# Perception and Conceptual Understanding of Biodiversity among Pre-Service Biology Teachers in Zaria, Nigeria

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## Abstract
This study titled Pre-service Biology Teachers Perception and Conceptual Understanding of Biodiversity was carried out in Zaria, Nigeria. Descriptive survey design was used to carry out the study. The population of the study were all pre-service biology teachers (final year 400 level B.Sc. (Ed) biology students of Ahmadu Bello University residing at Federal College of Education, Zaria study campus. Purposive sampling was used to select 80 pre-service teachers for the study. The instrument used for data collection was a validated questionnaire titled Perception and Conceptual Understanding of Biodiversity Questionnaire (PCUBQ). Split-half reliability method was adopted and Spearman-Brown was used to determine the co-efficient value of 0.74. The questionnaire was administered by researchers for two weeks. Frequencies, percentages, weighted mean, standard deviation and t-test statistics were used for data analyses. Results revealed that the perception of pre-service teachers on biodiversity is significantly positive (mean 3.56> benchmark mean 3.00). The level of conceptual understanding of biodiversity among pre-service biology teachers is also slightly higher (3.39) than benchmark (3.00). There was no significant difference in the level of conceptual understanding of biodiversity among males and females. (P =040>0.05). Recommendation among others includes that Biodiversity seminars, workshops, fieldtrips or clubs should be organized by teachers for students to celebrate biodiversity week. This will facilitate their interests and enhance conceptual understanding and knowledge of biodiversity.

**Keywords**: Biodiversity, Conceptual Understanding, Pre-service, Perception, Biology.

## Introduction

In today's global system, science education is much more than fact-based knowledge. Science education becomes meaningless and incomprehensible for learners, if the learners are unable to relate it with their lives. All living things on earth depend on the natural ecosystem to provide the resources for a healthy and secured life (United Nations, 2019). Humans have made unprecedented changes in ecosystems in recent decades to meet their expanding populations and booming economy. Their activities have taken the planet to the edges of a substantial wave at species extinction, further threatening the wellbeing of all (Ramadoss & Poyyamoli, 2011). The pressures on water, air and natural ecosystems will increase globally in the coming decades unless human attitudes and actions change (UN, 2019). The recognition of education as a tool to increase knowledge and awareness about biodiversity is duly acknowledged by Convention on Biological Diversity (CBD), Environmental Education (EE) and Education for Sustainable Development (ESD) to address environmental concerns through education (Navarro-Perez & Tidball, 2012).

Education is a key factor in developing pubic knowledge and awareness about issues that affects biodiversity across the world (Jiwa & Esa, 2015). It has also been acknowledged as an important tool to achieve sustainability as well as biodiversity protection through the transformation of human attitude towards nature (Abayneh, Solomon & Fisha (2017). Education for sustainable development addresses biodiversity by focusing on inter-linking issues of biodiversity livelihoods and agriculture (Ramadoss & Poyyamoli, 2011). Biodiversity education also share common goals with what has been conceived as conservation education. Navarro-Perez and Tidball (2012); Abayneh *et al.,* (2017) and Nsengimana, Habimana and Ngarukiye (2017) all agree that while studying conservation education the learners gain knowledge, awareness, basic understanding and he/she is sensitized about the environment. The students tend to derive a goal set of value feelings and are concerned about the environment which will lead them to protect and solve environmental issues.

The CBD (2014) defines biodiversity as the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystem which they are part. Navarro- Perez and Tidball (2012) defined biodiversity as representing variability in biological entities in a specific space at a specific moment in time. According to Yorek, Aydin, Ugalu and Dogan (2008), the term biodiversity was first used in the earth summit held in 1992 in Rio de Janeiro which generally means the diversity of living things and their living styles in the earth. It may be considered at three levels which is genetic diversity, species diversity and ecosystem diversity. Biodiversity is declining rapidly due to human activities such as harvesting, pollution, over exploitation, habitat destruction, modification and introduction of exotic species (CBD, 2014).

