Learning Styles and Academic Achievement in Chemistry among Senior Secondary Schools in Oruk Anam Local Government Area of Akwa Ibom State, Nigeria

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Abstract
The study investigated students' learning styles preferences and academic achievement in chemistry. Survey design was adopted for the study with the population of 450 Senior Secondary two (SS2) Chemistry students in Oruk Anam Educational Zone of Akwa Ibom State. Simple Random Sampling Technique was used to select 310 chemistry students as sample for the study. The data obtained were analyzed using Independent t-test and Pearson Product Moment Correlation (PPMC) techniques. The result of the findings revealed that there was no significant difference in the learning styles preferences among male and female students. Large proportion of the chemistry students were visual learners (68.7%) followed by auditory (18.1%) and kinesthetic learners (13.2%). There was statistically significant difference in academic achievement levels among secondary school students. Also there was weak or no correlation between academic achievement and learning styles preferences among male and female chemistry students. The study recommends that students need to understand their learning styles preferences and make use of such in order to develop meaningful and life-long learning.
Keywords: Learning styles, Senior Secondary School Chemistry Students, Academic achievement levels.

Introduction

Learning style has been defined as a set of cognitive, emotional and psychological factors that serve as relatively stable indicators of how a learner perceives, interact with and responds to the learning environment. Every individual has its own natural or habitual pattern of acquiring and processing information in learning situations. The common ways or patterns by which people learn are known as their learning styles. (Keefe, 1987). Learning style has dual characteristic which indicates how students learned and like to learn, as well as instructional strategy informing the cognition, context and content of learning. Everyone has a combination of various learning styles. Some people may find that they have a dominant style of learning with far less use of the other styles while others find that they use different styles in different circumstances. A core concept is that individuals differ in the ways they learn. Coffield., Moseley., Hall., &Ecclestone, (2004) states that the idea of individualized learning styles was initiated in 1970s and since then has influenced science education remarkably. Proponent of learning styles recommended that teachers should identify the learning styles of their students and adapt teaching methods to best fit learning style of each student. (Graf., Liu., &Kinshuk,

2010). It is important that Chemistry Students in Senior Secondary Schools identify their learning styles. Being aware of their individual pattern of learning, they can take responsibility for their own learning, attributes meaning to the process of learning, develops understanding of their own forms of learning and become much more satisfied with the environment they interact with. Chemistry teachers in Senior Secondary Schools should diagnose their students' learning styles. When this is done, they would be able to regulate the teaching-learning process in a desirable direction.

Generally, students acquire and process information in different ways: by seeing and hearing, reflecting and acting, reasoning logically and intuitively, analyzing and visualizing. Teachers also vary in their teaching methods, some apply instructions, lecture or demonstration while others lead students to self-discovery; some focus on principles and others on applications; some emphasize on memory and others understanding. When learning styles of most students mismatch with teaching methods of the teachers, the students may become bored and inattentive in the class, do poorly on examinations, get discouraged and lack interest about the subjects, curricular activities and themselves. In some cases lack of proper attention to individual students' learning styles lead to poor attendance and drop out of students in schools. It is commonly observed that many Chemistry teachers and students alike, in our nation's Senior Secondary Schools are given no or little attention to the concept of learning styles. Learning styles preferences may influence learning and subsequently academic achievement of Chemistry students in Senior Secondary Schools.

Theoretical/Conceptual Framework

VAK Learning Style Theory

The VAK learning style theory developed by Fleming (1995) states that each individual learner experiences learning through different sensory channels namely: visual (V), auditory (A) and kinesthetic (K). Individual learner may exhibit preference to any of these learning styles. Relating the theory to this study, learning style preferences may influence learning and academic success of students.

The present study is embedded on the VAK learning style theory because visual, auditory and Kinesthetic (VAK) modes of learning are the commonly preferred ways of learning in traditional Chemistry Classroom setting. Based on this theory, several scholars have developed learning styles inventories which can be applied in science education research and classroom setup including Barsch which categorizes learners based on their sensory perceptions. One family of learning style models that has gained popularity recently has been those which have emphasized sensory modalities as a means of providing stimuli to the learner is known as VAK (Coffield, Moseley, Hall, &Ecclestone, 2004). This model comprises of three sub-modes; Visual (V), Auditory (A), and Kinesthetic (K). Presently, one of the most common modes of exchanging information in today's modern society is speech, and it is attributed as auditory in the VAK model through the reception of this information by the ear. Other group of learners may show a preference for visual learning (V), which have not been particularly well covered by the methods of teaching in the secondary schools (Galasinski, 2000). Lastly, a group of learners within this model are learning via multiple sense, including touch,

hearing, smell & taste, described by the literature as Kinesthetic learners (K) and as such want concrete, multisensory experiences in their learning.

