EFFECTS OF JIGSAW IV INSTRUCTIONAL METHOD ON SECONDARY SCHOOL STUDENTS' INTEREST IN CHEMICAL EQUILIBRIUM

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Abstract
This research investigated the effects of Jigsaw IV Instructional Method on students' interest in Chemical Equilibrium. The study adopted a quasi-experimental research design, involving the pretest posttest non-equivalent control group design. One hundred and eight- six (186) Senior Secondary 2 (SS 2) Chemistry students drawn from Onueke Education Zone of Ebonyi State, Nigeria were used for the study. The instrument for data collection was Chemistry Interest Scale (CIS). Three experts validated the instrument for clarity, adequacy of items and relevance to the study. Factor analysis through the Principal Component Matrix was applied to determine the final items in CIS and its reliability coefficient was 0.66 using the Cronbach Alpha statistic. Two research questions guided the study and two null hypotheses were tested at 0.05 level of significance. The research questions were answered using mean and standard deviation while Analysis of Covariance (ANCOVA) was used to test the null hypotheses. It was found that Jigsaw IV Instructional method yielded higher mean interest score than the Lecture Teaching Method; male students had higher mean interest score than female students. Results of the hypotheses showed that there was a significant difference in the mean interest score of students taught Chemical Equilibrium using Jigsaw IV

Instructional Method and those taught using the Lecture Teaching Method; there was no significant difference in the mean interest scores of male and female students taught Chemical Equilibrium using Jigsaw IV instructional method. Recommendations include that Chemistry teachers should use Jigsaw IV instructional method to enhance the interest of students in Chemistry; administrative policies should be geared towards ensuring the use of Jigsaw instructional method by Chemistry teachers

Keywords: *Chemical Equilibrium, Interest, Jigsaw IV Instructional Method, Gender*

Introduction

Chemistry is one of the science subjects taught in senior secondary schools in Nigeria. Other science subjects at that level are Biology and Physics. Chemistry deals with the study of the composition, structure, properties and interaction of matter (Anand, 2014). Bagley (2014) defined Chemistry as the study of matter, its properties, how and why substances combine or separate to form other substances, and how substances interact with energy. Chemistry is that science which treats the structure, composition and properties of substances and the transformations they undergo (Ikoku in Igwe, 2013). The subject matter of Chemistry is non-living matter, with particular concern for structure, properties, reactions and uses of matter (Igwe, 2017). Chemistry deals with different aspects of matter and the interrelationship between them. The vast differences and interrelationships between the contents made it necessary that the more related components of the content of Chemistry should be grouped into branches of Chemistry.

Chemistry has many branches such as Organic, Inorganic, Physical, Analytical, Geochemistry and Biochemistry. However, in this study, the researchers used Chemical Equilibrium which is an aspect of Physical Chemistry contents for discussion. Physical Chemistry is the branch of Chemistry that studies the microscopic properties, atomic properties and phenomena in chemical systems. Fatokun, Egya and Uzochi (2016) defined physical Chemistry as the branch of Chemistry that is concerned with interaction and transformation of materials. Interest in physical Chemistry is informed by the fact that the principles of Chemistry that constitute the major concern of physical Chemistry are fundamental for the understanding of topics in other branches. Physical Chemistry therefore, deals with the study of such concepts as structure of materials, rate of reaction, energy transfers during reactions and chemical equilibrium. These topics deal with the microscopic

aspect of study of matter, which makes them abstract and often difficult to understand (Sendur, Toprak and Pekmez, 2011). The consequence of this is that students tend to regard the concepts as difficult. The implication of this is that special attention should be given to appropriate methods of teaching physical Chemistry concepts to make them interesting to students and subsequently improve their understanding of the concepts.

