The Influence of Learning Styles on Achievement in Physics of Senior Secondary School Students in Yaba Local Government Area of Lagos State

By

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Abstract

Different studies on the teaching and learning process have established students' different and unique ways of learning. Many researchers agreed that learning materials should not just reflect the teaching methodology, but should be designed for all kinds of students and all kinds of learning styles. This study adopted the survey research design to investigate the influence of learning styles on the achievement of secondary school students in physics. The population of the study consisted of all secondary school physics students in Yaba Local Government Area of Lagos State of which a sample of 191physics students of intact classes in the five schools randomly selected from population. Two research instruments which are Index of Learning Style (ILS) by Felder – Silverman (1988) and Physics Achievement Test(PAT) were used for data collection. The reliability coefficient of 0.75 was established for physics achievement test and 0.67 for the Index of Learning Styles using KR – 20. Five research questions guidedthe study. Data collected were analyzed using Pearson product moment correlation, paired sample t-test, independent sample t-test and descriptive statistics. The results showed that the learning style, age and gender have significant influence on students' achievement in physics. Visual and active learning are the predominant learning styles in physics classrooms and it was recommended thatteachers/instructors need to diagnose and identify students learning styles take these diverse learning styles into considerationsand design instructional methods that take care of those diversities and remain sensitive of such during the instruction process.

Background to the study

The teaching and learning of science at the senior secondary level have witnessed a paradigm shift from teachers – centerednessto learner-centred pedagogical approaches. Thus, different teaching and learning methods such as case studies, student-led discussions, and web-based modules that allow students to learn at their paces have been incorporated into classrooms to enhance students' learning, and thus replacing teacher-led teaching as the predominant means of delivering classroom instruction.Allan (2012) affirmed that teachers should assist students in constructing their knowledge as well as processing and analyzing information to make better decisions rather than merely transmitting knowledge.

How then can the academic achievement in Physics be best achieved? and what factors will predict further success in learners? These questions are becoming more and more relevant to teaching and learning of science and every other science related subjects (Emerson and Loehr, 2008; Roth, 2005 and Pinker, 1997).

Students are confronted with numerous challenges in learning physics resulting into poor performance of the student at the secondary level.This is in line with the submission of Lorna (2013) that 'students' challenges and difficulties as a results of students' variation in learning styles and ways of processing information. Babajide 2012,

Longjohn2009 and Okoronkwa 2004 ascribe this problem to teachers' poor method of instruction.As a result of these identified factors Alfonsec (2006) therefore stress that to accommodate students' different learning styles the teacher should adapt suitable techniques and methods that will cater or match with the individual students' learning styles in science classroom teaching and learning. Teachers also need to take cognizance of students learning style preferences which will create a landscape by which the students will either maintain their intelligence or not. Therefore, the teachers' knowledge about the students learning style is paramount so as to design instructional strategies that will take care of individual students learning styles and remove challenges and difficulties faced by individual students in classroom teaching and learning of physics.

Lorna (2013) studied the relationships between learning Style Preferences and academic performance of students and found that recognising students' learning style assist teachers in becoming more sensitive to students' differences in the classroom, thus promoting teaching practices that best suit the students learning styles. This finding agrees with the findings of Cuthbert (2005) that awareness of students learning styles is vital for allowing adjustment in the teachers' pedagogical approaches. Also, Garth-Johnson and Price (2000) pointed out that the learner's unique learning style, the understanding subjects matter and their academic achievements are closely related. In this regard, for science students to attained high level of achievement especially in physics, science education expertise must put into consideration the uniqueness of the physics students learning style.

