

Influence of Learning Styles On the Academic Performance of Chemistry Students in Ekiti State, Nigeria

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Abstract

This study investigated the influence of learning styles on the academic performance of chemistry students in Ikere Local Government Area of Ekiti State. The study adopted descriptive design of the survey type of research. The population of the study comprised of chemistry students in senior secondary schools in Ikere Local Government Area of Ekiti State. The sample of the study was four hundred (400) students selected from ten (10) secondary schools. Simple random sampling technique was used to select forty (40) respondents from each of the selected secondary schools. The instrument for data collection for the study was a questionnaire. The split half method of reliability was used to ascertain the reliability of the instrument. A coefficient of 0.87 was obtained. Frequency counts and percentage were used to analyse the research questions while the formulated hypotheses were tested using inferential statistics of Chi-square (χ^2). The findings of the study revealed that there were significant influences of kinesthetic, visual, auditory and tactile learning styles on academic performance of chemistry students. Based on these, it was recommended among others that teacher should always choose suitable teaching method that suit and meet the learning style and academic needs of students in chemistry class.

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Introduction

Education has become the world most powerful instrument to bring about change and transformation in the character of every individual member of any society and nation. According to Uriah and Wosu (2012), education deals with how to build, train and develop the innate capacities and potentials of every learner in order to make him or her responsible, resourceful and useful member of society. The process of education entails the systematic process that has influence on knowledge, skills and attitudes of people and also explains the transmission and development of the precious values, skills, cultures and attitudes in terms of disposition and perception of the immediate community. No doubt, education has demonstrated great impact in the lives of individual and nation as a result of invention and creativity through science. According to Ezeh (2013), science is word derived from the Latin word "scientia" which means knowledge. The knowledge in this context implies all the truth, facts, information and principles learned throughout time. Nigeria government also recognizes the impact and importance of science to the development of the nation as science is introduced in all level of education system in Nigeria. In primary and junior secondary schools, it is tagged as basic science and divided into three school subjects in senior secondary schools; chemistry, biology and physics.

Chemistry as a secondary school subject is an essential science subject with a lot of values and benefits attached to it. Chemistry is more than just a subject because it encompasses all that explains the behaviour, composition, analysis and features of matter. Ibrahim, et al. (2017) stated that the position of chemistry as a science subject is unique in achieving the scientific and technological advancement of any country in the contemporary world. The uniqueness in roles and importance of chemistry are feasible and well established in the development of science and technology in Nigeria. Considering, the great importance of Chemistry in our nation development, the government, researchers, chemistry teachers, Science Teachers Association of Nigeria (STAN) and other agencies are making efforts to promote achievement of students in Chemistry.

It is obvious that the major expected outcome of educational setting for teaching chemistry is students' academic performance and it is very essential and crucial to government, stakeholders in chemistry education, scientists, chemists and parents. Thus, the quality of students' performance remains a top concern for educators. It is meant for making a difference locally, regionally, nationally and globally. However, the academic performance of students in chemistry has not been encouraging. Nja and Obi (2019) opined that when student's academic performance in chemistry is poor, this indicates that students to be produced from those schools may not be able to perform very well in chemistry oriented courses and the duties they may be trained to do in the future. Educators, trainers and researchers have long been interested in exploring variables contributing effectively to quality of performance of learners. These variables that affect students' academic performance are both inside and outside the school. According to Odumber, et al. (2015), these factors may be termed as student factors, teacher factor, family factors, school factors and peer factors. Such include shortage of chemistry teachers in school, lack of adequate instructional materials/aids, poor classroom environment, large class size effect, teacher and students attitude, study habit, learning styles of students among others. Among students' factors that influence learning and academic performance, learning style is very essential and a great determinant.

Learning style deals with the ways and manners of individual mode of learning. Learning style relates with individual's affinity for how efficient learning is processed and achieved.

