



Influence of Learning Styles and Gender on Students' Academic Achievement in Otuocha Education Zone

Maduawia, Maureen C. & Eya N. M.

Department of Science Education, University of Nigeria, Nsukka

Corresponding author: srceceihm@gmail.com

Abstract

This study investigated the influence of learning styles and gender on students' academic achievement in chemistry. Two research questions with two corresponding hypotheses guided the study. Ex-post facto research design was adopted for the study. The population of the study was 242 SS II chemistry students for 2022/2023 academic session. A sample of 158 chemistry students participated in the study. Two instruments used for data collection were Learning Styles Inventory (LSI) and Chemistry Achievement Test (CAT). The internal consistency reliability index for CAT was 0.83 using KR-20 while that of LSI was 0.90 using Cronbach Alpha. Mean and standard deviation were used to answer research questions while two-way ANOVA was used to test the hypotheses. The results showed that learning styles and gender significantly influenced students' academic achievement in chemistry. Based on the findings, it was recommended that school administrators should provide variety of teaching resources and materials in schools.

Key Words: Academic Achievement, Gender, Learning Styles

Introduction

Education is one of the vital aspects of human resource development and an instrument that can be used to achieve a more rapid economic and scientific development in a country. Unfortunately, education at the secondary schools' level are not measuring up to the standard expected of them (Idowu & Oluwole, 2014). Chemistry being one of the subjects studied at the secondary school is included. Chemistry is the branch of science that deals with the study of the composition and properties of matter, changes in matter, and the laws and the principles that govern these changes. It is an experimental science which relies primarily on the harmony between theories and practice (Omwirhiren & Suleiman, 2016).

Apart from creating job opportunities, the importance of chemistry and its application in daily life can never be over emphasized. It has helped to provide our basic needs and improve the quality of people's life. For instance, the production of fertilizers and insecticides has helped to increase food production in the world. Chemistry is one of the science subjects that is studied by students who are interested in studying medicine and other related science-based professions in tertiary institutions. Considering this importance of chemistry, there is the need that the students' academic achievement in the subject at secondary school level be high

Academic achievement is the yardstick to measure the strength of the school and the capability of the learner. Popham (2011) defines academic achievement as the knowledge and/or skills students have acquired. Kpolovie, Joe and Okoto (2014) define academic achievement of student as the ability of the student to study and remember facts and being able to communicate his knowledge orally or in written form even in an examination condition. In many countries including Nigeria, the best school is known through their academic achievement especially in Senior School Certificate Examination (SSCE) which is marked by West African Examinations Council (WAEC). Hence Dev (2016) maintains that academic achievement of students is not only a pointer to the effectiveness of schools but a major determinant of the future of youths in particular and the nation in general.

Despite the important role which chemistry plays in the life of students, the academic achievement of students in the subject at Senior School Certificate Examination (SSCE) has been quite unsatisfactory over the years. Baanu, Oyelekan and Olorundare (2016) reported that the percentage credit pass level in SSCE (2008- 2014) was less than 50%. Okeke and Samuel (2021) in their study, revealed that the National Examination Council, (NECO), annual report (2017) analysis shows that only 4.41% of chemistry candidates that sat for the examination passed with distinction. The summary

of chief examiner's reports by West African Examinations Council (WAEC, 2016 - 2021) reveal that 43.0, 47.0, 29.0, 40.0, 54.0 and 18.0 are the raw means in 2016, 2017, 2018, 2019, 2020 and 2021 respectively with standard deviations of 15.36, 16.00, 13.78, 14.46, 17.83 and 12.41 respectively. A close look at the data shows a high standard deviation and low raw mean; an indication that students' achievements have not been good. This is an issue of great concern that calls for urgent attention. It should be noted that Chemistry students in Otuocha Education Zone were among those that sat for 2016 -2021 WAEC whose results were unsatisfactory. Factors such as unqualified teachers, lack of instructional resources, parental involvement, etc. have been examined to know why students of this area perform poor in chemistry but all prove abortive. One begins to wonder what is responsible for this poor academic achievement of students. Is it that chemistry is regarded as a difficult subject as Uzezi, Danjuma, and Auwal (2017) and Das & Mahapatra (2017) noted? This made the researchers to think of other variables that may be responsible to this, cardinal among which are learning styles and gender. The aim of this study put in question is what is the influence of learning styles and gender on students' academic achievement in chemistry in Otuocha Education Zone?

