IOSR Journal of Research & Method in Education (IOSR-JRME)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 10, Issue 3 Ser. IV (May - June 2020), PP 51-61
www.iosrjournals.org

Normalizing Fluctuating and Directional Asymmetric Data of Mathematics Achievement and Some Psychological Indices among Secondary School Students in Ogun State, Nigeria

Taiwo A.K.
Department of Counselling and Human Development Studies, Faculty of Education, University of Ibadan.

Abstract
The study adopted a survey design of ex-post facto type. Two hundred and fifty secondary school students were sampled. Five instruments were used to generate data. Seven research questions were raised and answered using t-test and regression analysis at 0.05 level of significance while the scores obtained from mathematics achievement test were normalized with the use of histogram and Q-Q normality plot while Kolmogorov Smirnov and Shapiro Wilkwere used to test for normality and control chart was used to test for degree ofnormality gained after transformation.The results showed that mathematics scores collected were skewed and were however normalized. Student attitude towards mathematics and study habit were found out to be good indicators of students performance in mathematics and predictors of variations in mathematics test scores of students. Research analysts, educators, school administrators, test assessors and examination bodies should always endeavour to transform the data collected from students' scores.

Keywords: *Asymmetric data, Attitude and Interest towards mathematics, Academic Motivation, Teacher Subject Mastery, Achievement Test.*

Date of Submission: 26-05-2020 Date of Acceptance: 13-06-2020

I. Introduction

Students' achievement has been an issue of concern to all stakeholders in education and more importantly achievement in mathematics. This is not farfetched since mathematics is one of the important subjects which act as a bridge for other professions and subjects.Over the years, poor academic performance has always been attributed to various factors such as school climate, class size, study habit, inadequate instructional materials etc and several attempts have been made to improve all these identified factors but to no avail (Aremu&Sokan, 2003). Therefore it is pertinent to reconsider the perception on students' achievement which invariably may not be due to infrastructural, personal or family factors but with the approach to grading system which thus brings about asymmetric scores.

Asymmetric data which is the abnormality in test scores and variation in test scores usually caused by non-normalization of test scores and inappropriate handling of test scores among educators, test experts and assessors and vsarious examination bodies is likely to be the unidentified and unnoticed factors hindering better academic achievement among students. This however leads to wrong interpretation of test scores, errors in inferences drawn from students' scores while grading and classifying and thus increasing systematic error.Based on this premise, this study seeks to investigate the extent to which normalizing fluctuating and directional asymmetric scores and other psychological indices (study habit, students' attitude towards mathematics, achievement motivation and teacher subject mastery) would influence performance in mathematics achievement test among secondary school students in Ogun State.

The tracking of academic achievement of any student is important in fulfilling number of purposes in life. Their achievement and failure need to be evaluated in order to foster improvement and make full use of learning process. Academic outcomes provide a framework for talking about how students' fare in school and a constant standard to which all students are held which are mostly determined by achievement test. Students' result also allow them to be ranked and sorted on a scale that is numerically obvious, minimizing complaints by holding teachers and schools accountable for the components of each and every grade (Owusu-Darko, 2011). This process is made possible through achievement test.

The importance of having a solid background in mathematics is well recognized as it serves as a gateway to future professions in a variety of fields (Akinsola, 2011; Tella 2008; Pandor 2006; De Klerk Wolters cited by Kurt, 2002). Mathematics is very important in our daily lives since it deals with real life situation in our daily activities (Ojose 2011). A thorough understanding of mathematics is an asset, if not essential, for applicants interested in obtaining better employment the world over. In other words, mathematical competence is an essential component in preparing numerate citizens for employment and it is needed to ensure the

continued production of highly-skilled persons required by industry, science and technology (Mikulski 2001; Steen 2001; House 2006).

Despite the recognition accorded to mathematics due to its relevance, Elekwa (2010) remarked that students' exhibit non- challant attitude towards mathematics, even when they know that they need it to forge ahead in their studies and in life. Such students who have already conditioned their minds that mathematics is a difficult subject are usually not serious in the learning of mathematics and therefore perform poorly in mathematics tests and examination. Analysis of school certificate mathematics examination results shows that students' performances in mathematics are consistently poor. Uwadiae (2010) reported that less than 42% of registered candidate in Senior Secondary Certificate Examination obtain credit pass in mathematics. Even the SSCE results released by WAEC and NECO for 2012 indicated poor achievement of students in mathematics. According to Olunloye (2010) this ugly trend of high failure rate in mathematics is a national disaster.

It has been observed that students who have high level of study habit and positive attitude towards mathematics would perform better and have high scores than students who possess poor study habit and this will brings about variation in the their test scores likewise their attitude towards mathematics. Also, in identifying institutional factors, instructional practice related factors predisposing academic failure and asymmetric data are opportunity to learn, classroom activities, motivation, readiness to teach, professional development, class size, school resources, instructional limitations and teacher subject mastery.