Learning style is peculiar to every individual which has to be developed in due time as individual is learning and have encounter with new and difficult knowledge. Thus, learning style entails how chemistry students process of learning and not what they are learning. The learning process of one student is different from another and so it is among all the students. Even in the same educational environment, learning does not occur in all students at the same level and quality (İlçin, et al, 2018).

Thus, learning style is crucial to how students will perform in chemistry. This is so because, how much student has learnt, what he has learnt and pattern of learning will determine if he or she is ready for academic performance. Dalmolin et al. (2018) discovered that there was a positive connection between learning styles and academic performance of students. A student with effective and well adapted learning style will surely be able to function well, assimilate well and have the ability to transfer knowledge from what is learnt to academic performance. Magulod Jr. (2019) also found a significant relationship between learning styles and academic performance of students. Students' learning styles are influenced by environmental, emotional and cognitive factors alongside their previous experiences.

In the teaching-learning environment there have been questions as to why some students learn better than other students under the same conditions. Educators are concerned about using different teaching methods and instructional materials to improve achievement of their students. Students on the other hand, have a role to play in improving their performance after a given period of instruction. If the teacher does all that is in his power to do to ensure good performance and the students do not play their part; then success may not be achieved. Hence, the learning style of every students could play a great role in the extent and depth of their academic performance.

Kinesthetic learning is a style of obtaining information. Kinesthetic learning's primary premise is that a student learns best when shown simulations, presentations and videos or when moving around in a hands-on environment. Similar to tactile learning, which emphasizes the likes of drawing, touching and building in educational circumstances, kinesthetic learning stresses full-body movement to process new information, for example, pacing back-and-forth while memorizing or drawing flowcharts and underlining notes while tapping legs. Moreover, these learners understand best with concrete or real-life examples (Adekunle, 2020).

The visual learning style is fairly self-explanatory. It is all about seeing things in order to learn them. This can take many forms, from spatial awareness, colours and tones, brightness and contrast, and other visual information. Visual learning examples include watching a video or in-person demonstration of cooking a meal, following a diagram to build furniture, looking at a graph to understand statistics, writing instructions on a white board for people to follow, and more. Visual learning focuses on what we can see, so anything that is looked at or watched is part of visual learning (Western Governors University [WGU], 2021).

Auditory learning is a kind of learning style in which a student learns through the process of listening. An auditory learner relies on the mode of listening and speaking as a pivot means of learning (Kostelnik, et al., 2004). Auditory learners are able to hear what is being said or instruction being disseminate in order to understand and grab the understanding of what is being taught but they may have difficulty with instructions that are drawn but if the writing is in a logical order it can be easier to understand.

Tactile learning is a learning style that suggests that people learn through touching, feeling and moving. This learning style emphasizes that learning for some and most people is done by doing. Students utilizing tactile style of learning are able to focus on more than one thing at

the same time, like studying or learning while listening to music. Their memories rely on remembering things by tracing back their minds on what their bodies did. They also show receptors that are very quick and hand-eye coordination that are very high. The learning involves students making use of their bodies to express their ideas, thoughts or how they have understood a particular concept in any field (Prime Essay [PE], 2020).

In view of the above, the purpose of this study was to determine influence of learning styles on the academic performance of chemistry students in Ikere Local Government Area of Ekiti State. Specifically, the research investigated the:

1. correlation between kinesthetic learning style and academic performance of chemistry students;
2. correlation between visual learning style and academic performance of chemistry students;
3. correlation between auditory learning style and academic performance of chemistry students; and
4. correlation between tactile learning style and academic performance of chemistry students.

Research Hypotheses

Ho1: There is no significant correlation between kinesthetic learning style and academic performance of chemistry students.

Ho2: There is no significant correlation between visual learning style and academic performance of chemistry students.

Ho3: There is no significant correlation between auditory learning style and academic performance of chemistry students.

Ho4: There is no significant correlation between tactile learning style and academic performance of chemistry students.