According to Kolb (2001), most language and creative students are mainly auditory. The way learners receive information based on the VAK theory, has been divided into three categories sometimes referred to as modalities: Visual - sights, pictures, diagrams, symbols; auditory - sound, words; Kinesthetic - taste, touch, and smell. An extensive body of research has established that most people learn most effectively with one of the three modalities and tend to miss or ignore information presented in either of the other two. There are thus visual, auditory, and kinesthetic learners, although there are some learners who tend to use a combination of both visual and auditory senses and have been termed as tactile learners (Doyran, 2000). Visual learners remember best what they see: pictures, diagrams, flow charts, time lines, films, demonstrations. If something is simply said to them they will probably forget it. Auditory learners remember much of what they hear and more of what they hear and say. They get a lot out of discussion, and learn effectively by explaining things to others (Doyran, 2000).Visual learners prefer to learn by reading books, seeing words, or looking at some teaching tools. They prefer to look at the written words on the black board than to only listen to the teacher. Therefore they like the teacher to write more than to talk in classroom. The PowerPoint presentation is suitable to these learners because it presents words, and pictures or charts. This type of learners will feel comfortable when teacher use the translation-grammar teaching approach in science teaching. Auditory learners may enjoy to have information with others by talking. They may dislike reading books. So in formal instruction settings, they would rather listen more than see more. A few teaching approaches may suit them, such as the oral approach, the situational approach, the audio-lingual approach, and communicative approach. Tactile learners and kinesthetic learners are similar (Doyran, 2000). The former prefer to learners by feeling or touching something with their hands while the later like movement. Learners of these two kinds will feel comfortable when teacher use the total physical response approach.

According to Sternberg (1997), learning will be more effective if it is tailored around the learning style approaches of the learners. The instructor/teacher should therefore establish the learning style preference of learners in order to design an effective instruction. Doyran (2000) puts this in the context of science [physics] teaching, arguing that the physics class should take into account the visual, auditory, and kinesthetic learner by designing instructional methods that involve these modalities in a typical class. Only then, can instructor believe that each learner has been reached at his/her learning point of need. Based on the VAK theory, instructors should ensure that activities are designed and carried out in ways that offer each learner the chance to engage in a manner that suits them best. Since the student's needs in a typical classroom are much diverse, the science teacher will have to employ different instructional methods which help each of the individual learners interact with the content in a way that they understands it well. For example, the teacher should utilize lecture and recorded conversation method to carter for the auditory learner; flip charts and PowerPoint presentation to meet the visual learner and writing/note taking and dramatization to meet the kinesthetic learner. By doing this the learners will be met at their point of learning;

they will discover their preferred learning styles and strategies, strengths and weaknesses in learning contexts and leverage on those opportunities for better academic achievement and ultimately acquire life-long learning attitude.

Abidin.,Rezace., Abdullah., Singh, (2011), in a study on the relationship between learning styles and academic achievement. A total of 317 students in an Islamic school in Malaysia participated in the survey study. The learning styles survey (LSS) instrument which is based on joy Reid's perceptual Learning-style preference questionnaire was used. The statistical procedures employed in the study were one-way ANOVA and multiple regression analysis. The analysis of the data indicated a significant relationship between overall academic achievement and learning styles. It was also found that the high, moderate and low achievers have a similar preference pattern of learning in all learning styles. More so, the learning styles framework does not change with subjects, when it actually plays an important role across all subjects. Therefore, the results suggest avenues of future research to understand the phenomenon.

Vaishnav., and chirayu, (2013) conducted a study on the analysis of learning styles and academic achievement among secondary school students in Maharashtra state. A sample of 200 students of class 9th, 10th and 11th standard was randomly selected for the study. Learning styles inventory by Victoria Chislett and Alan Chapman was used to identify the preferred learning style of students. The correlation between academic achievement and learning styles was determined using Pearson's product moment co-efficient method and also to identify the effect of learning style on academic achievement ANOVA F test was used. Findings of the study revealed that, kinesthetic learning style was more prevalent than visual and auditory learning styles among secondary school students. There exist positive high correlation between kinesthetic learning style and academic achievement ($r = 0.658$). The other two learning styles have positive relationship but not strong one; $r = 0.287$ for auditory learning style and $r = 0.129$ for visual learning style. The main effects of the three variables - visual, auditory and kinesthetic are significant on academic achievement.

