COLLEGES OF EDUCATION STUDENTS' AWARENESS OF USE OF MULTIPLE REPRESENTATIONS IN EXPLAINING CHEMISTRY CONCEPTS IN KWARA STATE, NIGERIA

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Abstract. The use of multiple representations in explaining chemistry concepts has been reported to be an unavoidable model for effective teaching and learning of chemistry concepts. Therefore, its awareness by colleges of education chemistry students is of paramount importance. The study was conducted to determine the awareness of use of multiple representations in explaining chemistry concepts. One hundred and seventy-five respondents were involved in the study. A researcher designed questionnaire tagged CSAMPQ was used to collect data from the respondents which was later analysed. The hypotheses were tested using Chi-square statistics. Finding from the study revealed that there was no significant association between both gender and level of education of the students and their awareness of use of multiple representations. It was therefore recommended that the teachers of these students should create awareness for those students that are not aware of the use of multiple representations and this should be irrespective of gender and level of education of the students.

Keywords: Awareness; Chemistry concepts; Colleges of Education; Multiple Representations.

1. Introduction

Chemistry is a science subject whose knowledge has great value in making provision for human sustenance (food, drugs, clothing materials, cleaning agents etc) for human beings to survive in life. Chemistry as a science subject has a major role to play in human life, and this is the main reason some topics of the subject is found in every other science subject. It is as a result of this some researchers referred to it as the mother of all sciences (Jimoh, 2005; Udousoro, 2011). Despite the importance attributed to knowledge of Chemistry it has been observed to be one of the science subjects students found difficult and full of abstract concepts (Azmat, 2013; Berg, 2013; Childs and Sihaan, 2009; Tima & Sutrisno, 2018). However, this difficulty experienced in learning of Chemistry by Chemistry students at all levels of education Berg (2013); Kern, Wood, Roehrig and Nyachuwaya (2010), has been attributed majorly to the nature of Chemistry (Johnstone, 1991; Gabel, 1999). According to Johnstone (1991) Chemistry is science subject which its concepts can be represented in three forms known as three levels of Chemistry.

The levels of Chemistry are model which is being used to described the three forms one can use to describe chemistry concepts otherwise known as multiple representation of Chemistry concepts. The multiple form of representations is macro and tangible, molecular and invisible, then symbolic and mathematical (Johnstone,2010). The macro representation which is the observable form of representations such as the activities carried out in the laboratory which involves the use of the sense organs for recognition of changes taking place during chemical reactions such as colour change, given off of odour, production of precipitate etc.; molecular representations which is otherwise known as submicroscopic representations is the use of particulates such as ions, atoms and molecules which are not visible to the naked eyes to represent phenomena and the third form of representations is the symbolic representation which has to do with use of symbols such as mathematical equation, chemical equation to represent chemical concepts. It has been observed that chemists easily make use of the three

forms of representations but students at both secondary as well as college found it difficult to transfer the understanding of one representation to the other (Johnstone, 1991).

The ability to transfer the conceptual understanding of one representation to another has been recognized as the goal of science education Gilbert (2010) but students found it difficult to comprehend. For effective training of college of Education Pre-service Chemistry teacher for the basic level of Chemistry teaching their overcoming of the difficulties encountered in the understanding of the model multiple representations of Chemistry concepts is very necessary. In order for the pre-service Chemistry teachers to possess adequate knowledge about the model multiple representations of Chemistry concepts put in place by Johnstone (1991) they need to be aware of the model. Awareness has been described as the knowledge required for essential and distinguishing Characteristics of Human beings to attain success (Opateye, 2012). It was stated further for science teachers to be productive in attaining educational goals they need to be aware of the educational policies and goals. In a like manner for pre-service Chemistry teachers to be able to understand and use the model multiple representations as the experts do they need to be aware of all what multiple representations is all about.

This study deem it necessary to consider some of the variables such gender and level of education of the students, since studies on the two variables have not been conclusive for example Hacer (2006) reported gender difference in favour of female students in the study titled effect of gender and reasoning ability on the students' understanding of ecological concepts and attitude towards science while Udousoro (2011) worked on effect of gender and mathematics ability of students' performance in Chemistry concluded that gender had no effect on academic performance of the Chemistry students. Cheung (2009) worked on students' attitudes toward Chemistry lessons: the interaction effect between grade level and gender in which interaction between grade level and gender was found to be statistically significant. This shows that the studies on gender and grade level of students are inconclusive and there is the need to investigate them whether they may influence the college students' awareness of use of multiple representations in explaining chemical concepts.

1.1 Statement of the Problem

To be able to make use of multiple representations in explaining chemical concepts there is the need to understand what multiple representations are all about, especially the Colleges of Education students who have been recognized to lay the science foundation of future scientists, that is, at the primary school level. According to Federal Republic of Nigeria (FRN) National Policy of Education that Nigerian Certificate in Education will be the minimum qualification for teaching at the basic level of Education (FRN, 2004). For effective performance of basic level science teachers there is the need to lay the teacher education foundation properly especially the chemistry aspect of their curriculum which has been recognized as an abstract science subject.

In the attempt to promote students' performance in chemistry much emphasizes has been laid on the use of multiple representations in explaining chemical concepts such as Tan, 2001, Chandrasegaran, Treagust, and Mocerino, 2007, Othman, Treagust and Chandrasegaran, 2004, Dhindsa and Treagust, 2009, Adesoji and Omilani, 2012, Yusuf, Oyelekan and Olorundare 2015. These studies were carried out to diagnose the conceptual understanding of chemistry students in different chemical concepts but the present study investigated the college of education chemistry students' awareness of multiple representations in explaining Chemistry concepts. This is thought to be necessary since awareness is being attributed to possession of knowledge about a concept.

