Predicting Students' Study Habits through Attitude to Mathematical Mistakes in Alimosho Local Government Area, Lagos State.

by

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Abstract
Discoveries enhancing societal development are sometimes products of repeated mistakes turned inventions. Young students who study mathematics often face the pitfall of computational errors which may possess adverse influence on their interest in the subject. This study therefore explored the attitude of upper basic students to mistakes made during the learning of mathematics and its influence on the prospect of functional study habits capable of predicting success at current and higher levels. The cross-sectional survey involved three hundred junior secondary school students from Alimosho local government area of Lagos state and was guided by three research questions and two hypotheses. A validated and reliable questionnaire comprising of Attitude towards Mistake and Study habits inventories was engaged for data collection in the study. Findings from analysis of data gathered indicated that students' attitude towards mistakes is positive with female students' mean attitude slightly greater than male students. As well, study habits was observed to increase significantly with students' advancement in class level and a positive attitude towards mathematical mistakes. The study findings led to the recommendation that teachers of Mathematics should assist in constructive and beneficial analysis of students' mathematical mistakes to help them develop and sustain effective study habits important for immediate and future self and societal development.

Keywords: Study habits, attitude, mistakes, mathematics

Introduction

Individuals are daily faced with circumstances, concepts and situations to which a person mustrespond positively or negatively. This reaction describes the attitude of the individual to that occurrence. Attitude mayalso be regarded as a positive or negative belief held by individuals which reflects opinions or feelings and sometimes manifest in behaviour (Joseph, 2013).While several studies have been geared towards improvement of students' achievement in mathematics quite few have addressed the problem of attitude in its various facets. This could be due to the fact that mathematics assessments are often directed toward the measurement of cognitive skills acquired while affective skills attract little or no attention (Awofala, 2013). The indisputable importance of mathematical knowledge suggests that both cognitive and affective strengths are needed by learners to study the concepts within the subject.

While few studies bother on students' attitude towards mathematics, fewer research works focus on attitude to mathematical mistakes which cannot be overlooked because of the problem-solving nature of mathematics. Although researchers (Lawal, 2009;Lai, 2012;Rong&Mononen, 2022) have studied error patterns in mathematics, students' attitude towards these errors is seldom the point of focus. Since attitude is capable of reflecting within individuals' behaviour or learned tendencies to concepts the important of this investigation is hereby established.

Mathematical concepts continually evolve with development thus advancing the need for comprehension which is a basis for the study of mathematics (Rushton, 2018). The level of students' understanding of mathematical concepts and procedures is easily measured through display of accuracy and precision evident by their frequency of mathematical errors. Mathematical errors can be regarded as misunderstanding of mathematical facts, procedures or terms which are obvious in students' attempts of mathematical exercises (Carter, 2013). Every mistake made by students in mathematics should not be attributed to chance or ignorance because there is a possibility of carelessness by not paying enough attention to details or background gaps in the student's knowledge of mathematics (Lai, 2012). Errors arise due to difficulties students experience while handling mathematical problems. These could be as a result of comprehension, procedural, measurement, presentation and transformation errors (Lawal, 2009;Rong &Mononen, 2022) among others. One plausible way to handle these errors is

through students' study habits which has been documented as a good predictor of students' mathematics achievement.

Musa and Garba (2019) explain study habits as the degree to which students engage typically denotes the degree to which students engage in consistent study inclusive of appropriate routines such as reviews of material, comprehensive note taking and conducive environment. In this study, it is meant to refer to a students' habitual way or plan of studying encompassing both personal, formal (school) and informal (peers and siblings)reading. Successful implementation of study routines by students determine how well they progress and outgrow their weakness (Odiri, 2015; Okesina,2019).When students' habitual mode of study are proactive, consistent, environment friendly and health promoting, it is referred to as good study habits while actions devoid of this are bad study habits.

Odiri (2015) as well as Ebele and Olofu (2017) confirmed that study habits play a significant role in determining the quality of education and achievement of students in mathematics as students cannot grasp all the learning needed on the subject from teachers inside the class. Study habits therefore subsumes both within and without classroom learning activities in mathematics. This links up with the importance of students' attitude to mistakes whether during personal study or classroom learning processes. Ranjana and Kumar (2012) examined the influence of attitude towards Mathematics and study habit on the achievement in Mathematics at the secondary school stage and found that relationship among achievement in mathematics was most closely related with attitude towards mathematics and study habit. The regression equation obtained showed that study habit contributed more than a quarter to achievement in mathematics. This result was corroborated by Ijadunola and Lawal (2016) who also found out that study habits was the highest predictor of students' mathematics achievement when compared with age and gender of students.

