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This nineteenth volume of African Journal of Educational Research contains fifteen well-researched articles by seasoned scholars in the field of education. These papers are a reflection of the authors' central concern in promoting the quality of education through quality research and publication. The Editorial Board of the journal is therefore, pleased to release this edition as it looks forward to the publication of other editions in due course.
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1. Papers must be original and may not have been previously submitted to any journal for publication.
2. Papers must not be more than 17 pages long, typed double spacing on one side of A4 paper.
3. Contributors are required to make sure that they conform with current APA format and present their papers in MSW. Such papers must carry the names and full addresses as well as the e-mail addresses of the contributors.
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Nigerian Colleges of Education Pre-Service Chemistry Teachers' Understanding of Sustainability and Education for Sustainable Development

By

Owoyemi Toyin Eunice

Abstract
In recent years, sustainability has been a worldwide paradigm cutting across several disciplines and teacher education is a vital first step in embedding education for sustainability in schools at any level. With the United Nations World Decade for Education for Sustainable Development (ESD) spanning the years 2005 to 2014, all school subjects are requested to contribute to this reform, including secondary Chemistry education. ESD is all about changing individual's environmental behaviour by emphasising waste reduction, recycling and energy efficiency. Any educational reform can only be successful if teachers possess sound knowledge and right attitudes through teacher education programmes. Unfortunately, in the case of Nigeria, information about pre-service and in-service teachers' understanding of sustainability is very rare. Moreover, few studies have focused on pre-service science teachers' understanding of sustainability and ESD as means for increasing people's sustainability knowledge. This study therefore set out to investigate the understanding of sustainability and ESD among pre-service Chemistry teachers in Nigerian Colleges of Education. One hundred pre-service chemistry teachers were sampled from two Colleges of Education located in Lagos State. The study adopted descriptive survey research design and an adapted questionnaire was used to collect relevant data. Data collected were analysed using descriptive statistical tool. The findings from the study showed that the pre-service Chemistry teachers possess little knowledge of sustainability and ESD but have a positive attitude towards inclusion of sustainability concepts in their future teaching. Based on the findings, reforms in teacher education and the development of appropriate curriculum materials are highly recommended.

Introduction
Since the 1980s, sustainability has been used more in the sense of human sustainability on the planet Earth and this has resulted in the most widely quoted definition of sustainability as a part of the concept of sustainable development. Sustainability could be defined as an ability or capacity of something to be maintained or to sustain itself. It is about taking what we need to live now, without jeopardizing the potential for people in the future to meet their needs. Many people seem to think that sustainability is all about caring for the environment. However, it should be obvious that it is much more than cooperating with nature. Sustainability does not just encompass environmental preservation but also the wellbeing and development of societies and economies that exist within and depend on it.

The effort to conserve nature in the context of sustainability is not the end but the means to achieve the need to advance human civilization at present and in the distant future. Living sustainably is about living within the means of our natural systems (environment) and ensuring that our lifestyle does not harm other people (society and culture). There is sometimes confusion about the meanings of "sustainable development" and "sustainability" and the relationship between them. A report on Education for Sustainable Development by the New Zealand Parliamentary Commission for the Environment (2004) proposes the following explanation:

Sustainability is the goal of sustainable development — an unending quest to improve the quality of people's lives and surroundings, and to prosper without destroying the life-supporting systems on which current and future generations of humans depend. Like other important concepts, such as equity and justice, sustainability can be thought of as both a destination and a journey (p.14).
Sustainable development (SD) is an approach to daily decisions that integrates probable consequences to the environment, the economy and human health and wellbeing. It is a way of making decisions that balances the needs of today without sacrificing the ability of future generations to meet their own needs.

With arrival of Agenda 21 (UNCED 1992) SD became a regulatory idea in international policy (Rauch 200). Within its policy, Agenda 21 delegated part of the action necessary for SD to education: “Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues” (UNCED 1992). The term Education for sustainable Development (ESD) was thus created. ESD is the process of equipping students with the knowledge and understanding, skills and attributes needed to work and live in a way that safeguards environmental, social and economic well-being, both in the present and for future generations.