Research Method

The research design adopted in this study was descriptive design of the survey type. The population for this study consisted of all the secondary school chemistry students in Ikere Ekiti LGA. This mainly consisted of senior secondary school chemistry students' class I, II and III. The sample size of four hundred (400) students was used for the study. The respondents were the selected students from ten (10) senior secondary schools within Ikere Local government. Simple random sampling technique was used to select forty (40) respondents from each of the selected secondary schools.

The research instrument for this study was a self-constructed questionnaire. The questionnaire was made up of two sections, A and B. Section A was used to collect the bio-data of the respondents while Section B was used to elicit information for data analysis which was designed to portray the four (4) research variables of the study and it was Likert rating format of response of Strongly Agree, (SA), Agree, (A), Strongly Disagree, (SD), Disagree, (D). Split half method was used to determine the reliability of the instrument. The researcher administered the instrument to thirty (30) respondents from one of the public secondary schools not selected for the research; the instrument was divided into even and odd numbers. Therefore, two sets of data were generated. The data collected were analysed with the use of Pearson's Product Moment Correlation (PPMC). The coefficient obtained was subjected to further analysis with the use of Spearman Brown's formula to determine the value of (r) at 0.05 level of significance. The reliability index was 0.87.

The researcher personally visited the schools to administer the questionnaire to the selected students in the ten (10) schools. The data collected were analysed using descriptive and inferential statistics.

Results

Table 1: Influence of kinesthetic learning style on academic performance

S/N	ITEM	SA	A	D	SD
1.	I learn when I am shown how to do something, and I have the opportunity to do it	266 (66.5)	127 (31.8)	7 (1.8)	0 (0.0)
2.	I tend to solve problems through a more trial-and-error approach	135 (33.8)	209 (52.3)	42 (10.5)	14 (3.5)
3.	Before I take a particular form of learning, I like to see someone else doing it first	146 (36.5)	164 (41.0)	67 (16.8)	23 (5.8)
4.	I am not skilled in giving verbal explanations but like to show my skills in practical	167 (41.8)	169 (42.3)	54 (13.5)	10 (2.5)
5.	I think better when I have the opportunity to experiment	210 (52.5)	164 (41.0)	20 (5.0)	6 (1.5)

Table 1 shows the influence of kinesthetic learning style on academic performance of chemistry students. The table revealed that 393 (98.2%) respondents agreed that they learn when they are shown how to do something, and they have the opportunity to do it while 7 (1.85%) respondents held a contrary opinion. In item 2, 344 (86.0%) respondents agreed that they tend to solve problems through a more trial-and-error approach while 56 (14.0%) disagreed. In item 3, 310 (77.5%) students held the view that before they take a particular form of learning, they like to see someone else doing it first while 90 (22.5%) respondents held a contrary view. In item 4, 336 (84.0%) students indicated that they are not skilled in giving verbal explanations but like to show their skills in practical. And lastly, in item 5, 374 (93.5%) respondents agreed that they think better when they have the opportunity to experiment while 26 (6.5%) disagreed.

Table 2: Impact of visual learning style on academic performance of students

S/N	ITEM	SA	A	D	SD
1.	I remember something better if I write it down	207 (51.7)	155 (38.8)	34 (8.5)	4 (1.0)
2.	Lesson with display of pictorial chart helps me to look at the teacher while listening and it keeps me focused	199 (49.8)	145 (36.3)	42 (10.5)	14 (3.5)
3.	I enjoy visual explanation of lesson and I like to use picture in my notes	141 (35.3)	136 (34.0)	89 (22.3)	34 (8.5)
4.	It is hard for me to understand what a person is saying when there are people talking or playing music	189 (47.3)	126 (31.5)	59 (14.8)	26 (6.5)
5.	If I am taking a test, the picture analyses make me to see the textbook page and where the answer is located	159 (39.8)	148 (37.0)	76 (19.0)	17 (4.3)
6.	I obtain information on an interesting subject by reading relevant materials	181 (45.3)	175 (43.8)	32 (8.0)	12 (3.0)
7.	I am skillful and enjoy developing or making	170	155	55	20

	graphs and charts	(42.5)	(38.8)	(13.8)	(5.0)
8.	I feel the best way to remember is to picture it in my head	190 (47.5)	127 (31.8)	59 (14.8)	24 (6.0)