Fluctuating asymmetry is a particular form of asymmetry, characterized by small random deviation from perfect symmetry. The fundamental basis for the study of fluctuating asymmetry is an a priori expectation that symmetry is the ideal state of bilaterally paired data. Fluctuating asymmetry measures deviations from the ideal state of symmetry, and is therefore thought to reflect the level of differentiation in data. It has attracted a great deal of attention because bilaterally symmetrical data are extremely common in nature. It consists of random deviations from perfect symmetry in test scores. It is a measure of test, which reflects students' average state of knowledge. Fluctuating asymmetry have long primarily used measurements of lengths or perhaps angles on the left and right sides of a set of scores (Graham, J.H, Raz, S.,&Nevo, E. 2010). More recently, however, many new tools have been developed in the field of mathematics (Van Donge, 2006), including methods for studying asymmetry of data. The measurement of fluctuating asymmetry is complicated by the fact that its magnitude and distribution are the same as the magnitude and distribution of measurement error(Van Donge, 2006).

Directional asymmetry on the other hand is the type of asymmetric that occurs in students' performance when the scores are in one side of the curve- either in the left-handed or right-handed side of the curve instead of being evenly distributed and therefore leads to asymmetrical data (Van Donge, 2006). Directional asymmetry is characterized by a symmetry distribution that is not centered on zero but is biased significantly, towards larger data either on the left or the right side.That is, positively skewed or negatively skewed.

Educational researches had identified both fluctuating and directional asymmetric scores as factors that contribute to academic failure (Schneider & Coleman 1993). The relative lack of symmetric data is unfortunate given that related literatures strongly suggest the possibility that directional and fluctuating scores disrupt academic functioning. Researchers have however suggested data transformation in normalizing asymmetric scores. Various statistical analyst and testers adopt various methods of data transformation to normalize abnormal data such as square root transformation, log transformation, inverse transformation, arcsine transformation and box cox transformation. (Schneider & Coleman, 1993).

From the review of studies in mathematics as shown in literatures, it was observed that most existing works in mathematics achievement test were carried out with other variables like students' attitude, parental socio economic status, class size, school climate, motivation, teachers' mastery but fewer researches had been carried out in investigating the presence, causes and influence of asymmetric scoreson students' achievement especially in mathematics. To fill this gap, this research work is aimed at normalizing fluctuating and directional asymmetric data of mathematics achievement test and other psychological indices such as students' attitude towards mathematics, achievement motivation, teacher subject mastery and students' study habit among secondary school students in Abeokuta metropolis of Ogun State.

II. Method

Design

The study adopted a survey design of ex-post facto type. The design was adopted because the variables of study are already in existence. The study normalized asymmetric data of mathematics achievement test and some other psychological indices among secondary school students in Ogun State.

Settings

The population of the study consists of all secondary school students in Abeokuta, Ogun State. There are 18 public senior secondary schools in Abeokuta North and 20 public secondary schools in Abeokuta South of Ogun State.

Sample and Sampling Techniques

The sample of the study consists of two hundred and fifty (250) respondents. Multi stage procedure was used in the study to select six (6) schools from the two (2) Local Government areas in Abeokuta Metropolis which are Abeokuta South and Abeokuta North Local Government area of Ogun State.The senior secondary schools in Abeokuta South and Abeokuta North were listed and three schools were randomly selected in each Local Government Area. Senior secondary students were stratified from the sample and were selected using the simple random sampling technique. Six senior secondary schools were sampled. Two hundred and fifty (300) students were selected from the six schools. This technique was used so that equal opportunity would be given to the schools in the two local governments to partake in the study in order to ensure good representativeness of the population.

Instrumentation

Following instruments were used to collect data for this study:

Students' Attitude towards Mathematics Scale

Students' attitude toward Mathematics developed by Ryan (2012) was used. Questions 1 to 15 were adapted and modified by the researcher. The scale measured the extent to which the students dispose and react to studying mathematics. The scale adopted a 4-likert response format ranging from SA=strongly agree to SD=strongly disagree. The scale yielded Cronbach reliability coefficient of 0.77

Achievement Motivation Scale

Achievement motivation Scale consists of twenty items developed by the researcher. It measured the extent to which the students are extrinsically or intrinsically motivated towards studying mathematics. The scale adopted a 4-likert response format ranging from SA=strongly agree to SD=strongly disagree. The scale yielded Cronbach reliability coefficient of 0.72 while the internal consistency analysis ranged from 0.43 to 0.89.

Teacher Subject Mastery Scale

Teachers' subject mastery scale consists of fifteen items developed by the researcher. The scale measured the extent to which mathematics teachers do understand the contents and topics in the mathematics syllabus and how it has influence on the understanding, interest and attitudes of the students towards mathematics. The students provided information based on their interaction in the class with the teachers on the teachers' subject mastery. The scale adopted a 4-likert response format ranging from SA=strongly agree to SD=strongly disagree and yielded Cronbach reliability coefficient of 0.75.

Study Habit Inventory

Study habit scale was adapted and modified from Bakare study habit inventory (1977). It measured the extent to which the student study and apply effective and useful study techniques in improving their performance in mathematics. The scale adopted a 4-likert response format ranging from SA=strongly agree to SD=strongly disagree. . The scale yielded Cronbach reliability coefficient of 0.81.

West Africa Senior Secondary Examination Council (WASSEC) 2018 Mathematics Objective Tests

West Africa Senior Secondary Council Examination (WASSCE) 2018 mathematics objective test was administered to the students to test their knowledge in mathematics and the scores collected from the test was transformed and normalized.