Learning style is how learners process incoming information, how they learn and how much they achieve from learning. Ray (2010) defines learning style as the characteristic cognitive, affective, social and psychological behaviours that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment. According to Alade and Ogbo (2014) learning style is the way an individual learns, understands and digests a piece of information in a learning environment. In another definition, Nja, Umali, Asukwo and Orim (2019) define learning style as various ways through which a learner acquires knowledge which influences his performance. Gudnason (2017) defines learning styles as a concept that, different people prefer to process information in different ways. Learning style is both a characteristic which indicates how a student learns and likes to learn, as well as the instructional strategy informing the cognition, context and content of learning. Students hardly perceive and react to a learning situation in exactly the same way in any given environment because every person has his or her own method or set of strategies when learning (Gokalp, 2013). For the purpose of this study, the researcher employs four different learning styles which are: visual, auditory, reading and kinesthetic.

Visual learners have high ability for visual recall and so they work well when given visual media to understand a concept such as maps, chart, diagrams, graph, and visual arts in general. Students in this group learn best by sitting in front of the class where they can be looking at the teacher in order to stay focus, looking at pictures and watching videos.

Another learning style which students manifest is auditory. Auditory learners like to use their ears. They learn best by spoken sources such as lectures and digital audio resources such as radio. They like to hear what people said, rearrange it and then say it aloud in their own way to understand the information better. Reading aloud, discussing with a group or partner as well as podcasts help this group of learners to learn best.

Furthermore, reading is among the learning styles students possess. Reading learners learn best by reading their own condensed version of notes. They do well with learning from list, diaries, and dictionaries and from the internet among others. They prefer to review class printouts, visit library to find books to read.

Kinesthetic learners use bodily sensations to gather information. Students with these learning styles have good balance and coordination and are good with their hands. Learning activities that provide physical activities and hands-on learning experiences work well for the learners. Students under this category learn best when study in short blocks of time, walk or move while reviewing their works or receiving lesson. The above learning styles are utilized by both genders (male and female students) in learning different subjects including chemistry.

Gender is the cultural assignment of roles to male and female, the socio-cultural definition of a boy/girl, or man/woman given by society. According to Ozofor (2010), gender is the socially constructed characteristic roles associated with male and female in a society. It is personality traits, attitudes, behaviours, values, related power, influences, roles and expectations (femininity and masculinity) that society ascribes to the two sexes on differential basis (Eze, 2013). According to Udosore (2011), gender is a cultural construct that distinguishes between the roles, behaviour, mental and emotional characteristics of males and females developed by the society. From the above definitions, one can deduce that gender is ascribed by the society and it is used to describe certain characteristics of male and female which are culturally and socially determined and are regarded as sex. Gender is one of the variables that influence enrollment of boys and girls in science related subjects like chemistry in schools.

From literature reviewed, many researches were carried out on learning styles and academic achievement. For instances, Garner-O'Neale and Harrison (2013) researched on the learning styles and academic achievement of chemistry students at the University of West Indies. Zhang, Huang, Quan and Kuo (2017) researched on impact of learning styles on students' academic achievement of 9th graders in China. Furthermore, Magulod (2018) researched on the learning style preferences and academic achievement of the applied science students in Philippine. The respondents of the aforementioned studies were undergraduates who are more matured while the respondents of the present study were secondary school students who were adolescence and not yet matured. Moreover, the locations of the reviewed studies were outside Nigeria. Most of the countries outside Nigeria are more advanced in technology and as such their students have better facilities that will help them master the concepts being taught at school than Nigerian students. Hence, there is need to replicate the study in Nigeria.

