

Stress-Related Illnesses and High School Students' Performance in Mathematics: Implication for Facing the Challenges of Global Competitiveness

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Abstract

The impact of stress and stress-related illnesses on the mathematics performance of boarding high school students" has become critical. It is well known that for several years the performance of high school students" in mathematics has been poor. Several studies in Kenya that sought to address the worrisome issue failed to investigate how stress- related illnesses militated against students" mental concentration and problem-solving abilities with concomitant failure in the subject. Yet for students to live quality life or face the challenges in a growing innovative competitive world, mathematics" skills are indispensable. One research question and one hypothesis were postulated for the study. It was hypothesized that there would be no significant difference in mean performance score in mathematics for students who were suffering from stress-related illnesses and those who were well. One hundred (100) female students participated in the study. Independent sample t-test was used in comparing the average Mathematics marks between the Not Stressed and Stressed students using the two independent samples. Focus group discussion (FGD) was also used to establish students" feeling and opinion about mathematics and/or stress-related illness arising from boarding school environmental factors that affected their performance. Results of the study showed that students who were not suffering from stress-related illness performed better than those who were affected by stress related illnesses. The study has implications for students particularly those in boarding high schools, teachers and school heads. It will greatly assist parents, Ministry of Education officials in planning and making decision in order to improve performance in mathematics for future enhanced sustainability and innovation for global competitiveness.

Key Words: Global Competitiveness, Stress-related Illnesses, Performance

INTRODUCTION

Learning and memory can be affected by stress. Although an optimal level of stress can enhance learning ability too much stress can cause physical and mental health problems (Klein & Boal, 2001). In the view of Beiock and DeCaro, (2007) stress can reduce self-esteem and may affect the academic achievement of students. High school students might experience high stress due to academic commitments, financial pressures and lack of time management skills. When stress is perceived negatively or becomes excessive, it can affect both health and academic performance and can have an adverse effect on students. If the pressure is prolonged and perceived as unmanageable, these experiences have been shown to elicit helplessness, depression and stress thereby placing the academic futures of some students in jeopardy. A considerable number of studies have been conducted to investigate the effect of stress factors on the grade point average (GPA) of secondary students (Trockel, Barnes & Egget, 2000).

However, these studies were conducted in isolation without incorporating a comprehensive list of stress factors. To date, no decisive answer has been found of whether the stress perceived by students influence their academic performance more so in mathematics which needs a lot of concentration. If students can learn to perform up to their ability in school, the same anxiety-easing techniques can make them better prepared for job interviews, business presentations, or other stressful tasks in life. People assume that large problems require large solutions. But the truth is that simple psychological interventions can have powerful effects. Trockel *et al.* (2000) further observed that a frequent occurrence on college campuses is that students become almost addicted to exercise, turning a healthy behaviour into one that is psychologically unhealthy. They opine that taking time out of frequent study hours to work out pulls away the grades of students. It may have psychological maladjustment and this increases their anxiety and stress, which has been associated with poorer academic performance.

A number of social factors that may contribute to stress among the college or high school students have been identified. They include lack of time and/or support for and from family and friends, family commitments, financial difficulties, and problems with college roommates. The academic motivation given by a student's roommate to the student has been shown to have a positive impact on that student's academic achievement. In fact, students who are more successful academically may create less stress for

their roommates and, thus, allow them to perform better (Ashcraft, 2002). Based on the review of literature, very little research has been conducted to ascertain whether problem with roommate is another factor contributing to stress and its effect on the academic performance among the high school boarding students. It is thus interesting to include this stressor in the study.

In conclusion, the literature indicated that perceived stress and the presence of the stress factors might influence the academic performance of students. In addition, it is also hypothesized that perceived stress and these stress factors present in different levels during the beginning, middle and end of term. Too much stress can interfere with a student's preparation, concentration, and subsequently performance, but positive stress can be helpful to students by motivating them to peak performance (Pfeiffer, 2001). In addition, a review of literature indicates that not much have been prioritized on stress-related research, particularly in Africa. The majority of investigations have taken place in the United States. Furthermore, prior studies have concentrated on collecting cross-sectional rather than longitudinal data (Trochel *et al.*, 2000).

This paper thus attempts to address the research gaps by including a more comprehensive list of stress factors and empirically test them against the academic performance of mathematics in boarding high schools. This suggests that pressure exerts its impact by taxing working-memory resources necessary for demanding computations. Working memory is the mental reserve that people use to process information and figure out solutions during tests. Math anxiety is fear or apprehension when just thinking about taking a math test. Cortisol is a hormone produced by the adrenal gland and associated with stress-related changes in the body; it is often referred to as the stress hormone.