Teaching biodiversity has been practiced some hundred years ago, but due to low baseline knowledge level (Valdes, Lenoir, De frenne, Andrieu, Brunet & Chabrerie *et al.*, 2019), it had become a challenging educational task emphasized at the CBD conference of Bonn in 2008 (Leather & Quicker, 2009). Therefore, specific knowledge on biodiversity is required from student's teachers who are involved in educating the future knowledge about biodiversity is crucial because the outcomes of human activities today are affecting its equilibrium in the world (Yli-Panula, Jeronen, Lemmetty & Pauna, 2018). Therefore, biodiversity education has been proposed to enable awareness and adequate knowledge in students and also to educate the public. Within the "Decade on Biodiversity from 2011 to 2020" educational institutions are expected to play a critical role to educate their students for better understanding of the concept (UN, 2011). The United Nations 2011 general assembly declared

the period 2011-2020 as "Decade on Biodiversity" to ensure the integration of biodiversity and to promote the implementation of a strategic plan to ensure its overall vision and living in harmony with nature. Student teachers need to have in-depth understanding of content knowledge, must be flexible and must be able to guide their students (upon graduation) on biodiversity to avoid misconception.

Biodiversity loss is a problem in many other countries in the world and particularly developing countries where poverty is still pervasive (Jibrin, Isyaku, Garba & Aminu, 2013). Biodiversity supports the growing populations in rural and urban areas but the pressure is becoming increasingly higher due to over-exploitation occasioned by high demand (Fiebelkorn & Menzel, 2013). Small population of people, living at low densities by means of traditional patterns of agriculture, pastorals and hunter-gather have for many centuries been able to use natural resources sustainably simply by not removing these resources faster than their reproductive or replenishment rates. However. Nigeria's large population is characterized by high percentages of illiteracy, unemployment and poverty, which act as powerful drivers of increasingly severe demands on the remaining biodiversity in Nigeria (Anwadike, 2020). Evidence based field studies have confirmed that natural processes of regeneration are not able to cope with the over-exploitation in high magnitude. Associated with this effect is urbanization. Towns are becoming larger, new villages are being established, farms and wood cutting activities are extending further and further from each settlement. New roads and tracks enable farming, hunting and wood cutting to occur in previously undisturbed habitats (Valdes, *et al.*, 2019).

To a large extent, poverty contributes a major threat to biodiversity and in other ways continues to further deepen the level of poverty in most rural areas. As an underlying factor for biodiversity degradation, poverty causes threats to biodiversity in two ways. First, the poor are pushed by the affluent and influential majority to destroy their own source of livelihoods for meager financial returns and the poor, due to deprivation find it difficult to secure any other alternative than to erode the very foundation of their own long term survival. Biodiversity is always at the receiving end being the readily available option for food, fibre and minimal commercial gain by the rural poor. The need for protection of biodiversity is therefore seen as elitist by the rural poor whose deprivation in terms of food and domestic needs have been pushed to the wall (Anwadike, 2020).

In the undergraduate biology programme, courses such as General Ecology, Plant Ecology, Principles of Wildlife Management, Nigeria Flora and Fauna and Conservation and Development of Natural Resources are taught at various levels which have biodiversity education included in them. It is expected that pre service teachers (graduating biology students) are adequately aware of and are knowledgeable about biodiversity. Pre-service teachers are student teachers about to graduate i.e final year 400 Level undergraduate students. Pre-service teaching is an essential experience in the preparation of future teachers. Although all academic and education courses, contribute knowledge, skills, and experiences to the prospective teacher, pre- service teaching provides the opportunity to experience the challenges and rewards of assuming the instructional and professional responsibilities of a full-time teacher (Yli-Panula, *et al.*, 2018). This research therefore intends to explore the Pre-service Biology Teacher's Perception and Conceptual Understanding of Biodiversity in Zaria, Nigeria.

