

Identification Of Predominant Learning Styles Of Senior Secondary Students In Relation To Achievement In Geometry In Federal Capital Territory Abuja, Nigeria

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Abstract: This study identified students' learning styles and investigated the relationship between senior secondary students' learning styles and achievement in geometry in Federal Capital Territory Abuja, Nigeria. Correlational Survey research design was used in this study with a sample size of 589 students comprising of 306 males and 283 females. This was drawn from six out of 31 schools in AMAC, Bwari and Gwagwalada Area Councils of FCT. This sample of students was randomly and purposively drawn from selected secondary schools. The two instruments used were Index Learning Style Questionnaire (ILSQ) and Geometry Achievement Test (GAT). The reliability of GAT using Kuder- Richardson 21 formula was 0.86 and ILSQ was 0.52 using Cronbach Alpha. The Point - Biserial Correlation was used to analyze relationship between the learning styles and achievement. The learning styles relationship to achievement is at 0.74 and t-Transform is 26.73. The findings among other things were that students' geometry achievement has relationship with different learning styles. Based on the findings, it was also recommended that students should be exposed to different learning styles and be aware of their strong learning style preferences and improve on the weaker ones. And also that mathematics teachers and school administrators should be conversant with students' learning styles for proper decision making. Professional bodies like STAN and MAN should be encouraged during conferences to popularize among mathematics teachers the importance of identifying the various learning styles of students.

Keywords: Learning Styles, Achievement, Geometry

I. INTRODUCTION

Secondary education is engaged in a sustained and continuous process of maximizing the quality of its output. In less developed countries quality is always in danger due to severe resource constraints. Thus it is important for educational institutions to focus on improving the critical variables in secondary education. Effective learning strategies allow people to get requisite information and develop different

views of looking at the concepts, implement and utilize them. One area which is receiving attention is the learning styles of students.

In addressing the issues of under - achievement in geometry, an area which has not received enough attention is the learning styles of students. Learning style has been defined as the way people come to understand and remember information. It is the way in which each learner begins to concentrate on, process, and retain new and difficult

information (Ulobabova, 2004). Li (2016) explained Learning Style as the individual processes used for understanding difficult tasks. Students' learning style preference which suggests that students should be exposed to different learning styles is based on researches that some students prefer certain methods of learning to others. According to Al-Balhan (2010), an effective learning style encourages active participation of the learner beyond mere listening. Li, Chen & Tsai (2008) found that students learn effectively in a harmonic environment and by using teaching aids which match their learning style preferences. Gokalp (2013) opined that students should be properly guided and given incentives to select individual learning style that are appropriate and applicable in their environment for them to achieve their personal academic objective.

Steve (2012) suggests that one of the first things educators can do to aid the learning process is to simply be aware and accommodate that there are diverse learning styles among the student population.

The accommodation of the variations in learning styles could improve curricular and the teaching process. According to Dunn (2003), one or two of these receiving styles is/are 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. An important principle in Dunn and Dunn's model is the idea that students' achievements are heavily influenced by relatively fixed characteristics (Dunn, 2003). The overview of the Dunn's model Coffield, Moseley, Hall, & Ecclestone, (2004)) contains the claim that 'the learning styles of students changed substantially as they matured from adolescence into adulthood'. This study would use Felder Silverman Learning Style Model (FSLSM) to find out the dominant learning styles for the learning of geometry.

Some researchers like Jihard Damavandi, Mahyuddin, Elias, Daud, & Shabani, (2011), Vizeshfar (2017); Gurpinar & Romanelli (2011) and Nweke (2016) confirmed that there is a relationship between learning style and students' academic achievement. Rohrer and Pashler (2012) asked a question, learning style, where is the evidence? Willingham, and Diener (2010) reported that the use of so called learning style has caused controversy, while Awang, Roddin and Kankia (2017) that there was no statistically significant difference. They further said that each learning style has its strengths and weaknesses. Based on the above, this study found out the predominant learning styles of students and its' relationship with the students' achievement in geometry in the Federal Capital Territory, Abuja, Nigeria.

The learning Styles are classified by Fleming (2006) into Visual, Auditory and Kinesthetic (VAK or VARK):

- Visual: Pictures, videos, graphics, diagrams, charts, models
- Auditory: Lecture, recording, storytelling, music, verbalization, questioning
- Kinesthetic: Acting, role-play, clay modeling

Gregorc has the learning styles as Concrete Sequential, Abstract Random, Abstract Sequential and Concrete Random (Hawk & Shah, 2007). Grasha and Reichmann (1974) classified Learning Styles as Avoidant, Participative, Competitive, Collaborative, Dependent and Independent (Katsioloudis & Fantz, 2012). In 1995, Professor Mark Tennant categorized types of learning into three categories: (A)ttitude, (S)kills, and (K)nowledge with his ASK design, which has been innumerable copied, modified and utilized among a variety of profit programs.