Mathematics has been the impediment or hindrance to the progress of many students, out of all the subjects in the school curriculum it is mathematics that records the most woeful and heart-rending results in publicly-conducted examination. This yearly poor performance of students in mathematics has been a constant source of concern, and anxiety to all stakeholders in the educational sector; the governments, the ministry of education, educationists, proprietors, principals, teachers, parents and students. The constant failure rate leads to this research on the impact of stress related illnesses on high school students' performance in mathematics: implications for facing the challenges of global competitiveness. In general, this research aims to find out the difference in mathematics performance of boarding high school students' who suffer from stress related illness and those who do not.

Many and varied factors can negatively affect the learner in mathematics including the emotional state and attitude of the learner. The boarding schools environment is quite different from home environment where the learner has been brought up and therefore may pose its challenges to the students which can affect learning / performance. Mathematics being one of the compulsory subjects in Kenyan certificate of secondary education and a major subject which requires logical thinking it is imperative that its performance be enhanced. The purpose of this study is to find out the difference in mathematics performance of boarding school student who suffer from stress related illnesses and the performance of those who do not.

MATERIALS AND METHODS

The study employed both quantitative and qualitative approach. A group of 50 students who had been identified over a period of time to be suffering from at least three stress related illnesses and another group who had no stress related illnesses were identified as the control group.

This study used casual quasi-experimental design to ensure that the result obtained reasonably answers the research questions. Although quasi-experiment is not very powerful in establishing causal relationship, it allows such relationships to be considered by a process of rejecting the null hypothesis. It estimates the causal impact of an intervention on its target population. Naturally occurring variables are measured within quasi experiments (Morgan, 2000). It allows the researcher to control the assignment to the treatment condition, but using some criterion other than random assignment (Dinardo, 2008). The limitation in Quasi-experiments is regarding internal validity, because the treatment and control groups may not be comparable at baseline. With random assignment, study participants have the same chance of being assigned to the intervention group or the comparison group. As a result, the treatment group will be statistically identical to the control group, on both observed and unobserved characteristics, at baseline.

This is particularly true if there are confounding variables that cannot be controlled or accounted for (Rossi, Henry, Lipsey, &Freeman, 2004).

This study targeted 235 form two boarding high school female students. Out of this a sample of 100 was randomly selected for the purpose of this study. Form two female students were chosen because they have comparatively exposed and adjusted to the boarding school environment and its challenges compared to the form ones. The form threes and fours were already fully adjusted and better able to manage their stresses and focus in their studies. They were more conscious of the nearness of their national examination and the value of good performance in mathematics.

A simple random sampling was used to select 50 form two female students in the boarding who have been observed and or had constantly complained of stress related sicknesses over a long period of time. In addition, a second 50 female students were selected from the same class who were free of such stress related sicknesses. Sources of determining those who suffer from stress related illnesses included: Observation, Absenteeism due to ill-health, Class discussion, and Records from the school health facility (clinic) of those who were treated of stress related illnesses.

Data was collected from the average of four different mathematics tests administered to the sampled students on different intervals. The scores of the four mathematics test were recorded and the average score was obtained for each student.

The Statistical Package for Social Science (SPSS version 17) was used to analyze the collected data. Descriptive statistics (frequencies, percentages, mean and standard deviation) were used to summarize the data. The correlation between the variables and the null hypothesis was ascertained using Pearson Product Moment Correlation Coefficient alpha α 0.05 level of significance. This tool assisted the researcher to describe the relationship between the research variables.

RESULTS AND DISCUSSION

Two independent random samples of Mathematics marks (scores), one from Not Stressed population and one from Stressed population. The data has been organized from the highest to the lowest mark in each category.

Table 1. Summary of Data Collected

Not-Stressed (n1=50)	60	60	58	54	52	51	50	49	46	46	
	45	45	45	45	43	43	42	42	41	40	
		39	38	38	38	37	37	36	36	36	36
		36	35	35	34	34	34	34	33	32	32
		31	30	29	28	27	27	26	25	25	25
Stressed (n2=50)	50	43	43	38	38	37	34	34	34	34	
	34	34	34	30	30	30	30	29	29	29	
		29	28	28	28	28	27	27	26	26	25
		25	23	23	22	22	22	22	21	21	20
		20	20	20	18	18	16	16	15	14	11

Table 2. Results of Various Statistical Analyses

Category			Statistic	Std. Error
Not Stressed	Mean		38.80	1.283
	95% Confidence Interval for	Lower Bound	36.22	
	Mean	Upper Bound	41.38	
	5% Trimmed Mean		38.41	
	Median		37.00	
	Variance		82.245	
	Std. Deviation		9.069	
	Minimum		25	
	Maximum		60	
	Range		35	
	Interquartile Range		12	
	Skewness		.571	.337
	Kurtosis		-.125	.662
	Mean		27.10	1.137
	95% Confidence Interval for	Lower Bound	24.82	
	Mean	Upper Bound	29.38	
Stressed	5% Trimmed Mean		26.84	
	Median		27.50	
	Variance		64.582	
	Std. Deviation		8.036	
	Minimum		11	
	Maximum		50	
	Range		39	
	Interquartile Range		13	
	Skewness		.452	.337
	Kurtosis		.321	.662