ESD means working with students to encourage them to:

(i) Consider what the concept of global citizenship means in the context of their own discipline and in their future professional and personal lives
(ii) Consider what the concept of environmental stewardship means in the context of their own discipline and in their future professional and personal lives
(iii) Think about issues of social justice, ethics and wellbeing, and how these relate to ecological and economic factors
(iv) Develop a future-facing outlook; learning to think about the consequences of actions, and how systems and societies can be adapted to ensure sustainable futures.

ESD is a vision of education that seeks to balance human and economic wellbeing with cultural traditions and respect for the earth’s natural resources. It became a political goal worldwide for education in general (UNESCO 2005a) and in science and chemistry education in particular (Burmeister, Rauch and Elks 2012), thereby acknowledging the importance of education in the process of sustainable development. All educational levels and domains are tasked with contributing to ESD, including science education.

The role of chemistry education in implementing ESD cannot be overemphasised due to the unique importance of chemistry in both the economy and the development of every society. The chemistry industry provides most of the raw materials necessary for every other type of business or endeavour. Chemistry is the basis of a modern energy supply, agriculture, innovative materials, communication, biotechnology and pharmaceuticals (Bradley 2005). Applying chemistry knowledge to industry and technology is also related to both the ecology and the social development of all societies at the local and regional levels. Unfortunately, chemistry-related technologies in the past were not always compatible with the ideas of SD. Industrial chemistry often contributed to the pollution of the environment, caused environmental accidents and employed industrial production methods which were not always efficient when judged by modern social standards. Chemistry companies in developed countries today seek cleaner production pathways, which decrease the overall amount of necessary raw materials and are in harmony with the social aims of society in which they operate (ECCC 1993). Part of this shift is embodied in the concept of Green or Sustainable Chemistry (Ceniti and Perathoner 2009).

Nevertheless, sustainable chemistry is still not implemented all over the world as most chemistry-related production is still far from being ecologically, economically, or socially sustainable. This reality dictates a new goal for chemistry education: chemistry education must contribute to developing a balanced and well reflected system of understanding in
our students as future citizens with regards to
chemistry and chemistry-related businesses
(Ware 2001). It should promote knowledge
and skills, which allow students to participate in
society debates and decision making processes in an informed manner in cases
where science and technology related issues,
are being decided. This places chemistry in a
prominent position for teaching learners about
sustainability issues and thereby contributing
to ESD (Burmeister et al. 2012). Therefore, the
study was set out to investigate the pre-service
chemistry teachers’ understanding about
sustainability and ESD.

Statement of Problem
It has become clear that teachers need
specific knowledge to contend with ESD in
general and chemistry lessons in particular.
A teacher needs specific subject matter
knowledge in those chemistry related issues
which can form a core to start ESD teaching in
the chemistry classroom. But this is not
enough as the teacher will also need know-
ledge dealing with sustainability, sustainable
development and ESD and their overall
meaning. Knowledge is needed about the
basic definitions, concepts and models used in
the sustainability debate. Unfortunately, know-
ledge about Nigerian pre-service teachers’
understanding and attitudes towards ESD in
chemistry education is scarce in literature.
Again, little or no progress has been made
towards implementing curricula change to
reflect sustainability concepts into Chemistry
Education. Reid and Petocz (2006) have
suggested that in order to incorporate
sustainability in all subjects “it would seem
necessary to tackle the ways in which academics themselves—the teachers—under-
stand the issue of sustainability” (p.121).
Therefore, the present study sought to
investigate the pre-service chemistry teachers’
understanding of sustainability and ESD. And
also find out their attitude towards the
inclusion and teaching of ESD in future at
secondary school level.