Data Analysis

The data collected were analyzed with the use of descriptive statistics, t. test and Regression analysis at 0.05 level of significance. Kolmogorov-smirnov and Shapiro-Wilk were used to test for normality of the scores while Q-Q normality plot and histogram were used to transform andnormalize the mathematics test score distribution collected to normal score distribution and control chart was used to test for the degree of normality gained after transformation.

III. Results

Research question 1

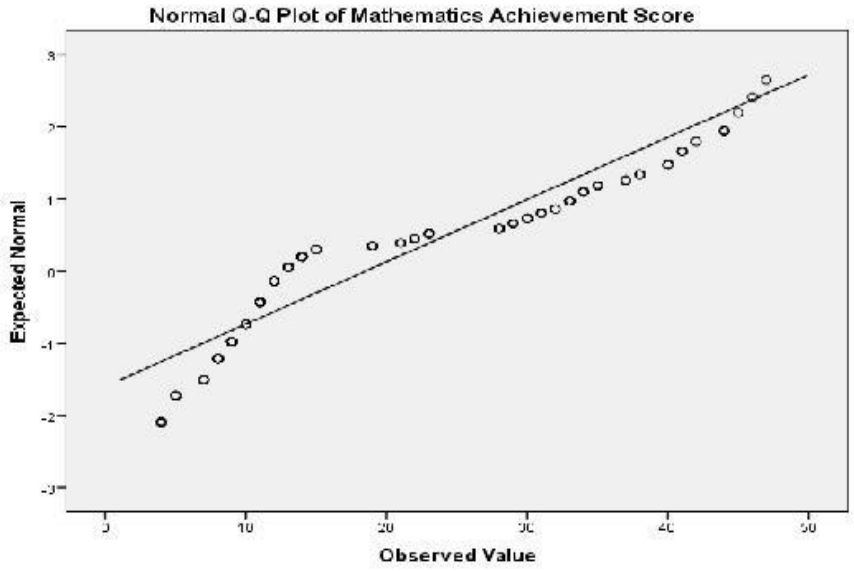
What is the normality status of mathematics achievement score?

Table 1: showing the normality status of mathematics achievement score.

Descriptive				**Test of Normality**			
			Statistic	Kolmogorov-Smirnov (K-S)		Shapiro-Wilk	
Mathematics Achievement Score	Mean		18.50	Statistics	.262	Statistics	.853
	95% Confidence Interval for Mean	Lower Bound	17.05	Df	299	Df	299
		Upper Bound	19.94	Sig	.000	sig	.000
	5% Trimmed Mean		17.89				
	Median		13.00				
	Variance		134.033				
	Std. Deviation		11.577				
	Minimum		4				
	Maximum		47				
	Range		43				
	Interquartile Range		19				
	Skewness		.847				
	Kurtosis		-.650				

Table 1 reveals that mathematics test score is significantly different from a normal distribution; K-S (299) = 0.262, $p<0.05$. Hence the distribution is not a normal distribution. The table further reveals that the skewness value (0.847) is greater than 0. Therefore the distribution is positively skewed. While the Kurtosis value is less than 1; therefore distribution is largely spread and not peaked at all. This is also supported by the large standard deviation value (11.577). However the minimum value (4) and the maximum value (47) indicates the presence of outliers in the distribution. To further explain the state of the distribution, Q-Q normality plot and histogram were used.

Fig 1



The Q-Q plot reveals that the score did not cleave with the diagonal towards the tail end. This implies that the distribution deviated from normality.

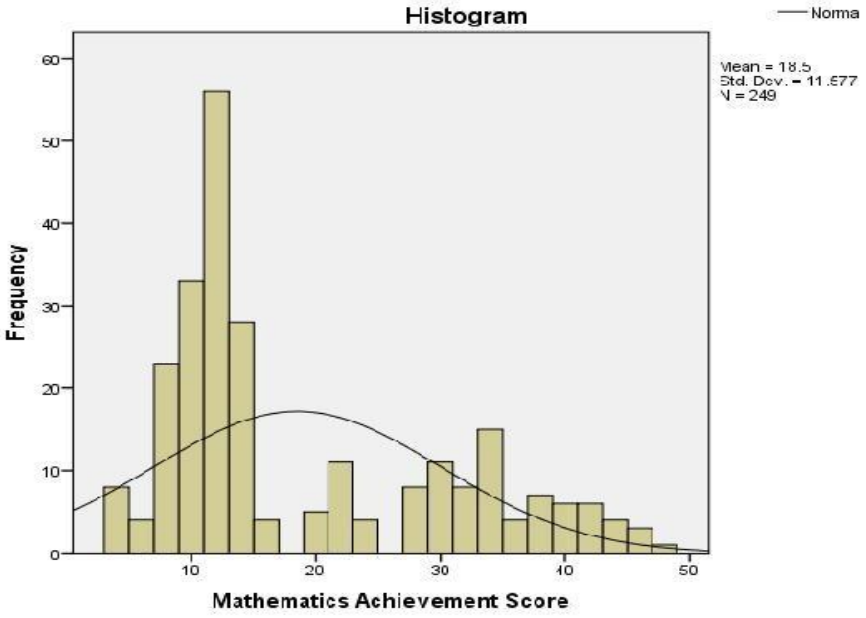


Fig 2: Histogram showing distribution of Mathematics Achievement Scores

The histogram also reveals that the distribution is not peaked and negatively skewed due large standard deviation score.
Since the distribution is not normal, it can lead to bias, type I and II error as well as error in interpretation of test score. The researcher is interested in finding out variables that contributes to the large variation in the distribution apart from systematic error. Therefore a question was raised;

Research question 2
Would there be any significant differences in the mathematics achievement test mean score of students with varying achievement motivation level?