Human beings have differentiated ways of learning, some can learn and assimilate in a better way by receiving the knowledge through visually, auditory or through hands on activities. Psychology and cognitive sciences have long time explored this question. Beacham (2012) reported that the dual coding (visual and verbal) theory states that information is processed through one of two usually independent channels that is the visual and verbal senses. While one channel processes verbal information such as text or audio, the other one processes visual information likes diagrams, images, animations, and others. The Sperry's Nobel Prize winning left-brain/right-brain model of thinking suggested that the right-hand side and the left-hand side of our brain possessed specialised and differentiated functions (Dervan, 2006). According to Beacham (2012), the left cerebral hemisphere is thought to be more verbal, logical or clinical, that is, more analytical, while the right cerebral hemisphere influences more the artistic and the sensing side of our intellect. Rose (1998) and Dervan (2006) reported that "Whole brain" learning is known to be a far more effective way to learn science and the better connected the two halves of the brain, the greater the potential of the brain for learning and creativity. It is of high importance for science education expertise to create a learning experience for "whole brain" learning which aid high retention and influences science or physics achievements.

Most educational systems have ignored individual differences that exist between learners, such as the learning ability, the background knowledge, the learning goals and the learning style (Ford and Chen, 2001). Educational systems generally provide a unique and standardized teaching material to all learners which tend to benefit to those whose learning style and background knowledge fits well with the teaching and learning materials. If the teaching style employed closely matches the student preferred style of acquiring knowledge,

learning becomes easier and more natural, learning time is reduced and high academic achievement are attained (Rose, 1998). On the other hand, if for example a student is predominantly of visual learner than verbal and all the knowledge was presented on the board in texts without auditory or visually aid resources, student will experience difficulties in learning the targeted content within the time frame. In few words, the conventional teaching resources and strategies generally tend to be of advantages to some students more than others. Ana and Saïd (2009), affeered that in this sense, it is necessary to deploy resources to support the learning process and learning style in a way that does not only suits the characteristics of a few, but that it adapts to the characteristics of each student.In line with the above submissions is the assertion of Udeani and Adeyemo (2011) who explained that the students' learning styles refers to the independent forms or ways students receive and process information and it implies that the student skills and preference in receiving and processing information differ. They further affeered that the learning styles exhibited by students depend on two major factors; the way students perceive information and the way they process information.

Gender and age are the two moderator variables used in this study. This due to the inconclusive results obtained on gender and age. Different researchers have found that gender and age of students have influence on their learning style while others found that gender and age of students learning have no influence on their learning style. Caroline, Nalia, Claire, Sharon and Maureen (2009) conducted a reviewdrawn from 18 research studies published from 2000 to 2008 and carried out in Australia, Chile, the United Kingdom, USA, Ghana and some other nations in other continents together with further information supplied by international contacts in 13 countries and states. There result shows statistically significant effects of relative age and learning styleon achievement (comparing the youngest to the oldest in the year group). They found that active and visual learner range 13 – 15 perform better than 16years and above. The physics student students are more of abstract learners. This result contradict the findings of Dietz and Wilson (1985), DeMeis and Stearns (1992) who obtained no significant influence of student's age and learning style on achievement.

Furthermore, Caroline et al (2009) suggests that the influence of gender and relative age operate independently of one another and there are limited direct evidence to support educational policies and practices in reducing relative age and gender influence, apart from the adoption of age standardized tests. Also, it has been observed that the male physics students performed better than their female counterpartwhich influences the achievement of physics students when not put into consideration. In contrary to the above findings, Lorna (2013) studied the influenceof gender, learning Styles and academic achievement of students and found that there is no significant influence the students' preference of learning style and their gender. Based on these contradictory results it was highly imperative that gender and age of the physics students and learning style should be further investigated.

The poor academic achievement of student in physics cut across all level of education in Nigeria. This may be due to the fact that physics teachers have not taken cognizance of students' learning style into class room teaching and

learning activities.In this plight, this study was set out to investigate the influence of learning styles on students' academic achievement in physics and moderating effect of age and genderof students on the dependent measure.