Chemistry education is concerned with inculcating in the learner the knowledge of matter, the laws governing their combinations and separations and how the knowledge of these properties can be used to achieve specific purposes (Igwe and Odo, 2016). Chemistry topics differ in their abstractness and difficulty. Research has shown that students perceive some topics as abstract and difficult. Sendur, Toprak and Pekmez (2011) identified chemical equilibrium and chemical bonding topics as abstract and difficult to students. Similarly, Gongden**,** Gongden and Lohdip (2011) found chemical equilibrium and laws of electrolysis difficult to senior secondary 2 Chemistry students. The implication is that efforts should be made to determine more appropriate teaching methods that will help students to overcome the difficulties through positive interest. This is the reason Chemical Equilibrium was investigated using the Jigsaw IV instructional method in this study.

In Nigeria secondary schools, Chemistry education is designed to ensure functional output to make graduates of Chemistry able to contribute to national development. The current curriculum of secondary school Chemistry was developed to achieve the goals of making the learner to acquire basic life skills for self-sustenance as well as making him/her relevant in the economic development of the nation. According to Federal Ministry of Education (FME, 2009:7) the objectives of Chemistry include enabling the students to: acquire basic theoretical knowledge and skills, apply skills to meet societal needs of creating employment and wealth, be positioned to take advantage of the numerous career opportunities offered by Chemistry, and show Chemistry and its link with industry, everyday life activities and hazards.

Chemistry prepares students to take courses leading to important professions (Igboanugo as cited by Achimugu (2016). Chemistry is a basic requirement for professional training in and practice of medicine, pharmacy, agriculture, food science, biotechnology, geology, metallurgy, engineering and science education. Chemists can convert the knowledge of Chemistry into vast investment opportunities for financial benefits and to create more jobs

(Oyekun, Oduyoye, Elemo, Akindoju, Karimu and Unuigbe, 2015). This is needed to alleviate from graduates of Chemistry the problem of seeking jobs and at the same time enhance national prosperity through wealth creation. There are many practical application of Chemistry in the industrial economy as Chemistry forms the foundation of many industries like metallurgy, petrochemicals, power generation, drug, and textiles (Igwe, 2017).

Despite the importance of Chemistry, the efforts of teachers and researchers to promote the learning of Chemistry by students for self-reliance, literature shows that there is low performance in secondary school Chemistry. There are evidences of low Chemistry interest (Udo and Udofia, 2014), leading to poor achievement in public examinations (Achimugu, 2016). The number of students who offer Chemistry at the secondary school level is small relative to the overall student population. Dike and Umegboro (2015) noted that the number of candidates offering Chemistry at the West African School Certificate Examination in Nigeria has been persistently and relatively low. The low enrolment in Chemistry may be due to low and negative interest in the subject by students.

Interest is the feeling one has in the course or process of wanting to know or learn about something or someone (Okorie, 2015). This definition is particular about interest in learning or carrying out related activities. In general, interest in a thing refers to the like for it. This like can be shown as a form or by acting in relation to it. Interest is a construct that falls within the affective domain of knowledge. Accordingly, Udo and Udofia (2014) defined interest as a feeling of like or dislike towards activity or something. Interest towards Chemistry denotes interest or feeling towards studying Chemistry. Espinosa, Monterola and Punzalan (2013) specifically defined interest in science as the students' disposition towards like or 'dislike' for science. In the context of this paper, the science referred to is Chemistry.

Okoyefi and Nzewi (2013) found that students perform well when they are exposed to methods that promote interest in them during the teaching-learning process. Students' achievement is therefore related to interest in the teaching-learning process. Agbi (2006) agreed that students' achievement in Chemistry is influenced by their interest in the subject. Since interest is something that motivates one to doing that thing or learning about it, interest also engenders effort. It is seen that the interaction of interest, motivation and effort results to achievement and success in learning.