Table 2: t-test summary showing differences in the mathematics scores of students with varying achievement motivation level

	Achievement motivation level	**N**	**Mean**	**Std. Dev**	**Df**	**t**	**Sig**	**P**
Mathematics Achievement test score	Low	135	17.60	11.745	297	- 1.334	.183	>0.05
	High	114	19.56	11.335				

Table 2 shows that there is no significant difference in the mathematics achievement test mean score of students with varying achievement motivation level ;$t(297)= -1.334$, $p>0.05$. Therefore students' achievement motivation scores did not contribute to variation in mathematics test scores.

Research question 3
Would there be any significant differences in the mathematics achievement test mean score of students based on teacher subject mastery?

Table 3: t-test showing differences in the mathematics scores of students based on teacher subject mastery.

	Teacher subject mastery	**N**	**Mean**	**Std. Dev**	**Df**	**T**	**Sig**	**P**
Mathematics Achievement test score	Low	247	18.58	11.585	297	1.289	.199	>0.05
	High	2	8.00	.000				

Table 3 shows that there is no significant difference in the mathematics test score of students based on teacher subject mastery; $t (297)= 1.289$, $p>0.05$. Therefore teacher subject mastery score does not contribute to variation in mathematics test score. Although the difference in the standard deviation of mathematics test scores

of students who believe that their teachers subject mastery is low (mean= 18.58 and standard deviation = 11.585) and those that belief is high is (mean= 8 and standard deviation = .000) extremely vary. This however can justify the presence of outliers in the distribution.

Research Question 4:
Would there be any significant difference in the mathematics achievement test mean score of students based on study habit level?

Table 4: t-test showing differences in the mathematics scores of students based on study habit level.

	Study habit	**N**	**Mean**	**Std. Dev**	**Df**	**t**	**Sig**	**P**
Mathematics Achievement test score	Low	244	18.09	11.326	297	-4.042	.000	<0.01
	High	5	38.60	1.342				

Table 4 shows that there is a significant difference in the mathematics test scores of students based on study habit; t(297)= -4.042, p<0.01. The result further shows that students with high (mean= 38.60 and std.dev= 1.342) study habit display higher mathematics test score than those with low study habit (mean= 18.09 and std.dev= 11.326). Size of effect (η^2= 0.062) reveals that study habit accounts for 6.2% variance in students mathematics test score. That is, study habit had moderate effect on the rate of change in students mathematics test score. However, the table further shows that the smaller the standard deviation the closer the distribution to normality but the larger the standard deviation the farther to normality and the higher the skewness. This implies that low study habit contributes to non-normal distribution of mathematics test scores.

Research question 5
Would there be any significant differences in the mathematics achievement test mean score of students based on attitude towards learning mathematics?

Table 5: t-test showing differences in the mathematics score of students based on attitude towards leaning mathematics.

	Attitude towards math	**N**	**Mean**	**Std. Dev**	**Std. Error**	**Df**	**t**	**Sig**	**P**
Mathematics Achievement test score	Negative	8	9.75	1.165	.412	297	-2.18	.030	<0.05
	Positive	241	18.79	11.654	.751				

Table 5 shows that there is a significant difference in the mathematics test score of students based on their attitude towards learning mathematics; t(297)= -2.189, p<0.05. The result further shows that students with positive attitude towards learning mathematics (mean= 18.79 and std.dev=11.654) display higher mathematics test score tendency than those with negative attitude (mean= 9.75 and std.dev= 1.165). Size of effect (η^2= 0.019) shows that attitude towards learning mathematics accounts for 1.9% variance in students mathematics test score. That is, attitude towards learning mathematics had small effect on the rate of change in students mathematics test score. However, the table further shows that the smaller the standard deviation the closer the distribution to normality but the larger the standard deviation the farther to normality and the higher the skewness. From the standard error of students with positive attitude (std.dev= .751) shows that among the mathematics test score of students with positive attitude there are large numbers of outliers. This implies that students who claimed to have positive attitude towards mathematics learning contributes to non-normal distribution of mathematics test scores.

Research question 6
Would there be any difference in the distribution of a transformed data and a non-transformed data.

Table 6: showing Normality difference between transformed and non-transformed test score

Non transformed mathematics test score		Transformed mathematics test score	
Mean	18.50	Mean	1.2171
St.Dev	11.577	St.Dev	0.25130
Skewness	.847	Skewness	.192
Kurtosis	.650	Kurtosis	.910
Minimum	4	Minimum	.70
Maximum	47	Maximum	1.68

Table 6 shows that after transformation the mathematics test score distribution became relatively normal compared to when it was non-normal. Kurtosis value increased to -.910 which is closer to 1 than .650. Skewness value reduced to .192 instead of .847. The rate of deviation from normality reduced as standard deviation fell from 11.577 to 0.251. The degree of the presence of outliers also reduced from (minimum= 4 and maximum = 47) to (minimum = 0.70 and maximum = 1.68). To further reveal the differences in the transformed and non-transformed mathematics test score the histogram and Q-Q plot of normality was employed.

