Innovations

Influence of Teachers' Pedagogical Behaviour, Gender and Peer group of Students on their Attitude towards Learning of Chemistry in Delta State Public Secondary Schools

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Abstract

This study investigated the influence of teacherpedagogical practices, students' gender and peer group on the irattitude towards chemistry. The study was guided by three research questions and three hypotheses. Thissurvey research adopted ex-post facto design. A total of 40 chemistry teachers and 378 senior secondary school III (SS 3) students served as a sample for the study. Questionnaire was the instrument used for data collection. The questionnaire was validated by an expert in science education. The reliability of the instrument was determined using test re-test method and gave reliability index of 0.84, 0.95 and 0.87 for students' attitude, teacher pedagogical behaviour andpeer group rating scale respectively. The data collected through the questionnaire were analysed with the aid of mean and standard deviation and Pearson product moment correlation coefficient and t-test statistics. The hypotheses were tested at 95% confidence level. The findings revealed that students have poor attitude towards the learning of chemistry. There was a significant difference between male and female students in their attitude towards the learning of chemistry. There was significant relationship between teacher pedagogical behaviour and peer group and their attitude towards the learning of chemistry. The study concludes by recommending that government of Delta State should invest on training for chemistry teachers on pedagogical strategies that could boost students' interest in chemistry.Parents as well as chemistry teachers should encourage the students to develop positive attitude towards chemistry.

Keywords: 1.*Attitude 2.,chemistry, 3.learning, 4.gender, 5.pedagogical behaviour, 6.peer group, 7.students.*

Introduction

It is the expectation of all Nigerians that the nation develops to its full potential. That a nation is globally recognized is as a result of scientific and technological advancement. For this to happen, there must be a concerted efforton the part of the government and citizens to take the learning of science-related courses seriously. These courses are prerequisites for the industrial revolution of the nation. One of those subjects that must be taken by students for the scientific and technological advancement of the nation is chemistry.Chemistry is a very essential science subject for the scientific and technological growthand for building entrepreneurial skills for job creation and national development (Nleonu&Ezelibe, 2020; Asiyai, 2018a; Akanbi, 2016). Chemistry is very important for the transformation of a nation's economy (Emendu, 2014). Chemistrythrough is functionality and relevance in practice, content and application has helped to address the need of students of tertiary institutions studying science related courses (Emendu, 2014; Asiyai, 2021b). Chemistry in particular plays animportantpart in the economic growth of a nation. It is vital for producing scientists at various levels.

The chemistry teacher is the most significant factor in the teaching and learning of the subject. Students generally look up to their teacher and copy most of his/her behaviour. The way the chemistry teacher relates with the students in the laboratory and classroom has great influence on their interest and learning of the subject. The chemistry teacher must be very careful and mindful of the way students are addressed and treated during instruction in the classroom. Students' attitude refers to their beliefs, feelings and behaviour towards the subject. Their attitude can be positive or negative. According to Ogembo, Otanga and Yaki (2015), students' attitudes have the ability to influence their learning.Studies have proved that students' attitude towards chemistry affects their learning and academic performance (Kubiatko, Balatova, Francovicova&Prokop, 2019; Kousa, Kavonius&Aksela, 2018; Ngila&Makewa, 2014; Seba, Ndunguru&Mkoma, 2013; Okoro&Uwah, 2013; Can, 2012; Khan, & Ali, 2012;Cheung, 2009). Students' attitudes toward chemistryarean important research area, particularly becauseof a mutual relation betweensuch attitudeand achievement.Learnerswithmore positiveattitudestowardchemistry are more likely to achievesignificantlybetterincomparison withlearners withnegative attitudes towardchemistry.

Despite the role of attitude in the academic achievement and overall success of students in chemistry, it has been observed that most students in Nigeria have poor attitude towards chemistry and science subjects in general. This observation has been supported by the result of several findings. For instance, Ogembo, et al. (2015) stated despite the recognition accorded chemistry, students' still manifest poorattitude towards the learning of the subject. Research findings by Sakariyau, Taiwo and Ajagbe (2016) revealedpoor attitude towards science subject among students in Nigerian schools.They added that students showed lack of interest in the learning of science subjects.Woldeamanuel, Atagana and Engiday (2013) also found that most students as a result of their perception that chemistry is a difficult subject, fear the subject. They further observed that most students in Ethopian universities are not favourably disposed to the learning of chemistry.

