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GENDER DIFFERENCES IN PERFORMANCE IN MATHEMATICS AMONG PRE-SERVICE TEACHERS IN THE BRONG-AHAFO REGION OF GHANA

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ABSTRACT: *The purpose of this study was to find out gender differences in performance in mathematics among Pre-service Teachers in the Brong-Ahafo Region of Ghana. A sample of one hundred pre-service teachers drawn by convenience sampling from the public College of Education was used for the study. The one hundred pre-service teachers which consist of fifty males and fifty females were conveniently selected from the second year form. The design for the study was a descriptive survey and for their performance in mathematics, pre-service teachers' actual examination scores were collected from the public College of Education and were analysed using the t-test in SPSS. The test was done on performance of pre-service teachers. Based on the findings of this study, there was a significant difference in their performance. Finally, it was also recommended that administrators and mathematics tutors in the public College of Education in the Brong-Ahafo Region should adopt strategies that suggest to pre-service teachers that they have what it takes to go through their studies successfully, and should focus their attention on how to reduce skills disparities among pre-service teachers.*

KEYWORDS: Performance; College of Education, Mathematics, Brong-Ahafo, Ghana

INTRODUCTION

The purpose of this study was to find out gender differences in performance in mathematics among Pre-service Teachers in the Brong-Ahafo Region of Ghana. This was designed to find out if significant difference exists between the performance of male and female pre-service teachers in mathematics.

It is of optimum importance that sufficient knowledge in mathematics equips one to fit well into various scientific and technological fields in this modern world. It is therefore implacable for any person to live anywhere in this world without making use of mathematics of some kind, a testimony that mathematics is very useful in all that we do. In addition mathematics is one single subject whose indispensable concepts, skills, generalizations and applications permeate many fields of study; science, technology, economics, geography, commerce, engineering, medicine, business and management studies, in industry and several other fields of human endeavour. Some local and international organizations or associations have been involved in various tasks concerning mathematics in schools, for instance, Japanese Overseas Voluntary Co-operation (JOVC) sends some of their teachers to some of the secondary schools to help in the teaching and learning of subjects like Mathematics and Science. In Ghana too, the Mathematics Association of Ghana (MAG) organises periodic workshops in the country to sensitized teachers on the importance of mathematics in the development of the country and ways to improve upon its teaching and learning.

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Furthermore, the history of formal education in Ghana reveals a long-standing attempt at giving equal educational opportunities to boys and girls. The Ghanaian society now appears sufficiently convinced of the importance of girls' education and attention now seems to be shifting towards addressing gender stereotyping in the choice of school subjects and careers, hence the popular saying, "when you educate a man you educate an individual; but when you educate a woman you educate a nation". Also, in Ghana, science and mathematics quizzes (Brilliant Science and Mathematics Quiz) are organized and shown on Ghana Television on Saturdays for senior high schools to test their performances in the subjects. Most at times, students from all male schools and all female schools do compete with each other and at times the male students emerge winners and sometimes the female students also do emerge as winners over their male counterparts.

The Girls Education Unit (G.E.U.) of the Ministry of Education has been organising Science and Mathematics clinics for girls in the Secondary schools every year, and its aim is to sensitize girls and make them have interest in Science, Mathematics and Technology, also various scholarships schemes have been put in place for girls, documentaries on what the girl-child is capable of doing when given the same opportunity as her counterpart. In order to improve upon the learning of mathematics, most countries are now setting up television stations to help in the teaching and learning of mathematics. For instance, there is Mathematics Television channel in the United Kingdom which is solely meant for the teaching and learning of mathematics at all levels of education.

According to the chief examiner's report for West African Senior Secondary School Certificate Examinations (2008) on Core Mathematics and the chief examiner's report for the Colleges of Education Examinations (2008, 2009) on Geometry, Trigonometry, Statistics and Probability, students performance in mathematics has been decreasing over the years, it is in view of this, that this research is carried out to ascertain whether the situation is true or false.

The Wisconsin Education Association Council (1996) set their definition of performance as the one requiring students to demonstrate skills and competencies by performing or producing something. Gender differences in mathematics performance have been a contentious issue in educational domain and research documents show great discrepancies among boys and girls in school mathematics (Sprigler and Alsup 2003). Also according to Janson (1996), Mullis' study (as cited in Manoah, Indoshi and Othuon, 2011), male advantage in mathematics performance is a universal phenomena, while early research (Fennema and Sherman, 1976) indicated that males out performed females in mathematics achievement at the junior high and senior high school levels. These earlier studies added that there were also significant differences in achievement towards mathematics between the boys and girls. Gallagher and Kaufman (2006) recognized that the achievement and interest of boys are higher than the girls. They however explained that they do not know the main cause of these differences.