Purpose of Study
The study attempts to investigate the pre-
service chemistry teachers’ understanding
Sustainability and ESD and attitudes of pre-
service teachers towards the inclusion and
teaching of ESD. Specifically, the objectives
are to find out:

(i) The level of understanding pre-
service teachers has of the terms
Sustainability and ESD.
(ii) The pre-service teachers’ source(s)
of knowledge about Sustainability
and ESD.
(iii) The pre-service teachers’ views
about the best school subjects to
promote ESD
(iv) The attitude of pre-service teachers
towards the inclusion and teaching
of Education for Sustainable
Development in their future teaching
in secondary school,

Research Questions
The study answered the following Research
Questions;

(i) What level of understanding do
pre-service teachers possess of
the terms Sustainability and ESD?
(ii) What are the sources of knowledge
possessed by pre-service teachers about
Sustainability and
ESD?
(iii) ESD?
(iv) What are views of the pre-service
teachers about the best school
subjects to promote ESD?
(v) What are the attitudes of pre-service
teachers towards the inclusion and
teaching of ESD in their future
teaching in secondary school?

Research Methodology
The Survey research design was adopted for
this study. Two Colleges of Education were
purposively selected from Colleges of
Education in Lagos State and 100 Chemistry
pre-service teachers from Federal College of
Education, Akoka and St. Augustine College
of Education, Akoka formed the sample size.
A research instrument called “Questionnaire on Sustainability and ESD Understanding” (QSESD) adapted from Burmeister and Eilks (2012) was used in the study to collect the necessary data. The instrument contains five sections: Section A solicits information on the participants’ bio-data. Section B seeks to find out the level of understanding about sustainability through some chosen sustainability terms. Section C seeks to know the respondents’ source of knowledge of sustainability. Section D seeks to know the best school subjects to promote ESD after the participants received a short theoretical introduction to the definitions of sustainability and the concept of ESD. And Section E tries to find out attitude of the respondents towards inclusion and teaching of Sustainability and Education for Sustainable Development in future.

The instrument undergone an experts validation and the reliability (0.64) determined using Cronbach Alpha.

Procedure for Data collection and Analysis
Data collected were analysed using descriptive statistics of frequency counts, percentage, mean and standard deviation.

