LEARNING STYLES AS DETERMINANT OF SENIOR SECONDARY SCHOOL STUDENTS ACADEMIC ACHIEVEMENT IN MATHEMATICS IN ENUGU STATE

[1]COLLENS, I. O. &[2]ADOLPHUS O. M.
[1&2]Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria
Department of Science Education
odo.collens@mouau.edu.ng, Adolphus4god@yahoo.com

Abstract
Learning styles of individuals' vary from person to person due to the presence of biological and psychological differences This study examined the learning styles as determinant of senior secondary school students' academic achievement in Mathematics in Enugu State. Four research questions were asked and four hypotheses were formulated to guide the study. The study adopted a correlational research design. The population of the study consists of 2083 senior secondary two mathematics students. A sample size of 400 mathematics students was used for this study. The sample size was determined using Yaro Yamane formula. The instruments used for data collection were questionnaire and Mathematics Achievement test. The questionnaire was titled, Mathematics Learning Style Questionnaire (MLSQ) while the achievement test was titled, Mathematics Achievement Test (MAT). The instruments were validated by three specialists. The reliabilities of the instruments were established using Cronbach alpha and Kuder Richardson (KR20) methods. Reliability indices of 0.76 and 0.88 were obtained for MLSQ and MAT respectively. Pearson's r statistics was used to answer research questions and the hypotheses were tested using converted t-test significance of simple linear correlation statistics also called t-test of correlation at 0.05 level of significance. Results of the analysis revealed among others that; a very high positive and significant relationship exist between the learning styles (visual learning style, aural learning style, read/write learning style and kinesthetic learning style) and students' academic achievement in Mathematics. Based on the findings, the researcher recommended that; teachers should find out the learning styles of their students and use appropriate instructional strategies that will appeal with the learning styles for effective teaching and learning to take place in mathematics classrooms.

Keywords: Learning styles, Academic Achievement and Mathematics

Introduction

Mathematics is the language of science and technology without which there is no meaningful societal co-existence. Mathematics is the science that deals with quantity and shapes. It is a science that deals with the logic of shape, quantity and arrangement. Osokoya (2015) described mathematics as a language of science while Adedeji (2018) argued that mathematics is not only the language of sciences, but essential

nutrient for thought, logical reasoning and progress. Mathematics liberates the mind and also gives individuals an assessment of the intellectual abilities by pointing towards direction of improvement. Adedeji concluded by saying that mathematics is the basis of all sciences and technology and therefore of all human endevaours.

The importance of mathematics in most fields of human endeavour cannot be underestimated. Its usefulness in science and technological activities as well as commerce, economics, education and even humanities is almost at par with the importance of education as a whole. Mathematics is useful virtually in all subjects because all fields of knowledge are dependent on it for solving problems and predicting outcomes (Adewale, 2008). The depth of mathematical knowledge an individual has dictates the level of accuracy of the individual's decision. This implies the fact that before an individual can function well in the society he/she must possess or have relatively good knowledge of mathematics especially in this era of technological age.

The place of mathematics in the life of any nations, according to Okereke (2016), is one which is inextricably linked with the place of development in that nation. Mathematics plays an indispensable role in realizing a nation's dream of rapid scientific and technological development. Indeed no nation that wants to develop scientifically and technologically neglects the mathematical components of her school curriculum. The Federal government of Nigeria, due to her quest for Science and Technology made mathematics a core subject in Secondary Schools of Nigeria.

Despite the importance placed on mathematics, researchers Maduabum and Odili (2006) had observed that students lack interest in the subject and perform poorly in it. Adedeji (2018), observed that mathematics is one of the most poorly taught, widely hated and abysmally understood subject in secondary schools. The performance of learners in Mathematics in the senior Secondary School Certificate Examinations (WASSCE, NECO & GCE) have not been encouraging, probably due to learning styles of the learners.

It is known that learning processes and styles vary from person to person due to the presence of biological and psychological differences. Abidin, Rezaee, Abdullah and Kiranjit (2011) points out more than three-fifths of a person's learning style is biologically imposed. Moreover, Felder and Brent (2007) state that all learners have individual attributes relating to their learning processes. Gokalp (2013) also holds that most teachers teach the way they have already learned. These might have caused the frustration of a good number of learners as they witness that their learning preferences are not accounted for by many teachers. The case is more serious in a context where learners come from diverse educational experiences and with different cultural backgrounds.