The Q-Q normality plot reveals that the transformed mathematics test score is relatively normal compared to the untransformed test score. To further understand the test score that best fit the normality curve. The histogram graph was drawn.

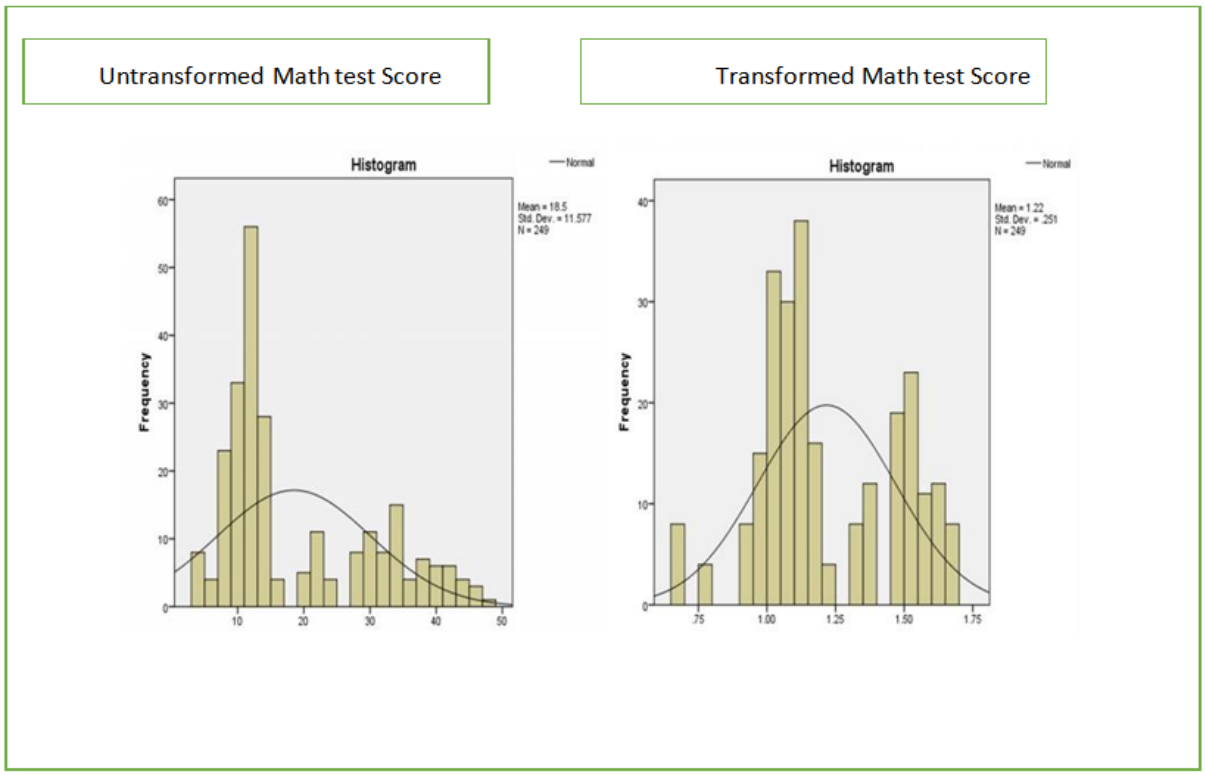


Fig 3: Untransformed and Transformed Math Test Score

The histograms show that transformed mathematics test score displayed relative normality with mean score= 1.22 and Std.dev= 0.251 than the untransformed mathematics test score with mean score = 18.5 and Std.dev = 11.577.

IV. Discussion of the Findings

The result in table 3 showedthat mathematics test score is significantly different from a normal distribution. Hence the distribution is not a normal distribution. The table further reveals that the skewness value (0.847) is greater than 0. Therefore the distribution is positively skewed. To further explain the state of the distribution normal q-q plot and histogram were used. The Q-Q plot reveals that the score did not cleave with

the diagonal towards the tail end. This implied that the distribution deviated from normality and also the histogram revealed that the distribution is not peaked and negatively skewed due large standard deviation score.

The finding of this study is in line with other research studies e.g. Lord (1955) reviewed the skewness and kurtosis of 48 aptitude, admissions, and certification tests. He found that test score distributions were generally negatively skewed and platykurtic. Cook (1959) replicated Lord's analysis with 50 classroom tests. Micceri (1989) gathered 440 distributions, 176 of these from large-scale educational tests, and he described 29% of the 440 as moderately asymmetric and 31% of the 440 as extremely asymmetric. He also observed that all 440 of his distributions were non-normal as indicated by repeated application of the Kolmogorov-Smirnov test (p<.01).

The result in table 4 showed that there was no significant difference in the mathematics achievement test mean scores of students with varying achievement motivation level. Therefore students' achievement motivation scores do not contribute to variation in mathematics test scores.The result of this study collaborated with Deci et al. (1999) meta-analyzed 128 studies that documented the effects of extrinsic rewards on intrinsic motivation represented by free-choice behavior and self-reported interest in the activity or task. The authors found that the use of extrinsic rewards significantly affected free-choice behavior, with an effect size of -0.24. There was no significant effect on students' self-reported interest. Thus, when students received extrinsic rewards in exchange for task participation, they were less likely to persist in the task once the reward conditions were removed, although their levels of self-reported interest did not decline.