Theoretical background

Piaget'stheory of Cognitive development (1952) includes four phases which are Sensori motor (from birth to two years), Preoperational (two to seven years), Concrete operational (seven to

eleven years), and Formal operational (twelve years and above). The phases are characterised by acquisition of knowledge through sensory and motor abilities, then language, perceptual images, and symbolic thought after which humans can engage in rational thinking through concrete objects and finally through abstractions and logical deductions. Piaget opined that individuals begin to adjust to their environment (human and non-human) from birth so cognition is a product of the interaction between heredity and environment. Cognitive structures change through processes known as Assimilation, Accommodation and Equilibrium.

Assimilation occurs when new objects or situations are combined or incorporated into previous knowledge or structures. When a learnerin fuses a new mathematical knowledge into an already acquired one, assimilation becomes evident. During problem solving in mathematics, students often encounter problems with varying degrees of difficulties which necessitates assimilation. Pitfalls are often woven into mathematical problems to help students learn, observe differences and acquire higher problem solving skills to achieve the objectives of mathematics education. These blocks of learning should then form *stepping stones* and not *stumbling blocks* to learning.

Accommodation is a modification of a scheme that occurs due to learners' response to new situations (von Glasersfeld, 1995). Construction of knowledge therefore thrives on previous experience and development. When a learner attempts to assimilate a new concept unsuccessfully, disequilibrium occurs. The learner there after at tains equilibrium (balance) by modifying the concept in several ways to aid its assimilation. Students are frequently faced with accommodation problems during mathematics instruction but need to be persistent so as to adequately interpret the new experience is a personal and uniquely understandable way to them as individuals. By implication, learners should be allowed to solve mathematical problems in different ways to allow for exploration (Ojose, 2008)while allowing them to make mistakes without being punished for them but to learn from their errors. This will allow mathematics instructors to identify students' mistakes in order to help low achievers or mathematically weak students (Lai, 2012).

By nature, mathematical concepts are hierarchical and cumulative, hence assimilation and accommodation are imperative in the formation of these concepts as postulated by Piaget. Thus,

constant practice and consistency in mathematical processes leads to unlearning, relearning and modification of already known concepts. Students' inability to form the concepts lead to repeated mistakes which may pave way for poor study habits, low achievement, lack of personal discoveries or lead to vices such as examination malpractice in the present and negative attitude to mathematics in the future. This could bring about career incapacitation or limited opportunities. The importance of study habits to the mathematics performance of students necessitates a study which proposes determinants of students' development of functional study habits.

A number of factors could make or mar students' study habits including frequency of mistakes during mathematical problem solving, lack of textbooks and unconducive environment. These mistakes areeither persistent or incidental deviations from the right track. Learners' attitudes to these mistakes as they solve mathematical problems can either encourage them to learn more about mathematics or resultin an abandonment of mathematics.

A credible cause of students' poor achievement in mathematics is negative attitude towards the subjectarising from repeated mistakes for which they tend to avoid mathematics(Regional Educational Laboratory Northwest, 2017). To this end, the attitude of students toward mathematical mistakes should be a major concern tostake holders in the educational sector. This makes it viable to investigate the attitude of students toward mathematical mistakes as a basis for functional study habits.

Research Questions

1. What is junior secondary school students' attitude to mathematical mistakes?
2. What is the relationship among students' class level, attitude towards mathematical mistakes and study habits?
3. What is the combined influence of attitude to mistakes and gender on students' study habits?

Hypotheses

On the basis of the stated research questions above, the following null hypotheses were formulated to guide the study:

$H_0$1: There is no significant relationship between students' class level, attitude to mistake and their study habits.

$H_0$2: There is no significant influence of attitude to mistakes and demographic variableson students' study habits.

Methodology

The study adopted a cross-sectional survey design centered on all Junior secondary school students within the Alimosho local government area of Lagos state as population. This local government was selected purposively being the most populated local government in Lagos state. Five schools were selected by simple random sampling technique after which the stratified random sampling technique with students' class as strata was used to select a sample of three hundred (300) students consisting of 146 male (48.7%) and 154 (51.5%) female students was drawn.