Table 2 shows the result of analysis of the impact of visual learning style on academic performance of chemistry students. The table revealed that for item 1, 362 (90.5%) respondents agreed that they remember something better if they write it down while 38 (9.5%) respondents disagreed. In item 2, 344 (86.0%) respondents held the view that lesson with display of pictorial chart helps them to look at the teacher while listening and it keeps them focused while 56 (14.0%) held a contrary opinion. In item 3, 277 (69.2%) students agreed that they enjoy visual explanation of lesson and they like to use picture in their notes while 133 (30.8%) students opposed the assertion. In item 4, 315 (78.8%) respondents agreed that it is hard for them to understand what a person is saying when there are people talking or playing music while 85 (21.2%) students disagreed. In item 5, 307 (76.8%) respondents agreed that if they are taking a test, the picture analyses make them to see the textbook page and where the answer is located while 93 (23.2%) disagree. In item 6, 356 (89.0%) students agreed that they obtain information on an interesting subject by reading relevant materials while 44 (11.0%) disagree. And lastly, in item 7, 325 (81.2%) respondents agreed that they are skillful and enjoy developing or making graphs and charts while the remaining 75 (18.8%) held a contrary opinion. In item 8, 317 (79.2%) students indicated that they feel the best way to remember is to picture it in their heads while 83 (20.8%) disagreed.

Table 3: Effect of auditory learning style on academic performance of students

S/N	ITEM	SA	A	D	SD
1.	I like reading audibly and it helps me use my finger as a pointer when reading to keep my place	142 (35.5)	140 (35.0)	76 (19.0)	42 (10.5)
2.	When my teacher is teaching chemistry, I get better understanding of the lesson than when reading	149 (37.2)	135 (33.8)	80 (20.0)	36 (9.0)
3.	I remember things that I hear rather than the things I see or read	131 (32.8)	136 (34.0)	75 (18.8)	58 (14.4)
4.	I learn to spell better by repeating the letters out loud than by writing the words on paper	112 (28.0)	116 (29.0)	132 (33.0)	40 (10.0)
5.	If I had the choice to learn new information through teaching or textbook, I would choose to hear it than read it	127 (31.8)	132 (33.0)	92 (23.0)	49 (12.3)
6.	I follow oral direction better than written one	124 (31.0)	130 (32.5)	105 (26.2)	41 (10.2)
7.	I require explanation of diagrams, graphs, or visual directions	161 (40.3)	150 (37.4)	72 (18.0)	17 (4.3)

Table 3 shows the result of analysis of the effect of auditory learning style on academic performance of chemistry students. The table revealed that in item 1, 282 (70.5%) respondents agreed that they like reading audibly and it helps them use their finger as a pointer when reading to keep their place while the remaining 118 (29.5%) respondents disagreed. In item 2, 284 (71.0%) students agreed that when their teacher is teaching chemistry, they get better understanding of the lesson than when reading while 116 (29.0%)

students opposed the statement. In item 3, 267 (66.8%) students stated that they remember things that they hear rather than the things they see or read while 133 (33.2%) respondents held a contrary view. In item 4, 228 (57.0%) respondents agreed that they learn to spell better by repeating the letters out loud than by writing the words on paper while 172 (43.0%) disagreed. In item 5, 259 (64.8%) students indicated that if they had the choice to learn new information through teaching or textbook, they would choose to hear it than read it while 141 (35.3%) disagreed. In item 6, 254 (63.5%) students stated that they follow oral direction better than written one while 146 (36.5%) disagreed. And lastly, in item 7, 311 (77.8%) students opined that they require explanation of diagrams, graphs, or visual directions while 89 (22.2%) students disagreed.