It is commonly believed that learning styles are not really concerned with "what" learners learn, but rather "how" they prefer to learn and it is also an important factor for learners' academic achievement. Learners have different strengths and preferences in the ways they take in and process information which is to say, they have different learning styles. Some prefer to work with concrete information (experimental data, facts) while other are more comfortable with abstractions

(symbolic information, theories mathematical models). A learning style is defined as the characteristics, strengths and preferences in the way people receive and process information (Felder & Brent, 2011). It refers to the fact that every person has its own method or set of strategies when learning.

Many learning style models exist in literature, such as the learning style model by Kolb (1984), Honey and Mumford (Clark, 2011), Felder and Silverman (Byrne, 2002) and Fleming (2001) (Coffiel, Moseley, Hall & Ecclestone, 2004). On learning style model, Felder and Spurlin (2005), indicated that the criterion for classifying learners is their perceptual behaviour. They make two categories: sensing and intuitive learners. 'Sensing' learners are concrete and methodical; they are good at memorising facts and doing hands-on work and are more comfortable with following rules and standard procedures. On the other hand, 'intuitive' learners tend to be abstract and imaginative; they like innovation and dislike repetition. As to the ways in which learners prefer input information to be presented, they can be either visual or verbal learners. Visual learners are those who prefer to receive in the form of pictures, diagrams, films and demonstrations while verbal learners prefer words as a medium for information transfer. Moreover, with respect to the ways of knowledge can be processed, learners can be put into two categories, namely 'active' and 'reflective'. An active learner, as suggested by the name, is someone who prefers to be actively involved in examining and employing knowledge with others. He does so in group discussions and interactions with others. Reflective learners tend to employ their introspection.

Active learners benefit the most in dialogue, role-play and team work learning activities while reflective learners are more inclined to ponder on perceived information.

Although there are different forms and models of learning styles; however, this study is geared towards assessing the different learning styles as identified by Fleming (2001) known as VARK (Visual, Aural, Read/write and Kinesthetic) learning style model. The VARK learning style is based on modalities or channels by which human expression can take place and is composed of a combination of perception and memory. VARK is derived from the accelerated learning world and seems to be about the most popular model due to its simplicity (Clark, 2011). VARK Learners use all four modalities to receive and learn new information and experiences. However, according to the VARK or modality theory, one or two of these receiving styles is normally dominant. This dominant style defines the best way for a person to learn new information by filtering what is to be learned. This style may not always be the same for some tasks. The learner may prefer one style of learning for one task, and a combination of others for a different task.

Fleming (2001) highlighted the following learning styles: Visual learning style is the learning style which focuses on watching to learn. The individuals who prefer visual learning style learn best through visual stimulation. The visual learners are able to read and understand and they study best when reading a text and using highlighters as visual stimulation that assist in remembrance (Coffiel, Moseley, Hall &Ecclestone, 2004). These learners benefit when diagrams, videos or similar visuals

are used to teach them. Auditory learning style is the style of learning through listening. Learners who prefer this learning style hear lectures; participate in discussion from which it is easy for them to understand the information better. For individuals who are auditory learners, written works are often difficult; information should therefore be sufficiently loud to be heard such that tone, pitch and sounds will aid comprehension. Individuals with Read/Write learning style prefer the use of definitions, reports, textbooks, printed hand-out, readings, manual, web pages, taking notes among others (Othman & Amiruddin, 2010). They will use the phrases such as "write them out", "let me read for you". They will perform well after reading and writing out instructions. Drago and Wagner (2004) also pointed out that read/write learners are note takers. They study better through note taking from lecture or from difficult reading materials. Kinaesthetic learning style refers to tactile learning, which is learning by doing something. The individual learns by touching, putting something together or take something apart using his hands. These learners are exploratory learners and need to move to understand the world around them (Dunn & Dunn, 2002).

