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THE IMPACT OF MATHEMATICS ON ACADEMIC PERFORMANCE OF STUDENTS IN TVET INSTITUTIONS IN GHANA.

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Abstract
The poor performance of students in tertiary institutions should be a concern not only to the administrators and educators, but also to industry players. Mathematics affects many aspects of life and it is impossible to escape from the application of mathematics. The paper seeks to investigate the significance of Mathematics in the academic performance of students. The objectives are to find the factors that affect the learning of mathematics and to determine the significance of Mathematics in academic performance of students. The research design adopted was quantitative in nature and content analysis was sued to study a total of 158 graduates from 2002 to 2013 graduation years from eight departments of Cape Coast Polytechnic now. Pearson correlation and simple linear regression analysis were applied to identify the relationship pattern between mathematics and English language and the class they obtained. Mathematics affected the academic performance of the students. Also it is worth noting that when a student passed English language that did not necessarily improved the academic performance of the student it had 0.633 as significance value which is higher than 0.05.
Keywords: Mathematics; Academic; Performance; Student; Ghana.

INTRODUCTION

Having a strong grounding in mathematics and English Language is important for young people in today's job market. Stakeholders in industries lament on the alarming gap between the literacy and numeracy skills they require and the skills that job applicants possess.

The poor performance of students in tertiary institutions should be a concern not only to the administrators and educators, but also to industry players.

According to the Ghana Education sector plan (2010-2020), it is evident that learning outcomes are generally low at basic and secondary levels and that there has been no significant improvement in quality since 2002. This has serious implications for the management of learning in the next decade.

The purpose of the science, technology, mathematics education (STME) policies is to strengthen the teaching and learning of science, technology, maths at all levels of the system so as to produce a critical mass of human resource that will stimulate Ghana's technological capacity.

One of the strategies is to achieve STME is to ensure that by 2020, 60% of all students in the Universities and 80% in the Polytechnics and Vocational institutions are registered in science and technology–related disciplines.

Mathematics, English and Science are the compulsory subjects that are required to gain admission at the tertiary level apart from the elective courses of science , art or business background. Those from the technical institution need to pass the compulsory subjects and their electives too.

Converging on the students' achievement of required skills and knowledge is essential to ensure that the students of vocational schools can survive throughout their program of study. Literacy and numeracy skills must be given extra attention especially at early level of their study to minimize the drop-out rates.

Rameli, et al. (2014) argued that student's academic achievement is a complex issue but it has always been used as an indicator to measure student's learning and understanding. Specifically, mathematics nervousness is one of the affective variables that related to the students' mathematics achievement. Mathematics nervousness generally refers to an uncomfortable situation that exists when a student is required to perform mathematical tasks during the teaching and learning process or examination in or outside the classroom.

Rameli, et al. (2014) noted that student's academic achievement is a complex phenomenon but it has always been used as an indicator to measure student's learning and understanding. Specifically, mathematics anxiety is one of the affective variables that related to the students' mathematics achievement. Mathematics anxiety generally refers to an uncomfortable situation that exists when a student is required to perform mathematical tasks during the teaching and learning process or examination in or outside the classroom

A mathematically literate student recognises the role that mathematics plays in the world in order to make well-founded judgments and decisions needed by constructive, engaged and reflective citizens (OECD, 2016).

Mathematics affects many aspects of life and it is impossible to escape from the application of mathematics. The importance of the acquisition of mathematics knowledge and skills can be seen for the students and for the nation. Thus, any element of prevention for students' mathematics achievement including mathematics anxiety should be resolved and not taken for granted. To reduce the level of math anxiety, it is necessary to minimize the negative effect of math anxiety during the examination situation so that the students will not hold by negative thought. The myth of second class education of TVET must be eliminated from the mind of all since it acts as one of the barriers to encourage students to keep motivated in learning mathematics.

The Problem Statement

The Organisation for Economic Co-operation and Development (OECD) Survey of Adult Skills published in 2013 showed that unemployed adults are twice as likely to have a poor level of literacy as those who are in full-time employment and 65% of the prison population have numeracy skills below that of an 11 year old or under with 48% showing the same levels in reading ability.

Ayitey (2015) reported concerns of government over the poor performance of students in Maths and Science deepen as recent results released by the West African Examination Council (WAEC) shows that about 99,917 candidates failed the Maths and Science papers.