A study carried out by kopsovich (2001) on the relationship between learning style of students and their mathematics scores on the Texas assessment of academic skills test revealed that the learning style preferences significantly impacted their mathematics achievement scores. Gender and ethnicity were mitigating factors in the findings. There was a significance relationship of 0.542 at the 0.05 level of significance. The author suggests that supplying the teachers with information concerning student's learning style preferences will benefit student achievement. Erton (2010) in a study of the Relations between Personality Traits, Language Learning styles and success in foreign language achievement, reported that male students tend to achieve higher in sciences than female counterparts.

A research study that investigated the impact of learning styles on the academic achievement of secondary school students in Iran was conducted by (JilardiDamavandi.,Mannhyuddin., Elias., Daud., and shabani, 2011). The David Kolb Learning style inventory was administered in eight public schools in Tehran. The mean of the test scores in five subjects, namely English, science, mathematics, history, and geography, was calculated for each student and used as a measure of academic

achievement. A total of 285 Grade 10 students were randomly selected as sample of the study. The results of the ANOVA showed that there was a statically significant difference in the academic achievement of the Iranian students that correspond to the four learning styles; in particular, the mean scores for the converging and accommodating group of students. A study carried out by Erton (2010) among five faculties at Bilkent University First year students has contributed to the field of learning style in education. The research was conducted among 102 freshman students between the age of 18 and 23 who responded to the Jeffrey Barsch's Learning style inventory and their test scores were used to calculate the statistical coefficient between the two variables. The study showed that there was a weak positive statistical relationship between the learning styles of the students and their achievement in foreign language (English) with a correlation coefficient of 0.306. Another study carried out by (Gappi. 2013), explored on the student's preferred learning styles and their academic achievements. The specific objectives of the study were to: describe the learning style preferences of the students; to find out whether learning style preferences of the students differed with age, gender and academic programme and to determine the relationship between the learning style preferences and the students' academic performances. The participants of the study consisted of all (131) freshman students who were accepted during the first semester of the academic year 2012-2013, composing of 18 natural youth and 13 young adults, the index of learning styles (ILS) questionnaire was utilize to carry out the rationale of the study. Permission to use the questionnaire was granted free of charge via internet, and the results demonstrated that generally the students were fairly well balanced in all four dimensions presented in the ILS questionnaire. The result further showed that there was no significant effect of age, gender and academic programme on the learning style preferences of the students. Based on the result, there was no significant statistical correlation between the academic achievement and the learning style preferences of the students.

The table below summarizes the VAK (1995) learning styles dimensions, how learners tend to learn and what the teachers need to do to ensure that learning is maximized.

Table 1: VAK learning Style Dimensions

Dimension	Learners tend to:	Teachers needs to encourage learners to:
Visual	Learn through seeing; Think in pictures and need to create vivid mental images to retain information; Enjoy looking at maps, charts, pictures, videos, and movies; Have visual skills which are demonstrated in puzzle building, reading, writing, understanding charts and graphs, a good sense of direction, sketching, painting, creating visual metaphors and analogies (perhaps through the visual arts),	Use graphics to reinforce learning, colours code to organize notes and possessions. Use colour to highlight important points in text, Take notes, illustrate ideas as a picture before writing them down, Ask for written directions, Use flow charts and

	Manipulating images, constructing, fixing, designing practical objects, and interpreting visual images.	diagrams for note taking, Visualize spelling of words or facts to be memorized.

Auditory	Learn through listening; Have highly developed auditory skills and are generally good at speaking and presenting; Think in words rather than pictures; Learn best through verbal lectures, discussions, talking things through and listening to what others have to say; Have auditory skills demonstrated in listening; speaking, writing, storytelling, explaining, teaching, using humour, understanding the syntax and meaning of words, remembering information, arguing their point of view, and analyzing language usage	Read aloud; Recite information to learn; Use tunes or rhymes as mnemonics devices; Read aloud and tape text questions or directions; Use verbal analogies and storytelling to demonstrate their point.
Kinesthetic	Learn through moving, doing and touching; Express themselves through movement; Have good sense of balance and eye-hand coordination; Remember and process information through interacting with the space around them; Find it hard to sit still for long periods and may become distracted by their need for activity and exploration; Have skills demonstrated in physical coordination, athletic ability, hands on experimentation, using body language; Crafts, acting, miming using their hands to create or build, dancing, and expressing emotions through the body.	Make models or role play to physically experience learning; Skim through reading materials before reading it in details; Annotate text and write questions while reading; Translate information into diagrams or other visual study tools; Recite a list of items by counting on fingers; Memorize or drill while moving e.g. when walking; Listening to music while studying.