Results of the Independent T-Test

Two independent sample t-test were used to compare means of two independent normally distributed populations. For large samples, the procedure often performs well even for non-normal populations. The procedure was also used to show the confidence interval estimate for the difference of two means. The test was used in comparing the average Mathematics marks between the Not Stressed and Stressed students using the two independent samples. Since the test was used for studying samples from normally distributed populations, the data was first checked for normality.

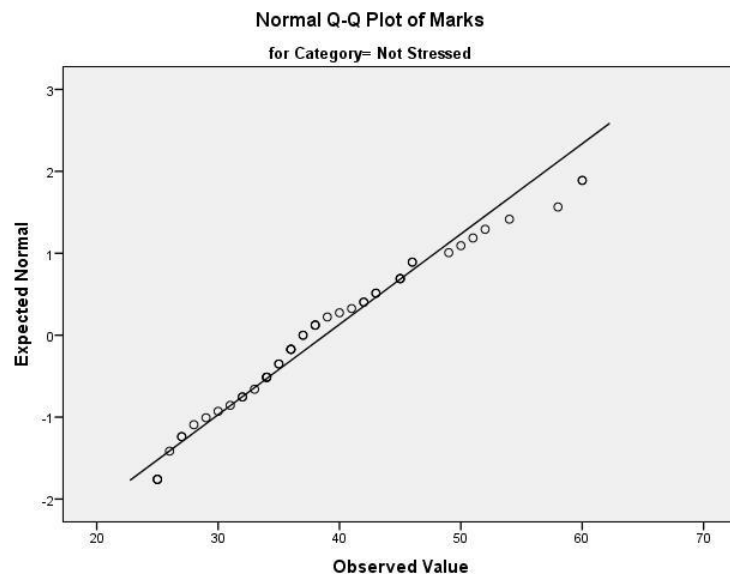


Figure 1. Plot of Marks (Normal Q-Q) for Non-Stressed

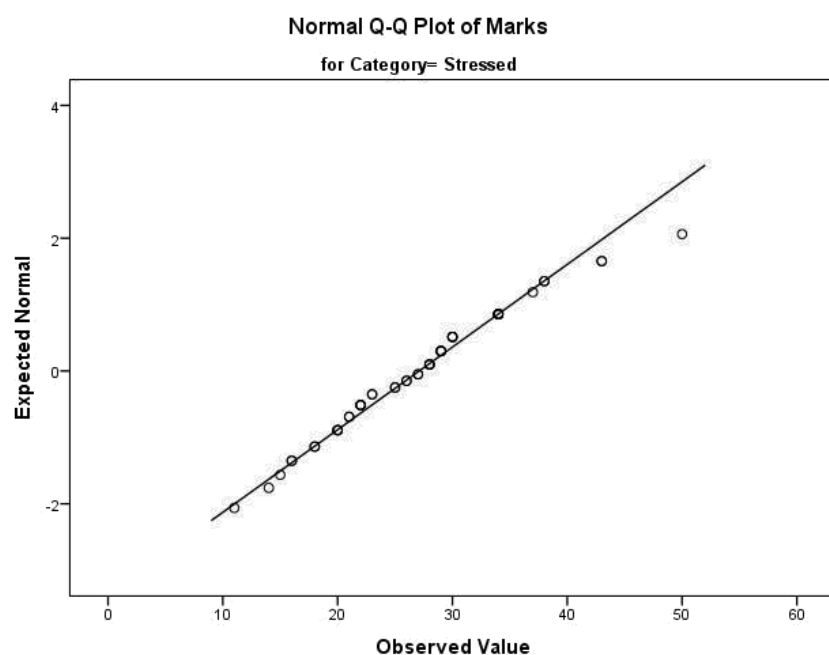


Figure 2. Plot of Marks (Normal Q-Q) Stressed Category

Table 3. Tests of Normality								
	Category	Kolmogorov-Smirnov ^a			Shapiro-Wilk			
		Statistic	df	Sig.	Statistic	df	Sig.	
Marks	Not Stressed	.115	50	.095	.957	50	.068	
	Stressed	.099	50	.200*	.978	50	.474	

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

The normality test results are as shown in the table 3. The p-values 0.068 and 0.474 from Shapiro-Wilk test of normality are both greater than 0.05 which imply that it is acceptable to assume that the Marks distributions for Not Stressed and Stressed populations are both normal (or bell-shaped).