Statement of the Problem

The consistence low achievement of students at the secondary school level has been a major concern to physics educators and researchers some of the causes identified are: teachers' poor method of instruction (Babajide 2012, Longjohn 2009 and Okoronkwa 2004), school environmental factor (Adeyemo 2013 and Ayodele 2004), student's family background (Adeyemo 2010), poor students' study habit (Babajide and Ukoh 2013), variations in students' learning styles and ways of processing information (Lorna 2013). Different instructional strategies have been suggested by researches among which are the adoption of active teaching strategies (Babajide, 2012), conductive learning environment (Adeyemo, 2013) adoption of good study habit of students (Babajide and Ukoh, 2013), with all these, the achievement of students have not improved. This may be due to the fact that physics teachers have not taken cognizant of studentsdifferent learning style in physics classroom instruction. This study therefore investigated the influence of students' learning styles on achievement in physics and the moderating effects of gender and age of students on learning styles of senior secondary school students in Yaba Local Government of Lagos state.

Research Questions

This study answered the following research questions:

1. What is the dominant learning style among physics students in Yaba Local Government Area in Lagos state?
2. Is there any influence of students learning style on achievement of students in physics?
3. Is there any influence of gender on students learning styles in physics?
4. Is there any influence of age on students learning style in physics?

Methodology

This study adopted the survey research design. The population consisted of all physics students in senior secondary schools in Yaba Local Government of Lagos State.Random sampling technique was used in selecting five schools from all the Schools in Yaba Local Government area of Lagos.Asample of 191physics students of intact classes from the five randomly selected schools was used.The study provided answers to five research questions.

Two instruments were used in collecting data. The first is the Index of Learning Styles (ILS) questionnaire which was used in calculating the learning style of the students. The questionnaire was adopted from Richard and Barbara (1988) and was used without alteration. The questionnaire consisted of forty-four items questions of two different options with only one correct answer which corresponds to a learning style; active and reflective learning styles, sensing and intuitive learning styles, visual and verbal learning styles, and sequential and global learning styles respectively. The students answer to each of the questionnaire items were used to compute his learning style using the learning style scoring sheetby Richard and Barbara (1988). Each computation categorised the student into a particular learning style such as: active learners, reflective learners, sensing learners, intuitive learners, visual learners, verbal learners, sequential learners and global learners.See

Appendix 1

The second instrument is the Physics Achievement Test (PAT) designed to measure the achievement of students in physics. It consisted of sixty multiple choice questions of four options A-D with only one correct answer.The research instrument was subjected to face and content validation by the researcher. After that, the instrument was trial tested infour senior secondarystudents who are not part of the sample.The reliability coefficient of PAT(r=0.75)using KR – 20,while that of index of learning style was 0.67 using KR – 20.

The data collected were analysed using Paired sample t test, independent sample t test and descriptive statistics was used for the analysisof the data collected.

Results

Results were presented in line with the stated research questions.

Research question 1: What is the dominant learning styles among physics students in Yaba Local Government Area in Lagos state?

Table 1: Descriptive statistics on ILS(Index of Learning Style)

	Frequency	Percent	Valid Percent	Cumulative Percent	Mean
ACTIVE	58	30.4	30.4	30.4	49.9483
REFLECTIVE	7	3.7	3.7	34.0	39.0000
SENSING	5	2.6	2.6	36.6	38.6000
INTUITIVE	4	2.1	2.1	38.7	40.2500
VISUAL	70	36.6	36.6	75.4	45.8143
VERBAL	17	8.9	8.9	84.3	37.2941
SEQUENTIAL	27	14.1	14.1	98.4	40.0000
GLOBAL	3	1.6	1.6	100.0	40.0000
Total	191	100.0	100.0		44.8429

From the Table 1, descriptive statistics shows that active learners are 30.40%, reflective learners are 3.70%, sensing learners are 2.60%, intuitive learners are 2.10%, visual learners are 36.60, verbal learner are 8.90%, sequential learners are 14.10% and global learners are 1.60%. The visual and active learner has the highest percentage while the intuitive and global learnershas the lowest percentage. This implies that the visual and the active learning style are the dominant learning style in a physics classroom.