However, the finding of this study opposed some studies which have found that academic motivation could be significant in influencing academic achievement of students. Boggiano, Shields, Barrett, Kellam, Thompson, Simons, & Katz, (1992) revealed that achievement motivation positively influenced academic performance. It was found that motivational orientation predicted children's standardized achievement scores that children with an intrinsic motivation orientation had higher reading and math scores and higher overall achievement scores compared to their extrinsic counterparts. (Sikwari 2014) also discovered a significant correlation between academic achievement and motivation and that motivation has impact on academic achievement of secondary school students in mathematics with respect to gender. Tella (2007) also found out that highly motivated students performed better academically than lowly motivated students and females are highly motivated compared to their male counterparts (Sikhwari 2014).

The result in table 5 showed that there was no significant difference in the mathematics test scores of students based on teacher subject mastery. Therefore teacher subject mastery score does not contribute to variation in mathematics test score. Although the difference in the standard deviation of mathematics test scores of students who believe that their teachers subject mastery is low (mean= 18.58 and standard deviation = 11.585) and those that belief is high is (mean= 8 and standard deviation = .000) extremely vary. This however can justify the presence of outliers in the distribution.

This study supported the findings of Glazerman, Mayer, and Decker (2006) that found out that having no preparation to teach (i.e., not having a college degree in math education, math teaching certification, or math teaching experience) did not prevent teachers from contributing positively to mathematics achievement of their students. In fact, it was observed that TFA teachers tended to produce significantly higher student test scores than the other teachers in the same schools – not just certified novice teachers but also certified veteran teachers and concluded that the salient factors of teachers' success in teaching are high academic records in any field of study, motivation, and enthusiasm to teach. Bankov, Mikova, and Smith (2006) in their investigation in Bulgaria using HLM to analyze TIMSS 2003 data for eighth grade math and science, this research suggested that having a teacher who had a major or main area of study in the subject taught was not associated with greater math or science achievement. Unexpectedly, students who had a life-science teacher with a degree in biology tend to have lower scores on the life-science assessment than students whose teachers did not have a degree in biology.

However, the finding of this study is inconsistent with some studies which have found that teacher subject mastery could be significant in influencing academic achievement of students. Darling- Hammond (2000) examined a study conducted in 1999 by Los Angeles County Office of Education on elementary student reading achievement and found that across all income levels, students' reading achievement was strongly related to the proportions of fully trained and certified teachers, much more so than to the proportion of new teachers in the school. The study concluded that differences in students' test scores was a teacher training issue and not due to new teachers' lack of classroom experience. Also using the data from NAEP 2000 for eighth-grade math, Greenberg, Rhodes, Ye, and Stancavage (2004) investigated the relationship between teacher qualifications (i.e., certification,academicmajor or minor, highest degree, total teaching experience and experience teaching mathematics) and student achievement and conclude that that teaching certification was positively associated with higher math achievement.

The result in table 6 showed that there was a significant difference in the mathematics test score of students based on study habit. The result further shows that students with high (mean= 38.60 and std.dev= 1.342) study habit display higher mathematics test score than those with low study habit (mean= 18.09 and

std.dev= 11.326). Size of effect (ŋ2= 0.062) reveals that study habit accounted for 6.2% variance in students mathematics test scores.

This study corroborated with the findings of Osa-Edoh and Alutu (2012) which examined the usefulness of inculcating in the students study habit as a means of enhancing their academic performance showed a high correlation between study habit and students' academic performance in secondary schools. Similarly, Nuthana and Yenagi (2009) found significant correlation between study habit and academic achievement. It further revealed that reading and note taking habits, habits of concentration, and preparation for examination had significant correlation with academic performance. Nonis and Hudson (2010) also conducted a study on performance of college students-impact of study time and study habit in which they found that some study habit had a positive direct relationship on student performance but others had a negative direct relationship.

V. Recommendations

Based on the findings of this study, it can be recommended that:
Counseling centers should be put in place in all secondary schools to help the students build and develop a strong study habit and positive attitude an interest towards mathematics.

Academic counselors should organize time to time guidance programmes such as workshops, symposia and public lectures for secondary school students to equipped them with the needed study skills and techniques to enhance their study skills and performance.

Teachers and educators should help the students develop positive attitude and interest towards school subjects especially in mathematics by studying the students in knowing the teaching method that improves their performance and impacting the knowledge to the students with the best teaching method.

Research analysts and test assessors should always endeavour to transform the data collected before analyzing it to avoid asymmetric data and make data transformation a routine data cleaning process.

Students should know the effect of their negative attitude and poor study habit towards mathematics and its advance effect on their academic performance and the importance of the improving their study habit and show a great interest in mathematics in order to performance in mathematics.

Various examination bodies should know the causes of students' academic failure and how they can carefully handle students' scores and also endeavor to transform the scores obtained from student test and know ways of normalizing asymmetric scores in having normally distributed scores to avoid asymmetric data and mostly important reduce failure rate.