1.2 Purpose of the Study

The major purpose of the study was to investigate Colleges of Education chemistry students' awareness of multiple representations in explaining chemistry concepts in Kwara state, Nigeria. Specifically, the study investigated the following:

(1) Influence of gender on colleges of Education students' awareness of use of multiple representations in explaining chemical concepts; and
(2) Influence of level of education on Colleges of Education students' awareness of use of multiple representations in explaining chemical concepts

1.3 Research Questions

(1) What is the influence of gender on college students' awareness of use of multiple representations in explaining chemical concepts?
(2) What is the influence of level of education on college students' awareness of use of multiple representations in explaining chemical concepts?

1.4 Research Hypotheses

(1) There is no significant association between the gender of the Colleges of Education students and their awareness of use of multiple representations in explaining chemical concepts.
(2) There is no significant association between the level of education of the Colleges of Education students and their awareness of use of multiple representations in explaining chemical concepts.

2. Methodology

The study is a descriptive research of the survey method; this method is thought to be appropriate since the study was basically on college students' awareness of use of multiple representations in explaining chemical concepts. One hundred eighty students were randomly selected from the three colleges of education owned by the Kwara state government, out of which 175 were properly answered and returned. The instrument used for the study was a researcher designed questionnaire tagged College Students Awareness of use Multiple Representations (CSAMPQ). The instrument consists of two sections which are section A, this entails the personal data of the respondents such as gender and level of education of the students while section B consists of 15 questionnaire items of four points likert scale of strongly agree, agree, disagree and strongly disagree which were later collapsed into two that is, agree and disagree after collation of the data for easy analysis.

The face and content validities of the instrument were determined by given it to experts in the field of chemistry from science education department university of Ilorin, Ilorin Nigeria. The reliability of the instrument was carried out using Cronbach alpha statistics and reliability coefficient of 0.67 was arrived at this is thought to be appropriate according to Cohen, Manion and Morrison (2011); Laerd Statistics (2013) they were of the opinions that reliability coefficient within the range of 0.35- 0.65 are statistically significant. The researcher sought the help of research assistance to administer the questionnaire to the students that were involved in the study. The analysis of result of the respondents to the questionnaire items was carried out using Statistical Package for Social Sciences (SPSS). The data was subjected to descriptive statistics such as frequency counts and percentages and the two hypotheses formulated were tested using Chi-square statistics since they were both made of categorical independent variables which are gender and level of education of the students and categorical dependent variable that is, the students' response to the questionnaire items.

3. Data Analysis and Results

Research Question 1: what is the influence of gender on college students' awareness of use of multiple representations in explaining chemical concepts?

Gender had no influence on the college students' awareness of use of multiple representations in explaining chemical concepts

Hypothesis 1 is related to research question 1

Research Hypothesis 1: there is no significant association between the gender of the Colleges of Education students and their awareness of use of multiple representations in explaining chemical concepts.

The result obtained in respect of hypothesis one is presented in Table 1.

Table 1. Chi-square analysis of association between gender and students' awareness

Gender	N	X^2	df	p
Male	96	6.613	3	0.085
Female	79			

As shown on Table 1 the X^2(3) = 6.613 at p > 0.05, since the p-value is greater than 0.05 it means that the null hypothesis formulated is not rejected that there is no significant association between gender of the Colleges of Education students and their awareness of use of multiple representations in explaining chemical concepts.

Research Question 2: what is the influence of level of education on college students' awareness of use of multiple representations in explaining chemical concepts.

Level of education did not influence college students' awareness of use of multiple representations in explaining chemical concepts

Hypothesis 2 has to do with research question 2

Hypothesis 2: There is no significant association between the level of education of the Colleges of Education students and their awareness of use of multiple representations in explaining chemical concepts.

Hypothesis 2 was answered using Table 2.

Table 2. Chi-square analysis of association between level of education and students' awareness

Level of education	N	X^2	df	p
Year 2	88	3.997	3	0.262
Year 3	87			

As shown on Table 2 the X^2(3) = 3.997 at p > 0.05, since the p-value is greater than 0.05 it means that the null hypothesis formulated is not rejected that there is no significant association between level of education of the Colleges of Education students and their awareness of use of multiple representations in explaining chemical concepts.

4. Discussion

The study found out that there was no significant association between gender of the Colleges of Education students and their awareness of use of multiple form of representation in explaining chemistry concepts. This finding is in disagreement with the finding of Odum, Akomaye and Chinyere (2013) who reported significant influence of gender on Chemistry teachers' level of identification and uses of laboratory apparatus. But the finding is in agreement with that of Udousoro (2011) who found out that there was no significant influence of gender on students' performance in Chemistry. Also the finding is in agreement with that of Majere, Role and Makewa (2012) who reported that there was no significant influence of gender on students' perceptions of the usefulness of physics and Chemistry. Another finding from the study also revealed that there was no significant association between Colleges of Education students' level of education and their use of multiple representations in explaining chemical concepts. The finding is in disagreement with that of Cheung (2009) who found out that there is interaction effect of both gender and grade level of secondary school students when their attitude to towards chemistry lesson was investigated.

5. Conclusion

It can be concluded from the study that there were no significant association between gender as well as level of education of the respondents and their awareness of use of multiple representations, that is, both male and female were of equally awareness of the use of multiple representations as an explanatory tool for explaining chemistry concepts and that irrespective of their level of education their awareness was still the same.

6. Recommendations

The following recommendations are thought to be appropriate for the study:

(1) Both male and female Colleges of Education students who are not aware of the use of multiple representations should be given equal opportunity of the awareness.

(2) The awareness of use of multiple representations in explaining chemistry concepts should be created for all the students irrespective of their level of education especially those who are not aware of it.

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