the risk tolerance power in doing this is slightly lower than it is for those of creativity and locus of control (Equation 3).

Conclusion

This study has provided evidence to suggest a link between undergraduates' creativity, locus of control and risk tolerance on the one hand, and their entrepreneurial inclination on the other. This implies that students who are creative and exhibit strong risk tolerance propensity are more likely to be inclined towards entrepreneurship.

Recommendations

1. The re-engineering of the Nigerian economy in the presence of available resources and business opportunities has attracted attention, thus there is the need to reposition the economy towards entrepreneurial drive for job creation, wealth creation and global competitiveness of the Nigerian youths/graduates. Therefore, entrepreneurship education must be given priority at the secondary and tertiary levels of education in Nigeria.
2. The Ministry of Education should ensure that career counselling is functionally available at all levels of education, particularly at the junior secondary level to the tertiary level. Career guidance by professional counsellors and school psychologists will enhance the understanding of the young people on entrepreneurship, creativity, locus of control and risk tolerance. It is anticipated that when this is done the problem of unemployment and poverty will be reduced to the barest minimum because the graduates, after completing their courses of study, will not solely rely on the government for employment but will endeavor to create jobs for themselves with some support from the government.

References

Akinboye, J. O. (1977). *Ibadan Creativity Assessment Scale.* Ibadan, Nigeria: University of Ibadan.

Baron, R. A. (2000). Psychological perspectives on entrepreneurship: Cognitive and social factors in entrepreneurs' success. *Current Directions on Psychological Sciences, 9*(1), 15-18.

Brandstatter, H. (1997). Becoming an entrepreneur: A question of personality structure? *Journal of Economic Psychology, 18*, 157-177.

Chu, P. (2000). The characteristics of Chinese female entrepreneurs: Motivation and personality. *Journal of Enterprising Culture, 8*(1), 67-84.

Denga, O. (2005). Psychological predictors of entrepreneurial aspiration of selected graduating students in five selected universities in South-South Zone of Nigeria. *Journal of Educational Studies, 4*, 1-3.

Gürol, Y., & Atsan, N. (2006). Entrepreneurial characteristics amongst university students: Some insights for entrepreneurial education and training in Turkey. *Education and Training, 48*(1), 25-38.

Kiadese, A. (2008). An assessment of the level of entrepreneurial aspiration of Ogun State tertiary institution students. *African Journal of Cross-Cultural Psychology and Sport Facilities, 10*, 21-27.

Kumbul-Guler, B., & Tinar, M. Y. (2009). Measuring the entrepreneurial level of the business: the relationship between the personal traits and entrepreneurial level. *Age Academic Review, 9*(1), 95-111.

McClelland, D. C. (1953). *The achievement motive.* New York, NY: Appleton-Century-Crofts.

Ngwoke, D. U., Oyeoku, E. K., & Obikwelu, C. L. (2013). Perceived locus of control as a predictor of entrepreneurial development and job creation among students in the tertiary institution. *Journal of Education and Practice, 4*(14), 49-54.

Pallant, J. (2010). *SPSS survival manual: A step by step guide to data analysis using SPSS* (4th ed.). New York, NY: McGraw-Hill.

Rotter, J. B. (1966). *Rotter's Locus of Control Scale.* Retrieved from http://www.mccc.edu/~jenningh/courses/documents/Rotter-locusofcontrolhandout.pdf.

Shaver, K. G. & Scott, L. R. (1991). Person, process, choice: The psychology of new venture creation. *Entrepreneurship Theory and Practice, 16*, 23-45.

Stangor, C. (2006). *Research methods for the behavioral sciences* (3rd ed.). Boston, MA: Houghton Mifflin.

Yusof, M., Sandhu, M. S., & Jain, K. K. (2007). Relationship between psychological characteristics and entrepreneurial inclination: A case study of students at University Tun Abdul Razak. *Journal of Asia Entrepreneurship and Sustainability, 16*(2), 110-117.