In spite of massive research evidence for male's superiority in mathematics achievement, some research findings do not support the difference between the two genders in mathematics achievement. For example, Springler and Alsup (2003) refered to researcher indications that showed no gender differences on the mathematically reasoning ability at elementary level. Findings from longitudinal study about gender differences in mathematics show that there is no difference among boys and girls in mathematics achievement, (Ding, Song and Richardson, 2007). This study shows that growth trend in mathematics between the two genders was equivalent during the study times.

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According to Mullis, Martin, Gonzales, & Chrostowski, (2004) the recent international study conducted by IEA showed that, on average across all countries, there was essentially no difference in achievement between boys and girls at either the eighth or fourth grade. Over the last three decades, diverse theories and frameworks have been developed and many have tried to identify factors that influence mathematics performance in order to reduce gender inequality in mathematics achievement (O'Connor-Petruso & Miranda)'s study (as cited in Campbell 2005). Geary (2000) has argued that research evidence show that gender differences in mathematics achievement are due to various factors such as biological factors, mathematics learning strategies, sex hormones on brain organization, and symbolic gender.

O'Connor-Petruso & Miranda's study (as cited in Campbell 2005) have shown that gender differences in mathematics achievement become apparent at the secondary level when female students begin to exhibit less confidence in their mathematics ability and perform lower than the males on problem solving and higher level tasks. In Ghana, Eshun (1999, 2000) also observed a higher achievement of males than females in mathematics at the secondary school level.

Wilmot (2008) even showed that in Ghana, the difference in mathematics achievement between boys and girls begins or becomes apparent at the sixth grade. According to Asante (2010) the Ghanaian government in realization of the significant role of mathematics to nation building, has made the subject compulsory at the basic and secondary levels. This was aimed at ensuring the inculcation of mathematics literacy and the associated equipment with logical and abstract thinking needed for living, problem solving and educational furtherance.

Available literature is replete with the fact that teachers believe that Science, Mathematics and Technology are meant mostly for boys and as such give the boys much attention during mathematics lessons than girls. Hence girls are not encouraged as much as boys to study mathematics; instead they are often ridiculed when they make mistakes or are unable to answer mathematics questions correctly. According to Wilmot (2008) available literature on teaching and student performance is replete with evidence that the teacher is one of the most important factors that influence student performance, especially in the developing world. In spite of this, there is widespread disagreement among researchers about which aspect of teachers' subject matter knowledge best relates to student performance. Several studies that have attempted to establish this link have relied on proxy measures of teacher knowledge (e.g., the number of university courses taken). In addition, various conceptualizations of teacher knowledge have presented it as a domain neutral domain. Consequently, there is the need for re-conceptualization of teacher knowledge in ways that is both domain specific and lends itself to some form of direct measurement instead of by proxy. The, Female Education in Mathematics and Science in Africa (FEMSA, 1997) project has shown that girls lack role models in that they come into contact with few women teachers handling science and mathematics. Another factor that seem to influence boys to elect or to take the mathematically related courses is the abundance of male mathematics teachers over females. In the review of mathematics education in the united kingdom in the late 1970s to early 1980s, the Assessment and Performance Unit (APU, 1985) report confirmed this. Outside the school, girls rarely see or hear of female mathematicians and scientists. Most parents consider girls as household bound and therefore should devote themselves to studies that are relevant to their future role as wives and mothers, FEMSA (1997) and APU (1985). There is a belief that the road to a mathematics-based career is long and difficult and this damages girl's marriage chances by the time taken. Most men also

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regard women mathematicians and scientists as somehow "abnormal" and not good for marriage.

Finally, influential individuals such as parents who hold gender-based stereotypes may discourage females from pursuing careers in math or related STEM fields (Davis-Kean, 2007). To correct this, schools may want to consider math forums for parents, which have been used in some school districts to encourage parents to take an active role in their child's math performance (Cavanagh, 2009). Nevertheless, pressures from some parents' causes' girls to fear that higher attainment in Mathematics will inhibit the development of their relationship with boys.

Statement of the Problem

Several studies (for instance, Aiken, 1970; Callaham, 1971; Fennema, 1980; Carpenter, (1980)'s study (as cited in Norton & Rennie, 1998) and Becker, (1990)'s study (as cited in Kaiser-Messmer 1993), have reported that there is generally a difference in attitude and performance between male and female students towards mathematics. These studies appear to suggest that female students do not have positive attitudes and as such perform poorly in mathematics as compared to their male counterparts.

Unfortunately, none of these studies were conducted at the teacher training college level in Ghana (now called Colleges of Education). Therefore this study was designed to fill this apparent vacuum and to find out whether there is gender difference in performance in mathematics among pre-service teachers in a public college of Education in the Brong-Ahafo Region of Ghana.

Significance of the Study

This study is significant because it is intended to show whether there is a significant difference in performance in mathematics among male and female pre-service teachers, to help confirm or deny the impression that mathematics is for only men and to help develop the ability and desire of pre-service teachers to pursue mathematical ideas and skills independently.