Since individuals respond differently to certain situations, the preferred learning style of a learner may not always be the same for different learning tasks. The learner may prefer one style of learning for one task, and yet a combination of other styles for a different task. It is the dominant style that defines the best way for a person to learn new information which occurs by filtering what is to be learned. In support of effective learning, Clark (2011) is of the opinion that the most effective teaching methods involve a combination of all three sensory components. According to the VARK theorists, we need to present information using all three styles. This allows all learners the opportunity to become involved, no matter what their preferred style may be. Even though there are various definitions of learning style and model, which are unique and steady methods of effective learning and information processes which are widely accepted (Graf, Lin, & Kinshuk, 2008). As learning style, learning strategy also play a key role during the entire learning process. Learning style is a relatively stable trait, but allows flexibility of learning strategies, which could be changed when facing various situations or tasks.

Learners have unique ways of learning, which may greatly affect the learning process and consequently their academic achievement and its outcomes. Learners learn in many ways by seeing and hearing; reflecting and acting; reasoning logically and intuitively; memorizing and visualizing. It behoves on this study to ascertain the relationship between learning styles and students academic achievement in mathematics in Enugu education zone of Enugu State.

Against the above exposition as background, the study on which this article is based is aimed at examining the relationship between learning styles and academic achievement of Senior Secondary School students in Mathematics in Enugu Education zone of Enugu State.

The following research questions were posed to guide the study:

1. What is the extent of relationship between the visual learning style and students' achievement in Mathematics?
2. What is the extent of relationship between the aural learning style and students' achievement in Mathematics?
3. What is the extent of relationship between the read/write learning style and students' achievement in Mathematics?
4. What is the extent of relationship between the kinesthetic learning style and students' achievement in Mathematics?

Hypotheses

The following null hypotheses were formulated and were tested at 0.05 level of significance:

Ho_1 There is no significant of relationship between visual learning style and students' achievement in Mathematics.

Ho_2 There is no significant of relationship between aural learning style and students' achievement in Mathematics.

Ho_3 There is no significant of relationship between read/write learning style and students' achievement in Mathematics.

Ho_4 There is no significant of relationship between kinesthetic learning style and students' achievement in Mathematics.

Methodology

This study adopted a correlational design. This study was carried out in Enugu education zone of Enugu State. The population of the study consists of 2083 senior secondary two (SS 11) mathematics students. The sample size for this study is 400 SS II Mathematics students determined through Taro-Yamane formula. The instruments used for data collection are a questionnaire and mathematics achievement test. The questionnaire is titled: Mathematics Learning Style Questionnaire (MLSQ) was adopted by the researchers with four point likert scale of strongly agree, agree, disagree and strongly disagree and was rated by mathematics students. The items used are mainly based on Fleming (2001) VARK (Visual, Aural, Read/Write and Kinesthetic) learning style model. The achievement test is titled: Mathematics Achievement Test (MAT). The MAT consisted of 50 multiple choice items adopted from WAEC past questions. The MAT was based on Mathematics curriculum of Geometry, Algebraic process and longitude/latitude. The instruments were face and content validated and its reliability established using Cronbach alpha statistic with that yielded an index of 0.76 for the questionnaire (MLSQ) and Kuder Richardson (KR_{20}) statistics was used to establish the reliability of MAT which gave a reliability index of 0.88. The instruments were administered by the researchers using face to face method, with the assistance of four well-informed research assistants to ensure a one hundred (100) percent return of completed instrument. Research questions were answered using Pearson (r) statistic while the hypotheses were tested using converted

t-test of significance of simple linear correlation statistic thus indicated the "significance" or "non-significance" of the extent of relationship existing between the variables. The hypotheses were tested at 0.05 levels of significance. The bases for the decision for the research questions' conclusion were as follows: 0.00=no relationship, 0.01-0.19=very low relationship, 0.20-0.39=low relationship, 0.40-0.59=moderate relationship, 0.60-0.79=high relationship, 0.80-0.99=very high relationship and 1.00=perfect relationship (Uzoagulu, 2011). The acceptance or rejection of null hypotheses was based on the calculated value of the t-test of correlation coefficient "r". When the t-calculated is greater than the t-tabulated, the null hypothesis was rejected but if otherwise, the null hypothesis was accepted.

