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FACTORS AFFECTING STUDENT'S PERFORMANCE IN MATHEMATICS: FACTOR ANALYSIS APPROACH

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ABSTRACT

Performance in Mathematics by students has been observed to be poor persistently. This paper sought to investigate the factors affecting student performance in mathematics and to establish the strategies that can be adopted to improve performance in Mathematics by students in school of environmental, Federal polytechnic Bauchi. The study is to determine the basic factors that affect student's performance in Mathematics. Descriptive survey research design was adopted for the study. The target population was all students taking Mathematics courses in School of Environmental. Stratified random sampling was adopted to select 200 respondents which comprised students from Architecture, Quantity survey, Building Technology, Estate Management and Surveying Geo-informatics. The data for the research was collected by use of questionnaires. The results revealed that ten items were retained and were categorized under four different categories which are Attitude, Role of lecturer, Peers and Interest. Improving on these factors and sensitization of the practices which prohibit student's effective participation in learning Mathematics could improve performance in Mathematics. It is anticipated that the findings of this study will give curriculum developers new insights into emerging issues on performance and influence the student and lecturer. Students are also expected to benefit from the findings; because improved Mathematics performance will give them good opportunities in confronting future challenges.

Keywords: Mathematics, Performance, Scree Plot, Factor Analysis.

INTRODUCTION

As soon as children begin talking, parents begin teaching their children to recite the ABCs and count from 1 to 10. Even at an early age, parents realize the importance of teaching their children the basics of reading mathematics before they enter school (Sheldon &

Epstein, 2009). Sheldon and Epstein stated, "In every school across the country, students are taught and expected to learn mathematics beginning with number recognition in kindergarten. For Africa, many problems for students begin before they even enter school (Education Trust, 2008). Many children enter school with little knowledge. They come from homes in which the parents are uneducated, often cannot speak English, and possibly struggling economically. These students are entering school already at a disadvantage (Education Trust). Mathematics often becomes a subject area that countless students will have difficulties and problems mastering. Students need to be encouraged to acquire, and be provided with, the necessary academic skills to enter math and science related professions (Cavanaugh, 2007b). Mastering mathematics has become more important than ever before in the world. Students with a strong background in mathematics have an advantage over those students who struggle when competing in the job market. In the job market, workers who have a strong mathematics and science background are more likely to be employed and earn more than those with lower achievement even if they have not gone to college (Department of Education, 1997). To compete in our 21st century global economy, it is critical that students leave high school knowledgeable and proficient in mathematics.

Today's graduates need to have solid mathematics skills regardless of whether they enter the workforce or continue into higher education (USDOE, 2008b).President Bush's National Mathematics Advisory Panel, convened in 2006; stated America's math education system is broken and must be fixed. Schools must find ways to improve instruction and provide students with rich experiences in mathematics as they progress through the school system (Newton, 2007). To produce a generation of students who can compete globally will require schools to prioritize the effective teaching of mathematics (Brown. & Center for Comprehensive School Reform and Improvement, 2009). If not, then students are likely to repeat the cycle of poor learning experiences, inadequate foundational knowledge and skills, and weak educational outcomes in mathematics (Newton). One factor that may affect a student's ability to succeed academically has been associated with low self- efficacy and lack of motivation (Margolis & McCabe, 2006). Low self-efficacy causes motivational problems that hinder academic achievement. Margolis and McCabe stated, "It is not surprising that many struggling learners have low self-efficacy for academics. They believed they lack the ability to succeed" (p. 218). Therefore, students will avoid academics and give up quickly when faced with difficulties. Other possible factors that may affect student achievement are socioeconomic status conditions and ineffective instructional strategies (Colvin, 2003). Colvin stated, "The link between socioeconomic status and academic achievement in the United States is among the strongest in the world" (p. 14). A

statistical study done in Texas found that if economically disadvantaged students were lucky enough to have five consecutive above average teachers in term of effectiveness, the tight link between socioeconomics and academic achievement could be broken (Colvin). Too many students today are not learning the mathematics they will need to be successful outside the classroom. In many instances, students do not have the opportunity to learn significant mathematics.