The implication of the above is that students with negative attitude towards chemistry may fail to learn the subject. Several reasons have been given to be responsible for the students' negativeattitude towards chemistry. These include students' gender and teachers' methods of teaching (Musengiana, Kampire&Ntawiha, 2021),teacher likability (Obaje&Eje, 2021), lack of teaching aids (Chekovir etal, 2014). The focus of this study is on the influence teacher pedagogical behaviour, gender and peer group of students on theirattitude towards learning of chemistry.

Statement of the Problem

The external examinations result of Nigerian secondary school students over the years have been poor. Secondary education stake holders are concerned about school improvement efforts that can be made to improve students' performance in the subject. Though lots of researches have been conducted in this regards, majority of the studies were conducted in other countries and other states of Nigeria. In Delta State, attention has not been concentrated on influence of teacher pedagogical behaviour, gender and peer group of students on their attitude towards chemistry in public secondary schools.

Research Questions

The following research questions were raised:

1. What is the attitude of students towards learning of chemistry in public secondary schools in Delta State, Nigeria?
2. How does chemistry teachers' pedagogical behaviour influence students' attitude towards learning of chemistry in public secondary schools in Delta State, Nigeria?
3. What is the difference between male and female students in their attitude towards the learning of chemistry in public secondary schools in Delta State, Nigeria?
4. How does peer group of students predict their attitude towards the learning of chemistry in public secondary schools in Delta State, Nigeria?

Hypotheses

The following hypotheses were generated from the above research questions:

1. There is no significant relationship between teacher pedagogical behaviour and students' attitude towards learning of chemistry.
2. There is no significant difference between male and female students in their attitude towards the learning of chemistry.
3. There is no significant relationship between peer group and students' attitude towards learning of chemistry.

Literature Review

Gender and Students' Attitude towards Science Subjects

Past research found that gender is an important predictor of attitudinal behaviour towards the learning of science-related subjects. Heng and Karpudewan (2015) indicated that gender is an important variable that is likely to affect students' attitude towardschemistry. Girls have been reported to have more positive attitude than boys towards learning chemistry (Kousa, Kavonius&Aksela, 2018; Kubiatko, Babatova, Francovicova&Prokop, 2017; Heng&Karpudewan, 2015; Ngila&Makewa, 2014; Kan& Akbas, 2006). In addition, Osborne, Simon & Collins (2003) stressed that there is still a bias against physical sciences held by girls, suggesting that at an individual level the overwhelming majority of girls still choose not to take physical science. Furthermore, Aigbomian (2002) averredthat male students had better performance than their female counterparts in science-related subjects. He gave several reasons for such variability. For instance, in science classes, boys often dominate laboratory equipment, controlling hands-on experiments while girls observe and take notes.

Teacher Pedagogical Behaviour and Students Attitude towards Learning of Chemistry

The chemistry teacher is very important in the teaching and learning of the subject. The teacher implements the curriculum and spends more time with the students in school. The teachers' methods of instruction are very significant in igniting students' interest and motivation in the subject. His/her ways of attending to students, supporting them in their learning, calling them by their names and giving individual attention when needed matters a lot in their attitude towards learning the subject. The chemistry teacher's knowledge and pedagogical behaviour has great influence of students' attitude, feelings about the subject, learning and engagement in classroom activities (Asiyai, 2021b). Studies have shown that students' attitude and learning of chemistry improved when the chemistry teacher employed innovative instructional strategies including problem-solving and ICT based learning (Adegbola&Depar, 2019), multi-media-based simulation (Shah& Khan, 2015), use of teaching aids (Chepkorir etal, 2014), and active- learning strategies in the classroom (Aksela, 2018; Kousa et al, 2018; Kubiatko, et al, 2019; Sigh &Chiboye, 2016). Factors such as classroom environment and climate created by the chemistry teacher, classroom interactions involving students, interpersonal relationship between teacher and students, students' classroom activities created by the chemistry teacher have been found to influence students' attitude towards learning of chemistry (Yildirim, 2018; Montes et al, 2018; Ngila&Makewa, 2014).