Results

Research Question One: What is the extent of relationship between the visual learning style and students' achievement in Mathematics?

Table 4.1: Pearson correlation of relationship between the visual learning style and students' achievement in Mathematics

V	n	∑XY	SS	SP	S^2	Cov.	R	Remarks
X	400	11580	8301.571		24.781			**Very High**
				9280.964		27.704	**0.81**	**Positive**
Y	400	16113	15904.330		47.476			**Relationship**

Variables (V:X&Y), Sample Size (n), Summation (∑), Sum of Squares (SS), Sum of Products (SP), Variance (S^2), Covariance (Cov.), Pearson r (r), and Remarks

Magnitude of Relationship = Very High
Direction of Relationship = Positive
Percentage Coefficient of Determination = 65.61%

Table 4.1 showed the relationship between the visual learning style and students' achievement in mathematics with a coefficient (r) index of 0.81 which is very high. This implies that there is a very high positive relationship between the visual learning style and students' achievement in Mathematics. The percentage coefficient of determination shows that 65.61% of the variations in students' achievement in Mathematics could be attributed to visual learning style.

Hypothesis One: There is no significant of relationship between visual learning style and students' achievement in Mathematics.

Table 4.2: Converted t-test of simple linear correlation of Relationship between visual learning style and students' achievement in Mathematics

V	n	∑XY	R		df	t_{cal}	t_{tab}	Decision
X	400	11580						
			0.81	0.05	398	**25.037**	1.96	**H_0 Rejected**
Y	400	16113						

Sample Size (n), Coefficient of Relationship (r), Alpha Level (α), Degree of Freedom (df) and t-test of Significance of Correlation between two Variables

Table 4.2 presented the test of the coefficient of the relationship between visual learning style and students' achievement in Mathematics. The degree of freedom is 398 and the t-calculated value of 25.037 is greater than the t-tabulated value of 1.96. Since the t-calculated value is greater than the t-tabulated value, the null hypothesis is rejected; thus concluding that there is significant relationship between visual learning style and students' achievement in Mathematics.

Research Question Two: What is the extent of relationship between the aural learning style and students' achievement in Mathematics?

Table 4.3: Pearson correlation of relationship between the aural learning style and students' achievement in Mathematics

V	n	∑XY	SS	SP	S^2	Cov.	r	Remarks
X	400	11580	8301.571		24.781			**Very High**
				9287.536		27.724	**0.83**	**Positive**
Y	400	15149	15244.497		45.506			**Relationship**

Variables (V:X&Y), Sample Size (n), Summation (∑), Sum of Squares (SS), Sum of Products (SP), Variance (S^2), Covariance (Cov.), Pearson r (r), and Remarks

Magnitude of Relationship = Very High
Direction of Relationship = Positive
Percentage Coefficient of Determination = 68.89%

Table 4.3 showed the relationship between the aural learning style and students' achievement in Mathematics. Through the sum of squares and sum of products, or through the variances and covariance, a coefficient (r) of 0.83 was realized. The coefficient shows that there is a very high positive relationship between the aural learning style and students' achievement in Mathematics. The percentage coefficient of determination shows that 68.89% of the variations in students' achievement in Mathematics could be attributed to aural learning style. The result here is that there is a very high positive relationship between the aural learning style and students' achievement in Mathematics.

Hypothesis Two: There is no significant relationship between aural learning style and students' achievement in mathematics.

Table 4.4: Converted t-test of simple linear correlation of relationship between aural learning style and students' achievement in Mathematics

V	n	∑XY	r		df	t_{cal}	t_{tab}	Decision
X	400	11580						
			0.83	0.05	398	**26.739**	1.96	**H_0 Rejected**
Y	400	15149						

Sample Size (n), Coefficient of Relationship (r), Alpha Level (α), Degree of Freedom (df) and t-test of Significance of Correlation between two Variables

Table 4.4 presented the test of the coefficient of the relationship between aural learning style and students' achievement in Mathematics. The degree of freedom is 398 and the t-calculated value of 26.739 is greater than the t-tabulated value of 1.96. Since the t-calculated value is greater than the t-tabulated value, the null hypothesis is rejected; thus concluding that there is significant relationship between aural learning style and students' achievement in Mathematics.