In others word, students lack the commitment or are not engaged in learning due to ineffective instruction or curriculum (National Council of Teachers of Mathematics [NCTM], 2000). Mathematical skills are a lifelong necessity. It is unclear what innovations, strategies or factors have the most impact on student achievement in mathematics on the TAKS test. Prevention and intervention programs are essential to support at-risk students. The overwhelming majority of school and district leaders do not know how to help teachers better prepare students to succeed in mathematics (Wagner, 2003). The implementation of NCLB has impacted how school districts are judged. The new law fundamentally redefines what it takes to be a successful school system, and district leaders would be wise to begin taking steps now to meet the new demands (Jerald & Haycock, 2002). Schools will no longer be judged as successful unless all students regardless of race or socioeconomic status can be taught successfully.

MATERIAL AND METHOD

This study sought to identify factors affecting student performance in mathematics in school of environmental at the federal polytechnic Bauchi. The target population was 200 respondents which comprised of Architecture, Quantity survey, Building technology, Estate management and Surveying geoformatic. The data for the research was collected by the use of questionnaires which student were randomly selected using the stratified sampling method across the six department tin the polytechnic. The questionnaire was adopted from Radzil (1997) 30 statements written to reflect on mathematics beliefs and motive. This statement was measure using the Likert scale by assigned scores 1= strongly disagree to 5= strongly agree.

Factor Analysis

The major purpose of factor analysis is the orderly simplification of a large number of inter-correlated measures to a few representative constructs or factors. Factor analysis is based on the assumption that all variables correlate to some degree. Consequently, those variables that share similar underlying dimensions should be highly correlated, and those

variables that measures dissimilar dimensions should yield low correlations. These high/low correlation coefficients will become apparent in the correlation matrix because they form clusters indicating that variables "hang" together. The primary role of factor analysis is to identify these clusters of high inter-correlations as independent factors.

RESULT

Analysis of data was carried out using SPSS v21. Response was subjected to factor analysis using principal component method of extraction. From the result obtained in table 1 below, the Kaiser-Meyer-Olking Measure of Sampling Adequacy is recorded at 0.789 (<0.000) provided an acceptable adequacy of using factor analysis. (KMO) statistics should be greater than (0.600) is used for assessing sampling adequacy and evaluates the correlations and partial correlations to determine if the data are likely to coalesce on factor (i.e. some items highly correlated, some not). The Bartlett's test evaluates whether or not our correlation matrix is an identity matrix (1 on the diagonal and 0 on the off –diagonal). This result indicates that our correlation matrix (of items) is not an identity matrix the off-diagonal values of our correlation matrix are not zero; therefore the matrix is not an identity matrix. See table 1 in Appendix.

Scree Plot

This test is used to identify the optimum number of factor that can be extracted before the amount of unique variable begins to dominate the common variance structure. The purpose of factor analysis is to reduce the number of variables to a smaller number. In this study, factor analysis is used to derive the new variables which are called factors in order to give better understanding about the data. The graphical scree plot proposed by Chattel (1966) was used to reduce the number of factors from items in the instrument. Only the first ten have eigen values over 1.00, and together these explain over 60% of the total variability in the data. See figure 1 in the Appendix. This implies that a ten factor solution will probably be adequate, and data should be extracted for the four items. These items have the point at which the eigen values seem to level off.

Items with loadings of more than 1.0 and above are considered valid contributor in table 3 below presents the factor loading under four different categories. Factor 1 = Attitude, Factor 2 = Role of lecturer, Factor 3 = Peers and Factor 4 = Interest. Items 5,8,12, 14, and 25 were loaded under Factor 1. Items 3, 6, 13, 15, 19, 22, 23, and 30 were loaded under Factor 2. Items 10, 11, 16, 17, 27, and 29 were loaded under Factor 3. Items 1, 2, 4, 7, 9, 18, 20, 21, 24, 26 and 28 were loaded under Factor 4 in table 2 of the Appendix.

DISCUSSION

This study was carried out to explore the factors affecting student's performance in Mathematics (Case study, school of environmental federal poly Bauchi). See Appendix, from table 3, results suggest that ten of the items were retained and were categorized under four different categories which are Attitude, Role of lecturer, Peers and Interest. The first factor (Attitude) comprised question 5 and 8 items and question 3 and 6 items were categorized under Factor 2 (Role of lecture). As in Factor 3 (Peers), 10 items were included. Question 1, 2, 4, 7, and 9 items were categorized under Factor 4 (Interest). These four factors contributed to student performances.