The society at large should create awareness and provide enlightening programmes on the importance of mathematics in developing the society at large and how efforts can be made by the society to provide the need to improve mathematics achievement among secondary students in order to meet the needs for mathematics and science of the world in this twenty-first century.

VI. Conclusion

The study investigates the normalization of directional and fluctuating asymmetric data of mathematics achievement test and other psychological indices. It was found out and concluded that students' attitude towards mathematics and study habit are significant predicators of students' mathematics achievement scores while students' achievement motivation and perceived teachers subject mastery are not significant predictors of students' mathematics test scores. It was also concluded that transformation of mathematics test score distribution became relatively normal compared to when it was non-normal and not transformed.

References

[1]. Abu-Hilal, M. M. 2000. A structural model of attitudes toward school subjects, academic aspirations, and achievement. Educational Psychology, 20, 75–84.
[2]. Akinsola, M.K. 2011. Mastery Learning, Cooperative Mastery Learning Strategies and Students'achievement in Integrated Science.Retrieved from http://scholar.google.com/scholar?q=mastery +learning+cooperative+mastery on 12/06/2016.
[3]. Angoff, W. H. 1984. Scales, Norms, and Equivalent Scores. Princeton, NJ: Educational Testing Service.
[4]. Aremu, A. O. &Sokan, B. O. 2003.A Multi-Causal Evaluation of Academic Performance of Nigerian learners: Issues and implications for national development.Department of Guidance of Counselling, University of Ibadan, Ibadan.
[5]. Bankov, K., Mikova, D., & Smith, T. M. 2006. School quality and equity in central and eastern Europe: Assessing between-school variation in educational resources and mathematics and science achievement in bulgaria. Prospects, 36 (4), 448-473.
[6]. Beaton, A. E. 1998. Comparing cross-national student performance on TIMSS using different test items.International Journal of Educational Research, 29, 529-542.
[7]. Beaton, A., Mullis, I., Martin, M., Gonzalez, E., Kelly, D., & Smith, T.1996b. Mathematics achievement in the middle school years. Chestnut Hill, MA: Boston College.
[8]. Boggiano, A. K., Shields, A., Barrett, M., Kellam, T., Thompson, E., Simons, J., & Katz, P. 1992. Helpless deficits in students: The role of motivational orientation.Motivation and Emotion, 16, 3, 271-296.

