Assessment of pre-service teacher’s gender differences on perception of teaching chemistry in secondary schools in Nigeria

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The study determined the Undergraduate Pre-service Teachers (UPST) gender differences in the perception of teaching Chemistry in secondary schools in Nigeria. A survey design was used for the study. The population of the study consists of 58 UPST from three tertiary institutions in the North Central, North East and South East geo political zones of Nigeria. Proportionate stratified random sampling technique was used to select 44( 8 male, 12 female from KSCOE, Akpan, 15 male, 4 female from ATBU, Bauchi and 5 male from ISU, Owerri) UPST. Teaching Chemistry Topic (TCT) questionnaire was developed, validated and used for data collection. Stability coefficient of 0.84 was established for the reliability of the instrument. Hypotheses were tested at α=0.05 level of significance. The data was analyzed using percentages and Chi-Square test. Findings from the study revealed that 53.6% male and 50% female UPST enjoy teaching the topics periodicity, electrons is and metals associated with the concept of inorganic chemistry and there are no significant (Chi-Square = 2.503, p> α) differences in gender on chemistry topic UPST find difficult to teach. Lectures on chemistry teaching methods to focus on topics identified as difficult to teach by UPST was among the recommendation made from the study.

Key words: Assessment, pre-service teachers, gender differences, teaching chemistry.

INTRODUCTION

Assessment, as used in the context of this study, refers to the direction for action on the outcome of Undergraduate Pre-Service Teachers (UPST) teaching chemistry in secondary schools in Nigeria. The UPST refers to those students in Chemistry Education from the Department of Science Education (DSE) who had undergone final year teaching practice in secondary schools.

Chemistry is the science of matter and its transformation (American Chemical Society [ACS], 2012). Chemistry as a subject in secondary school, its topics are taught under sub-concepts such as general, organic, inorganic, physical and practical chemistry. Shwartz et al. (2013) observed that attainment of chemical literacy for all citizens and provision of a preparatory course for future chemistry education at the university level and other tertiary institutions were among the justifications for chemistry teaching in secondary schools. Teaching of chemistry as subject in secondary schools is often associated with challenges such as teachers competency (Copriady, 2014), chemistry vocabulary, [ACS], (2012), abstract nature of some topics associated with chemistry concepts (Broman et al., 2011; Rosemary et al., 2016), and poor method of teaching (Machina,
Inadequate teachers training is the major factor on poor students' performances in science subjects (Celestine, 2013). Machine (2012) observed that poor students' achievement in chemistry is perceived to be partially resulting from poor classroom instruction among pre-service teachers. Although, 67.4% of the teaching practice teachers felt that chemistry content taught at the university does not reflect the expectations of the secondary school chemistry syllabus (Machina, 2012) and some of the topics required at secondary school level were not well addressed at the university (Machine 2012; Omorogbe and Celestine, 2013). Suggestions for improvement of the relative performance of chemistry education at secondary school level were given through improvement of teacher-student interaction, use of e-learning, field work and projects as a method of instruction, more laboratory work and connection of some of the chemistry topics to everyday life, and the uses of content representation design (Owoyemi and Adesoyi, 2012; Machine, 2012; Onyekuru and Ibegbunam, 2013; Hume and Berry, 2013). All these were acknowledged.

However, there is need to study the chemistry topics in secondary schools the UPST enjoy teaching, find difficult to teach and reasons associated with each based on gender differences.

Gender among the UPST was chosen as the variable for comparison for the chemistry topics taught at secondary school level so as to determine if there is any differences associated with gender on the teaching of chemistry in secondary schools in Nigeria. This hoped to address chemistry teaching in secondary school among the UPST.

In view of this, the study is to determine the UPST gender differences on the perception of teaching chemistry in secondary schools in Nigeria. Specifically, the study determined:

i.) Chemistry topics in secondary schools male and female UPST enjoys teaching and reasons associated with it.
ii.) Chemistry topics in secondary schools male and female UPST find difficult to teach and reason associated with it.
iii.) Gender differences on the Chemistry topics in secondary schools UPST enjoy teaching.
iv.) Gender differences on the chemistry topics in secondary schools UPST find difficult to teach.

Hypotheses

The following hypotheses were tested at $\alpha = 0.05$ level of significance.

$H_0$: There is no significant difference in gender on the Chemistry topics in secondary schools UPST enjoys teaching.

$H_1$: There is no significant difference in gender on the Chemistry topics in secondary schools UPST find difficult to teach.