Results and Discussions

Table 1: Pre-service Teachers’ level of Understanding of Sustainability

<table>
<thead>
<tr>
<th>S/N</th>
<th>Sustainability Terms</th>
<th>Participants Responses</th>
<th>%</th>
<th>%</th>
<th>Cumulative %</th>
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<tbody>
<tr>
<td>1</td>
<td>Environmental problems</td>
<td>Yes</td>
<td>98</td>
<td>98.0</td>
<td>98.0</td>
</tr>
<tr>
<td>2</td>
<td>Environmental problems</td>
<td>No</td>
<td>02</td>
<td>02.0</td>
<td>100.0</td>
</tr>
<tr>
<td>3</td>
<td>Pollution</td>
<td>Yes</td>
<td>94</td>
<td>94.0</td>
<td>94.0</td>
</tr>
<tr>
<td>4</td>
<td>Pollution</td>
<td>No</td>
<td>06</td>
<td>06.0</td>
<td>100.0</td>
</tr>
<tr>
<td>5</td>
<td>Exhaustion of resources</td>
<td>Yes</td>
<td>52</td>
<td>52.0</td>
<td>52.0</td>
</tr>
<tr>
<td>6</td>
<td>Exhaustion of resources</td>
<td>No</td>
<td>47</td>
<td>47.0</td>
<td>100.0</td>
</tr>
<tr>
<td>7</td>
<td>Climate change</td>
<td>Yes</td>
<td>92</td>
<td>92.0</td>
<td>92.0</td>
</tr>
<tr>
<td>8</td>
<td>Climate change</td>
<td>No</td>
<td>08</td>
<td>08.0</td>
<td>100.0</td>
</tr>
<tr>
<td>9</td>
<td>Renewable energy</td>
<td>Yes</td>
<td>67</td>
<td>67.0</td>
<td>67.0</td>
</tr>
<tr>
<td>10</td>
<td>Renewable energy</td>
<td>No</td>
<td>33</td>
<td>33.0</td>
<td>100.0</td>
</tr>
<tr>
<td>11</td>
<td>Health</td>
<td>Yes</td>
<td>40</td>
<td>40.0</td>
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<tr>
<td>12</td>
<td>Health</td>
<td>No</td>
<td>60</td>
<td>60.0</td>
<td>100.0</td>
</tr>
<tr>
<td>13</td>
<td>Lifestyle</td>
<td>Yes</td>
<td>43</td>
<td>43.0</td>
<td>43.0</td>
</tr>
<tr>
<td>14</td>
<td>Lifestyle</td>
<td>No</td>
<td>57</td>
<td>57.0</td>
<td>100.0</td>
</tr>
<tr>
<td>15</td>
<td>Social injustice</td>
<td>Yes</td>
<td>41</td>
<td>41.0</td>
<td>41.0</td>
</tr>
<tr>
<td>16</td>
<td>Social injustice</td>
<td>No</td>
<td>59</td>
<td>59.0</td>
<td>100.0</td>
</tr>
<tr>
<td>17</td>
<td>Politics</td>
<td>Yes</td>
<td>43</td>
<td>43.0</td>
<td>43.0</td>
</tr>
<tr>
<td>18</td>
<td>Politics</td>
<td>No</td>
<td>57</td>
<td>57.0</td>
<td>100.0</td>
</tr>
<tr>
<td>19</td>
<td>Industry</td>
<td>Yes</td>
<td>90</td>
<td>90.0</td>
<td>90.0</td>
</tr>
<tr>
<td>20</td>
<td>Industry</td>
<td>No</td>
<td>10</td>
<td>10.0</td>
<td>100.0</td>
</tr>
<tr>
<td>21</td>
<td>Production processes</td>
<td>Yes</td>
<td>76</td>
<td>76.0</td>
<td>76.0</td>
</tr>
<tr>
<td>22</td>
<td>Production processes</td>
<td>No</td>
<td>24</td>
<td>24.0</td>
<td>100.0</td>
</tr>
<tr>
<td>23</td>
<td>Circular economy</td>
<td>Yes</td>
<td>45</td>
<td>45.0</td>
<td>45.0</td>
</tr>
<tr>
<td>24</td>
<td>Circular economy</td>
<td>No</td>
<td>55</td>
<td>55.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 1 shows the results on pre-service teachers’ level of understanding of sustainability based on some sustainability terms. The results showed that the pre-service teachers possess some level of understanding about sustainability through the following terms—environmental problems (98.0%), pollution (94.0%), climate change (92.0%), industry (90.0%), production processes (76.0%), renewable energy (67.0%) and exhaustion of resources (52.0%). But unfortunately all the terms with high percentages are more of ecological/ environmental aspect of sustainability. As indicated in table 1, the pre-service teachers’ understanding of politics (43.0%), lifestyle (43.0%), circular economy (45.0%), social injustice (41.0%) and health (40.0%) as aspect of sustainability is low.
Table 2: Sources of Knowledge of Sustainability

<table>
<thead>
<tr>
<th>S/N</th>
<th>Knowledge</th>
<th>Sources</th>
<th>No. of Participants</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Environmental problems</td>
<td>Chemistry studies/ Media</td>
<td>82</td>
<td>82.0</td>
</tr>
<tr>
<td>2</td>
<td>Pollution</td>
<td>Chemistry studies/ Media</td>
<td>96</td>
<td>96.0</td>
</tr>
<tr>
<td>3</td>
<td>Industry</td>
<td>Chemistry studies/ Media</td>
<td>72</td>
<td>72.0</td>
</tr>
<tr>
<td>4</td>
<td>Climate change</td>
<td>Media/studies in my second subject</td>
<td>70</td>
<td>70.0</td>
</tr>
<tr>
<td>5</td>
<td>Production processes</td>
<td>Chemistry studies/Media</td>
<td>50</td>
<td>50.0</td>
</tr>
<tr>
<td>6</td>
<td>Circular Economy</td>
<td>Media</td>
<td>41</td>
<td>41.0</td>
</tr>
<tr>
<td>7</td>
<td>Renewable energy</td>
<td>Media</td>
<td>40</td>
<td>40.0</td>
</tr>
<tr>
<td>8</td>
<td>Exhaustion of Resources</td>
<td>Media</td>
<td>41</td>
<td>41.0</td>
</tr>
<tr>
<td>9</td>
<td>Lifestyle</td>
<td>Media/studies in my second subject</td>
<td>42</td>
<td>42.0</td>
</tr>
<tr>
<td>10</td>
<td>Social Justice</td>
<td>Media</td>
<td>39</td>
<td>39.0</td>
</tr>
<tr>
<td>11</td>
<td>Politics</td>
<td>Media</td>
<td>37</td>
<td>37.0</td>
</tr>
<tr>
<td>12</td>
<td>Health</td>
<td>Media</td>
<td>35</td>
<td>35.0</td>
</tr>
</tbody>
</table>