The instrument for data collection is a questionnaire validated by two experts with an internal consistency of 0.60.The questionnaire is sectioned into three: biodata, Attitude to Mathematical Mistakes Inventory (ATMMI) and Study habits. The ATMMI was adapted from Leighton (2015)while the Study habits inventory was adopted from Charles-Ogan and Alamina (2014) with an internal consistency of 0.80. The ATMMI is made up of 22 items set on a four-point scale of Never, Rarely, Sometimes and Always. The study habits inventory was made up of 18 items set on a similar scale with that of the ATMMI.

Data was collected manually after due permission was obtained from the schools sampled. Responses were analysed using mean, frequency, standard deviation, Pearson product moment correlation and multiple linear regression with the aid of Statistical Package for Social Sciences. All hypotheses were tested at $\alpha = 0.05$

Analysis of Data

Research question 1:What is junior secondary school students' attitude to mathematical mistakes?

Table 1: JSS Students' Attitude to Mathematical Mistakes by Gender

Gender	Mean	N	Std. Deviation
Male	62.08	146	7.30
Female	63.58	154	7.17
Total	62.84	300	7.26

Students' attitude to mathematical mistakes as presented in Table 1 shows that female students on the overall have a better attitude to mistake (m = 63.58, sd = 7.17) than male students in mathematics (m = 62.08, sd = 7.30). Generally speaking, the students have a good attitude to mistakes in mathematics (m = 62.84, sd = 7.26). This mean value translates to 71.41% of the maximum points obtainable on the ATMM inventory which is quite high.

Research question 2:What is the relationship among students' class level, attitude towards mathematical mistakes and study habits?

Table 2: Relationship among students' class level, ATMM and study habits

		CLASS	ATT TO MISTAKES	STUDY HABIT
CLASS	Pearson Correlation	1		
	Sig. (2-tailed)			
ATT TO MISTAKES	Pearson Correlation	.439**	1	
	Sig. (2-tailed)	.000		
STUDY HABIT	Pearson Correlation	.170*	.228**	1
	Sig. (2-tailed)	.012	.002	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 2 reveals the relationship among Class, and Attitude of Junior secondary school students' attitude to mathematics mistakes and study habits. Data analysis illustrates that all relationship magnitude among the variables and study habits are positive indicating progress along same direction.

The p-value for each correlation magnitude is less than 0.05 depicting statistical significance of all the relationship among the variables we therefore reject the null hypothesis and conclude that

there is a statistically significant relationship between class ATMM and study habits.

Research question 3: What is the combined influence of attitude to mistakes, classlevel and gender on students' study habits?

Table 3: Linear Regression of Class, Gender and ATMMI on Study habits

		B	Std. Error	*B*eta	T	Sig.
1	(Constant)	31.381	5.027		6.242	.000
	Gender	3.378	1.100	.189	3.070	.002
	Class	2.045	.731	.188	2.800	.006
	Attitude to Mistake	.521	.114	.422	4.566	.000

$r^2 = 0.201$, $F(4, 296) = 13.43$

The summary of regression analysis puts the Adjusted R square value at 0.201 signifying that gender and attitude to mistakes in mathematics jointly account for 20.1% of the variations observed

in students' study habits. ANOVA statistics as presented in the table reveals that the predictors class level, gender and ATMMI significantly predicts students' study habits with $F(4, 296) = 13.43$; $p = 0.000$. Thus, the null hypothesis is rejected and we conclude that the influence of attitude to mistakes and demographic variableson students' study habits is statistically significant.

The standardized coefficients show that the highest influence on students' study habits is exerted by Attitude towards mathematical mistake ($B = 0.422$) followed by Gender ($B = 0.189$). Class level comes last with$B = 0.188$

Discussion of Findings

Students' ATMMI analysis by gender showed a faintly higher value for female students than males although students' points on the inventory was adjudged as high indicating a positive attitude towards mathematical mistakes. Junior secondary school students' study habits was observed to progress as their class level advances indicating that as these students moved higher academically, their study habits increased. This could be due to their exposure to higher concepts in mathematics which leads into a more rigorous involvement in the subject.

A close observation of the relationship magnitude and direction among the variables showed significant positive progress between the variables which is reflective of how students' class

associates with their study habits in a positive manner. Similarly, ATMM was found to correlate momentously with students' study habits as well.

Predictive investigation indicate that together, the variables explain more than one-fifth of the disparity observed in students' study habits. The quantification of Beta coefficients gave a comparative view of the influence of each variable on study habits with ATMM as the highest followed by gender and lastly students' class level. This result in is consonance with Ranjana and Kumar (2012) as well as Ijadunola and Lawal (2016) It therefore appears that ATMM encourages JSS students to study hardest and leads to a better achievement in the subject. This solution to dwindling mathematical proficiency will help to develop and sustain functional study habits in students so that distractions posed by phones, social media and social vices are conquered leading to national development.