Dee, Nauman, Livesay, & Rice, (2002) published *Creating Significant Learning Experiences: An Integrated Approach to Designing College Courses*. He opines that the principles of Blooms Taxonomy and its expansion to accommodate new learning types. The Institute of Education at the University of London (2003) from their conducted research commissioned by the British Government's Learning and Skills Development Agency posit that students do not learn through their preferred or defined learning style to the exclusion of other learning styles. Honey and Mumfords (2006) in Wikipedia (2013) have the learning styles grouped as Activists, Reflectors, Theorists and Pragmatists. Kolb learning styles are Convergers, Divergers, Assimilators and Accommodators. Jung through Myers-Briggs Type Indicator measures psychological type of learning styles in four bi-polar areas of Extroversion versus Introversion, Sensing versus Intuition; Thinking versus Feeling and Judgment versus Perception. The Multi-Modal Paired Associates Learning test measures modality preferences in seven areas of Aural; Haptic; Interactive; kinesthetic; print; Visual and Olfactory. It is used to assess individual strengths and weaknesses in learning styles. Learning styles in consideration of the multiples intelligence as posited by Felder -Silverman in Felder - Solomon (2006) are grouped into Active/Reflective; Sensory/Intuitive; Visual/Verbal; and Sequential/Global learners. This study used Felder-Solomon Learning Styles Questionnaire in order to classify the students into their different dominant learning styles of Active / Reflective, Sensing/ Intuitive, Visual/Verbal, Sequential/Global learners for better achievement score in geometry.

Geometry is the branch of mathematics that deals with measurements and relationships of lines, angles, surfaces and solids. Gilmer (2001) discusses the use of geometry in styling of hair into cornrow patterns as an entry point for engaging African American females in geometry. Students learnt to work collaboratively to master topics, skills and knowledge for use in practical creative ways (Abakpa & Iji, 2011). The enormous number of problems and theorems of elementary geometry was considered too wide to grasp in full even in the last century. Even nowadays the stream of new problems is still wide. (Prasolov, 2001). Despite the importance of mathematics, students tend to perform poorly in mathematical concepts especially geometry. Chief Examiners report of WAEC (2008, 2014, 2015, 2016 and 2017) consistently observed that among all the topics in secondary school mathematics, students have consistently performed poorly in geometry related questions.

Previous studies have shown that persistent failure of Nigerian students in WAEC SSCE mathematics has necessitated the need to study and understand the effective

learning strategies that allow requisite information to the learning of mathematics (Uloko & Imoko, 2007; and Abakpa & Agbo - Egwu, 2008). Awokoya and Fafunwa in Maliki, Ngban and Ibu (2011) argued that for any nation to be relevant, she must appreciate the importance of mathematics and get committed to its enhancement in her educational system. This is especially important in a world where science and technology have become an integral part of the world culture, though many improvements have not been observed in students' achievement in mathematics (Ojerinde, 2006). The failure in mathematics was so high that Nigeria ranked second to the last position when compared with five other English speaking West African countries in mathematics in West African School Certificate Examination Akintayo & Samuel, in Nweke, (2016). There is consistency in failure which is evident even in the Students' performance in Mathematics of West African Examination Council (WAEC) May/June Result of 2008- 34.52%, 2009- 38.2%, 2010- 41.73% 2014 - 31.28 %, 2015 - 36% and 2016 = 38.7 credit pass. The last SSCE result of (2017) as announced by the Head of National Office of WAEC Mr. Olu Adenipekun was 26.01% in Nov./Dec 2017 credit pass level in English and Mathematics.

The results of a study by Dunn & Dunn as cited by Nweke (2016) suggested that students whose learning styles were accommodated achieved 75% of a standard deviation higher than students for whose learning style had not been accommodated. This is to say that learning style has a positive influence on academic performance. Many researchers have reported that students often classified as poor achievers, learning disabled, at-risk youth, or dropouts were able to improve their academic performance when instruction was redesigned to respond to their particular learning style preferences said Maliki, Ngban & Ibu (2010). In agreement to the above, (Kurumeh 2004; Uloko 2006) were of the opinion that for the challenged persons, teachers should evolve strategies that will ensure their active participation. There have been studies on the effect of learning styles on student achievement in Biology, Engineering, Accounting and in other areas Worley, (2012). Given the established importance of learning style in influencing students' academic performance, this study focused on identification of students' learning styles and relationship between Students Learning Styles and their achievement in Senior Secondary School Geometry in Federal Capital Territory, Abuja, Nigeria. In this study therefore, effort will be made to find the dominant learning styles of students in FCT, the relationship to their geometry achievement in secondary school.