Loss of biodiversity has become a serious issue in many places around the world. Many factors, such as habitat loss and degradation, excessive nutrient loss, air and water pollution, over-exploitation, unsustainable use of natural resources and invasive species contribute to the loss of biodiversity. The United Nations "Decade on Biodiversity" expects all educational

institutions to play a critical role in educating their students. Since biodiversity education was inculcated into Nigerian undergraduate biology curriculum, it was expected that the students upon graduation should have adequate knowledge about the concept and should be able to further teach and educate their own students as education as a key factor in developing knowledge awareness about issues. Research evidence has shown low baseline knowledge level and these have led to further loss of biodiversity. Teachers are most influential in educating people to protect biodiversity and integrate it through education. Student Teachers should be knowledgeable about biodiversity to ensure the successful integration of it in teaching and learning. This research therefore, explores Pre-service biology student teachers knowledge to determine their perception, awareness level and conceptual understanding of biodiversity.

**Objectives of the Study**

The objectives of the study are to:

1. Determine the perception level of Pre-service Biology Teachers on biodiversity.
2. Determine the level of conceptual understanding of Pre-service Biology Teachers on biodiversity.
3. Determine gender difference in the level of conceptual understanding of biodiversity among Pre-service Biology Teachers.

**Research Questions**

The following research questions were posited to guide this study.

1. What is the perception level of Pre-service Biology Teachers on biodiversity?
2. What is the level of conceptual understanding among Pre-service Biology Teachers on biodiversity?
3. Is there any gender disparity in the level of conceptual understanding of biodiversity among Pre-service Biology Teachers?

**Hypothesis**

The Null hypothesis postulated for this study is:

$HO_1$: There is no significant difference in the level of conceptual understanding of biodiversity among male and female Pre-service Biology Teachers of Ahmadu Bello University, Zaria

**Research Methodology**

The study adopted the descriptive survey design. The scope of the study is Ahmadu Bello University, Zaria pre service teachers residing at Federal College of Education, Zaria Study campus. The study area is located in Zaria at $11^{o}$ 4N and $7^{o}$42E on the Nigeria map. Four hundred level graduating students are the participants of this study with a population of 127. Eighty (42 males & 38 females) students were taken as sample of the study based on availability of respondents. The instrument used for data collection was a questionnaire designed by the researcher consisting of 40 questions titled 'Perception and Conceptual Understanding of Biodiversity Questionnaire' (PCUBQ). The PCUBQ consists of three sections. Section A is general information about the respondents, section B comprises of 15 questions on Pre-service Biology Teacher's Perception of Biodiversity while Section C consists of 23 questions on Pre-service Teachers Conceptual Understanding of Biodiversity. The PCUBQ items are presented with a five point likert scale. This questionnaire (PCUBQ) was administered to graduating

students of Ahmadu Bello University, Zaria pre service biology teachers residing at Federal College of Education, Zaria Study campus.

The PCUBQ was validated by two conservation education and one science education experts with PhD Ahmadu Bello University, Zaria. Content validity was done which led to correction and restructure of the questionnaire. Most of the questions in the PCUBQ were found to be satisfactory. To ensure the reliability of instrument, split half method was used. Forty (40) questionnaires were administered to the graduating students of Biology Education of Ahmadu Bello University, Zaria FCE Kano study campus. Spearman brown was used to calculate the reliability coefficient of 0.74. Copies of the questionnaire was administered to the pre-service teachers by the researchers through personal contact. The researchers administered and collected the questionnaires themselves for a period of two weeks. A total of 80 copies of the questionnaire were administered and retrieved from the pre-service teachers. Some of the pre-service students travelled without returning the PCUBQ'S given to them. The arithmetic mean values were computed as 5 + 4 +3 + 2 + 1= 15/5 =3.00. Therefore, a total mean score of 3.00 and above was used as cut-off point for agree while any mean score below that indicate disagree. Frequencies and percentages were used to analyze the biodata variables of respondents while weighted mean scores, standard deviation and t-test statistics were used for answering research questions and hypothesis testing.

## Results

### Research Question 1:

What is the Perception level of Pre-service Biology Teachers on Biodiversity? The perception of pre-service teachers on biodiversity were analyzed and presented in Table 1.