Also many studies were done on gender and academic achievement. For examples, Ani and Egbo (2013) research on the effect of gender on students' achievement in chemistry and discovered that female students performed better than their male counterparts. Ezeudu and Obi (2013) showed that male students out performed female students in chemistry. Also, Ejedegbe (2016) revealed that boys' schools perform better than girls' schools. While, Ain, Atta and Khurshed (2022) found out that female students performed significantly higher than male students in their research gender difference in secondary school chemistry achievement. Conclusively, it is seemingly clear that there is disagreement on the part of researchers with respect to which gender perform better in chemistry. Such disagreement as above requires further investigation and that was what the present study did.

Research Questions

The following research questions guided the study.

1. What is the influence of learning styles on students' academic achievement in chemistry?
2. What is the influence of gender on students' academic achievement in chemistry?

Hypotheses

The following hypotheses were formulated to guide the study and were tested at 0.05 level of significance.

- Ho₁:** Learning styles do not have any significant influence on students' academic achievement in chemistry
- Ho₂:** Gender does not have any significant influence on students' academic achievement in chemistry

Methodology

The study adopted ex-post facto design. This is because the two independent variables cannot be manipulated. The study was conducted in Otuocha Education Zone of Anambra State, Nigeria. The population comprised 242 (122 females and 120 males) in the 2022/2023 senior secondary two (SS II) chemistry students in 24 coeducational public secondary schools in area. The sample size for this study was 158 SS II chemistry students. There are three Local Government Areas in Otuocha Education Zone (Anambra East, Anambra West, and Ayamelum). Two Local Government Areas were sampled using simple random sampling by balloting without replacement. There are 15 coeducational public schools in the two sampled Local Government Areas (7 schools in Anambra East and 8 schools in Anambra West). All the 15 schools were sampled. In the 15 schools in both Local Government Areas, all the chemistry students were used since the number is not much.

Chemistry Achievement Test (CAT) and Learning Styles Inventory (LSI) were used for the study. CAT comprised twenty-five (25) multiple-choice items was developed by the researchers. CAT was subjected to content and face validation. The content validation of CAT was ensured through strict adherence to the test blue print. LSI consists of sixteen (16) items adapted from VARK questionnaire, version 8.01. These instruments were validated by experts in Psychology, Chemistry and Research, Measurement and Evaluation. The two instruments were trial tested with twenty students outside the area of study and scores obtained were used to establish the reliability. The reliability coefficient of CAT was 0.83 using Kuder-Richardson's formula 20 while that of LSI was 0.90 using Cronbach alpha. Face-to-face method of data collection was employed in the administration of the instruments. Mean and standard deviation were used to answer research questions while hypotheses were tested using ANOVA (two-way) at alpha level of 0.05.

Results

Table 1
Mean and Standard Deviation for the Influence of Learning Styles on Students` Academic Achievement in Chemistry

Learning Style	n	\bar{X}	SD
Visual	52	13.79	3.08
Auditory	25	8.40	3.98
Reading	41	15.71	3.07
Kinesthetic	40	16.93	3.47

From Table 1 above, students who are visual learners had a mean academic achievement score of (\bar{X} =13.79, SD =3.08), auditory learners (\bar{X} =8.40, SD =3.98), reading/writing learners (\bar{X} =15.71, SD =3.07) and kinesthetic learners (\bar{X} =16.93,

SD =3.47). It implies that students who are of kinesthetic learning style achieved higher in chemistry, followed by reading, visual and lastly, auditory learning styles.