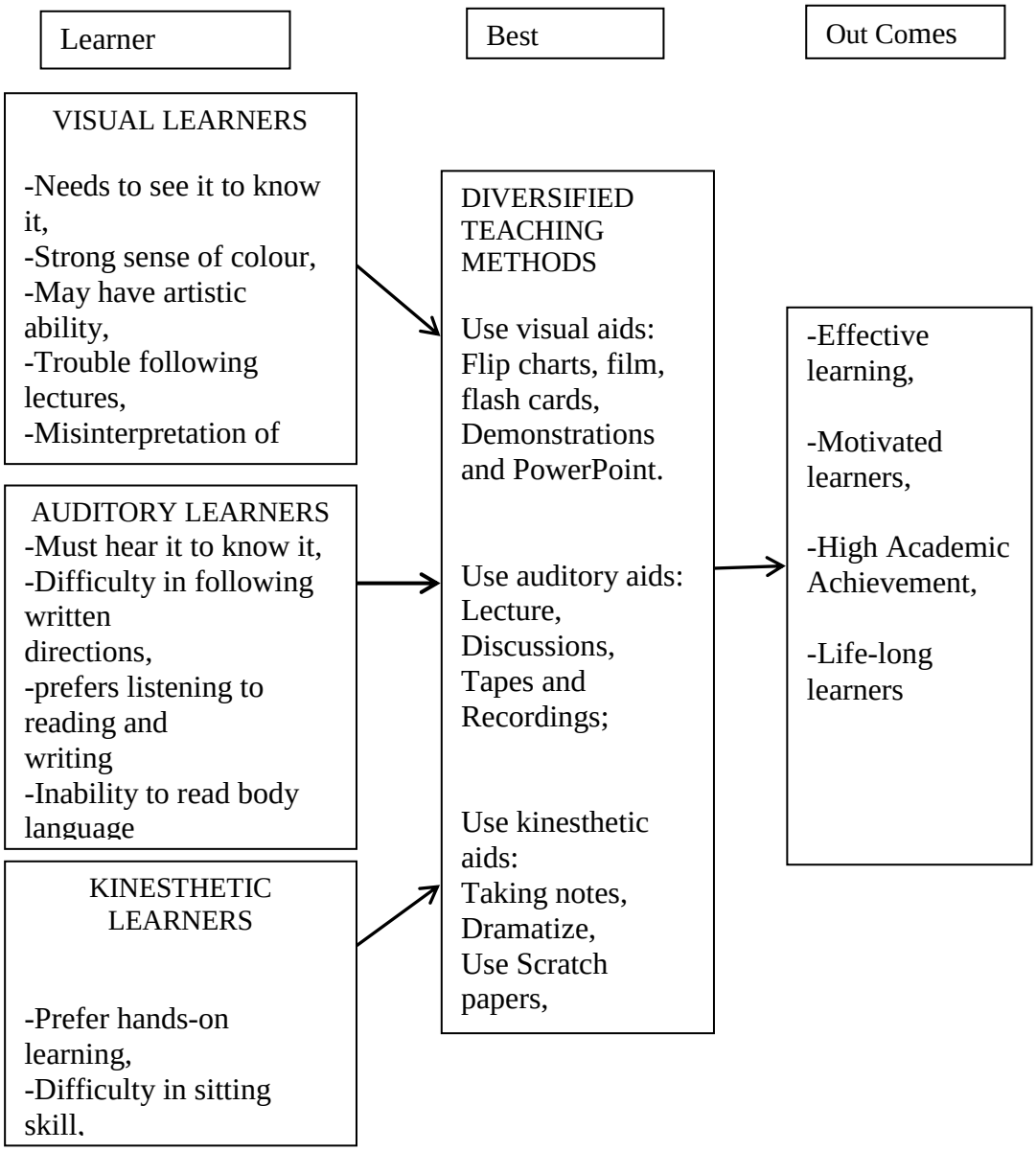

Figure 1: Conceptual Frame work.

Fleming claimed that visual learners have a preference for seeing (think in pictures; visual aids represent ideas using methods other than words such as graphs, charts, diagrams, symbols). Auditory learners' best learn through listening (lectures, discussions, tapes). Kinesthetic/tactile learners prefer to learn via experience - moving, touching, and doing (active exploration of the world; science projects; experiments). The

use of Fleming's learning style models in instruction allows teachers to prepare classes that address each of these areas, especially in science education. Students can also use the model to identify their preferred learning style and maximize their learning by focusing on the mode that benefits them the most. It is on this learning style that the present study is anchored.

Why learning style?

How can science teachers improve the performance of their students if they do not know how the students learn? How can teachers pretend any longer that they are serious about creating a learning society if teachers have no satisfactory responses to the question; what model of teaching do science teachers adopt and how do they use it to improve their practice and that of the students?