The instructional technique applied is important in enhancing the interest of students in Chemistry. Njoku (2004) stated that method of teaching Chemistry accounts for poor interest in the subject. Elsgest as cited by Ajiboye and Ajitoni (2008) observed that children learn best by being fully interested in their own work, by seeing themselves in it and doing it themselves, by verifying their own supposition, by experimenting themselves, by drawing conclusions themselves on the strength of evidence they have collected themselves. Methods of teaching Chemistry should therefore be such that will enhance interest. This means that conceptual understanding of abstract concepts in Chemistry can be made simpler, more concrete and more interesting to learners using appropriate pedagogy. The instructional method should therefore generate, promote and sustain the interest of the learner for his/her active participation in the teaching-learning process. This is in line with the assertion by Ajiboye and Ajitoni (2008) that to develop interest in children for better achievement, the pedagogy should be participatory through social interaction, togetherness and action-oriented communication.

The Social Learning Theory developed by Albert Bandura in 1971 lends credence to purposive interaction to enhance students' interest in learning. The major premise of the theory is that learners can improve their knowledge and retention by observing and modelling the desired behaviours, attitudes and reactions of others. The theory presupposes that learning environment should provide opportunities for social interaction that would facilitate observation and modelling of desired behaviour. The implication is that for learning to enhance interest and produce mutually positive and sustainable outcome, the learning environment and activities should be such that will promote socio-cultural interactions among the learners.

Based on the above theoretical conception, this study investigated effects of Jigsaw IV instructional method on students' interest in Chemical Equilibrium. Jigsaw as a method that involves students working in groups to become experts on specific topics. It is a learning method in which the members of the class are organized into groups, and then rearranged in new groups to share their learning. According to Sahin (2010), Jigsaw instructional method is based on group dynamics and social interactions. Timayi, Bolaji and Kajuru (2015:15) stated that the Jigsaw learning method generally was developed by Elliot Aronson and his colleagues in 1978 "with the goals of reducing conflict, enhancing positive educational outcomes, helping students to realize that they

are essential components of a whole and encouraging cooperation in a learning environment."

In practice, a Jigsaw instructional IV class is divided into several small groups (home groups) of the same or related subtopics/segments of the topic to be learnt. After preparation of the subtopics/segments, the classes then re-group into new groups (expert groups), with a member from each of the home groups forming part of the expert group to interact and become 'experts' in the respective subtopics. After interaction in the expert group, each member will then go back to his 'home group' to interact, with the experts in different subtopics taking turns to teach their home groups the aspect of the topic in which they are experts. This is followed by a class assessment. This procedure as was discussed by Turacoglu, Alpat and Ellez (2013) are outlined in steps as follows:

Step 1: Groups of 3-7 are formed and different subtopics of the topic are distributed to members to work on. This is the home group.

Step 2: Members leave their home groups to form specialization groups with other students responsible for the preparation of the same subtopic with them.

Step 3: Back to their home groups each student teaches the subtopic which he studied in the specialization groups.

Step 4: All the students are then assessed on the topic.

The positive attributes of the Jigsaw instructional method have been explored to enhance students' interest in many contexts. However, studies on the effect of jigsaw IV instructional method on students' interest are hardly found in Chemistry in Nigeria. It was therefore necessary to determine whether Jigsaw IV Instructional method improved students' interest in Chemical Equilibrium in senior secondary schools in Nigeria or not.

An intervening variable involved in this study was gender. Gender has been found to influence students' disposition towards the study of Chemistry and their achievement in the subject. Gender refers to the economic, social, political and cultural attributes and opportunities associated with being male or female (Organization for Economic Co-operation and Development (OECD) as cited by Onyegegbu, 2008). Owojaiye and Maxwell (2013) found

that gender differences significantly influence students' interest status in Chemistry. Evans, Schweingruber, and Stevenson (2002) also found significant gender differences in the achievement and interest of students. Hofstein and Mamlock-Naaman (2011) reviewed studies on gender issues related to attitude towards, and interest in Chemistry and found that research findings vary on gender influence on students' interest in Chemistry. The instructional method therefore may impact variously on the interest of male and female learners. This fact makes it pertinent to find out if there is gender-related difference in the effects of Jigsaw IV instructional method on students' interest in Chemistry.