**Table 1: Pre-service Teachers' Perception on Biodiversity**

| S/N | Statement | Mean | Std. Dev. | Decision |
|---|---|---|---|---|
| 1 | The term diversity is familiar to me | 4.23 | 1.27 | High |
| 2 | I can define biodiversity correctly | 3.55 | 1.53 | High |
| 3 | Biodiversity is important to the society | 4.45 | 1.05 | High |
| 4 | Biodiversity is important to the society | 3.98 | 1.23 | High |
| 5 | Students need to study biodiversity | 3.91 | 1.36 | High |
| 6 | Concept of biodiversity is difficult to understand | 4.19 | 1.26 | High |
| 7 | Students need to acquire knowledge on biodiversity | 3.29 | 1.36 | High |
| 8 | Preservation of biodiversity reduces economic development | 4.13 | 1.31 | High |
| 9 | Government should spend money to preserve and protect biodiversity | 4.48 | 1.02 | High |
| 10 | Institutions should educate students adequately on biodiversity | 2.85 | 1.32 | Low |
| 11 | Teachers need to be knowledgeable on biodiversity | 3.13 | 1.59 | High |
| 12 | Teachers are responsible for educating the society about biodiversity through their students | 2.14 | 1.08 | Low |
| 13 | There is need to integrate biodiversity conservation education as a separate course in the curriculum of undergraduate students | 2.66 | 1.39 | Low |

| | | | | |
|---|---|---|---|---|
| 14 | Training in biodiversity education is necessary to enhance students teacher knowledge content in biodiversity | 3.01 | 1.53 | High |
| 15 | Biodiversity loss is a global problem | 3.34 | 1.60 | High |
| | **Cumulative** | **3.56** | **1.33** | **High** |

**Benchmark: Mean ≥3.00 = High level; Mean < 3.00 = Low Level**

Table 1 shows the pre-service teachers' perception of biodiversity. From the table the cumulative mean of 3.56 is higher than the benchmark mean of 3.00 and a standard deviation of 1.33. This is an indication that their response pertaining biodiversity is positive.

**Research Question 2:**

What is the level of conceptual understanding among Pre-service Biology Teachers on biodiversity?

In order to answer the research question, respondents' opinion on the level of conceptual understanding of biodiversity among pre-service biology teachers were analyzed and presented in Table 2.

**Table 2: Opinion of Respondents on Level of Conceptual Understanding of Biodiversity**

| S/N | Statement | Mean | SD | Rks |
|---|---|---|---|---|
| 18 | Biodiversity represents variability in biological entities in a specific space at a specific moment in time | 2.68 | 1.46 | Low |
| 19 | Basic skills for plant and animal species identification is a fundamental aspect of learning and understanding biodiversity | 2.79 | 1.44 | Low |
| 20 | Biodiversity concept involves diversity at three levels i.e. eco-systems, gene and species | 3.03 | 1.44 | High |
| 21 | Genetic diversity refers to the differences in genetic makeup between distinct species | 2.48 | 1.40 | Low |
| 22 | Species diversity is measured in relation to a given area from small field to the entire planet | 2.68 | 1.33 | Low |
| 23 | Ecosystem diversity deals with the variation in ecosystem within a geographical location and its overall impact on human existence and the environment | 3.55 | 1.48 | High |
| 24 | Biodiversity loss can cause human disease, lack of food and environmental disaster | 4.31 | 1.07 | High |
| 25 | Biodiversity is necessary for the continuation of the energy cycle | 3.63 | 1.42 | High |
| 26 | Campaigns through social and mass media are alternative ways to promote biodiversity | 3.68 | 1.47 | High |
| 27 | There is need to preserve biodiversity for continuity, future generation and prevent extinction | 3.21 | 1.29 | High |
| 28 | Need to maintain a balance of food chain, because of the interdependence of species is important | 3.80 | 1.44 | High |
| 29 | To preserve variety of biodiversity because of genetic implications | 3.93 | 1.50 | High |
| 30 | Observation of biodiversity for future knowledge, uses and economics values is necessary preserving | 3.83 | 1.39 | High |