‘‘Any scientific or technological advancement largely depends on a strong mathematical background. More importantly, a not-too-good a pass in the subject prevents a student from pursuing further studies, even in the humanities in the universities.’’ (Aidoo, 2014)

Aim and Objectives

The paper seeks to investigate the significance of Mathematics in the academic performance of students.

Objectives

The objectives are stated as follows

1. To find the factors that affect the learning of mathematics
2. To determine the significance of Mathematics in academic performance of students.

The International Mathematics and Science Study (TIMSS) conducted in 2011 , in which Ghana participated with 35 countries, reports that mathematics learners came last with a mean score of 331 (ibid.). This mean was significantly lower than the international benchmark of 513. The percentage of students scoring at or above low was 21 percent at intermediate the students had 5 percent while at or above high recorded percent.

Presented table 1 are brief descriptions of what eighth graders should know and be able to do at the Low, Intermediate, High, and Advanced benchmarks in mathematics. TIMSS benchmarks are cumulative; therefore, student performance at the High benchmark includes the competencies associated with the Low and Intermediate benchmarks. Extensive descriptions of what students should know and be able to do at each benchmark can be found in the *TIMSS 2011 International Results in Mathematics* report.

Table 1: TIMSS International Benchmarks for Achievement in Mathematics at Grade 8

No	Item	Score	Description
1	Advance	625	Students can reason with information, draw conclusions, make generalizations, and solve linear equations.
2	High	550	Students can apply their understanding and knowledge in a variety of relatively complex situations.
3	Intermediate	475	Students can apply basic mathematical knowledge in a variety of situations.
4	Low	400	Students have some knowledge of whole numbers and decimals, operations, and basic graphs.

Source: TIMSS 2011 International Results in Mathematics

FACTORS THAT CONTRIBUTE TO STUDENTS UNDER-ACHIEVEMENT IN MATHEMATICS

Tella (2007) at different times highlighted some contributing factors to students under-achievement in mathematics to include among others; large class sizes, anxiety, lack of preparation among candidates, poor understanding of mathematical language by both teachers and students, overloaded mathematics content, stereotype teaching method, inadequate number of qualified mathematics teachers, poor Mathematics background and poor mathematics classroom environment.

Tella (2007) indicated that teaching methods and strategies employed by teachers during lessons are mainly the traditional and passive one that cannot make a positive impact on the teaching of Mathematics by the learners. Mathematics which appears to be the base of all science subjects demands systematic and interesting methods that will gear up the learners. It therefore, implies that the old teacher center method may not be able to meet the need of the twenty first century teaching and learning process.

The issues of motivation of students in education and the impact on academic performance are considered as an important aspect of effective learning. However, a learner's reaction to education determines the extent to which he or she will go in education. The impact of motivation on education of mathematics of a child cannot be undermined.

Motivation and Mathematics

According to Tella (2007) in making instruction interesting in learning mathematics, there is need to use methods and material which will make the learning of mathematics, active, investigative and adventurous as much as possible. Such methods also must be ones that take into account, learner's differences and attitudes towards mathematics as a subject.

To enhance self-esteem of learners, which will in turn improve attitude of such pupils, it is recommended that varying activities (game activities), which has been designed to contain mathematics problems ranging from easy to very difficult, should be used. At least each pupil no matter their ability level should be able to answer some questions correctly. This would go a long way to motivate such pupils towards further learning (Tella, 2007). When an activity is designed with its central feature being an admired situation, experience or individual, it would go a long way in motivating, pupils to learn mathematics.

Achievement Motivation

In a classic study to assess the differences in strengths of people's achievement motives McClelland and Colleague in Aire and Tella (2003) developed a projection technique using selected picture cards from the Thematic Apperception Test (TAT). The technique assumes that, when asked to write stories about the pictures, respondents will project their feelings about themselves onto the characters in the pictures. Assessment of the responses involves noting references to achievement goals (concern over reaching a standard of excellence). Subjects who refer to achievement goals are often rated high in achievement motivation; those who rarely or never refer to achievement goals are rated low.

Individuals' actual achievement behaviour depends not only on their motivation to achieve but also on whether they expect to achieve and whether they fear failure. People are more likely to work hard when they perceive a reasonable chance to succeed than when they perceive a goal to be out of reach (Tella, 2007).

In addition to child rearing practices, reviewed previously, teaching styles and communication pattern affect children's attributions. When teachers are caring and

supportive and emphasize the teaching learning process over the performance outcomes, and when they give feedback, children tend to be motivated to achieve and to expect success (Tella,2007).