As regards to the problem of the study, there is students' low interest in Chemistry. This is evidenced by WAEC Chief Examiner's report (2015) in Chemistry examination, which indicated poor achievement of students in the examination that could have been due to lack of interest by students during the teaching-learning process. The students' low interest in Chemistry is of serious concern to the stakeholders and researchers. The low interest in Chemistry has been blamed particularly on the predominant use of teacher-centred approaches like the lecture method by Chemistry teachers (Igwe, 2017). Specifically, lack of active involvement of students and linear mediation of information from teacher to students seem to be responsible for the low interest of students taught using the lecture method. This is another concern of the stakeholders and researchers. Therefore, the researchers reasoned that student-centred and innovative approaches in teaching and learning of Chemistry might enhance interest in Chemistry as may be found in Jigsaw IV Instructional Strategy. The problem of this study therefore, in question form is what is the effect of Jigsaw IV Instructional method on students' interest in Chemical Equilibrium?

The main purpose of the study was to determine the effect of Jigsaw IV instructional method on the interest of secondary school Chemistry students. Specifically, the study determined the:

1. effect of Jigsaw IV instructional method on secondary school Chemistry students' interest in Chemical Equilibrium;
2. effect of Jigsaw IV instructional method on male and female secondary school students' interest in Chemical Equilibrium;

The work was delimited to determining the effects of jigsaw IV instructional method on the interest of secondary school students. The subjects (students) of the study were SS II Chemistry students in selected senior secondary schools in Onueke Education Zone of Ebonyi State. The aspects of chemical equilibrium taught were: concept of equilibrium; law of mass action and equilibrium constant; Le Chaterlier's Principle and Factors affecting chemical equilibrium; and industrial applications of Le-Chatelier's Principle.

The following research questions guided the study:

1. What is the mean interest score of Chemistry students taught Chemical Equilibrium with Jigsaw IV Instructional method and those taught with the Lecture Teaching Method?
2. What is the mean interest score of male and female Chemistry students taught Chemical Equilibrium with Jigsaw IV Instructional method?

Two hypotheses were tested for this study at 0.05 level of significance, thus:

HO_1: There is no significant difference in the mean interest score of students taught Chemical Equilibrium using Jigsaw IV instructional method and those taught using the Lecture Teaching Method.

HO_2: There is no significant difference between the mean interest score of male and female secondary school Chemistry students when taught Chemical Equilibrium using Jigsaw IV instructional method.

Method

The research adopted quasi-experimental, pre-test, post-test non-equivalent control group design. This design is appropriate for this study because the subjects were made up of one treatment group and one control group where each group was made up of intact classes.

The design is represented thus:

O_1 X O_2 (Experimental group)

O_3 ~X O_4 (Control group)

where O_1 and O_2 are pre-test and post-test for the treatment group and O_3 and O_4 are pretest and posttest for the control group. X represents the treatment (Jigsaw IV instructional method) and ~X represents the control condition

(Lecture Teaching Method). E represents treatment group while C represents the control group.

The study was carried out in Onueke Education Zone of Ebonyi State Nigeria. Ebonyi State is one of the states of Nigeria designated as educationally disadvantaged. Researches on the issues of educational interests relating to the State are still very scarce in literature.

The population of the study comprised 1,498 Chemistry students in SS 2 in public schools in Onueke Education Zone (source: Secondary Education Board, Onueke Zonal Headquarters, Onueke, 2018). The choice of this target population was informed by the fact that chemical equilibrium was taught in SS 2 of the secondary school curriculum.

Purposive sampling technique was used to choose the schools. The criteria used were that the schools must have up to 20 Chemistry students in SS II and the Chemistry teacher must possess at least a B. Sc./B. Ed in Chemistry Education. The final list of schools used was arrived at through simple ballot with replacement of schools that met the criteria after the purposive sampling. Through this process, six schools were selected.

The six schools were grouped into two clusters, with three schools per cluster. Each group was made up of schools that were not closer to one another. This was to avoid students in one treatment group communicating with students in the other group on the content of the topic taught. Simple ballot with replacement was used to assign school clusters to treatment and control groups. The treatment group was made up of 49 male and 42 female students from three secondary schools while the control group was made up of 43 male and 52 female students, giving a total sample size of 186 students.