| | | | | |
|---|---|---|---|---|
| 31 | All life forms are worth preserving for aesthetic world | 4.29 | 1.23 | High |
| 32 | Planting of trees can be used for protection of biodiversity | 3.64 | 1.43 | High |
| 33 | Loss of biodiversity would affect our survival of life | 2.99 | 1.48 | Low |
| 34 | Forest clearance for agricultural or development and other human activities is justifiable even if it affects biodiversity resources | 3.15 | 1.38 | High |
| 35 | There is no need to bother about biodiversity resources as far as food is secured for any source | 3.14 | 1.36 | Agreed |
| 36 | Biodiversity loss does not have any impact on the socioeconomic and stability of environment | 2.10 | 1.14 | Low |
| 37 | Biodiversity conservation should mainly be the responsibility of government rather than individual/society | 3.80 | 1.44 | High |
| 38 | Students should not participate and spend time to control biodiversity resources | 3.93 | 1.50 | High |
| 39 | Conservation of biodiversity is not a matter that concerns me | 3.83 | 1.39 | High |
| 40 | As citizens, we have the responsibility to participate voluntarily in activities that are concerned with conservation of biodiversity | 3.61 | 1.32 | High |
| | **Cumulative** | **3.39** | **1.38** | **High** |

**Benchmark: Mean ≥3.00 = High Level; Mean < 3.00 Low**

Table 2 shows the opinion of respondents on conceptual understanding of biodiversity. The table shows a cumulative mean of all the items to be 3.39 which is higher than the benchmark mean of 3.00 and a standard deviation of 1.33. This is implying that their response on the conceptual understanding of biodiversity is noteworthy.

**Research Question 3:**

Is there any gender difference in the level of conceptual understanding of biodiversity among Pre-service Biology Teachers?

In order to answer research question three, the opinion of respondents on the level of conceptual understanding of biodiversity among pre-service biology teachers was analyzed according to gender using mean and standard deviation as presented in Table 3.

**Table 3: Summary of Gender Disparity in the Level of Conceptual Understanding of Biodiversity among Pre-service Biology Students**

| Gender | N | Mean | SD | Mean Difference |
|---|---|---|---|---|
| Male | 42 | 54.95 | 18.14 | |
| | | | | 3.45 |
| Female | 38 | 51.50 | 18.43 | |

Table 3 shows that there is a gender disparity between the level of conceptual understanding of biodiversity among male and female pre-service teachers with mean scores of 54.95 and 51.50 for male and female pre-service teachers respectively with a mean difference of 3.45 in favour of the male pre-service teachers. This indicates that males have slightly higher level of conceptual understanding of biodiversity than female pre-service biology teachers of Ahmadu Bello University, Zaria. The significance of the mean difference is tested in the related hypothesis.

**Hypothesis Testing**

There is no significant difference in the level of conceptual understanding of biodiversity among male and female pre-service biology teachers of Ahmadu Bello University, Zaria.

To test Null Hypothesis One, the opinion of male and female respondents on the level of conceptual understanding of biodiversity were subjected to an independent samples t-test. The result is shown in Table 4.

**Table 4: Independent Samples t-test Analysis for Difference in the Level of Conceptual Understanding of Biodiversity among Male and Female Pre-service Biology Teachers**

| Variable | N | Mean | SD | df | t-cal. | t-crit. | p-value | Decision |
|---|---|---|---|---|---|---|---|---|
| **Male** | 42 | 54.95 | 18.14 | | | | | |
| | | | | 78 | 0.84 | 2.00 | 0.40 | NS |
| **Female** | 38 | 51.50 | 18.43 | | | | | |

**Not Significant at P≤0.05**

Table 4 shows the summary of independent samples t-test analysis for difference in the level of conceptual understanding of biodiversity among male and female pre-service biology teachers of Ahmadu Bello University, Zaria. The table revealed that P = 0.40 > 0.05. In other words, the t-cal of 0.84 is less than t-crit of 2.00.