There is a strong intuitive appeal that instructors should pay closer attention to student's learning styles by diagnosing them, by encouraging learners to reflect on them and by designing teaching and learning interventions around them. When this is done, learners will become more motivated to learn by knowing their strength and weaknesses as learners. In turn, instructors can respond to individual's strengths and weaknesses, then retention and achievement rates and learning to learn skills provide a foundation for life-long learning. If instructors accept that people are all different in similar ways and that is possible to identify and measure these differences reasonably accurately, then the potential benefits for teachers and learners are phenomenal. A greater knowledge of a range of learning styles will help the instructors to be more aware of their preferred teaching style (coffield, Moseley, Hall, and Ecclestone, 2004). This might include the way they communicate and the kinds of methods and techniques used to explain things. It might also include the way they plan lessons and the kinds of tasks and activities devised for learners; recognize their student's learning style preference, particularly those that are different from their own and also understand better the difficulties and barriers that young people experience in their learning. Potentially, the most attractive claim is that teachers will be able to match their teaching to their student's learning styles by explaining and presenting things in different ways using alternative teaching aids and techniques and tailoring activities that they provide to suit their students learning styles. Greater awareness of their own dominant learning styles can help teachers to provide learning activities that are more inclusive of the other styles and which reach all students.

Relevance of learning styles on learning and teaching

With the shift from an instructional to a learning paradigm there is growing acceptance that understanding the way students learn is the key to science education improvement. To achieve a desired learning outcome, one should provide teaching interventions that are compatible with the student's learning styles. Thus, learning styles is a concept that is important not only in shaping teaching practices, but also in highlighting issues that help school administrators think more deeply about their roles in facilitating students learning. When teaching takes place in or out of the classroom, students are expected to learn. Teaching is intended to result in learning, secondary school teachers can benefit from understanding and applying certain principles of

learning when designing and implementing their teaching initiatives. Neglecting or misapplication of principles of learning could easily result in teaching that fails to achieve results, it is important that teachers become familiar with the underlying principles in learning. Previous studies have reported that student's learning performance could be improved if proper learning style dimension is taken into consideration when developing any learning or instructional process (Graf, Liu, and Kinshuk, 2010).

Sims, and Sims. (1995) reported that learning may not take place if the teaching is not structured to facilitate learning even when the teaching mode is appropriate. Learning principles that will affect the learning of students and the success of teaching efforts are setting the stage, provide clear instructions and modeling appropriate behaviour when emphasizing particularly skills or competencies. Teaching efforts today are made at the classroom level with relatively large group of students. Thus, while the teaching approaches are at the class (macro) level, learning takes place at the individual student (micro) level, influenced by their individual learning style preferences (Sims & Sims 1995). The challenge to teachers is the attempt to bridge this gap. Proponents of learning style assessment contend that optimal instruction requires diagnosing individuals learning style and tailoring instruction accordingly.

Assessment of learning style typically ask people to evaluate what sort of information presentation they prefer (words versus pictures versus speech) and or what kind of mental activity they find most engaging or congenial (Analysis versus listening) although assessment instruments are extremely diverse, most common-but not the only - hypothesis about the instructional relevance of learning style is the meshing hypothesis, according to which instruction is best provided in a format that matches the preference of the learner (e.g. for a visual learner emphasizing visual presentation of information). In teaching, whether teachers are aware of it or not, an assumption underlying many of the current teaching practices is that students are 'empty vessel 'and teacher's role is to fill them with knowledge and academic content. But increasingly, research on student learning suggests the metaphor of 'dialogue' is more appropriate in that it emphasis the interactive, cooperative, rational aspects of teaching and learning. (Steve, 2000).

Once faculty shifts from the empty 'vessel' model to a dialogue and communal one; old habit in teaching begins to shift. A lecture class no longer entails simply a scripted delivery of information (no matter how well done), but it may also include a variety of 'active learning' techniques that truly engage students in the collective dialogue. This is built on the fact that student's bodies are increasingly diverse, not only in terms of ethnicity and gender but also in terms of age, nationality and cultural background. This diversity can affect classroom settings in many ways, including the diversity of learning styles. For example, older students who can draw from their life experience are more likely to be independent, 'self-directed' learners (Knowles, 1980). Despite the apparent tendencies, it is equally important not to pigeonhole students on the basis of expected learning styles since a vast range of individual differences is evident with any demographic group (Knowles 1980). The contention is that, by making an effort to consider students learning styles teachers may be able to reap equal satisfaction from reinvigorating their teaching practices hence high academic achievement (Erdogan.,Bayran., &Deniz, 2000). Realistically, no teacher can expect to develop

different ways of teaching for each individual student in their class, but they can provide variety of learning experiences such that at one point or another each learning style is addressed.