[9]. Bolaji, C. 2005: A study of factors influencing students' attitude towards mathematics in the Junior Secondary Schools; Mathematics teaching in Nigeria. Retrieved on March2016 from http://www2.ncsu.edu/ncsu/aern/bolajim.html.
[10]. Darling-Hammond, L. 2000. How teacher education matters. Journal of Teacher Education, 51 (3), 166-173.
[11]. Deci, E. L., Koestner, R., & Ryan, R. M. 1999.A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation.Psychological Bulletin, 125(6), 627–668.
[12]. Elekwa, U.C.C. 2010. Effects of collaborative teaching/learning strategies on the mathematics
[13]. Friedman, M. 1937. The use of rankS to avoid the assumption of normality implicit in the analysis of variance.Journal of theAmerican Statistical Association, 32(200), 675-701.
[14]. Glazerman, S., Mayer, D., & Decker, P. 2006. Alternative routers to teaching: the impacts of teach for America on student achievement and other outcomes. Journal of Policy Analysis and Management, 25 (1), 75-96.
[15]. Graham, J.H.; Raz, S.; Hel-Or, H.;&Nevo, E. 2010. Fluctuating asymmetry: Methods, theory, and applications. Symmetry.2, 466–540.
[16]. Greenberg, E., Rhodes, D., Ye, X., &Stancavage, F. 2004.Prepared to teach: Teacher preparation and student achievement in eighth-grade mathematics: American Institutes for Research. Paper presented at AERA 2004, San Diego, CA.
[17]. House, J. D. 2006. Mathematics beliefs and achievement of elementary school students in Japan and the United States: Results from the third international mathematics and science study, The Journal of Genetic Psychology, 2006, 167 (1), 31–45.
[18]. Ihendinihu, U.E. 2008.Effects of Guided Scoring Instructional Strategy on the performance of secondary school students in mathematics in Abia state. Unpublished M.ED Dissertation submitted to the faculty of education, Abia- state University Uturu
[19]. Iji, C. O. 2005.Effect of logo and basic Programming on the Achievement and Retention in Geometry of Junior Secondary School Students.Journal of Mathematical Association of Nigeria
[20]. Iji, C.O. 2008. Reforming School Mathematics Curriculum in line with global challenges.Proceedings of the 49th Annual Conference of STAN.pp226- 230.
[21]. Kahn M.J. 2001.Changing science and mathematics achievement: Reflection on policy and planning.Perspectives in Education, 19(3): 169-176.
[22]. Lord, F. M. 1955. A survey of observed test-score distributions with respect to skewness and kurtosis. Educational and Psychological Measurement, 15, 383-389.
[23]. Ma, X., &Kishor, N. 1997. Assessing the Relationship Between Attitude Toward Mathematics and Achievement in Mathematics: A Meta-Analysis. Journal for Research in Mathematics Education, 28 (1), 26-47.
[24]. MandrekarJN, Mandrekar SJ, Cha SS. 2006. An Intuitive Simulation Based Approach for Assessing Symmetry. Journal of Statistics and Applications. 1(1):113-120.
[25]. Micerri, T. 1989. The unicorn, the normal curve, and other improbable creatures.Psychological Bulletin, 105, 156-166.
[26]. Mikulski B. A 2001.Amendment to the Elementary and Secondary Education Act.From< http://mikulski. senate.gov/press/01/05/2001509952.htmls (Retrieved June 20, 2016).
[27]. National Center for Educational Statistics. 2003. NAEP Report. Washington, DC: U.S. Department of Education.
[28]. National Mathematical Centre. 2009. Revamping Mathematics Teaching and Learning at secondary schools. Abuja, Nigeria.
[29]. Nonis, S. and Hudson, G. 2006. Academic performance of college students: Influence of time spent studying and working. Journal of Education for Business, January/February 151-159.
[30]. Nuthana, P.G., and Yenagi, G.V. 2009. "Influence of study habits, self-concept on academicachievement of boys and girls". Karnataka Journal of Agriculture science, 22 (5), 1 135-1 138.
[31]. Ojose B 2011. Mathematics literacy: Are we able to put the mathematics we learn into everyday use? Journal of Mathematics Education, 4(1):89-100.
[32]. Olunloye, O. 2010. Mass Failure in Mathematics: A National Disaster.Tribune of 07/02/2016.retrieved from http/www.tribune.com.ng on 08/05/2011.
[33]. Osa-Edoh G. I. & A.N.G. Alutu.2012. A Survey of Students Study Habits in Selected Secondary Schools: Implication for Counselling. Current Research Journal of Social Sciences 4(3): 228-234
[34]. Osborne, J. W. 2002. Normalizing data transformations.ERIC Digest, ED470204. Available online: www.eric.ed.gov
[35]. Owusu-Darko. I. 2011. Application of Generalized Estimating Equation Model on Students Academic Performance.A Case Study of final Year Students at Knust.
[36]. Pandor .N . 2006. Not Yet Where We Want To Be. Address by the Minister of Education on the Release of the 2006 Senior Certificate Examination Results. Cape Town: Parliament, 26 December 2006.
[37]. Ryan G. S. 2012. Development and Validation of an Instrument to Assess Precollege Arabic Speaking Students' Attitudes toward Science.M.ScThesis.University of Illinois at Urbana-Champaign, Urbana, Illinois.
[38]. Sakia, R. M. 1992. The Box-Cox transformation technique: A review. The statistician, 41, 169-178.
[39]. Salmon, M .F. 2005. Teachers identification of the difficulty Levels of topics in the primary school mathematics curriculum in Kwara state. ABACUSl(30): 20-29.
[40]. Sawilowsky, S., & Blair, R. C. 1992.A more realistic look at the robustness and Type II error properties of the t.test to departures from population normality. Psychological Bulletin, 111(2), 352-360.
[41]. Schneider B. & Coleman J. 1993.Parents, Their Children, and Schools: An Introduction. In: Schneider Barbara. Parents, Their Children, and Schools. Boulder, CO: Westview; pp. 1–12.
[42]. Sikhwari T.D 2014: A study of the Relationship between Motivation Self- Concept and Academic Achievement of Students at a University of Limpopo Province, South Africa. International Journal of Educational Science6(1) 19-25.
[43]. Steen L A (Ed.) 2001. Mathematics and Democracy: The Case for Quantitative Literacy. New Jersey: The Woodrow Wilson National Fellowship Foundation.
[44]. Tella A. 2007. The impact of motivation on students' academic achievement and learning outcomes in mathematics among secondary school students in Nigeria. Eurasia Journal of Mathematics, Science and Technology Education3(2): 149-55
[45]. Tella A. 2008. Teacher variables as predictors of academic achievement of primary school pupils mathematics. International Electronic Journal of ElementaryEducation, 1(1): 17-33.
[46]. Uhumuavbi, P.O. &Umoru, G.E. 2005. Relationship between Interest in Mathematics and Science Among Polytechnic Students - A Case Study of Auchi Polytechnic. Nigerian Journal of Professional Teacher 1 (1), 71-76.
[47]. Uwadiae, I. 2010. WAEC Releases may/June WASSCE Results.Thisday newspaper of 20/08/2010. Retrieved from allafrica.com.nigeria.nig on 06/05/2011 in Psychology, 87,49-79 in R. Zan and P. Martino, "Attitude toward mathematics: overcoming the positive/negative dichotomy," in Beliefs and Mathematics.
[48]. Van Dogen, S. 2006. Fluctuating asymmetry and developmental instability in evolutionary biology: Past, present and future.J. Evol. Biol.19, 1727–1743.

[49]. West African Examination Council 2010.Chief Examiner's Reports. May/June SSCE, Lagos: WAEC Publication.
[50]. West African Examination Council.2005. Mathematics Maths Objective/Theory Essay Expo Answers SSCE WASSCE Objectives.

Taiwo A.K. "Normalizing Fluctuating and Directional Asymmetric Data of Mathematics Achievement and Some Psychological Indices among Secondary School Students in Ogun State, Nigeria." *IOSR Journal of Research & Method in Education (IOSR-JRME)*, 10(3), (2020): pp. 51-61.