Peer Group and Students' Attitude towards Learning Chemistry

Some scholars acknowledged that children's experience with peers constitute an important part of their development (Ryan, 2000). Other studies have linked students' motivation in learning and academic achievement with their peer group (Amoke&Olumilua, 2021; Ajibade, 2016; Filade, Bello, Uwaoma, Anwanane&Nwangbutuka, 2019; Okorodudu, 2013).

For instance, some studies believed that male students are more likely to possess positive attitude towards science-related subjects than their female counterparts. Study by Ngila and Makewa(2014) indicates that peer group could be considered major determinants of students' attitude towards learning and achievement in science. The study relied on socio-cultural variables such as gender roles and other characteristics of the individual to explain such variability in attitude of students towards learning of science subjects. Majority of studies conducted on similar

topic were carried out in other States of Nigeria and in other countries. How teacher pedagogical behaviour, students' peer group and gendercould explain variability in students' attitude towards chemistry remain to be established, especially with particular reference to secondary schools in Delta State. This is the gap in literature that the present study sought to address.

Methods

This study is correlational in nature because it sought to establish the relationship that exists between and among several variables of the study. In this regard, the correlational method of ex-post facto research design was adopted, which helped the researchers to achieve the purpose of the study.The population of the study comprised 25,600 senior secondary school three (SSS 3) students from public secondary schools in Delta State in the 2020/2021 academic session. The researchers sampled 40 chemistry teachers and 378 students from schools across the 25 Local Government Areas of Delta State. In order to determine the sample size, the researchers relied on the recommendation of Gill, Johnson and Clark (2010). In their study of sample size determination, they recommended that when a given population is between 25,000 and 49,999, that a sample size of 378 is adequate for a research activity.The researchers used a proportionate sampling technique to select the students.

The researchers used questionnaire to collect data for this study. The questionnaire contains two sections; A and B. Section A of the questionnaire represented the demographic data of the students such as gender and location. Section B contained some rating scales, developed for the purpose of the study. The rating scales include Peer Group Influence Rating Scale and Attitude towards Learning of Chemistry Rating Scale. The researchers structured the items forSection B on a four-point Likert-type scale, ranging from 1 for strongly disagree to 4 for strongly agree.

In order to establish the validity of the instrument, the researchers took some steps. For instance, experts in the field of measurement and evaluation as well as science education determined the face and content validities of the instrument. The researchers after generating the items, produced and handed over the questionnaire to the experts. The researchers requested the experts to examine the items that make up the various scales, to see if they were in line with the behaviour that the instrument expected to measure. The researchers considered all suggestions that the experts made before producing the final copies for pilot study. The researchers used Cronbach alpha reliability coefficient, which produced a measure of internal consistency to estimate the internal consistency of the items in the questionnaire. The result obtained showed the following coefficients, Peer Group Influence Rating Scale = .95; and AttitudeTowards Learning Chemistry Rating Scale = .87.

The researchers personally administered the questionnaire to the students with the help of three research assistants, who were coached on how to conduct the administration and retrieval of the instrument. For ethical reason, the researchers obtained the permission of the school principal. The students were assured that the process is voluntary and that they were free to accept or decline to participate in the study. The researchers ensured that the students properly filled and returned the questionnaire in good condition. The students were cooperative.The researchers used Pearson's product moment correlation coefficient to analyse the data at 95% confidence level.

ResultsThe results of data analysis in answer to the research questions and hypotheses are presented in Tables.

Research Question One: How do teachers assess the attitude of students towards the learning of chemistry in public secondary schools in Delta State, Nigeria?