The instrument for data collection was Chemistry Interest Scale (CIS). CIS was developed by the researchers for assessing students' interest in Chemistry. The instrument was divided into two sections: section A and section B. Section A required information on the bio-data of the subject. Initial draft of section B contained 30 items. The items were structured in line with the four-point rating scale with the options Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The students were required to tick against the option that represented their agreement with each statement. The options represented

values of SA = 4, A = 3, D = 2 and SD = 1 for positive statements and SA = 1, A = 2, D = 3 and SD = 4 for negative statements.

CIS was given to three experts for face validation; one in Chemistry, the other in Psychology and the third in measurement and evaluation. Some of the items were restructured but none was dropped. Then the face validated CIS was administered to thirty (30) SS 2 Chemistry students who were not participants in the main study, for trial testing. Data collected were subjected to factor analysis via the Principal Component Matrix. Through the varimax rotated matrix option, three items were dropped for poor loading (that is being impure), thereby leaving 27 items for the study. Data collected from the 27 items were subjected to test of reliability using the Cronbach Alpha approach. The reliability coefficient was 0.66, showing a good reliability.

The researchers used the permanent Chemistry teachers in the sample schools to teach the topic: Chemical equilibrium in their respective intact classes.

(i) Procedure for Jigsaw IV Instructional Strategy

The following steps were followed in the implementation of the Jigsaw IV method. The steps formed the framework. Adjustments were made by respective Chemistry teachers to accommodate environmental realities. The steps of the framework are:

1. Firstly, administer the CAT to the students as pretest
2. Highlight specifically, the role of the students in their groups.
3. Students were divided into 5–6-person jigsaw groups (**home groups**) and one student from each group appointed as a leader.
4. A subtitle/subtopic/segment of the day's lesson was assigned to each student in the group to learn; using codes for subtitles across groups as shown below:

   A1, B1, C1, D1, E1, F1, G1, H1, …. (n)1: subtitle/subtopic/segment 1.

   A2, B2, C2, D2, E2, F2, G2, H2, …. (n)2: subtitle/subtopic/segment 2

   A3, B3, C3, D3, E3, F3, G3, H3, …. (n)3: subtitle/subtopic/segment 3.

   Where 1, 2, 3 stand for subtitles of the lesson.
5. Students were given time to study their own subtitle in details.

6. Students with same subtitles from the 'Home Groups' then moved to form the **expert groups**. The students in the expert group, led by a leader chosen by them, discussed the main points of their subtitle, ensuring active participation of each 'expert'. Each member took note, ready to represent the subtitle in his or her 'home group'.
7. The students then moved back to their respective home groups where they took turns to teach their groups what they learnt from the expert groups.
8. At the end of the group interactions, the students returned to the class for general review and assessment by the teacher.

(ii) Procedure for the Lecture Method

The regular Chemistry teachers used the lesson plans for Lecture Teaching Method which was prepared by the researchers. The teacher taught chemical equilibrium using the lecture approach for the same period as used for the treatment group. At the end of the teaching, the teacher administered the instrument again as post-test.

Before the treatment, CIS was administered on the subjects as pre-test. Respondents were given 30 minutes to respond to CIS. At the end, CIS was administered again on the subjects for the same durations as post-test. Before using the instrument as post-tests, the items were reshuffled to ensure that the pre-test did not influence the responses in the post-test that might result from familiarity with the items.

Each item in CIS was weighted and total value collated. Then, mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) statistic was used to test the hypotheses at 0.05 alpha level.

Results

Table 1: Mean Interest Score of Students Based on Teaching Methods

Teaching Methods	N	Adjusted Mean $\overline{X}$	Standard Deviation
Jigsaw IV Instructional Strategy	91	89.77	6.54
Lecture Method	95	66.63	3.99

Table 1 shows that the mean interest score of students taught Chemical Equilibrium using the Jigsaw IV instructional method is 89.77 with standard deviation of 6.54. The interest mean score and standard deviation of students taught Chemical Equilibrium using the lecture method are 66.63 and 3.99 respectively. The mean interest score of the students taught Chemical Equilibrium using the Jigsaw IV instructional method is greater (89.77) than the mean interest score (66.63) of those taught using the Lecture Teaching Method.