**METHODOLOGY**

A survey design was used for the study. The population of the study consists of 58 Undergraduate Pre-service Teachers (UPST) from three tertiary institutions in the North Central, North East and South East geo political zones of Nigeria. Of these population, 22 (9 male and 13 female) UPST were from Department of Science Education, Directorate of Undergraduate Studies, Kogi State College of Education, Akpan from the North Central zone, 21 (17 male and 4 female) from the Department of Education Foundation, Faculty of Technology Education, Abubakar Tafawa Balewa University (ATBU) Bauchi, from the North East zone, and 5 (All male) from Department of Physical Sciences, Imo State University (ISU), Owerri from South East zone. The population of the study was characterized by UPST whose average age stood at 27 years, with the range from 22 – 30 years. Of these population also, 44% had chemistry teaching experience that ranges from 2 - 8 years. Proportionate stratified random sampling technique was used to select 44 UPST. Table 1 gave the summary.

Table 1 shows the distribution of the sample from each institution as used in the study.

Teaching Chemistry Topic (TCT) questionnaire was developed, validated and used for data collection. The TCT items were developed by one of the co-authors and experienced Chemistry teacher. The validity of the TCT questionnaire was determined by experts from Measurement and Evaluation. The TCT questionnaire consists of 2 sections (A and B). Section A was made of up three items that demand the subject to indicate gender, age and teaching experience if any. While section B comprises of four structured opened ended items demanding the subject's to indicate the topic he/she enjoy or find difficult to teach and the reason for each. The TCT instrument was pilot tested using ten, National Certificate in Education (NCE) final year students from COE, Akpan. Stability coefficient of 0.84 was established for the reliability of the instrument. The instrument was administered twice within an interval of two weeks.

The data collection instrument was administered and collected by each of the co-authors in their various institutions.

The data was analysed using percentages and Chi-Square test

**RESULTS**

Table 2 shows 53.6 and 50% of male and female UPST enjoy teaching the concept of inorganic chemistry and
Table 1. Summary of the UPST based on institution as used in the study.

<table>
<thead>
<tr>
<th>Institution</th>
<th>KSCOE Akpan</th>
<th>ATBU, Bauchi</th>
<th>ISU, Owerri</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, Male</td>
<td>8</td>
<td>15</td>
<td>5</td>
<td>28</td>
</tr>
<tr>
<td>Gender, Female</td>
<td>12</td>
<td>4</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>19</td>
<td>5</td>
<td>44</td>
</tr>
</tbody>
</table>

Table 2. Chemistry topic UPST enjoy teaching.

<table>
<thead>
<tr>
<th>Concept</th>
<th>Topic</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Chemistry</td>
<td>Particles nature of matter</td>
<td>17.9%</td>
<td>18.7%</td>
</tr>
<tr>
<td>Organic Chemistry</td>
<td>Carbon and its compounds</td>
<td>3.6%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Inorganic Chemistry</td>
<td>Periodicity, Electrolysis &amp; metals</td>
<td>53.6%</td>
<td>50%</td>
</tr>
<tr>
<td>Physical Chemistry</td>
<td>Gas laws</td>
<td>17.9%</td>
<td>18.8%</td>
</tr>
<tr>
<td>Practical Chemistry</td>
<td>Qualitative &amp; Quantitative Analysis</td>
<td>7.1%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3. Chemistry topic UPST find difficult to teach.

<table>
<thead>
<tr>
<th>Concept</th>
<th>Topic</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Chemistry</td>
<td>Particles nature of matter</td>
<td>32%</td>
<td>37%</td>
</tr>
<tr>
<td>Organic Chemistry</td>
<td>Carbon and its compounds</td>
<td>11%</td>
<td>6%</td>
</tr>
<tr>
<td>Inorganic Chemistry</td>
<td>Metals, Acid, base and salt</td>
<td>21%</td>
<td>19%</td>
</tr>
<tr>
<td>Physical Chemistry</td>
<td>Stoichiometric topics</td>
<td>21%</td>
<td>19%</td>
</tr>
<tr>
<td>Practical Chemistry</td>
<td>Qualitative &amp; Quantitative Analysis</td>
<td>15%</td>
<td>19%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

example of the topics associated with it is periodicity, electrolysis and metals. The reason for enjoying teaching the topics associated with it is the Practical nature of the topics as revealed from the data obtained from the study.

Table 3 shows 32 and 37% of male and female UPST find the teaching of the topic Particles nature of matter associated with the concept of general Chemistry difficult to teach. While the data obtained from the study shows that the abstract nature of the topics associated with these concepts makes it difficult for the UPST to enjoy teaching the topics.

H01: There is no significant difference in gender on the Chemistry topics in secondary schools UPST enjoy teaching.

To test hypothesis (H01) above, Chi-Square test was used using Statistical Product and Services Solution (SPSS) version 16.0. The result was tabulated on Table 3.

Table 3 revealed the result on Chi-Square test on the H01 shows no significant difference at Chi-Square = 0.680, p = 0.954 at α = 0.05 level of significance.

H02: There is no significant difference in gender on the Chemistry topics in secondary schools UPST find difficult to teach.

The above hypothesis (H02) was tested at α = 0.05 level of significance using SPSS version 16.0 and the result was tabulated on Table 4.