A specific attention has been given to chemistry education perhaps due to its wide application in medicine, pharmacy and in the Nigerian 6-3-3-4 system of education curriculum where chemistry subject is optionally taught in most senior secondary schools. Chemistry being one of the three core sciences is an important aspect of life in all, especially with the rise in globalization of science education where the human race needs a common and identifiable scientific knowledge for technological advancement (Ray. 2010). Most of the courses in higher education also require good result in chemistry subject since the subject lays a sound scientific foundation for advancement in science education. For these reasons, achievement in Senior Secondary School Chemistry has been and continues to be researched on and understood in the light of the factors affecting achievement. A number of learning -related concepts, such as perception of academic control and achievement motivation which have been a focus of attention when attempting to identify factors affecting learning related performance (Cano-Gracia, and Hughes, 2000).

Relevance of Learning Style on Academic Achievement

Academic achievement has, for the past centuries, been the nucleus of interest in Science education research. Exploring the issue of achievement has extended beyond simple issues of intelligence and prior academic achievement into how learners interact with the learning material. Steve (2000) claims that satisfactory learning styles culminates and influences academic achievement. Students need to understand their learning styles preferences and make use of such in order to improve their academic success (Simpson & Wiener 1989). Several factors have been identified in explaining academic achievement: demographic status (Ray, 2010), intelligence (Deary., Strand., Smith, & Fernandez, 2007); behavioral characteristic (Lane., Barton-Arwoo., &Nelsonz, 2008); and psychological factors such as attributes (Erdogan., Bayram, &Deniz, 2008) Self-esteem (Reasoner, 2005) self-efficacy (Olatunde, 2009) and Self-concept (Holliday, 2009).

The constructs academic achievement is defined as successful completion, through effort of the acquisition of academic content and skills. Olatunde, (2009) States that, accomplishment " is sometime used in place of "achievement ". According to the writer educational achievement is measured by standardized achievement test developed for school science subjects. This implies that academic achievement is measured in relation to what is attained at the end of a course, since it is the accomplishment of long term objective of education. What is important is that the test should be a standardized test to meet national or state norm. For a test to be standardized, it must be valid for over a period of time. Academic achievement discourse prefer that all students in a school take the same course work and engage in that course work in the same way - through traditional methods such as note-taking, raising hands for questions, and reading the same textbooks. The bottom line in academic achievement discourse is based on grades and test scores. Academic achievement has always been influenced by the learners

previous education performance, parents income and social status, student's social and emotional status or wellbeing, the school environment, learner's attitude (Erdogan., Bayram., and Deniz, 2008), among other factors. The present research study is aimed at determining the preferred learning styles as they relates with academic achievement of students without really understanding the causal-effect relationship. An experimental research can be conducted in future to examine the causal-effect relationship between the two variables so as to confidently and empirically state whether or not learning styles determines achievement in science education.

Statement of the problem

The worrisome observation about Senior Secondary School Chemistry students' preferred learning styles and the decline of the student's academic achievement in the Akwa Ibom Senior Secondary Two Promotion Examinations (AKSS2PE) result is a problem that bothers parents, teachers, policy makers and government. Existing evidence shows that AKSS2PE results for chemistry students in public secondary schools are deteriorating yearly across all schools in the state (MOE, 2018). Most chemistry students do not seem to have learned how to learn or discover their preferred learning styles for different learning materials and content in the subject. There are observed to be inattentive in class, get discouraged about the subject and themselves. In some worse cases, they do poorly on tests, examinations and opt out of the subject. Review of literature has shown that very limited numbers of works have been reported in the literature on the role of preferred learning styles by students as they relate with students academic achievement.

Therefore, this study seeks to investigate students learning styles preferences and its relationship with academic achievement in chemistry.

Research questions:

The following research questions were formulated to guide the study:

1. What is the difference in learning styles preferences among male and female secondary school chemistry students in OrukAnam Educational Zone, Akwa Ibom State?
2. What is the difference between high and low academic achievers among secondary school chemistry students in OrukAnam Educational Zone, Akwa Ibom State?
3. What is the relationship between preferred learning styles and academic achievement among male and female chemistry students in OrukAnam Educational Zone, Akwa Ibom State?

Research Hypotheses:

The following hypotheses were tested statistically in this study:

1. There is no significant difference in learning styles preferences among male and female secondary school chemistry students in OrukAnam Educational Zone, Akwa Ibom State.

2. There is no significant difference between high and low academic achievers among secondary school chemistry students in OrukAnam Educational Zone, Akwa Ibom State.
3. There is no significant relationship between learning styles preferences and academic achievement among male and female chemistry students in OrukAnam Educational Zone, Akwa Ibom State.

Research Methodology

Research Design:

This study adopted a descriptive survey design. In descriptive survey design, data collection is carried out in a structured process without manipulation and is aimed to describe the characteristics of selected phenomenon.