Zampetakis, L. A., Gotsi, M., Andriopoulos, C., & Moustakis, V. (2011). *Entrepreneurship and Innovation, 12*(3), 189-199. doi:10.5367/ijei.2011.0037

Zechmeister, J. S., Zechmeister, E. B., & Shaughnessy, J. J. (2001). *Essentials of research methods in psychology*. Boston, MA: McGraw-Hill.

Call for Papers

The Ghana Journal of Education: Issues and Practice is an official journal of the College of Education Studies, University of Cape Coast. This peer reviewed journal aims to provide a credible platform for educational researchers to share their research and other scholarly works. The journal is dedicated to research studies on education in Ghana and other African countries. Research studies on issues and practice in education conducted in contexts other than Ghana or Africa should provide relevance of the study to the Ghanaian or African context. The journal publishes original research, review of scholarly concepts and papers in diverse areas of education including, innovative and best practices in teaching and learning across the curriculum in diverse settings, assessment and evaluation issues, analysis of educational policies and their implementation, and developmental and sustainability issues in education. The journal is published in print once a year in December.

Author Guidelines

Interested persons are invited to submit scholarly manuscripts/ articles/papers for consideration and publication in the journal. Authors should refer to the guidelines below and adhere to them.

Submission of Manuscripts

1. Articles/ papers/manuscripts should be submitted in English.
2. Manuscripts are accepted for consideration with the understanding that they are original material and are not under consideration for publication elsewhere.
3. A separate title page must be provided to enhance peer review. The title page must have the title of paper, names of all authors, their affiliation, mail postal address, email address, phone and fax numbers. An asterisk should be placed against the name of the corresponding author in the case of joint authorships.
4. Manuscripts containing the title of the paper should be saved in both Word and PDF files and sent to the Editor-in-Chief via the email address: gje@ucc.edu.gh. The author(s) name(s) should not appear anywhere in the manuscript. The author(s) should use “author(s)” any time he/she/they cite(s) his/her/their work in the manuscript.

5. Length of Abstract: An abstract of not more than 200 words must accompany the article.
6. Key words: four to six keywords must be stated. These should be separated by a semicolon.
7. Length of manuscripts: The length of the manuscripts should – not be more than 12 000 words
8. Font size and line spacing: The manuscripts should be double spaced and of Times New Roman font size of 12 on A4 sheet with margins of 4.0 centimetres on the left and 2.5centimeters on the right, top and bottom.
9. Authors are responsible for all statements made in their work and for obtaining permission from copyright owners to reprint or adapt tables or figures or to print a quotation of 500 words or more.
10. Language, in text references, format and symbols/letters/ equation/transcriptions and references must conform to the style of the publication manual of the American Psychological Association 6th Edition.
11. The structure of a typical empirical study should include Background to the study, which entails the statement of the problem being investigated. Normally, the background should summarize relevant research to provide context, and explain what other authors' findings, if any, are being challenged or extended. Purpose of the study, Research Question(s)/Hypotheses, Methodology, Results, Discussion, Conclusion and Recommendation/Implication. Acknowledgement may be included for funded projects.
12. All manuscripts received will be acknowledged promptly. Feedback on manuscript from reviewers will be communicated to the corresponding author.
13. Rolling deadline for submission: Manuscripts are welcome throughout the year.

Publication Fees

On acceptance of manuscript for publication Ghanaian authors will be required to pay a publication fee of GH₵300 while foreign

authors pay $150. Authors will be given a copy of the issues in which their articles are published.

Queries

For further information/ clarification, please contact the Editor –in-Chief:

Prof. Ernest Kofi Davis
Institute of Education
School of Educational Development and Outreach
College of Education Studies
University of Cape Coast
Cape Coast
Ghana

Email: gje@ucc.edu.gh
Telephone: +233 (03321) 36925
Mobile: +233 248 155 451