Table 1:Attitude of students towards the learning of chemistry as assessed by their teachers

S/N	Students Attitudes towards the learning of chemistry	Mean	SD	Remarks
1	My chemistry students attend class regularly	2.92	0.55	Agreed
2	They are punctual to class	2.76	0.65	Agreed
3	They are attentive during chemistry lesson	2. 58	0.67	Agreed
4	They copy their chemistry notes	2.66	0.94	Agreed
5	They all do their assignments	2.40	0.69	Disagreed
6	They are sometimes noisy during chemistry lesson	2.68	0.84	Agreed
7	They do not show interest in some chemistry concepts	2.66	0.55	Agreed
8	They answer questions asked during lesson	2.42	0.49	Disagreed
9	They participate actively during lesson	2.44	0.76	Disagreed
10	Some students are lazy and dread chemistry	3.00	0.88	Agreed
11	They experience difficulty in learning some chemistry topics	3.34	0.62	Agreed
12	Some students exhibit lack of interest in chemistry	2.90	0.66	Agreed
	Weighted mean	2.73	0.69	

From the data in Table 1, all the items have mean score above 2.50 the cut-off mean score for taking decision. It clearly shows that all the items are the attitude of students towards the learning of chemistry in public secondary schools in Delta State, Nigeria.Some exhibit lack of interest in the subject, some experience difficulty in learning some topics, some are lazy and dread the subject, they do not participate active and ask questions during chemistry lesson sometimes the class is noisy during lesson and not all the students do their assignments. The conclusion drawn is that in Delta State, Nigeria public secondary schools, students have poor attitude towards the learning of chemistry.

Research Question Two: How does chemistry teachers' pedagogical behaviour influence students' attitude towards learning of chemistry in public secondary schools in Delta State, Nigeria?

Table 2: Mean and standard deviation scores on teacher pedagogical behaviour and students' attitude towards learning of chemistry in secondary schools

S/N	ITEMS	MEAN	SD	REMARK
	My chemistry teacher'spedagogical bahaviourinfluenced my attitude towards the subject by his/her;			
1	frequent use of passive instructional teaching methods	3.30	0.90	Agreed
2	teaching the subject theoretically always	3.16	0.88	Agreed
3	often calling students who do not answer questions negative names	2.82	0.67	Agreed
4	not carrying all students along during lesson	2.94	0.59	Agreed
5	not involving students in activities during lesson	3.10	0.49	Agreed
6	not giving students assignment after each class	2.75	1.00	Agreed
7	boring nature of the class sometimes	3.22	0.38	Agreed
8	display of lack of teaching skills	2.80	0.66	Agreed
9	inability to manage students' indiscipline during lesson	2.76	0.63	Agreed
10	lack of good questioning techniques	3.00	0.71	Agreed
11	not motivating students in their learning	3.10	0.68	Agreed
12	not attending to students on individual basis	2.68	0.55	Agreed
13	coming late to class	3.18	0.80	Agreed
14	coming to class unprepared	3.06	0.73	Agreed

The mean value of all the items in Table exceeded 2.50 the bench mark score. This indicates that the respondents agreed with all the teacher factors in items 1 to 14 that they represent the ways their chemistry teachers' pedagogical practices influenced their attitude towards the learning of the subject. Therefore, chemistry teachers' frequent use of passive instructional methods of teaching, the boring nature of the chemistry class, teaching of the subject theoretically, non-involvement of students in activities during chemistry lesson, not motivating students through giving individual attention to them, the teachers lack of good questioning technique, teachers lateness to class and coming to class unprepared, not carrying all students along during chemistry lesson, often labelling students negatively, the teachers' display of lack of teaching skills, inability of the chemistry teacher to control students' indiscipline during lesson

Research Question Two: What is the ways gender of students influenced their attitudes towards thelearning of Chemistry in secondary schools?

Table 3: Mean and standard deviation scores on ways gender of students influenced their attitudes towards learning of chemistry in secondary schools.