Study Population:

In the present study, all the 450 senior secondary two (SS2) chemistry students in 2018/ 2019 school year in OrukAnam education zone formed the target population.

Sample and Sampling Techniques:

A multistage sampling technique was adopted. Samples of 10 out of 15 public senior secondary schools in OrukAnam education zone were selected by lottery. Thereafter, in each of the 10 selected public schools, 32 senior secondary two (SS2) chemistry students who have written Akwa Ibom Senior secondary Two Promotion Examinations (AKSS2PE) were selected through simple random sampling making a total sample of 320 students that participated in the study.

Instrument for Data Collection:

A set of questionnaire was used for data collection. The questionnaire comprised of demographic data, end of term examination score sheet for retrieval of achievement scores of the participants and a standardized VAK questionnaire (version 7.2) design by Neil Fleming in 1995 which explored different individual styles of learning. The VAK questionnaire has 14 questions or statement that assessed into Visual (V), Auditory (A), and Kinesthetic (K). Based on the VAK questionnaire scoring chart, the highest scores would be the dominant learning style of an individual. The scoring chart comprised all the answers for all the 14 questions according to each category, Visual (V), Auditory (A) and Kinesthetic (K).

Data Collection Procedure:

After obtaining approval from each of the 10 selected schools, the investigator personally administered a set of questionnaire to the individual participants and requests the students to respond to every components of the questionnaire which takes 10-20 minutes in the classroom. Thereafter, the questionnaire were retrieved from the students and the promotion examination scores of the participated students were retrieved from the subject or class teachers' records using scores' sheet.

Data Processing and Analysis:

For data processing, all the data were gathered and manually counted the total score of each questionnaire followed by each component. Those that were not fully completed by the students and some who inappropriately answered the questionnaire by continuous circling one single option constantly were excluded from the study. More so, the student who have no promotion examination scores in chemistry which was the guideline used for portraying the academic achievement, were also excluded from the study. A calculated mean score of 60 is used in categorizing the academic achievement into high and low levels. A student who scores 60% and above was deemed to have highly achieve, while the student who has 59% and below was deemed to have lowly achieve. The exclusion of some questionnaires resulted in the 310 samples used for the analysis. The data from the 310 samples were coded, entered and analyzed using the statistical package for social science (SPSS) version 20.0.

Results

Table 2.0: Descriptive statistics of the basic variables (N = 310)

Variables	Frequency	%
Students learning Style Preferences		
Visual (V)	213	68.7
Auditory (A)	56	18.1
Kinesthetic (K)	41	13.2
Total	310	100.0
Gender		
Male	156	50.3
Female	154	49.7
Total	310	100.0
Academic achievement levels		
High	165	53.2
Low	145	46.8
Total	310	100.0

Result from table 2 shows different learning style preferences, gender and level of academic achievement. It depicts that chemistry students preferred visual (68.7%) followed by auditory (18.1%) and kinesthetic (13.2%). For gender 50.3% (156) were male students while 49.7% (154) were female students. In terms of academic achievement levels, 53.2% (165) of the student falls under high achieving groups while 46.8% (145) were low achievers.

Hypothesis one:

1. There is no significant difference in learning styles preferences among male and female secondary school chemistry students in Oruk Anam Educational Zone, Akwa Ibom State.

Table 3.
Independent t-test analysis showing results of the difference in learning styles preferences among secondary school chemistry students by gender

Variables	Groups	N	$\bar{X}$	SD	DF	t-val	Crit-val
Student Learning Styles	Male	156	73.6538	11.07666	308	0.321	1.966
	Female	154	73.2468	11.25365			

The result as on the table 3 above indicated that the calculated t-value 0.321 was less than the critical t-value 1.966 at 0.05 level of significance and 308 degree of freedom. With that the null hypothesis was accepted and the alternative hypothesis was rejected.

Hypothesis two: There is no significant difference between high and low academic achievements among secondary school chemistry students in OrukAnam Educational Zone, Akwa Ibom State.

Table 4:
Independent t-test analysis showing results of the difference in academic achievement levels among secondary school chemistry students

Variables	Groups	N	$\bar{X}$	SD	DF	t-val	Crit-val
Academic achievement	High	165	60.7455	0.67764	308	3.069	1.966
	Low	145	58.6966	0.46134			

From the results in table 4 above, the calculated t-value 3.069 was higher than the critical t-value 1.966 at 0.05 level of significance and 308 degree of freedom. With that, the null hypothesis was rejected and the alternative hypothesis was accepted.

Hypothesis three: There is no significant relationship between learning styles preferences and academic achievement among male and female chemistry students in OrukAnam Educational Zone, Akwa Ibom State.