Table 2
ANOVA Analysis for the Influence of Learning Styles and Gender on Students` Academic Achievement in Chemistry

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1540.330 ^a	7	220.047	23.418	.000	.522
Intercept	25528.739	1	25528.739	2716.849	.000	.948
LearnStyle	695.023	3	231.674	24.656	.000	.330
Gender	291.703	1	291.703	31.044	.000	.171
LearnStyle * Gender	59.352	3	19.784	2.105	.102	.040
Error	1409.468	150	9.396			
Total	34934.000	158				
Corrected Total	2949.797	157				

Table 2 shows that the influence of learning styles on students` academic achievement in Chemistry is significant, $F(3,150) = 24.656$, $p = 0.00$. Thus, the null hypothesis which states that learning styles do not have any significant influence on students` academic achievement in chemistry was rejected. The result also showed that 33% of the

variance increase in students` achievement in chemistry was due to the influence of learning style, $\eta^2 p = 0.33$. This result is followed by a Post Hoc test in Table 3 in order to identify where the difference lies.



Table 3
Scheffe Post Hoc Multiple Comparison Test

(I) LearnStyle	(J) LearnStyle	Mean Difference			95% Confidence Interval	
		(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Visual (V)	A	5.38846*	.81097	.000	3.0961	7.6808
	R	-1.91886	.69595	.059	-3.8861	.0484
	K	-3.13654*	.70080	.000	-5.1174	-1.1556
Auditory (A)	V	-5.38846*	.81097	.000	-7.6808	-3.0961
	R	-7.30732*	.84555	.000	-9.6974	-4.9172
	K	-8.52500*	.84954	.000	-10.9264	-6.1236
Reading (R)	V	1.91886	.69595	.059	-.0484	3.8861
	A	7.30732*	.84555	.000	4.9172	9.6974
	K	-1.21768	.74054	.442	-3.3109	.8756
Kinesthetic (K)	V	3.13654*	.70080	.000	1.1556	5.1174
	A	8.52500*	.84954	.000	6.1236	10.9264
	R	1.21768	.74054	.442	-.8756	3.3109

*. The mean difference is significant at the 0.05 level.

The multiple pair wise comparison post hoc test using Scheffe in Table 3 reveals that mean achievement of auditory and visual learners was significantly lower than that of Kinesthetic learners. But no significant difference was found between the mean achievement scores of kinesthetic and reading

learners. More so, the mean achievement scores of auditory learners were significantly lower than that of reading learners. However, the mean achievement score of visual learners and reading learners are similar. Equally, the mean achievement scores of auditory and visual learners are similar.

Table 4
Mean and Standard Deviation for the Influence of Gender on Students` Academic Achievement in Chemistry

Gender	n	\bar{X}	SD
Male	74	16.04	3.86
Female	84	12.63	4.12

From Table 4 above, male students had a mean achievement score of (\bar{X} =16.04, SD = 3.86) and female students (\bar{X} =12.63, SD = 4.12). Based on this result, the mean achievement score of male students in chemistry is higher than that of the female students.

The analysis of variance result in Table 2 above shows that the influence of gender on students` academic achievement in Chemistry is significant, $F(3,150) = 31.044$, $p = 0.000$. Therefore, the null hypothesis which states that gender does not have any significant influence on students` academic achievement in Chemistry was rejected. The result also showed that 17.1% of the variance increase in students` achievement in Chemistry was due to the influence of gender, $\eta^2p = 0.171$.

Discussion

Analysis of research question one revealed that students who are kinesthetic learners achieve higher in chemistry. Further analysis showed that learning styles significantly influence students` academic achievement in chemistry. This implies that the way students assimilate instructions affect their academic achievements. This is so because a student`s learning style is part of him/her which he /she utilizes while receiving instruction. Therefore, the way they understand and retain concept taught differ. In this study, kinesthetic learners made the highest score. Kinesthetic students hear the teacher, observe the teacher and carry out the activities as the class teacher has demonstrated. Hence, they make use of three senses at once while the lesson is going on. Therefore, the result is not surprising since one tends to retain what one practicalizes. This result is in consonant with the famous quote of Benjamin

Franklin, “Tell me and I forget, teach me and I remember, involve me and I learn.”