CONCLUSION/RECOMMENDATIONS

Generally, these four factors will become a very helpful indicator in discussing the important element of students' beliefs about mathematics. In the future, it will increase the performance in mathematics. The findings in this study will be beneficial to students of school of environmental in Federal Polytechnic Bauchi in order to provide a model to be used as a yardstick to solve under performance in Mathematics courses. It will also give in depth understanding to the underlying problem in learning Mathematics, and consequently will improve Mathematics performance and achievement in the near future, not only for student in federal poly Bauchi but for students in higher institutions in general.

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APPENDIX

Table1: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.789
Bartlett's Test of Sphericity	Approx. Chi-Square	1369.601
	Df	435
	Sig.	.000

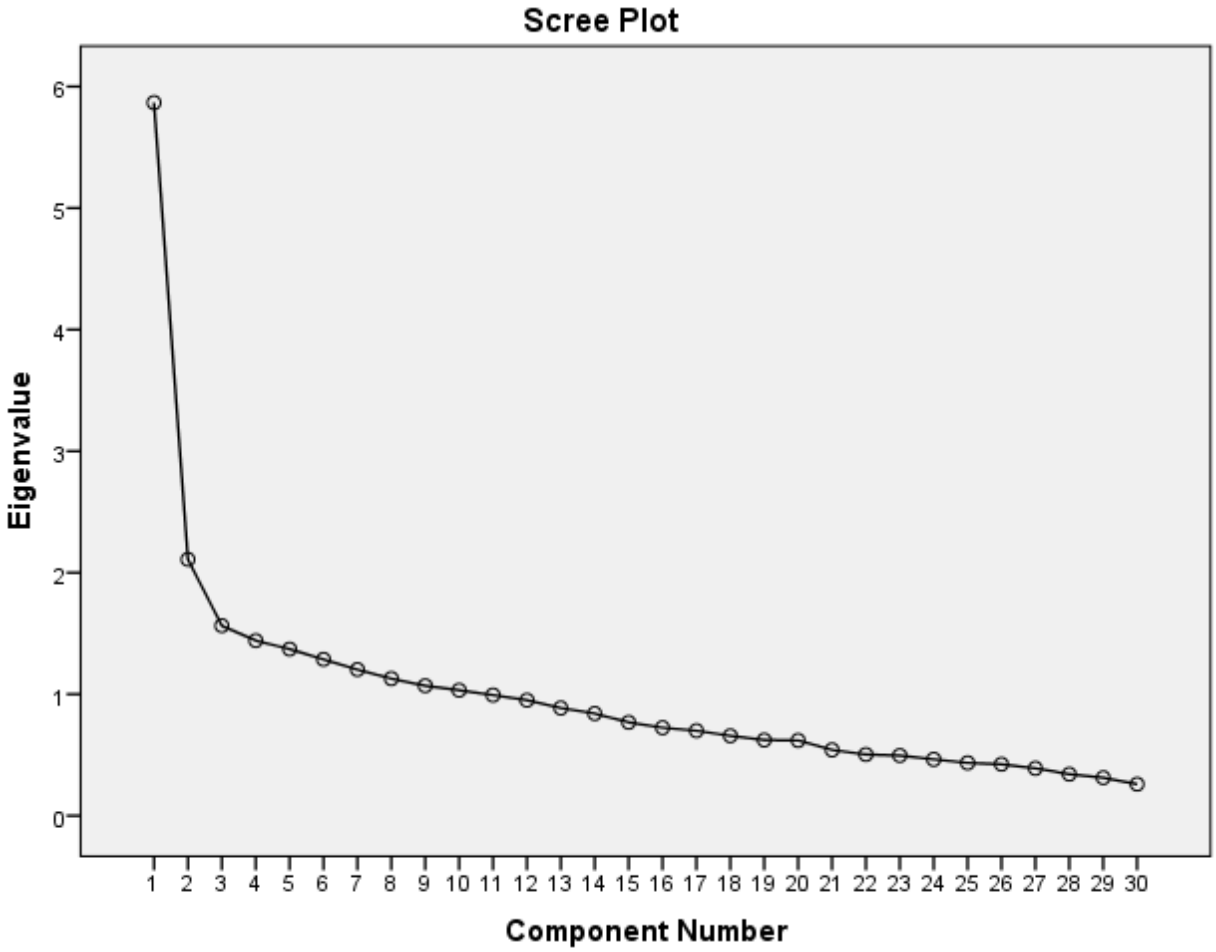

Fig 1: Scree plot Diagram Showing the Eigen values of The Items.