Students' achievements in geometry are related to how individuals do, in fact, learn. Systematic ways to identify individual preferences for learning and suggestions for teaching students with varying learning styles can be based on an individual's diagnosis of his learning style. Comprehension of individual differences and learning styles can provide teachers with the theory and knowledge upon which to base decisions. Cognitive style, the way that people acquire process, and display information, varies from person to person. Despite people's individuality, commonalities in cognitive patterns tend to exist within and differ between cultures (Maliki, Ngban & Ibu 2011).

THE PROBLEM

Traditional learning strategies or methods required teachers to simply pass on the information to students through concepts and theories. This method failed because it was not completely accepted and utilized by students. Students have different ability levels. Hence, both teachers and governments are concerned about the low level of achievement of Nigerian students in Senior Secondary School Certificate mathematics examination. The failure rate is as observed by Chief Examiners of WAEC (2005, 2008 and 2014). They had observed that among all the topics in secondary school mathematics, the one towards which students have shown negative attitude is geometry. The candidates showed greater weakness in geometry sections of the syllabus. The concern of this study therefore, is to ascertain the preferred learning styles of students and find out whether there are relationships between students' learning styles and their achievement in geometry.

RESEARCH QUESTIONS

- ✓ What are the dominant learning styles among the SS2 students in geometry?
- ✓ What is the relationship between the senior secondary students' learning styles and their mean achievement score in geometry?

PURPOSE OF THE STUDY

The Purpose of the study was to identify students' learning styles and find the relationship between students' learning styles and their academic achievement in senior secondary school geometry in the FCT. The specific objectives of the study were to:

- ✓ identify the dominant learning styles among SS2 students.
- ✓ determine the relationship between the students' learning styles and their achievement in geometry.

STATEMENT OF THE HYPOTHESES

The following null hypothesis was formulated and tested at 0.05, level of significance.

H₀₁: There is no significant relationship between SS2 students' learning styles and their mean achievement scores in geometry.

II. METHODS

This study was conducted to identify the predominant students' learning styles in relations to their achievement scores in geometry. Co-relational Survey is the research design. The study used multistage sampling for data collection. The study sampled three council areas of Bwari, Gwagwalada and Municipal by systematic sampling. It also sampled two schools from each council area which were co-educational by random sampling. The subjects of the study comprised all SS2 students from each school of study. The study's participants were 589 students comprising of 306

males and 283 females. The instruments for this study were: Geometry Achievement Test (GAT) of 23 multiple choice questions and a 44 - Index Learning Style (ILS) questionnaires. GAT was both face and content validated by two mathematics educators, two mathematics teachers and one expert in measurement and evaluation. The instrument was administered on students for trial testing. The Kuder-Richardson (K-R)₂₁ method of measurement was used. The reliability coefficient for GAT is 0.86 while that of ILSQ is 0.52 using Cronbach Alpha. The research generated the results through descriptive statistics of mean and standard deviation. The null hypothesis was tested using Point - Biserial for a relationship between the learning styles which gave $r = 0.74$ with t-Transform of 26.73 for a t-critical value of 1.96.

III. PRESENTATION OF DATA

The Index Learning Style (ILS) was used to categorize 589 students into four different learning styles as shown in the Table 1. In each of the style, (Larger value – smaller value) + Larger value letter = learning style preference. For Example, a totals 3 and b totals 8, $8 - 3 = 5b$ Create Index Learning Style form and place answers on the appropriate locations on the four scales. Data were clearly presented in tables. Learning Style a/b depicts a continuum of different learning styles showing perception or processing continuum as in Kolb's learning theory. 1a/b shows balanced preferences, 3a/b to 5a/b represents moderate preferences while 7a/b to 11a/b represents strong preferences. The researchers considered all the preferences and came up with the result as seen in the Table 1.