Recommendations

Upon the premise of the study findings, the following recommendations are proposed

1. Mathematics teachers rather than emphasize students' mistakes should assist in constructive analysis of students' mathematical mistakes to help them develop and sustain effective study habits important for immediate and future societal development.
2. Students should be encouraged to make attempts without fear of mistakes as this will improve their study habits and aid personal discoveries and mathematics achievement.
3. A more robust exploration of students' attitude towards mathematical mistakes and study habits should be investigated using higher class level of learners for a more comprehensive assessment of the relationship between the variables.

References

Awofala, A. O. A., Arigbabu, A. A. &Awofala, A. A. (2013). Effects of framing and team assisted individualised instructional strategies on senior secondary school students' attitudes toward mathematics, *ActaDidacticaNapocensia, 6* (1) 1-22.

Charles-Ogan, G., &Alamina, J. (2014). Students' study habits and performance in public and private schools Mathematics in Port Harcourt Area, Rivers state. *Journal of International Academic Research of Multidisciplinary Studies, 2* (7), 258 – 265.

Demir, S., Kilinc, M., &Dogan, A. (2012). The effect of curriculum for developing efficient study skills on academic achievement and studying skills of learners. *International Electronic Journal of Elementary Education, 4*(3), 427-440.

Dorko, A. (2019). Generalization, Assimilation, and Accommodation. *The Mathematics Educator, 28* (2) 33–51.

Ijadunola, K. T. &Lawal, R. F. (2016). Age, gender, study habits and students' performance in Mathematics. *Akoka Journal of Pure and Applied Science Education, 14* (1), 25 – 35.

Joseph, G. (2013). A Study on School Factors Influencing Students' Attitude towards Learning Mathematics in the Community Secondary Schools in Tanzania: The case of Bukoba Municipal Council in Kagera Region.Retrieved from http://repository.out.ac.tz/919/.

Kibrislioglu, N. (2015). An Investigation about 6th Grade Students' Attitudes towards Mathematics. *Procedia-Social and Behavioral Sciences,* 186, 64-69. https://doi.org/10.1016/j.sbspro.2015.04.024.

Lai, C. F. (2012).*Error analysis in Mathematics*. Behavioural Research and Teaching, University of Oregon.

Lawal, R. F. (2009). An Investigation into the Problems Encountered by Senior Secondary School Students in the Acquisition of Algebraic Problem Solving Skills. A Paper presented at the 5th National Conference of School of Science Education, Federal College of Education (Technical), Akoka, Lagos, May 13-16, 2009.

Leighton, J. P. (2015). Developing and validating the Attitudes towards Mistakes Inventory (ATMI): A Self-Report Measure. Paper presented at the annual meeting of the National Council on Measurement in Education (NCME), Chicago, Illinois.

Loibl, K., &Rummel, N. (2014). Knowing what you don't know makes failure productive. *Learning Instruction*, 34, 74–85.

Mendezabal, M. J. N. (2013). Study habits and attitudes: The road to academic success. *Open Science Repository Education,* DOI: 10.7392/Education.70081928.

Musa, D.C. &Garuba A., (2019). Attitude to Mathematics, Study Habit and Academic Performance of selected secondary schools in Makurdi Metropolis. *Journal of Advance Research in Mathematics and Statistics,* 6 (7).

Ojose, B. (2008). Applying Piaget's theory of cognitive development to Mathematics instruction. *The Mathematics Educator, 18* (1) 26–30

Okesina, A.F. (2019). Causes of poor study habits of students as expressed by primary school teachers in Nigeria. *MimbarSekolahDasar*,6(1)1-10 DOI: 10.17509/mimbar-sd. v6i1.15224.

Piaget, J. (1952). *The origins of intelligence in children*. International Universities Press.

Ranjana, C.&Kumar D. D. (2012). Influence of attitude towards mathematics and study habit on the achievement in Mathematics at the secondary stage. *International Journal of Engineering Research and Applications,* 2(6), 192-196.

Regional Educational Laboratory Northwest (2017). Improving students' attitudes and belief about Mathematics: A literature summary of research-based practices and Strategies.

Rong, L.&Mononen, R. (2022). Error analysis of students with mathematics learning difficulties in Tibet. *Asian Journal for Mathematics Education, 1*(1) 52 – 65.

vonGlasersfeld, E. (1995). *Radical constructivism: A way of knowing and learning*. Falmer Press