Table 2 shows the sources of knowledge about sustainability by pre-service teachers. Majority of the respondents got to know about the following sustainability terms— environmental problems (82.0%), pollution (96.0%), industry (72.0%), and production processes from chemistry studies and media (news from radio, TV and information from internet) while climate change (70.0%) and lifestyle (42.0%) were known through media and studies in second subject by few participants. Knowledge of the rest of sustainability components in the study were gotten from media.

This shows that the major source of knowledge of sustainability is media followed by chemistry studies. This can be attributed to the fact that the term sustainability is not yet included in teacher education curriculum and taught in schools in various forms.

Table 3: Pre-service Teachers' Ranking of the Best School Subjects to Promote ESD

<table>
<thead>
<tr>
<th>S/N</th>
<th>Subject</th>
<th>Rank</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chemistry</td>
<td>1</td>
<td>2.900</td>
<td>.333</td>
</tr>
<tr>
<td>2</td>
<td>Biology</td>
<td>2</td>
<td>2.850</td>
<td>.425</td>
</tr>
<tr>
<td>3</td>
<td>Physics</td>
<td>3</td>
<td>2.610</td>
<td>.549</td>
</tr>
<tr>
<td>4</td>
<td>Other Science Subjects</td>
<td>4</td>
<td>2.600</td>
<td>.522</td>
</tr>
<tr>
<td>5</td>
<td>Geography</td>
<td>5</td>
<td>2.530</td>
<td>.611</td>
</tr>
<tr>
<td>6</td>
<td>Social Studies</td>
<td>6</td>
<td>2.430</td>
<td>.728</td>
</tr>
<tr>
<td>7</td>
<td>Economics</td>
<td>7</td>
<td>2.370</td>
<td>.661</td>
</tr>
<tr>
<td>8</td>
<td>Religious Studies</td>
<td>8</td>
<td>2.330</td>
<td>.779</td>
</tr>
<tr>
<td>9</td>
<td>Other Social Subjects</td>
<td>9</td>
<td>2.310</td>
<td>.734</td>
</tr>
<tr>
<td>10</td>
<td>Other Subjects</td>
<td>10</td>
<td>2.290</td>
<td>.743</td>
</tr>
<tr>
<td>11</td>
<td>&quot;inter-disciplinary&quot;</td>
<td>11</td>
<td>2.210</td>
<td>.795</td>
</tr>
<tr>
<td>12</td>
<td>&quot;social sciences&quot;</td>
<td>12</td>
<td>1.960</td>
<td>.777</td>
</tr>
<tr>
<td>13</td>
<td>&quot;natural subjects&quot;</td>
<td>13</td>
<td>1.870</td>
<td>.774</td>
</tr>
<tr>
<td>14</td>
<td>&quot;every subject&quot;</td>
<td>14</td>
<td>1.850</td>
<td>.770</td>
</tr>
</tbody>
</table>

From table 3, chemistry was ranked first (mean score of 2.900) followed by biology. Physics, other science subject and geography as best school subjects to promote ESD.

Table 4: Pre-service Teachers’ Responses on the School level ESD should be taught

<table>
<thead>
<tr>
<th>Level</th>
<th>Responses</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A (Agree)</td>
<td>SA (Somewhat Agree)</td>
</tr>
<tr>
<td>JNS</td>
<td>45(45.0%)</td>
<td>29(29.0%)</td>
</tr>
<tr>
<td>NSS</td>
<td>47(47.0%)</td>
<td>21(21.0%)</td>
</tr>
</tbody>
</table>

[A (Agree), SA (Somewhat Agree), PA (Partly Agree), DA (Disagree)]
From table 4, 45.0% and 47.0% of the respondents agreed that ESD should be taught at JSS and SSS respectively, 29.0% and 21.0% also somewhat agreed that ESD should be taught at JSS and SS respectively.