Research question 2: Is there any influence of learning styles on students' achievement in physics?

Table 2: Paired samples statistics on the effect of learning achievement in physics

		Mean	N	Std. Deviation	Std. Error Mean	T	Df	Sig.
Pair 1	ILS	4.0209	191	2.27563	0.16466	53.810	380	0.000
	PAT	44.8429	191	9.47942	0.68591			

From Table 2, the mean of the learning styles (ILS) is 4.0209 and the mean of physics achievement is 44.8429 the mean difference is significant at 0.05 level of significance. This shows that there is an influence of learning style on the students' achievement in physics.

Research question 3: Is there any influence of gender on students learning styles in physics?

Table 3: Independence sample t-test value of gender and physics student learning style

	GENDER	N	Mean	Std. Deviation	Std. Error Mean	T	Df	Sig.
ILS	MALE	81	3.2963	2.02141	0.22460	10.258	189	0.00
	FEMALE	110	4.5545	2.31305	0.22054	9.429		

From the Table 3, the mean of the male students is 3.2963 and the mean of the female is 4.5545,the mean difference of male and female is 1.2582 which is significant at 0.05 level of significance. Thisimply that there is an influence of physics students' gender on their preference of learning style. The male physics students were predominantly visual learners with a while the female students were predominantly active learner. The male visual learners are 50 with PAT mean score of 36.01 and the female active learners are 45 with PAT mean score 40.23.

Research question 4: Is there any influence of age on students learning style in physics?

Table 4: Independent sample t-test of age of students and learning style

	AGE	N	Mean	Std. Deviation	Std. Error Mean	df	T	Sig.
ILS	13-15YEARS	119	4.9580	1.90626	0.17475	189	-2.666	0.002
	16YEARS AND ABOVE	72	2.4722	1.97856	0.23318		-2.337	

From Table 4, the mean value of ages 13-15years was 4.9580 and ages 16years above was 2.4722 the difference in mean was significant at 0.05 level of significance. Meaning there was significant influence of age of the physics students on their preference of learning style. The students of ages 16years and above are predominantly reflective, sensing, intuitive, sequential and global learners and students of ages 13 – 15 are predominantly visual, verbal and active learners. The 16years and above has a PAT mean score of 38.28 and 13 – 15years has a PAT mean score of 42.21

Discussion

This study found that learning styles significant influence the achievement of senior secondary school physics students which is in line with the findings of Adeyemo, Babajide, and Amusa (2013) who studied the relationship among teachers' problem solving abilities, students' learning styles and students' academic achievement in physics and found that there is a significant influence of learning style on student academic achievement in mathematics and physics. This implies that when physics students who are visual learners are taught with pictures, short videos and other forms of visual aids they performed better in their academic activities likewise when active learners are taught with hands on activities, demonstration, participating in drama and other forms of active learning models they also performed better. According to Peacock (2001) and Adeyemo, et al (2013), when instruction in an education setting is matched with the students' learning styles; students achieve higher scores than when mismatched.

Miller (2008) also found that both student examination scores and student's attitude toward learning scores were significantly higher when presentation was matched with student learning styles. This study is also in line with Mutua (2015) who worked on a correlation study between learning styles and academic achievement among secondary school students and reported that the instructors need to be cognizant of the student differences and broaden their range of teaching methods accordingly to be an effective teacher. Awareness of physics student classroom learning styles allows for effective teaching that will reach students learning via different teaching methodologies.