Table 5: Pearson product moment Correlation analysis showing the relationship between learning styles preferences and academic achievement by gender.

Correlation				
Students learning style			**Gender**	
		Overall	**Male**	**Female**
Visual (V)	Pearson correlation	0.031	-0.010	0.157
	sig (2-tailed)	0.646	0.916	0.100
	N	213	105	108

Auditory (A)	Pearson correlation	0.140	-0.013	0.305
	Sig (2-tailed)	0.331	0.953	0.130
	N	56	30	26
Kinesthetic (K)	Pearson correlation	-0.147	0.340	-0.058
	Sig (2-tailed)	0.346	0.155	0.789
	N	41	21	20

Result from table 5 shows a very weak or no relationship among all the various learning styles dimensions. The visual learners had overall correlation coefficient r=0.031, auditory learners r = 0.140 and the kinesthetic learners r = -0.147. Among the visual learners, male had r = -0.010, female r = 0.157 while auditory learners, male r = -0.013, female r = 0.305 and for the kinesthetic learners, male r = 0.340 whereas female r = - 0.058.

Discussion of Findings

The findings from table 2 revealed that the visual learners were the majority (68.7%) compared to those who preferred auditory (18.1%) and or kinesthetic (13.2%). Specifically, the kinesthetic learners were the least preferred learning style. This is consistent with the findings of Laxman et al (2013) who found out that kinesthetic learning style was the least among their study population.

The finding of this study were found contrary to what Vaishnav and Chirayu (2013) found in their study on learning style and academic achievement where they found out that the kinesthetic learners were the majority. The difference may be explained by the cultural contexts considering that these studies were conducted in different countries. According to Gappi (2013), the cultural environment of the students to a large extent dictates the way the students receive and process information in a learning environment. For gender 50.3% (156) were male students while 49.7% (154) were female students.

Result from table 3 revealed that there is no significance difference in students learning styles preferences among male and female students. The result of this findings is supported by Erton (2010) who found that male student tend to perform in sciences higher than the female students.

Result from table 4 revealed that there was statistically significant difference between high and low academic achievement groups among secondary school chemistry students. The result of these findings is in consonance with the findings of Abidin et al (2011) who found in their study on learning styles preferences and academic achievement that the proportion of student who achieved high in academics were greater than those who achieved low.

Findings from table 5 revealed that there is very weak or no correlation between the overall academic achievement and the various learning style dimensions. The result of this study is in consonance with the findings of Gappi, (2013) in a study on the students' preferred learning styles and their academic performance where it was found

that there was no significant statistical correlation between the overall academic achievement and the learning style preferences among secondary school students.

In term of gender, male students had a very weak-negative (r = -0.010) or no relationship with visual learning style while the female student had a weak positive (r = 0.157). Male students also had very weak negative (r = -0.013) or no relationship with the auditory style of learning whereas females (r = 0.305) was moderate positive. Further, male students shows low positive (r = 0.340) correlation with kinesthetic style of learning compared to the female students with very weak negative (r = -0.058) or no relationship with kinesthetic style of learning.

Conclusion

Based on the findings of this study, the following conclusions were reached:

1. Large proportion of the senior secondary two (SS2) chemistry students were visual learners (68.7%) followed by auditory learners (18.1%) and the least was kinesthetic learners (13.2%).
2. There was no statistically significant difference in learning style preferences among male and female chemistry students in OrukAnam education zone Akwa Ibom State.
3. There was a statistically significant difference between high and low academic achievements among secondary school chemistry students in OrukAnam education zone Akwa Ibom State.
4. There was weak or no relationship between learning styles preferences and the overall academic achievement among male and female chemistry students in OrukAnam education zone Akwa Ibom State.

It is evident from the study that the students only visualized spelling of words or facts to be memorized but have not had enough verbal analogies and storytelling to demonstrate their point nor make models or role play to physically experience learning. The students are expected to rise to these challenges by equipping themselves with discussions, tapes and recording, notes taking, drama, use of scratch papers, experiment and hand-on activity learning techniques to acquire multimodal learning style which enhance meaningful and life-long learning for nation building.

Recommendation

The present study yield some essential insights into learning styles preferences among senior secondary chemistry students and the following recommendations are made:

(a) Teachers/instructors need to take into account their students diverse learning styles, design instructional strategies that take care of those diversities and remain sensitive of such during the instruction process.
(b) Students need to understand their learning styles preferences and make use of such to develop meaningful and life-long learning.
(c) School administrators need to provide various learning materials which can bring diversity in the classroom by employing visual, auditory and kinesthetic

materials such as use of technology and students' project writing and presentation among other methods.

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