Table 4. Group Statistics					
	Category	N	Mean	Std. Deviation	Std. Error Mean
Marks	Not Stressed	50	38.80	9.069	1.283
	Stressed	50	27.10	8.036	1.137

Table 5. Levene's Test for Equal variances										
		Levene's Test for Equality of Variances			t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
Marks	Equal variances assumed	.852	.358	6.828	98	.000	11.700	1.714	Lower 8.299	Upper 15.101
	Equal variances not assumed			6.828	96.602	.000	11.700	1.714	8.299	15.101

The Levene's Test for Equal variances yields a p-value of **.852**. This means that the difference between the variances is statistically insignificant and one should use the statistics in the **first row**. The p-value

.000, less than 0.05, indicates that there is significant difference between average marks for Not Stressed and Stressed. The 95% confidence interval for the difference between two means is **(8.299, 15.101)**. (This is for the average marks of Not Stressed minus average marks of Stressed, because we have defined Group 1 as Not Stressed and Group 2 as Stressed.)

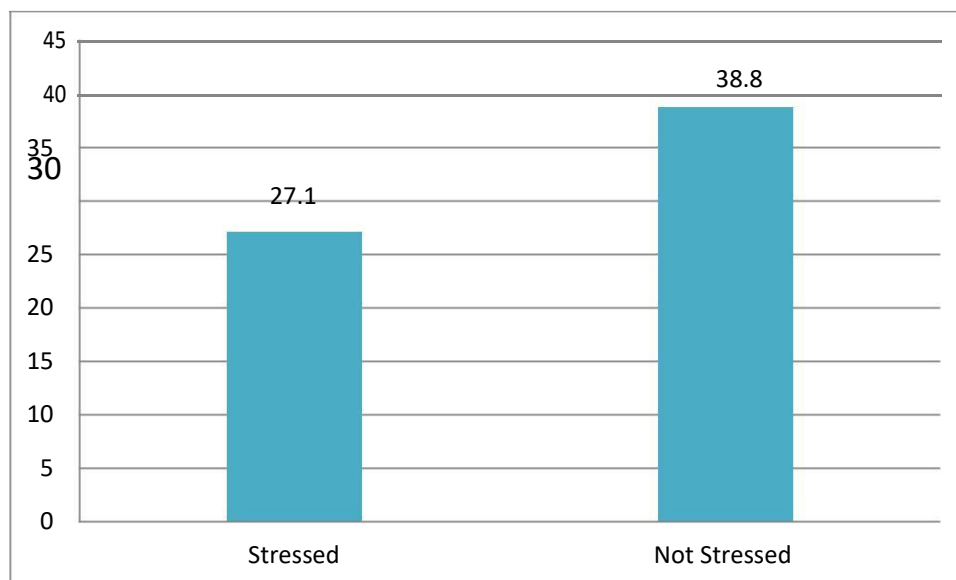


Figure 3. Graph of Scores for the two Categories

CONCLUSION AND RECOMMENDATIONS

The finding in this study throws light on the effect of stress and stress related illness on mathematics performance. Stress impairs mental concentration, logical thinking, problem solving and decision making. Understanding the mechanisms by which stressful academic situations impact performance allow us to design quick, cost-effective, and easy to use interventions to help students in the classroom. Effort should be made by stake holders, principals, teachers, including students themselves to minimize stressors in boarding schools. This will go a long way in enhancing greater concentration in mathematics and thus improve mathematics performance.

Ramirez and Beilock (2011) demonstrated that asking students to write about their thoughts and feelings about an upcoming test immediately before they take the test can lessen the negative impact of pressure on performance. Creating a conducive and less stressful environment in boarding schools, for example relaxing rigid rules and providing facilities and leisure opportunities that are similar to those found in individual homes.

Mathematics anxiety is characterized by feelings of tension, apprehension, or fear about performing mathematics and it has been suggested that, similar to other stressful situations, high mathematics-anxious individuals perform poorly in math due to disruptions of the working-memory available for mathematics performance (Ashcraft, 2002). Actions as simple as having students reaffirm their self-worth, by listing important values like relationships with friends and family, coping with stressful conditions have been shown to boost the test scores of females in mathematics. Adequate attention should be paid to students who suffer from stress-related illnesses like headaches, cold, and shortness of breath, dizziness, nausea, muscle tension, fatigue, fast talking, and trembling, sleep disturbances, eating problems, abnormal disturbances.

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BIO-DATA

Colette Obika is a sister in the congregation of Immaculate Heart of Mary sisters. She holds a Bsc in mathematics and Msc in counselling psychology from Mount Kenya University. She is actively involved in research in the field of counselling and has published widely in that field.