The finding of the study agreed with Ibitam (2020) that students with kinesthetic learning style perform better than students with other learning styles. The result is also strengthened by the finding of Magulod (2018) that students of applied sciences prefer kinesthetic as their major learning styles. Contrary to this finding Zhang, Huang, Quan and Kuo (2017) revealed that students that used discussion method out performed students with other learning styles. A student that assimilates instruction with discussion method in Renzulli’s theory has the same characteristic with auditory learner in Fleming theory. This means that auditory learners perform better than other learners. The disparity may be as a result of teaching methods of teacher or learning environment of students.

The result of research question two showed that the mean achievement score of male students in chemistry is higher than that of the female students. Further analysis revealed that gender significantly influence academic achievement in chemistry. This implies that male and female students understand chemistry in different ways. The result is not surprising in that male and female students are different in biological make up. Hence, their differences may affect the way they understand things.

The finding of this study agrees with the findings of Raheem (2017) who showed that male students performed better than female students in mathematics, science and social science. Chemistry is one of the science subjects taught in secondary schools. Nonetheless, the findings of Eya and Ezeh (2020) revealed that gender has small effect on students’ academic achievement in chemistry. The researchers said that the percentage variance in the students’ academic achievement attributed to gender is 3.8% which is also small. More so, the finding is not in consonant with the findings of Ajayi and Ogbaba (2017) that there is no significant difference in the mean achievement scores between male and female students taught stoichiometry using hands-on-activities (kinesthetic leaning style). The discrepancies may be due to location of the school, teaching methods of the teachers and learning environment of students.

Conclusion

In line with the findings of the study on influence of learning styles and gender on students’ academic achievement in chemistry in Otuocha Education Zone, it is concluded that learning styles

and gender significantly influenced students’ academic achievement in chemistry.

Recommendations

Based on the findings, it is recommended that

1. The arm of Government in charge of post primary schools in Otuocha Education Zone should organize periodic workshops to educate teachers on how to discover students’ learning styles while teaching.
2. The school administrators should provide variety of teaching resources and materials in schools to enable teachers teach with different teaching strategies. Hence, accommodating variety of students with different learning styles in the classroom.
3. State Governments should have special packages for science teachers especially those of chemistry. Such incentives will motivate the teachers to teach the subjects effectively to the benefit of the students.
4. Teachers should be gender sensitive and use strategies that appeal to students.

References

- Ain, Q., Atta, B. & Khursheed, M.K. (2022). Gender differences in secondary school chemistry achievement: A case study of Muzaffarabad, Azad Jammu and Kashmir. *Pakistan Journal of Educational Research*, 5(2), 1-10.
- Ajayi, V. O. & Ogbaba, J. (2017). The effect of gender on senior secondary chemistry students’ achievement in stoichiometry using hands-on-activities. *American Journal of Educational Research*, 5(8), 839 -842.
- Alade, M. O. & Ogbaba, A. C. (2014). A comparative study of chemistry students’ learning style preferences in selected schools in Lagos metropolis. *IOSR Journal of Research & Method in Education*, 4(1), 45 – 53. www.iosrjournals.org
- Baanu, T. F., Oyelekan, O. S., & Olorundare, A. S. (2016). Self-efficacy and chemistry students’ academic achievement in senior secondary schools in North-Central, Nigeria. *The Malaysian Online Journal of Education Science*, 4(1), 43 – 52.
- Das, P & Mahapatra, R., L. (2018). Scope of learning chemistry in the curriculum up to secondary level in West Bengal: An overview. *EDULIGHT Journal* 6(13)
- Dev, M. (2016). Factors affecting the academic achievement: A study of elementary school