S/N	Students gender influence and their attitude towards learning of chemistry	Male Students			Female Students		
		Mean	SD	Remark	Mean	SD	Remark
1	I see chemistry as a subject that demands too much memorization	2.70	0.77	Agreed	2.93	0.77	Agreed
2	I see the subject as difficult	2.42	0.84	Disagreed	2.66	0.99	Agreed
3	I find chemistry concepts too technical to understand	2.40	0.66	Disagreed	2.64	0.45	Agreed
4	I see chemistry curriculum is very broad	2.76	0.56	Agreed	3.10	0.39	Agreed
5	I see chemistry as a worthy subject	2.70	0.88	Agreed	2.90	0.57	Agreed
6	Chemistry is one of my best subjects	3.10	0.55	Agreed	2.43	1.11	Disagreed
7	I always enjoy my chemistry lesson	2.43	0.91	Disagreed	2.48	1.20	Disagreed
8	Chemistry is too mathematical for me	2.47	0.68	Disagreed	2.68	0.52	Agreed
9	Chemistry lesson is always interesting	2.25	0.81	Disagreed	2.44	0.76	Disagreed
10	Chemistry lesson is sometimes boring	2.66	0.66	Agreed	2.80	0.99	Agreed
11	Chemistry concepts are mainly abstract	2.62	1.17	Agreed	2.68	1.02	Agreed
12	I can have a positive attitude towards the learning of chemistry if my teachers improve his teaching	2.98	0.99	Agreed	3.20	1.12	Agreed
	Weighted Mean	2.64	0.79		2.53	0.82	

For Table 2, 2.50 is taken as the bench mark. For male students items 1, 4, 5, 6, 7 10, and 12 have mean score that exceeded the bench mark. For female students, all the items except items 6 and 8 have mean score above 2.50. Male and female students agreed that chemistry demands too much memorization, the curriculum is too broad, the concepts are mainly abstract and that chemistry is a worthy subject. They responded negatively by disagreeing that they always enjoy their chemistry lesson, chemistry lessons are sometimes boring, and that they could develop a positive attitude towards chemistry if their teacher improve his/her teaching. Only male students see chemistry as one of their best science subjects (mean = 3.10). The grand mean score of 2.64 for male students and 2.53 for female students seem to mean that both male and female students have poor attitude towards the learning of the subject.

Research Question Three: How does peer group of students predict their attitude towards learning of chemistry in secondary schools in Delta State, Nigeria?

Table 4: Mean and standard deviation scores on how peer group of students predict theirattitudes towards learning of chemistry in secondary schools.

S/N	ITEMS	MEAN	SD	REMARK
	Student peer group predict their attitude towards chemistry in the following ways;			
1	My choice of chemistry is linked with the influence of my peers	2.75	0.87	Agreed
2	I read my chemistry note books whenever my friends are reading theirs	2.92	0.82	Agreed
3	I wait for my friends and we go to school together	2.70	0.69	Agreed
4	I sometimes follow my peers to party and miss my chemistry lesson	2.84	0.50	Agreed
5	The support I received from my friends have helped my learning of chemistry	3.10	0.49	Agreed
6	I can say that my feeling about chemistry is associated with my peer influence	2.75	1.00	Agreed
	Weighted Mean	2.84	0.72	

Data in Table 3 indicates that the mean score for all the items is above 2.50 the bench mark score. Thus, all the items are the ways peer group predicts students' attitude towards the learning of chemistry. The weighted mean score of 2.84 clearly shows that all the items represent the influence of peer group on students' attitude towards learning chemistry.

`Hypotheses Testing

Hypothesis 1: There is no significant relationship between teacher pedagogical behaviour and students' attitude towards learning of chemistry.

Table 4: Pearson r showing relationship between teacher pedagogical behaviour and students' attitude towards learning of chemistryin secondary schools

Variables	Mean	SD	R	P	Decision
Teacher pedagogical behaviour	41.87	9.67	0.83	0.001	Significant
Students Attitude towards Chemistry	32.76	8.30			

From Table 4, r =0.83, p<0.05. The null hypothesis is not accepted. Therefore, there is a significant relationship between teacher pedagogical behaviour and students' attitude towards learning of chemistry in public secondary schools in Delta State, Nigeria.

Hypothesis 2: There is no significant difference between male and female students in their attitude towards the learning of chemistry

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Table 5: t-test of difference between male and female students' attitude towards learning of chemistry

Groups	N	Mean	SD	DF	t-calculated	t-critical	Decision
Male	220	31.69	9.48	412	1.224	1.960	NS
Female	190	30.36	9.86				

Data in Table 5 shows that the t-calculated value 1.224 is less than the t-critical value ate Degree of Freedom (DF)412 and 0.05 level of significance. The hypothesis 2 is not retained. Thus, there is no significant

difference between male and female students in their attitude towards learning of chemistry. The implication of this result is that male and female students have similar attitudes towards the learning of chemistry.