Table 4, shows the result computed on testing the H02. From the result, Chi-Square = 2.503, p = 0.644 at α = 0.05 level of significance, thus the H02 was not rejected.

Findings

i.) 53.6% male and 50% female UPST enjoy teaching the topics periodicity, electrons are and metals associated with the concept of Inorganic Chemistry.

ii.) Practical nature of the topics and easier demonstration were the reasons given by UPST for enjoying teaching of those topics.

iii.) 32% male and 37% female UPST find the topic particles nature of matter associated with the concept of General Chemistry as difficult to teach.

iv.) The abstract nature of some of the topics associated with the concepts makes it difficult for the UPST to teach.

v.) There are no significant (Chi-Square = .680, p > α) differences in gender on the Chemistry topics in secondary schools UPST enjoy teaching.

vi.) There are no significant (Chi-Square = 2.503, p > α) differences in gender on the Chemistry topics in
secondary schools UPST find difficult to teach.

Discussion

In discussing the results of the study, limitation on the availability of chemistry laboratories and its equivalent teaching materials where the UPST were posted for the teaching practice must be acknowledged.

To achieve objective I of the study, result in Table 2 was used. From the result on Table 2, topics such as periodicity, electrons are and metals associated with the concept of inorganic chemistry was found to attract highest (53.6% male and 50% female) percentages for the chemistry topics UPST enjoy teaching in secondary school. Findings from this study also revealed that the UPST enjoy teaching the topics associated with these concepts because of the practical nature of the topics involved in each concept in addition to the easier demonstration to students. The finding is in support of previous work done by Broman et al. (2011), Rosemary et al. (2016) who observed that most teachers found it easy to teach these topics (periodicity, electrons is and metals) as these are areas that have many simple and clear rules to follow.

Determining chemistry topics male and female UPST find difficult to teach in secondary school and reason associated with it, was the second objective of the study. This (objective ii) was achieved and the result was shown in Table 3. From the result on Table 3, the topic particles nature of matter under the concept general chemistry had the highest percentage (32% male and 37% female) as difficult to teach in secondary school among the UPST. Although, the finding falls below the percentage of 44% of teachers who found stoichiometry difficult (Broman et al., 2011) when compared with the 40% from the study (Table 3). Reasons attached for finding the topics associated with chemistry concepts difficult by the UPST was attributed to the abstract nature of some of the topics associated with the concepts. This finding was in agreement with previous findings by Broman et al. (2011); Rosemary et al. (2016).

The result of gender differences on the Chemistry topics in secondary school UPST enjoy teaching (objective iii) was shown in Table 2. This result (Table 2) was used on testing the H₁ the result which was shown on Table 4. Although, the result of Table 2 revealed differences between male and female on percentages each on the topics UPST enjoy teaching. However, these differences were not statistically significant (Chi-Square = 0.680, p> α). Thus, the H₁ was not rejected at α = 0.05 level of significance. Finding from this, revealed that there is no significant difference in gender on the topic UPST enjoy teaching.

The H₂ was tested using the result on Table 3. The result on of testing H₂ was shown in Table 4. Careful analysis on the result on Table 3 revealed differences in percentages between male and female UPST on the topics find difficult to teach. However, these differences were not statistically significant (Chi-Square =2.503, p> α) at α = 0.05 level of significance. Finding from this, revealed that there is no significant difference in gender on the topic UPST find difficult to teach.

Conclusion

The study assessed then UPST gender differences on the perception of teaching chemistry topics in secondary schools in Nigeria. Chemistry UPST from three tertiary institutions (ATBU, Bauchi, KSCO, Ankpa and ISU, Owerri) drawn from three out of the six geo political zones of Nigeria were used in the study. Although the findings from the study revealed the topics UPST enjoy or find difficult to teach, however, no significant difference was observed between male and female UPST on the chemistry topics UPST enjoy or find difficult to teach.[

Recommendations

i.) Lectures on Chemistry teaching methods to focus on topics identified as difficult to teach by UPST.

ii.) There is the need for the uses of modern soft wares on teaching those topics identified as difficult to teach by UPST.

iii.) Chemistry Head of Departments in secondary schools to monitor and assist the UPST on methods and approach to teaching Chemistry topics in secondary schools.

Table 4. Chi- Square test on the gender differences between male and female UPST perception on perception on Chemistry topics in secondary schools find difficult to teach.

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Df</th>
<th>Asym-Sig (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>2.503*</td>
<td>4</td>
<td>0.644</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>2.527</td>
<td>4</td>
<td>0.640</td>
</tr>
<tr>
<td>Linear-by –Linea Association</td>
<td>0.002</td>
<td>1</td>
<td>0.963</td>
</tr>
<tr>
<td>N of Valid cases</td>
<td>200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 cell 0% has expected count less than 5. The minimum expected count is 8.50.
REFERENCES