- students of NCR Delhi, India. *Journal of Education and Practice* 7 (4). www.iiste.org
- Ejedegbe, O. (2016). Gender difference in secondary schools students' achievement in chemistry. *International Journal of Trend in Research and Development*, 3(3), 1-7.
- Eya, N. & Ezeh, D. (2020). Meta-analysis of influence of gender on students' academic achievement in chemistry in Nigeria. *Journal of Chemical Society of Nigeria*, 45(4). <https://doi.org/10.46602/jcsnv45i4.488>
- Eze, D. N. (2013). Science without women: A paradox. 75th Inaugural Lecture of the University of Nigeria, Nsukka
- Ezeudu, F. O., & Obi, T., N. (2013). Effect of gender and location on students' achievement in chemistry in secondary schools in Nsukka Local Government Area of Enugu State, Nigeria. *Research on Humanities and Social Sciences*, 3(15), 50 - 55.
- Garner-O'Neale, L. D. and Harrison, S. (2013). An investigation of the learning styles and study habits of chemistry undergraduates in Barbados and their effect as predictors of academic achievement in chemical group theory. *Journal of Educational and Social Research*, 3(2), 107-122. doi:10.5901/jesr.2013.v3n2p107
- Gokalp, M. (2013). The effect of students' learning styles to their academic success. *Creative Education*, 4(10), 627 - 632, doi: 10.4236/ce.2013.410090
- Gudnason, J. (2017). Learning styles in education: A critique. *Journal of Graduate Studies in Education*, 9(1), 1 - 5
- Ibitham, B. (2020). Influence of learning styles on academic achievement of chemistry students. <https://dx.doi.org/10.2139/ssrn.3714684>
- Idowu, R. A. & Oluwole, B. A. (2014). Effects of student-teacher ratio on academic achievement of selected secondary school students in Port Harcourt Metropolis, Nigeria. *Journal of Education and Practices*, 5(24), 100 - 106
- Kpolovie, P. J., Joe, A. I., & Okoto, T. (2014). Academic achievement prediction: Role of interest in learning and attitude towards school. *International Journal of Humanities Social Sciences and Education* 1(11), 73 - 100. www.arcjournals.org
- Nja, C. O., Umali, C. B., Asuquo, E., E., & Orim, R., E. (2019). The influence of learning styles on academic performances among science education undergraduates at the University of Calabar. *Academic Journals*, 14(17), 618 - 624, doi: 10.5897/ERR/2019.3806
- Okeke, B. E. & Samuel, N. C. (2021). Achievement motivation and locus of control as predictors of secondary schoolstudents' achievement in chemistry in Enugu State, Nigeria. *Journal of Research & Method in Education* 11(4), 27 - 34. doi:10.9790/7388-110405273
- Omwirhiren, E. M., & Suleiman, L. (2016). An investigation into the effects of laboratory, guided-unguided discovery (inquiry) and lecture-demonstration teaching methods on senior secondary students' achievement in acid-base titration practical test in selected secondary schools in Giwa Local Government Area of Kaduna State, Nigeria. *IOSR Journal of Research & Method in Education*, 6(3), 20 - 26. doi: 10.9790/7388-0603042026
- Ozofor, J. N. (2010). Emerging 9-3-4 system of education: need to incorporate lessons from the past. *Journal of Teacher Perspective* 1(2), 180 - 188
- Popham, J. W. (2011). *Classroom Assessment: What Teachers Need to Know*, 6th ed. Massachusetts, Boston: Allyn & Bacon.
- Raheem, B. O. (2017). The influence of gender on secondary school students' academic performance in South-West. Nigeria. *Journal of Social Sciences*, 31(1), 93 - 98. doi:<https://doi.org/10.1080/09718923.2012.11893018>
- Ray, B. D. (2010), Academic achievement and demographic traits of homes schools students: a nationwide study in academic leadership. *The Turkish Online Journal*, 8(1) 22-30
- Udosoro, U. J. (2011). The effect of gender and mathematics ability on academics performance of students in chemistry. *An International Mult-disciplinary Journal Ethiopia*, 5(4), 21
- Uzezi, J. G., Danjuma, E., & Auwal, A. M. (2017). Assesment of conceptual difficulties in chemistry syllabus of Nigerian science curriculum, as perceived by high school college students. *American Journal of Educational Research* 5(7), 710 - 726. Doi:10.12691/education-5-73
- Zhang, M., Huang, L., Quan Y., & Kuo, Y. (2017). The impact of learning styles on academic achievement. *International Journal of Intelligent Technologies and Applied Statistics*, 10(3), 173 - 185. doi:10.6148/IJTAS.2017.1003.04