Table 4: Effect of tactile learning style on academic performance of students

S/N	ITEM	SA	A	D	SD
1.	I learn better using my hand than any other part of my body	180 (45.0)	147 (36.8)	55 (13.8)	18 (4.4)
2.	I learn quickly and permanently based on what I can feel	191 (47.8)	163 (40.8)	36 (9.0)	10 (2.5)
3.	I learn effectively when I can manipulate an object or learning materials	146 (36.5)	202 (50.5)	40 (10.0)	12 (3.0)
4.	When I can't think of solution to a problem, I like to use my hands-on activities experience to get the solution	168 (42.0)	183 (45.8)	40 (10.0)	9 (2.2)
5.	I enjoy learning with hands-on activities	164 (41.0)	171 (42.8)	51 (12.8)	14 (3.4)

Table 4 shows the result of analysis of the effect of tactile learning style on academic performance of chemistry students. The table revealed that in item 1, 327 (81.8%) respondents agreed that they learn better using their hand than any other part of their body while the remaining 73 (18.2%) respondents disagreed. In item 2, 354 (88.5%) students agreed that they learn quickly and permanently based on what they can feel while 46 (11.5%) students opposed the statement. In item 3, 348 (87.0%) students stated that they learn effectively when they can manipulate an object or learning materials while 52 (13.0%) respondents held a contrary view. In item 4, 351 (87.8%) respondents agreed that when they can't think of solution to a problem, they like to use their hands-on activities experience to get the solution while 49 (12.2%) disagreed. And lastly, in item 5, 335 (83.8%) students opined that they enjoy learning with hands-on activities while 65 (16.2%) students disagreed.

Test of Hypotheses

Ho1: There is no significant correlation between kinesthetic learning style and academic performance of chemistry students.

Table 5: Chi-square test of students' response

Response	Kinesthetic learning style & academic performance in chemistry	Cal χ^2	Tab χ^2	Remark
Agree	336 (200.0)	194.66	3.84	significant
Disagree	64 (200.0)			
Total	400 (400.0)			

The result of the analysis in Table 5 above shows the influence of Kinesthetic learning style on academic performance of chemistry students. The chi-square test revealed that calculated

$\chi^2(194.66)$ was greater than the critical χ^2 value (3.84) at the 0.05 level of significance. This means that there is significant influence of Kinesthetic learning style on academic performance of chemistry students. Hence, the null hypothesis was not upheld.

Ho2: There is no significant correlation between visual learning style and academic performance of chemistry students.

Table 6: Chi-square test of students' response

Response	Visual learning style & academic performance in chemistry	Cal χ^2	Tab χ^2	Remark
Agree	277 (200.0)	74.54	3.84	significant
Disagree	123 (200.0)			
Total	400 (400.0)			

Table 6 shows the result of analysis of the influence of visual learning style on academic performance of chemistry students. The chi-square test revealed that calculated $\chi^2(74.54)$ was greater than the critical χ^2 value (3.84) at the 0.05 level of significance. This means that there is significant influence of visual learning style on academic performance of chemistry students. Hence, the null hypothesis was not upheld.

Ho3: There is no significant correlation between auditory learning style and academic performance of chemistry students.

Table 7: Chi-square test of students' response

Response	Auditory learning style & academic performance in chemistry	Cal χ^2	Tab χ^2	Remark
Agree	284 (200.0)	81.22	3.84	significant
Disagree	116 (200.0)			
Total	400 (400.0)			

Table 7 shows the result of analysis of the influence of auditory learning style on academic performance of chemistry students. The chi-square test revealed that calculated $\chi^2(81.22)$ was greater than the critical χ^2 value (3.84) at the 0.05 level of significance. This means that there is significant influence of auditory learning style on academic performance of chemistry students. Hence, the null hypothesis was not upheld.