Table 6: Pearson r showing relationship between peer group and students' attitude towards learning of chemistryin secondary schools

Variables	Mean	SD	R	P	Decision
Peer Group	17.06	4.37	0.77	0.001	Significant
Students Attitude towards Chemistry	32.76	8.30			

From Table 10, r =0.77, p<0.05. The null hypothesis is not accepted. Therefore, there is a significant relationship between peer groupand students' attitude towards learning of chemistry in public secondary schools in Delta State, Nigeria.

Discussion

For the first research question the finding revealed thatchemistry teachers' frequent use of passive instructional methods of teaching, the boring nature of the chemistry class, teaching of the subject theoretically, non-involvement of students in activities during chemistry lesson, not motivating students through giving individual attention to them, the teachers lack of good questioning technique, teachers lateness to class and coming to class unprepared, not carrying all students along during chemistry lesson, often labelling students negatively, the teachers' display of lack of teaching skills, inability of the chemistry teacher to control students' indiscipline during lesson are the ways teachers' factors influence students attitude towards learning chemistry. This finding concurs with Shah and Khan (2015), Kousa, Kavonius and Aksela (2018) who reported that teachers instructional methods statistically influenced their attitudes towards the learning of chemistry.

For research question two, the findings revealed that gender greatly influence students' attitude towards the learning of chemistry by male and female students having mixed feelings. For example,male students, male and female students agreed that chemistry demands too much memorization, it requires too much memorization, the curriculum is too broad, and that chemistry lessons are always, they perceive chemistry as a too broad. Female students agreed that chemistry is too difficult and the concepts are too technical, the subject is too mathematical and they have phobia for chemistry. Male students agreed that they have positive attitude towards chemistry but female students disagreed. Thus, it is clear that male students have more positive attitude towards learning chemistry than female students. The hypothesis tested revealed that there was a significant relationship between gender and attitude of students towards chemistry. This finding is at variance with Kubiako etal (2017), and Ngila and Makewa (2014) who found that girls have more positive attitude than boys towards the learning of chemistry.In addition, sex can significantly predict students' attitude towards chemistry. This means that students' attitude towards the learning of chemistry can vary on the basis of gender and that male students have significantly different mean scores than female students.The finding also agrees with Singh&Chiboye(2016), who found a significant influence of gender on attitudes towards science.The finding also agrees with Jones et al. (2000), who reported that males have more positive attitudes toward science than females.

For research question three, the finding showed that peer group influenced students' attitude towards chemistry by making them chose chemistry because of their peers, copying the reading or study habit of their friends, through support provided by their friends, and bygoing to school together with their peers. The hypothesis tested revealed that there was a significant relationship between peer group and students' attitude towards chemistry. This finding lends credence with Amoke and Olumilua (2021) and Filade, Bello, Uwaoma et al (2019) who found that peer group significantly predicted students' attitude towards learning and their academic performance. The finding is also in agreement with Hussain et al (2013) who reported that students selection of school and choice of subject was greatly influenced by their peers.

Conclusion/Recommendations

In line with the findings of the study, it can be concluded that students' attitude towards the learning of chemistry can be influenced by teacher and socio-demographic factors. Such factors include teacher, gender (demographic) and peer group (social). These factors were able to significantly predict students' attitude towards the learning of chemistry. The implication is that chemistry should be made interesting for the students so that they can develop positive attitude towards the subject. Additionally, the abstract nature of chemistry should be made more concrete so that it will arouse the interest of the students during teaching and learning. Chemistry should be taught through activity centred methods involving the use of digital tools, power points, concept mapping, question and answer and practical demonstrations.On the basis, the following recommendations were made:

1. Parents as well as chemistry teachers should encourage female students to develop positive attitude towards chemistry.
2. Efforts to improve the students' attitude towards chemistry should take into account their gender
3. Parents should be mindful of the type of friends their children keep and always be on guard for signs, which indicate that the children are being negatively influenced.

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