Table2: Detail of factor analysis showing the loading of each items

	Items	Factors			
s/n		1	2	3	4
5	I am feeling angry when answering question in mathematics.	0.620			
8	Mathematics too many number and word caused me to become confuse	0.574			
12	I always passed the mathematics test	0.577			
14	Mathematics allows me to think logically and reasonably.	0.543			
25	I feel confident to answer question in mathematics.	0.519			
3	Lecturer success to attracted and give the attention to student while teaching.		0.690		
6	It's because the lecturer is good.		0.578		
13	Lecturer are always ready to discuss with student about topic that is poorly understood		0.502		
15	Lecturer encourage student to ask question if there are problem in mathematics		0.671		
19	Sometime lecturers are not confident in teaching.		0.614		
22	Lecturer can answer all question submitted by student.		0.618		
23	Mathematics skill enables a person going into a work of professional and technical field.		0.573		
30	Normally, I like to solve mathematics problem.		0.683		
10	I always imitate my friends answer in mathematics.			0.724	
16	My friends always help me solve mathematics problem.			0.632	
29	Lecturer success to attracted and give the attention to student while teaching.			0.584	
17	The success of their peers in mathematics gives a boost to me to be more work			0.572	
11	My friends always engaged me with mathematics problem solving.			0.542	
21	I love mathematics because is useful in all others subject.				0.725
26	Mathematics test question is more difficult when compare with other subject question				0.694
20	I love mathematics.				0.636
18	Mathematics give me edge over others subject.				0.629
9	Mathematics can help me in leaning other subject.				0.628
7	Mathematics can help me to strengthen my mind.				0.616
27	I prefer mathematics than other subjects.				0.601
4	Normally, I like to solve mathematics problem.				0.575

1	I prefer mathematics than other subjects.				0.536
2	I always help other partner to resolves the problem of mathematics.				0.514
28	I always help other partner to resolves the problem of mathematics.				0.505

Table 3: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.868	19.559	19.559	5.868	19.559	19.559	3.295	10.983	10.983
2	2.109	7.030	26.589	2.109	7.030	26.589	2.800	9.335	20.318
3	1.563	5.211	31.799	1.563	5.211	31.799	1.983	6.609	26.927
4	1.441	4.804	36.603	1.441	4.804	36.603	1.707	5.689	32.616
5	1.371	4.571	41.174	1.371	4.571	41.174	1.634	5.445	38.061
6	1.287	4.289	45.463	1.287	4.289	45.463	1.480	4.933	42.994
7	1.202	4.008	49.470	1.202	4.008	49.470	1.416	4.719	47.713
8	1.128	3.761	53.231	1.128	3.761	53.231	1.314	4.380	52.093
9	1.070	3.566	56.797	1.070	3.566	56.797	1.258	4.192	56.286
10	1.033	3.442	60.239	1.033	3.442	60.239	1.186	3.953	60.239
11	.992	3.308	63.547						
12	.950	3.167	66.714						
13	.886	2.954	69.668						
14	.841	2.802	72.471						
15	.769	2.562	75.032						
16	.724	2.413	77.446						
17	.700	2.332	79.778						
18	.657	2.192	81.969						
19	.623	2.076	84.046						
20	.620	2.066	86.111						
21	.542	1.806	87.917						
22	.504	1.678	89.595						
23	.496	1.652	91.248						

24	.464	1.545	92.793						
25	.435	1.449	94.242						
26	.424	1.413	95.654						
27	.390	1.299	96.954						
28	.342	1.139	98.093						
29	.313	1.042	99.135						
30	.259	.865	100.000						

Extraction Method: Principal Component Analysis.

Reference to this paper should be made as follows: Lawal, A. S. and Nenlat R. (2015), Factors Affecting Student's Performance in Mathematics: Factor Analysis Approach. *J. of Physical Science and Innovation,* Vol. 7, No. 1, Pp. 56-64.

Biographical Notes

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Lawal Ademola S. a Principal Lecturer and an external Examiner to some Polytechnic. He had contributed to several papers published in both national and international journals. He had several papers presented in conferences.