MATERIALS AND METHODS

The type of study and design used for this research is the descriptive research design and it specifies the nature of a given phenomena. It determines and reports the way things are. It thus involves collecting data to test hypothesis or answer research questions concerning current status of the subject of the study, (Gay, 1992). The purpose of descriptive research is to observe, describe and document aspects of a situation as it naturally occurs. It sometimes, serves as a starting point for hypothesis generation or theory development. In descriptive research, the events or conditions either already exist or have occurred and the researcher merely selects the relevant variables for an analysis of their relationships.

According to Best and Khan (1998), descriptive research is concerned with the conditions or relationships that exist, such as determining the nature of prevailing conditions, practices and attitudes; opinions that are held; processes that are going on; or trends that are developed. Amedahe (2002), also maintains that in descriptive research, accurate description of activities,

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objects, processes and persons is the objective. The population was made up of all second year pre-service teachers from the public college of education in the Brong-Ahafo Region of Ghana.

The sample included hundred pre-service teachers selected from the public college consisting of fifty males and fifty females. A convenience sampling was used to select the pre-service teachers from the second year forms in the college. According to Castillo (2009), a convenience sampling is a non-probability sampling where subjects are selected because of their convenient accessibility and proximity to the researcher. The convenience sampling is useful because it allows the researcher to obtain basic data and trends regarding his or her study without the complications of using a randomized sample. It is also useful in documenting that a particular quality of a substance or phenomenon occurs within a given sample. The main disadvantage is that the units that are easiest to obtain may not be a representative of the population.

The instrument used to measure pre-service teachers' performance was pre-service teachers' scores on mathematics (Statistics and Probability) collected from the Institute of Education, U.C.C., through the vice principal academic.

Theory/calculation

Data on pre-service teachers' scores in mathematics content (Statistics and Probability) collected from the institute of education through the vice principal academic, were then put into a frequency table form for easy interpretation. The independent samples t-test was then used to analyse the scores of pre-service teachers' performance. The t-test was the best to be used because it is a parametric statistical test used to see whether a difference between the means of two samples is significant. The t-test provides an exact test for the equality of means of two normal populations with unknown but equal variances. Theoretically, the t-test can be used even if the sample sizes are very small, as long as the variables are normally distributed within each group and the variation of scores in the two groups is not reliably different.

RESULTS AND DISCUSSION

An independent samples t-test was conducted to compare the performance of male and female pre-service teachers' in mathematics.

***Research hypothesis*:** There is no difference in performance between male and female pre-service teachers' in mathematics.

Table 1: Frequency table for the scores of male and female pre-service teachers'

Scores	Number of Respondents (Males)	Number of Respondents (Females)
90 – 99	0	0
80 – 89	2	0
70 – 79	7	10
60 – 69	2	28
50 – 59	17	12
40 – 49	1	0
30 – 39	0	0
Total	50	50

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Table 1 shows the scores of male and female pre-service teachers' in mathematics.

Table 2: Group statistics of respondents

	Gender	N	Mean	Standard Deviation
Scores of Pre-service teachers	male	50	62.90	8.440
	female	50	63.84	7.000

Table 2 shows the number of pre-service teachers, means and standard deviations of scores obtained. The female pre-service teachers had mean slightly higher than their male counterparts but recorded a slightly lower standard deviation in scores obtained.

Table 3: Results of the Independent Samples t-test on scores obtained in mathematics

		Levene's Test for Equality of Variances					
		F	Sig.	T	Df	Sig.(2-tailed)	Mean Difference
Scores of College A	Equal variances assumed	1.159	.284	-.606	98	.546	-.940
	Equal variances not assumed			-.606	94.757	.546	-.940

From Table 3, the significant value is 0.284 and the alpha level is 0.05 which means that the significant value is greater than the alpha level and this means that the column labelled equal variances assumed's t-value is chosen. Also, the significant (2-tailed) value is 0.546 which implies that it is greater than the alpha level of 0.05; hence there is no statistically significant difference in performance in mathematics for male and female pre-service teachers. the t-test conducted showed males (M = 62.90, SD = 8.440) do not have higher level of performance in mathematics than females (M =66.84, SD = 7.000); t(98) = 0.606, P = 0.546 (two-tailed), d = .05 in the public college. This result showed both male and female pre-service teachers have no difference in mathematics performance and that is in accordance with Ding, Song and Richardson (2007) revelation that there is no difference among boys and girls in mathematics achievement. It however contradicts Janson (1996), Mullis' study (as cited in Manoah, Indoshi & Othuon 2011) revelation that male advantage in mathematics performance is a universal phenomena. The results in this work therefore indicated that there was no statistically significant difference in performance in mathematics of male pre-service teachers than their female counterparts.

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CONCLUSIONS

The conclusions drawn from the result of the study indicated that there was no statistically significant difference in performance between male and female pre-service teachers in mathematics in the public college of education in the Brong-Ahafo region of Ghana.

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