RESEARCH QUESTION 1

Learning Style a / b	11a	9a	7a	5a	3a	1a	1b	3b	5b	7b	9b	11b	Total
Active/ Reflective	0	2	0	18	28	56	30	16	3	1	0	0	154
Sensing/ Intuitive	2	4	16	32	22	40	16	14	2	0	0	0	148
Visual/ Verbal	2	4	10	16	42	40	22	6	1	3	0	0	146
Sequential/ Global	0	0	8	24	36	46	20	6	1	0	0	0	141
Total	4	10	34	90	128	182	88	42	7	4	0	0	589

Table 1: Profile of Dominant Learning Styles of SS2 Students in Geometry

Table 1 reveals Active / Reflective students were 154 in number. Active Students were 104 while Reflective students were 50 in number. The next learning style group was Sensing / Intuitive learners with a total of 148 students having Sensing as 116 students while Intuitive was 32. The Visual / Verbal group were 146 students. Visual has 114 students while Verbal has 32 students. Lastly, was Sequential / Global group with 141 students; Sequential has 114 while Global has 27 students.

RESEARCH QUESTION 2

Learning Style	N	GAT Mean Score	SD	r
Act/Re	154	65/35	16.32	0.86
Sens/ Intui	148	60/40	18.52	0.45
Vis/Verb	146	68/32	17.22	0.88
Seq./Glo	141	56/44	17.99	0.77
Total	589	50.00	17.51	0.74

Table 2: Relation of the Learning Styles of SS2 Students and their Achievement in Geometry.

The highest mean score of 68 is from the Visual / Verbal group with r of 0.88. This is seconded by Active / Reflective group with a score of 65 and r of 0.86. Sensing / Intuitive group followed with a score of 60 and r of 0.45 while the lowest mean score is 56 from Sequential / Global with an r of 0.77. The total r is 0.74

HYPOTHESIS 1

Ho1: There is no significant relationship between the SS2 students' learning styles and their mean achievement score in geometry.

To test the relationship of the identified learning styles, Point-Biserial correlation was used for their relationship and the result of the coefficient was 0.74. Then the t- transform was used to test the level of significance at 0.05 levels. When t was transformed, below is the summary. Statistical Summary: $r = 0.74$; t-Transform = 26.73; t-critical 1.96

Since t Transform is greater than t critical, the Null hypothesis HO1 is rejected. Therefore there is a significant relationship between students learning styles and their achievement scores.

IV. DISCUSSION OF RESULTS

The finding that Students have different learning preferences is in agreement with Li, Chen, & Tsai,(2010), Worley, (2012), Vizesfar, (2017) and Awang, Roddin & Kankia (2017) who found that students learn effectively in a harmonic environment and by using teaching aids which match their Learning style preferences. With respect to the psychometric properties of the ILS instrument Felder and Brent result indicated that the instrument had moderate reliabilities. El-Ba Results show that the students in the experimental group (mean = 45.91), whose learning styles were accommodated for, performed better than the students in the control group who studied using the traditional method (mean = 43.80) of teaching.

The finding that there was significant relationship between learning styles and achievement scores of students agreed with Golkap (2013), Gurpinar & Romanelli (2011) and Jihard Damavandi, Mahyuddin, Elias, Daud, & Shabani, (2011) whose results of the analyses of variance showed that there is a statistically significant difference in the academic achievement of the students that correspond to the four learning styles.

V. RECOMMENDATIONS

The following recommendations were made based on the findings of this study:

- ✓ Students should be encouraged to identify their strong learning style preference and improve on their weaker preferences in order to maximize their learning potentials; Succeed on all educational levels; Understand how best to study and score better on examinations and tests;

Overcome limitations in the classroom; Reduce frustration and stress levels through organized seminars and workshops.

- ✓ Mathematics Teachers should be encouraged to prepare their lessons very well while putting into considerations students learning styles. This will ensure that students benefits maximally from the geometry lessons. Mathematics teachers should be encouraged to play the role of a facilitator in the classroom. Mathematics teachers and school administrators should have learning style knowledge upon which to base their decisions from organized workshops, seminars and reading publications in academic journals.
- ✓ Professional bodies like STAN and MAN should be encouraged during conferences to popularize among mathematics teachers the importance of identifying the various learning styles. They should take cognizance of this in their mathematics classrooms.

VI. CONCLUSION

From the findings of this study, it was discovered that there is a relationship between learning styles and students achievement in geometry. It identified different learning styles according to Felder–Silverman Learning style model and Felder-Soloman (2004) learning style questionnaire (LSQ). These identified styles are Active / Reflective; Sensing / Intuitive; Visual / Verbal and Sequential / Global. Active, Sensing, Visual and Sequential are the perception (how we think and feel - emotional response about a task means how to transform the experience) continuum while Reflective, Intuitive, Verbal and Global are the processing (how we approach / watch and do a task) continuum.

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