The age of the physics studentsalso hadinfluence on their preference of learning style that is the active and visual learners within the age range of 13 – 15years perform better than the active and visual learners of the age range of 16years and above. The physics students of the age 16years and above are more of abstract learners which has an impact on the way they process new information. In line with this, Huitt and Hummel (1998) asserted that only 35% of science students are formal operational, this supports Piaget psychology learning theory; many people do not think formally during adulthood, that is, they learn better when they can touch, feel and are involved in the classroom activities. From the report of Huitt and Hummel (1998), teachers are expected to use instructional materials such as power point, hands on practical, videos, and give time to allow the students to think and solve problems on their own. This contradict the findings of Dietz and Wilson (1985), DeMeis and Stearns (1992) who obtained no significant influence of student's age and learning style on achievement.

Also, the study reveals that the physics students' gender significantly influence their learning styles and this is also supported by the positiverelationship whichexisted between the physics students' gender and their learning styles.This findingcontradicts the work of Lorna (2013) who studied the relationships between learning Styles and academic performance of students and found that there is neither significant influence nor relationship between the students' preference of learning style and their gender. In this plight, it is highly imperative that gender of the physics students should be put into consideration for effective teaching and learning. This was better explained by Mutua (2015), in his report on a correlation study between learning styles

and academic achievement among secondary school students. In his study, the male students mean score is 60.79 (SD=7.119) which is lower than the females' 62.48 (SD=6.814). He further reported that, female love social context and likes to get involved in discussions which make them more active in the classroom activities including opportunities to work independently, in pairs with peers, in larger groups and with teachers. The implication of this finding is that male students are passive in classroom discussion while their female counterpart are active, hence, they showed superiority over their male counterpart in classroom hands on activities and discussions. This contradict the findings of Jorge (1990) who found that male students primarily preferred only hands on activities to learn new information while their female students'counterpart preferred more varieties in their educational resources.

The findings from the study also showed that female students responded that they preferred that they are of participatory visual, verbal and active learning style while the male preferred the intuitive, sensing, sequential, global and reflective learning style. Hence, the visual and active learning styles are the predominant learning style in the physics classroom which is in line with findings of Mutua (2015) who found that the visual and active learningstyles are the predominant learning style among secondary school students and he recommends that school administrators should made provision for varieties of learning materials such as technological gadget as well as developing students in project writing and presentation of findings to engage the students on active form of learning.

Conclusion

The study found that the learning styles had significantinfluence on the students' academic achievement in physics. Also, the study revealed that the age and gender of the physics students has effect on their learning style and the visual and active learning styles are the predominant learning style in the physics classroom.

Recommendations

The following recommendations are made:

Teachers/instructors need to diagnose and identify students learning styles take these diverse learning styles into considerations ,and design instructional methods that take care of those diversities during the instruction process.

Teachers should also help their students to understand their learning style preferences and make use of such and used the appropriate instructional materials that will aid permanent learning.

School administrators need to provide various learning materials which can bring diversity in the classroom by employing visual, reflective and active materials such as use of technology and students project writing and presentation among other methods.

Physics curriculum developers, school administrator and physics teachers should create an enabling environment that will help the male visual and active learners to perform better in physics classroom instruction.

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Appendix 1: Learning style questionnaire scoring sheet

Activist/Reflector			Sensing/Intuitive			Visual/Verbal			Sequential/Global		
Q	**A**	**b**	**Q**	**a**	**b**	**Q**	**A**	**b**	**Q**	**a**	**b**
1			2			3			4		
5			6			7			8		
9			10			11			12		
13			14			15			16		
17			18			19			20		
21			22			23			24		
25			26			27			28		
29			30			31			32		
33			34			35			36		
37			38			39			40		
41			42			43			44		
Total (add up each column)											
Activist/Reflector			**Sensing/Intuitive**			**Visual/Verbal**			**Sequential/Global**		
Q	**A**	**b**	**Q**	**a**	**b**	**Q**	**A**	**b**	**Q**	**a**	**b**
[redacted]			[redacted]			[redacted]			[redacted]		
Larger – smaller + Letter of Larger											
[redacted]			[redacted]			[redacted]			[redacted]		

Example: if your total was 3 for a and 8 for b: 8 – 3 = 5, b is letter of larger so you would enter 5b.