**Discussion of Findings**

Table 1 present results of pre-service teachers' perception of biodiversity. From the table the cumulative mean 3.56 > benchmark mean of 3.00 and a standard deviation of 1.33 indicating positive perception level. Particularly, majority of the respondents were of the perception that Government should spend money to preserve and protect biodiversity as this item attracted the highest mean response of 4.48 with a standard deviation of 1.02. On the other hand, respondents disagreed that teachers are responsible for educating the society about biodiversity through their students as this item attracted the lowest mean of 2.14 which is lower than the benchmark mean of 3.00 and a standard deviation 1.08. From the cumulative mean score in Table 1, it can be deduced that pre-service teachers of Ahmadu Bello University, Zaria have a high level of perception on biodiversity. This finding is similar with that of Nsengimana *et al.,* (2017) who found out that that the level of knowledge of pre-service teachers on biodiversity conservation is high. On the other hand, the finding disagrees with the finding of Yorek *et al.,* (2008) who revealed that 80% of the students/teachers had poor perception level of biodiversity.

Results of findings from Table 2 shows specifically that majority of the respondents were of the opinion that biodiversity loss can cause human disease, lack of food and environmental disaster as this item attracted the highest mean response of 4.31 with a standard deviation of 1.07. On the other hand, respondents disagreed to the fact that biodiversity loss does not have any impact on the socioeconomic and stability of environment as this item attracted the lowest mean of 2.10 which is lower than the benchmark mean of 3.00 and a standard deviation of 1.14. This is an indication that biodiversity loss has impact on the socioeconomic and stability of environment where human beings live. The table revealed that the pre-service teachers in Ahmadu Bello University, Zaria have a high level of conceptual

understanding of biodiversity. This is supported by the finding of Nsengimana *et al.,* (2017) and Jiwa and Esa (2015) who found conceptual understanding of biodiversity among teachers to be good. On the other hand, this finding disagrees with that of Hasna, Nuryani & Topik (2017) who found out that in general teachers do not holistically understand the concept of biodiversity. Yeneayehu *et al.,* (2018) also discovered poor knowledge but favorable perception of biodiversity among students.

Table 4 presents the summary of t-test analysis for difference in the level of conceptual understanding of biodiversity among male and female pre-service biology teachers of Ahmadu Bello University, Zaria. The table revealed that the p-value (0.40) is greater than 0.05 alpha level of significance. Therefore, the hypothesis which states that there is no significant difference in the level of conceptual understanding of biodiversity among male and female pre-service biology teachers of Ahmadu Bello University, Zaria is retained. This implies that both male and female pre-service teachers have good conceptual understanding of biodiversity. This agrees with the findings of Jiwa and Esa (2015) who found out that the overall knowledge about biodiversity among student teachers is good because the mean score obtained is 75.58%. This is also evident in the responses on the conceptual understanding of biodiversity as indicated by a cumulative mean of 3.39 which is an indication that their understanding of the concept is positive. On the other hand, the finding disagrees with the finding of Yorek *et al.,* (2008) who revealed that 80% of the students/teachers had poor perception and conceptual understanding level of biodiversity implying that the level of perception and conceptual understanding level of biodiversity is low.

## Conclusion

This research concludes that pre-service teachers of Ahmadu Bello University Zaria have a positive perception of biodiversity and good conceptual understanding of biodiversity. However, gender disparity does not exist in the level of conceptual understanding of biodiversity among male and female pre-service biology teachers of Ahmadu Bello University, Zaria. Teachers should encourage student-teachers that are knowledgeable about biodiversity to educate and sensitize all stakeholders on the relevance of protecting the biodiversity in the environment in which we live.

## Recommendations

In this study the following recommendations were made:

1. Individuals, students as well as government and non-governmental organizations should help in the process of ensuring that the biodiversity within our environments are protected so as to prevent extinction of species.
2. Biodiversity seminars, workshops, fieldtrips or clubs should be organized by teachers for students to celebrate biodiversity week. This will facilitate their interests and enhance conceptual understanding and knowledge of biodiversity.
3. Continued efforts should be done also by teachers in the classroom to raise students' knowledge of biodiversity through conservation education.

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