Table 2: Mean Interest Score of Students Based on Gender

Gender	N	Adjusted Mean $\bar{X}$	Standard Deviation
Male	49	90.90	6.75
Female	42	88.45	6.10

From Table 2, it can be seen that the mean interest score and standard deviation of male students taught Chemical Equilibrium using the Jigsaw IV instructional method are 90.90 and 6.75 respectively. The mean interest score of female students in the group is 88.45 with the standard deviation as 6.10. The Table also shows that male students have higher mean interest score than female students when taught Chemical Equilibrium using the Jigsaw IV instructional method.

Table 3: ANCOVA Results of Mean Interest Scores Based on Teaching Methods

Source of variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Covariates	345.585	1	345.585	12.102	0.001
Pretest	345.585	1	345.585	12.102	0.001
Main Effects	24594.105	2	12297.052	430.642	0.000
Method	24320.040	1	24320.040	851.686	0.000
Gender	21.243	1	21.243	0.744	0.390
2-Way Interactions	84.312	1	84.312	2.952	0.061
Method X Gender	84.312	1	84.312	2.952	0.061
Explained	25060.081	4	6265.020	219.401	0.000
Residual	5168.484	181	28.555		
Total	**30228.565**	**185**	**163.398**		

Method: Significant at $p < 0.05$

Results in Table 3 reveal that the significance of "F' for method is 0.000 at alpha level of 0.05. The significance of F (0.000) is less than the alpha level (0.05), hence, HO_1 is rejected. This means that there is a significant difference between the mean interest score of students who are taught Chemical Equilibrium using Jigsaw IV instructional method and those taught using the Lecture Teaching Method.

Table 4: ANCOVA Results on Students' Mean Interest Scores Based on Gender

Source of variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Covariates	6.033	1	6.033	0.143	0.706
Pretest	6.033	1	6.066	0.143	0.706
Main Effects	129.818	1	129.818	3.077	0.083
Gender	129.818	1	129.818	3.077	0.083
Explained	135.851	2	67.926	1.610	0.206
Residual	3712.303	88	42.185		
Total	**3848.154**	**90**	**42.757**		

Gender: Not Significant at p > 0.05

From Table 4, the significance of "F" for gender is 0.083 at alpha level of 0.05. The significance of "F" (0.083) is greater than the alpha level (0.05), hence, HO_2 is not rejected. This means that there is no significant difference between the mean interest score of male and female secondary school students when taught Chemical Equilibrium using Jigsaw IV instructional method.

Discussion

Results in Table 1 showed that the students who were taught Chemical Equilibrium using the Jigsaw IV instructional method had higher mean interest score than those taught using the Lecture Teaching Method. Therefore, Jigsaw IV instructional method increased the mean interest score more than the Lecture Teaching Method. The Jigsaw IV instructional method is a good method that can be used to enhance students' interest in Chemistry generally.

The higher mean interest score of students taught using the Jigsaw IV instructional method may be due to the interaction among the students in the group activities. This is in line with Udo and Udofia (2004) that methods in which students are actively involved in the teaching and learning activities

enhance students' interest. Similarly, Gilbert (2006) and Holbrook (2005) noted that interest in Chemistry depends on the pedagogy applied in teaching the subject. It is therefore imperative on Chemistry teachers to use the Jigsaw IV instructional method to enhance students' interest in the subject as it involves active participation of students in the teaching and learning activities that provoke interest in students. This result is in agreement with the findings of Abbas (2009) that Jigsaw method enhanced interest of students in geometry. Similarly, Chukwu (2009) and Okeke (2015) found that the use of Jigsaw led to higher mean interest score than the Lecture Teaching Method.