Research Question Three: What is the extent of relationship between the read/write learning style and students' achievement in Mathematics?

Table 4.5 Pearson correlation of relationship between the read/write learning style and students' achievement in Mathematics

V	n	∑XY	SS	SP	S^2	Cov.	r	Remarks
X	400	11580	8301.571		24.781			**Very High**
				7802.000		23.290	**0.85**	**Positive**
Y	400	12460	10133.667		45.506			**Relationship**

Variables (V:X&Y), Sample Size (n), Summation (∑), Sum of Squares (SS), Sum of Products (SP), Variance (S^2), Covariance (Cov.), Pearson r (r), and Remarks

Magnitude of Relationship = Very High
Direction of Relationship = Positive
Percentage Coefficient of Determination = 72.25%

Table 4.5 showed the relationship between the read/write learning style and students' achievement in Mathematics. Through the sum of squares and sum of products, or through the variances and covariance, a coefficient of 0.85 was realized. The coefficient shows that there is a very high positive relationship between the read/write learning style and students' achievement in Mathematics. The percentage coefficient of determination shows that 72.25% of the variations in students' achievement in Mathematics could be attributed to read/write learning style. The result here is that there is a very high positive relationship between the read/write learning style and students' achievement in Mathematics.

Hypothesis Three: There is no significant relationship between read/write learning style and students' achievement in Mathematics.

Table 4.6: Converted t-test of simple linear correlation of relationship between read/write learning style and students' achievement in Mathematics

V	n	∑XY	r		df	t_{cal}	t_{tab}	Decision
X	400	11580						
			0.85	0.05	398	**29.568**	1.96	**H_0 Rejected**
Y	400	12460						

Sample Size (n), Coefficient of Relationship (r), Alpha Level (), Degree of Freedom (df) and t-test of Significance of Correlation between two Variables

Table4.6 presented the test of the coefficient of the relationship between read/write learning style and students' achievement in Mathematics. The degree of freedom is 398 and the t-calculated value of 29.568 is greater than the t-tabulated value of 1.96. Since the t-calculated value is greater than the t-tabulated value, the null hypothesis is rejected; thus concluding that there is significant relationship between read/write learning style and students achievement in Mathematics.

Research Question Four: What is the extent of relationship between the kinesthetic learning style and students' achievement in Mathematics?

Table 4.7: Pearson correlation of relationship between the kinesthetic learning style and students' achievement in mathematics

V	n	∑XY	SS	SP	S^2	Cov.	r	Remarks
X	400	11580	8301.571		24.781			**High**
				8179.964		24.418	**0.65**	**Positive**
Y	400	16141	19346.497		57.751			**Relationship**

Variables (V:X&Y), Sample Size (n), Summation (∑), Sum of Squares (SS), Sum of Products (SP), Variance (S^2), Covariance (Cov.), Pearson r (r), and Remarks

Magnitude of Relationship = High
Direction of Relationship = Positive
Percentage Coefficient of Determination = 42.25%

Table 4.7 showed the relationship between the kinesthetic learning style and students' achievement in Mathematics. Through the sum of squares and sum of products, or through the variances and covariance, a coefficient of 0.65 was realized. The coefficient shows that there is a high positive relationship between the kinesthetic learning style and students' achievement in Mathematics. The percentage coefficient of determination shows that 42.25% of the variations in students' achievement in mathematics could be attributed to kinesthetic learning style. The result here is that there is a high positive relationship between the kinesthetic learning style and students' achievement in Mathematics.

Hypothesis Four: There is no significant of relationship between kinesthetic learning style and students' achievement in Mathematics.

Table 4.8: Converted t-test of simple linear correlation of relationship between kinesthetic learning style and students' achievement in Mathematics

V	n	∑XY	r		df	t_{cal}	t_{tab}	Decision
X	400	11580						
			0.65	0.05	398	**15.444**	1.96	**H_0 Rejected**
Y	400	16141						

Sample Size (n), Coefficient of Relationship (r), Alpha Level (), Degree of Freedom (df) and t-test of Significance of Correlation between two Variables

Table 4.8 presented the test of the coefficient of the relationship between kinesthetic learning style and students' achievement in Mathematics. The degree of freedom is 398 and the t-calculated value of 15.444 is greater than the t-tabulated value of 1.96. Since the t-calculated value is greater than the t-tabulated value, the null hypothesis is rejected; thus concluding that there is significant relationship between kinesthetic learning style and students' achievement in Mathematics.