Ho4: There is no significant correlation between tactile learning style and academic performance of chemistry students.

Table 8: Chi-square test of students' response

Response	Tactile learning style & academic performance in chemistry	Cal χ^2	Tab χ^2	Remark
Agree	358 (200.0)	238.64	3.84	significant
Disagree	62 (200.0)			
Total	400 (400.0)			

Table 8 shows the result of analysis of the influence of tactile learning style on academic performance of chemistry students. The chi-square test revealed that calculated χ^2 (238.64) was greater than the critical χ^2 value (3.84) at the 0.05 level of significance. This means that there is significant influence of tactile learning style on academic performance of chemistry students. Hence, the null hypothesis was not upheld.

Discussion of Results

The finding of hypothesis revealed that there is significant influence of Kinesthetic learning style on academic performance of chemistry students. This was in line with the finding of

Damaaudi *et al.* (2011) that the kinesthetic learning style had effects on students' performance and students of the kinesthetic learning style perform significantly higher than students with other learning style. Kinesthetic learning style has advantages in completing traditional intelligence tests and in making decisions, and persons with this learning style tend to do well on technical tasks and less well in interpersonal relations.

Hypothesis 2 revealed that there is significant influence of visual learning style on academic performance of chemistry students. This was in line with Bhati and Bart (2013) that the visual thinker is different in being one who is able to generate and explore multiple answers to problems. Visual thinkers tend to choose the liberal arts and humanities. Visual thinking is related to fluency lie, the ability to produce multiple ideas in response to a task rapidly, flexibility (i.e the ability to produce multiple ideas in response to a task rapidly), flexibility (i.e the capacity to consider multiple approaches to problems, originality (i.e the tenderly to produce novel ideas in response to a task), and elaborate (i.e, the ability to consider the implications and consequences of ideas).

The finding indicated that there is significant influence of auditory learning style on academic performance of chemistry students. This disagreed with the assertion of Bhatti and Bart (2013) that the auditory learning style who perceives information through abstract conceptualization and transforms that information through reflective observation, auditory learner tend to be rational unemotional and more interested in abstract concepts high in people. As the students with auditory learning style, were found out to be consistent in academic performance and perform well.

The finding of the study revealed that there is significant influence of tactile learning style on academic performance of chemistry students. The finding complimented the assertion of Fleming (2019) that tactile learners can remember and transfer knowledge from one lesson to another once they have acted them out. Tactile learners like to experience the world and act out events. To remember the periodic table in chemistry lesson, tactile learners may remember the pattern by pointing to each of the elements on the chart. The finding was also consistent with Warren (2021) that some students learn best when touching or manipulating objects. Using hands-on, tactile learning activities helps the leaners to learn every subject better.

Conclusion

Then study concluded that learning styles influenced and enhanced academic performance of chemistry students. Visual, auditory and tactile learning styles improved and influenced academic performance of chemistry students.

Recommendations

These recommendations were made:

1. Teacher should always choose suitable teaching method that suit and meet the learning style and academic needs of students in chemistry class.
2. In view of the fact that the learning style approach was more effective in teaching chemistry and enhancing students' performance in chemistry, government through ministries of education should ensure that textbook authors incorporate learning styles approach in the instructional method, for secondary schools chemistry text.
3. It further recommended that teacher should diversify teaching strategies as the diversification of teaching strategies would address a wider variety of learning styles, thereby helping to minimize mismatches between learning and teaching styles, whilst ensuring that less preferred learning styles of students are accommodated.

4. Chemistry teachers should be trained on how best to involve students learning style so as to facilitate students' performance and attitude in the lesson. This could be achieved through seminars and workshops for teachers in secondary schools.
5. Teachers should vary their teaching methods and strategies to pave way for students to use different learning styles in chemistry class.
6. Chemistry students should endeavour to identify their unique learning styles and use them.

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