It can be said therefore that interest and attitude of learner towards a particular subject matters a lot. This is because these two constructs according are high motivating factor which can lead to better achievement on the part of the learner. Good attitude and better interest learners display particularly in Mathematics serve as an encouragement even to the teacher. And this can help the teacher a lot to disseminate his teaching to the best of his ability and knowledge making use of all available resources rather than resorting to the use of chalk and talk when learners show no interest or negative attitude. Moreover, when the students display good attitude and better interest in Mathematics, the teacher is motivated and this may cause him to forget whatever hindrances to the teaching of the subject from his own part. Effective instructional skills in Mathematics knowledge on the part of the teacher; couple with student's interest in the subject and the display of positive attitude as earlier pointed out, are good motivating factors which when combine together is assumed will result to better achievement in Mathematics.

RESEARCH METHOD

The research design adopted was quantitative in nature and content analysis was sued to study a total of 158 graduates from 2002 to 2013 graduation years from eight departments (Building Technology; Civil Engineering; Secretarial and Management; Accountancy; Marketing; Statistics; and Tourism) of Cape Coast Polytechnic now. Pearson correlation and simple linear regression analysis were applied to identify the relationship pattern between mathematics and English language and the class they obtained.

RESULTS AND DISCUSSION

The model fitting information was designed to helping in analysing the variables that are being considered.

Table 2: Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	64.527			
Final	50.438	14.089	2	.001

Link function: Logit.

From the table 3 it was realised that when only one variable is considered the significance is less than 0.05 which means it has some effect on their performance when the two variables are combined then it can also have effect on the performance however when three or four variables are together will not affect the performance.

Table 3: K-Way and Higher-Order Effects

	K	df	Likelihood Ratio		Pearson		Number of Iterations
			Chi-Square	Sig.	Chi-Square	Sig.	
K-way and Higher Order Effects[a]	1	31	116.997	.000	147.418	.000	0
	2	25	49.795	.002	62.146	.000	2
	3	13	12.146	.516	10.429	.659	3
	4	3	1.180	.758	.840	.840	4
K-way Effects[b]	1	6	67.202	.000	85.272	.000	0
	2	12	37.650	.000	51.717	.000	0
	3	10	10.965	.360	9.589	.477	0
	4	3	1.180	.758	.840	.840	0

a. Tests that k-way and higher order effects are zero.

b. Tests that k-way effects are zero.

From table 4 Mathematics affected the academic performance of the students. Also it is worth noting that when a student passed English language that did not necessarily improved the academic performance of the student it had 0.633 as significance value which is higher than 0.05.

Table 4: Partial Associations

Effect	df	Partial Chi-Square	Sig.	Number of Iterations
Sex*English*Math	1	2.886	.089	3
Sex*English*Class	3	.217	.975	3
Sex*Math*Class	3	2.067	.559	4
English*Math*Class	3	4.436	.218	4
Sex*English	1	2.539	.111	4
Sex*Math	1	4.129	.042	3
English*Math	1	.068	.794	3
Sex*Class	3	12.174	.007	3
English*Class	3	5.367	.147	4
Math*Class	3	10.071	.018	3
Sex	1	30.244	.000	2
English	1	.228	.633	2
Math	1	20.286	.000	2
Class	3	16.444	.001	2

Students will feel inferior when thinking about their failure or poor results in mathematics achievement since mathematics is one of the subjects considered for college or university admission. Students with good mathematics achievement are perceived able to get through rigorous study demanded in higher education institution.

CONCLUSION

Mathematics anxiety affecting students' mathematics achievement through the cognitive interference experienced by the students. This interference could occur during the mathematics class or taking mathematics test or examination. The cognitive interference could be experienced by the students when they are preparing for their test or examination.

Apart of that, the cognitive interference model is supported by Information Processing Model introduced by Naveh- Benjamin (1991) which proved that students, who experiencing test anxiety and face difficulty in the stage of processing information are incapable to code, organize and retrieve information.

Mathematics affects many aspects of life and it is impossible to escape from the application of mathematics. Therefore, awareness about the importance of the ability to apply mathematics knowledge and skills in the career world should be created among students. The

importance of the acquisition of mathematics knowledge and skills can be seen for the students and for the nation.

Polytechnics are entrusted to carryout responsibility in enhancing STEM education. This is very significant because report revealed that many job opportunities will be created through the execution of economic transformation program that require technical and vocational education training (TVET) qualifications.

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