While the rest partly agreed or completely disagreed. This implies that majority of the respondents agreed that ESD should be taught at JSS and SSS levels of education.

Table 5: Pre-service Teachers’ Attitude towards Implementation of ESD in future Teaching

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>%</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>44</td>
<td>44.0</td>
<td>44.0</td>
</tr>
<tr>
<td>Somewhat</td>
<td>32</td>
<td>32.0</td>
<td>76.0</td>
</tr>
<tr>
<td>Partly Agree</td>
<td>14</td>
<td>14.0</td>
<td>90.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>10</td>
<td>10.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 5 shows that 44.0% of the respondents agreed to implement ESD in their future teaching while 32.0% of the respondents somewhat agreed, 14.0% partly agreed and 10.0% did not agree. This means that the majority of the respondents agreed that ESD will be implemented in their future teaching as seen in table 5 and figure 1.

Discussion of Findings

The participants associated ‘sustainability’ with environmental/ecological contexts, such as environmental problems, pollution, climate change, renewable energy, industry, production processes and exhaustion of resources (see table 1). The most popular ideas were preventing environmental problems, saving resources and developing renewable energies. This implies that the pre-service teachers are of the view that ecological/environmental issues have a lot to do with sustainability while economy and social issues have little to do with the concept. This might be because these concepts are yet to be included in the teacher education curriculum. Despite the importance of knowledge of sustainability and ESD, the findings from this study indicate that pre-service teachers possessed minimal understanding. These findings is in
line with the claim made by Mohamed, Zohar and Sharifah (2005), Owoloyeni and Akinyele, (2013) who reported that pre-service teachers showed little or no knowledge at all of sustainable development and ESD. These findings were also similar to the findings of Burmeister et al. (2012) that asserted that the major source of awareness of sustainability was associated with ecological contexts.

Table 2 showed that majority of the pre-service teachers had their main source of knowledge about sustainability and ESD from media. This was followed by chemistry studies and educational studies. The most often mentioned source of information is outside of the teacher education curriculum. This finding supports the finding of Burmeister and Eilks, (2012) who reported that there is a major lack in the awareness of sustainability among teachers.

In table 3, the participants acknowledged the important role of both science in general and chemistry education in particular. Chemistry, biology, physics and geography were the most frequently mentioned subjects. Few participants did not even mention specific subjects, but of the opinion that ESD should be promoted in every school subject.

Majority was of the view that ESD should be taught in both JSS and SSS educational levels. The participants also expressed positive attitude towards implementing ESD in their future teaching. These findings corroborated the assertion of UNESCO (2005), that there was a very high level of positive responses from students and the education sector in general about the inclusion and implementation of sustainability and ESD into the curriculum at all levels of learning.

Conclusion
Tertiary educators must lead the way in navigating the new education for sustainability terrain. The first step in this process is to understand and meet the needs of pre-service teachers in relation to education for sustainability at the point of entry to their career. This is critical in the wake of the current global environmental stresses, and also to fulfill the aims declared by UNESCO (2005), wherein the pre-service teachers’ role is of paramount importance to supporting ESD and sustainable development.

Based on the findings of the study, the following conclusions were reached—it was concluded that the pre-service teachers have understanding of the ecological aspect of sustainability concept but their understanding of the other two aspects; social and economy is minimal compare to what is needed for effective teaching of sustainability through ESD in the field of education. The pre-service teachers also have positive and the right attitude towards the teaching of education for sustainability. Hence, there is urgent need to modify the national curriculum to ensure inculcation of sustainability concepts and infusing these concepts in the teacher education curriculum would offer the pre-service teachers opportunity to be adequately informed and also learn ESD basic pedagogies.

Recommendations
Based on the findings from the study, it is recommended that education policy makers should as a matter of urgency see the adjustment and modification of teacher training schools’ curricula this would help to equip the pre-service teachers with the concepts of sustainability before starting their career. The Government should also make provision for in-service training of service teachers through regular seminars, conferences and workshops attendance, as these would help them to be abreast of current issues about sustainability. Finally, the concept of sustainability and ESD should not be restricted to any particular discipline but rather should cut across all disciplines.

References