Discussion of the Findings

The discussion of findings of this study was presented as follows:

It was revealed in this study that there is a very high positive and significant relationship between the visual learning style and students' achievement in Mathematics. This shows that there is very high tendency for visual learning style to improve students' achievement in Mathematics. This is in line with findings of Drago and Wagner (2004) who observed that visual learners are easy to be disturbed or change in focus by movements or actions, whereas noise usually does not bother them. Visual learners readily grasp ideas through the use of charts, graphs, and pictures. This finding also confirmed with Lu and Yang (2018) who revealed that a significant correlation and interaction effects exist between learning achievement and visual/verbal learning style and concentration.

It was revealed in this study that there is a very high positive and significant relationship between the aural learning style and students' achievement in Mathematics. This is in line with findings of Miller (2001) who remarked that learners with aural learning style can remember information through loud reading or mouthing when reading especially when learning new thing. In line with this finding, Bethel-Eke and Eremie (2017) study showed that a significant relationship exist between aural learning styles and academic performance of students.

The study further revealed that there is a very high positive and significant relationship between the read/write learning style and students' achievement in mathematics. This shows that there is very high tendency for read/write learning style to improve students' achievement in Mathematics. This finding is in consonance with the result of Jiraporncharoen, Angkurawaranon, Chockjamsai, Deesomchok and Euathrongchit (2015) who studied learning styles and academic achievement of

undergraduate students in Thailand and found out a positive association between the two.

The study also established that there is a high positive and significant relationship between the kinesthetic learning style and students' achievement in Mathematics. This shows that there is high tendency for kinesthetic learning style to improve students' achievement in Mathematics. This is in line with findings of Wolfman and Bates (2005) who attested to this by adding that kinesthetic learning style can increase students' learning motivation. Magulod (2018) also revealed that the students of applied sciences courses preferred kinesthetic as major learning styles while they manifest a moderate level of study habits.

Conclusion

This study examined students learning styles as determinant of academic achievement in Mathematics in Enugu education zone of Enugu State. Based on the findings accruing from this study, it was concluded that visual, aural, read/write and kinesthetic learning styles are significant associated variables with students' achievement in Mathematics. Hence, the variables are concomitant variables.

Recommendations

Based on the discussion and conclusion the following recommendations were made: 1. Teachers should find out the learning styles of their students and use appropriate instructional strategies that will concise with the learning styles for effective teaching and learning to take place in Mathematics classrooms.

2. Workshops and seminars should be organized for mathematics teachers to update their knowledge and familiarize themselves with the index of learning style questionnaire for possible use in order to identify their students' learning styles with a view to incorporate them into appropriate instructional strategy during lesson.

References

Adedeji, T. (2018). Teacher variables as predictors of academic achievement of primary school pupils mathematics. *International Electronic Journal of Elementary Education. 1*(1), 16-31.

Adewale, G. (2008). Effect of brain-storming on students' achievement in junior secondary school mathematics. An effort in making schools effective. *Journal of Sociology and Education in Africa. 7*(1), 203-218.

Abidin, M.J.Z., Rezaee, A. A., Abdullah, H.N., &Kiranjit, K.B.S. (2011). Learning styles and overall academic achievement in a specific educational system. *International Journal of Humanities and Social Science, 1*(10), 143-152

Bethel-Eke, O.A. &Eremie, M. (2017). Learning styles and academic performance of junior secondary school student in Rivers State: Implications for counselling. *International Journal of Innovative Development & Policy Studies, 5*(3), 52-61

Byrne, D. (2002). A *study of individual learning styles and educational multimedia preferences: an experiment using self-directed online learning resources*. School of Computer Applications, Dublin City University, Ireland. Available from www.computing.dcu.ie/~mfarren/educators.html

Clark, D. R. (2011). Visual, Auditory and Kinesthetic Learning Style (VAK). Retrieved Jan 8, 2013 from http://www.nwlink.com/~donclark/hrd/styles/vakt.html