HO_1 stated that there is no significant difference in the mean interest score of students taught Chemical Equilibrium using Jigsaw IV instructional method and those taught using the Lecture Teaching Method. The result relating to the hypothesis was presented in Table 3 which showed that there was a significant difference between the mean interest score of students taught Chemical Equilibrium using Jigsaw IV instructional method and those taught using the Lecture Method. This finding can be attributed to the active involvement of students in learning and teaching activities when Jigsaw IV instructional method was used. The learning strategy has sequential steps that are ordered and when followed resulted to enhanced interest of the students in studying Chemical Equilibrium. This finding agreed with Sule (2010) and Okeke (2015) who found that the difference between the mean interest score of treatment and control groups was significant.

With respect to research question 2, results in Table 2 indicated that male students had higher interest mean score than female students when taught Chemical Equilibrium with Jigsaw IV Instructional method. The higher mean interest score of male students may be due to the fact that male students are more curious and enthusiastic in participating in novel group activities. Most literatures have revealed that male students have greater enterprising tendency towards science than the female students who are said to be language prone. The finding is in line with the assertion of Fakorede as cited in Nworgu, Ugwuanyi and Nworgu (2013) that girls have low interest in science.

HO_2 stated that there is no significant difference between the mean interest score of male and female secondary school students when taught Chemical Equilibrium using Jigsaw IV instructional method. The result in Table 4 showed that there was no significant difference between the mean interest scores of male and female students taught Chemical Equilibrium using Jigsaw IV instructional method. This can be explained by the fact that the interactive

nature of Jigsaw IV Instructional method is beneficial to both male and female students in terms of excitement to activities in the lesson.

In terms of the statistical non-significant difference in the mean interest score, Chukwu, (2009), Sule, (2010), Baran, (2016) and Godpower-Echie and Ihenko (2017) in their different studies agreed with the finding of this study that there was no significant difference in the mean interest score of male and female students in Chemistry.

The findings of the research have some educational implications. If Chemistry teachers should use the Jigsaw IV instructional method, students' interest in Chemistry will be enhanced. On the other hand, failure to use the strategy by Chemistry teachers would deny students the opportunity of enhanced interest in Chemistry associated with the use of the strategy.

The strategy did not discriminate substantially on the basis of gender. This finding has important implications for Chemistry education. If Chemistry teachers use the Jigsaw IV instructional method, it will close the gap in interest between male and female students and increase inclusiveness in Chemistry classes. Conversely, if Chemistry teachers do not use the strategy in teaching Chemistry, the students will not benefit from the strategy's ability to increase the interest of female students and the inherent benefit of bridging the gap between the interest of male and female students in Chemistry.

Conclusion

Available research evidences show that students' interest in Chemistry is low and declining leading to poor achievement as revealed in students' performance in public examinations. The persistent low interest in Chemistry has been of great concern to Chemistry educators and researchers. Among the factors responsible for the low interest is said to be the use of inappropriate teaching method.

This research was aimed at investigating the effect of Jigsaw IV instructional method on secondary school students' interest in Chemical Equilibrium with the view to determining the efficacy of the method in improving students' interest in Chemistry generally. The findings of the study showed that Jigsaw IV instructional method enhanced students' mean interest in Chemical Equilibrium significantly. The difference between the mean interest score of male and female students was not significant. The method therefore proved to

be effective in bridging the gap between male and female students' interest in Chemical Equilibrium. The researchers believe that with continual use of Jigsaw IV instructional method, interest in Chemistry will be enhanced to the credit of higher achievement.

Recommendations

The researchers recommended the following to enhance interest in Chemistry:

1. Chemistry teachers should use Jigsaw IV instructional method in teaching other Chemistry concepts in secondary schools as it enhances interest of Chemistry students.
2. Chemistry teachers should use Jigsaw IV instructional method unassumingly for both male and female as it favours both sexes.
3. Education stakeholders should organize workshops for serving Chemistry teachers on the use of Jigsaw IV instructional method.

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