Coffield, F., Moseley, D., Hall, E., &Ecclestone, K. (2004). *Learning styles and pedagogy inpost-16 learning: A systematic and critical review.* Learning and Skills Research Centre. Retrieved from http://www.lsda.org.uk/files/PDF/1543.pdf

Drago, W. A., & Wagner, R.J. (2004). VARK preferred learning styles and online education. *Management Research News, 27*(7), 1-13

Dunn, P., & Dunn, A. (2002). An approach for detecting learning styles in learning management systems based on learners' behaviors. *International Conference on Education and Management Innovation IPEDR* (30).IACSIT Press, Singapore.

Duru, V.N. (2011). *Curriculum studies, concepts, development and implementation*Owerri: Avanglobal Publications

Federal Republic of Nigeria (2013). *National policy in education;* Lagos: NERDC

Felder, R., & Brent, R. (2011). Understanding student differences.*Journal of English Education, 94*(1), 57-72

Felder, R.M. & Spurlin, J. E. (2005). Application, reliability, and validity of the index of learning styles.*Intl. J. Engr. Education, 21*(1), 103-112

Fleming, N. (2001). *Teaching and Learning* Styles: VARK strategies. New Zealand: ND Fleming

Fleming, N. (2015). The VARK modalities. Available at: www.vark-learn.com.Accessed on 1 March 2015.

Gappi, L.L. (2013). Relationships between learning style preferences and academic performance of students. *International Journal of Educational Research and Technology, 4*(2), 70-76

Gokalp, M. (2013). The effect of students' learning styles to their academic success.*Academic Journals, 8*(17), 1634-1641.

Graf, S., Lin, T., &Kinshuk, T. (2008).The relationship between learning styles & cognitive traits – Getting Additional Information for Improving Student Modeling.Comput.*Hum. Behav. 24*(2), 122-129

Honey, P., & Mumford, A. (1992). The manual of learning styles: Revised version. Maidenhead: Peter Honey

Jiraporncharoen, W., Angkurawaranon, C., Chockjamsai, M., Deesomchok, A., &Euathrongchit, J. (2015). Learning styles and academic achievement among undergraduate medical students in thailand. ***Journal of Educational Evaluation for Health Professions, 1*(1), 1-7**

Kolb, A.Y. (1984). The learning way: Meta-Cognitive aspects of experiential learning. *Simulation Gaming, 40*(3), 297-311.
Lu, T., & Yang, X. (2018). Effects of the visual/verbal learning style on concentration and achievement in mobile learning.*EURASIA Journal of Mathematics, Science and Technology Education, 14*(5), 1719-1729
Maduabum, D. & Odili, G. A. (2006). *Mathematics in Nigeria secondary schools.* A Teaching Perspective. Port-Harcourt-Rex-Charles and Patrick
Magulod, G.C. (2018). Learning styles, study habits and academic performance of filipino university students in applied science courses: implications for instruction, *Journal of Technology and Science Education, 9*(2), 184-198
Miller, P. (2001). *Learning styles: the Multimedia of the minds*: Unpublished
Okereke, S. C. (2016). Impact of familiar quantities on pupils achievement in mathematics. In Matt, A. G. Akale (Ed). *Proceedings of the 43rd Annual Conference of STAN.* 352-362.
Okigbo, E. C. & Osuafor, A. M. (2008). Effect of using mathematics laboratory in teaching mathematics on the achievement of mathematics students. *Academic Journals of Educational Research and Review 3*(8), 257-261.
Osokoya, M. M. (2015). Science education and national development in Nigeria: Trends and Issues. *African Journal of Historical Science in Education, 1*(2)
Othman, N., &Amiruddin, M. H. (2010). Different perspectives of learning styles from VARK model.*Procedia - Social and Behavioral Sciences* (Vol. 7, pp. 652-660).
Uzoagulu, A. E. (2011). *Practical guide to writing research project reports in tertiary institutions*. Enugu: Cheston publishers
Wolfman, S.A & Bates, R.A (2005). Kinesthetic learning in the classroom. *Journal of Computing Science in Colleges, 21*(1), 203 -206