

# Science Student Teachers' Ideas About Biological Diversity

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## Abstract

The significance of the biodiversity in biology and environmental education has gradually increased in the last years. The main reason is the increasing of the effect of the human activities on the biodiversity and global environmental issues. The aim of this study is to analyze the ideas of the science student teachers on the biological diversity. The data was collected by means of free word association test from 143 science student teachers who are studying in an Education Faculty of a state university during the fall semester. The free association test revealed the conceptual frameworks of the participants regarding the biological diversity. The results indicated the lack of the awareness of the science student teachers regarding the thorough meaning of this concept despite their good knowledge of importance of the biological diversity. The results were discussed with the relevant literature and suggestions were developed.

**Keywords:** biological diversity, science student teachers, free word association test.

## 1. Introduction

The biological diversity represents the interspecies diversity between the ecosystem which includes the ground, maritime and water resources which forms the life on the earth and their components and the organism, the differences between the livings and the relations with each other, i.e. the ecosystem which embraces the plants, the animals and the microorganism as well as their genes and the living things the biodiversity (Nevo, 1985). The biological diversity has three fundamental components: the diversity of the ecosystem, the species and the gene (Kassas, 2002). The biological diversity is an indicator of a health environment. However the excessive and unsustainable usage of the biological or natural resources has significantly destroyed the biodiversity in the last century resulting in a human life threat. The lack of clarity regarding the certain hypotheses, effects, opportunities and restrictions regarding the decreasing of biodiversity is however an element of the educational issues (Gayford, 2000).

In the study of Dikmenli (2010) aiming to determine the conceptual frameworks of the biology student teachers regarding biodiversity, in spite of their knowledge of biodiversity term, they were not quite aware about the complex concepts of this term and especially the sustainable use of the biodiversity. Today the significance of the biodiversity is undisputedly recognized in the scientific public opinion. However, the biodiversity is an abstract, complex and confusing concept, at least in term of educational conditions (VanWeelie & Wals, 2002). It is therefore difficult of the students to easily understand and learn such concepts (Randler, 2008). Thus, it is important to reveal the conceptual frameworks of the science student teacher regarding the biodiversity. Knowing the conceptual frameworks of the prospective teachers is one of the key factors in taking future oriented significant educational measures because today's prospective teachers are the student teachers and policy makers of the future.

### 1.1. Purpose

The purpose of this study is to research the conceptual frameworks of the science student teachers by using the free word association test. This study focuses on the following question: How do science student teachers conceptualize the term "biological diversity"?

## 2. Methodology

### 2.1. Participants

The participants of this study are 143 science student teachers who are studying at Ahmet Kelesoglu Education Faculty of Necmettin Erbakan University in Turkey. The age average of the students was 21.8. The age of the students changed between 18 and 25. Majority of the science student teachers were females (103 of 143). The gender differences were not counted for in this study. This study was conducted in April 2017.

### 2.2. Data Collection and analysis

The participating science student teachers were asked to complete the free word association test. In the test, the term "biological diversity" was presented to them as a stimulus term as follows:

Biological diversity: .....

Biological diversity: .....

Biological diversity: .....

Biological diversity: .....

Biological diversity: .....

Free word association test technique is based on the assumption that providing a stimulus word and asking respondents to freely associate the ideas which come to mind gives relatively unrestricted access to mental representations of the stimulus term (Bahar, Johnstone, Sutcliffe, 1999; Dikmenli, 2010; Sato & James, 1999). Data obtained from the free word association test were analyzed. The response words were categorized, using a criterion of semantic relationship and the frequencies of the words in each category were calculated. Many studies have shown this type of data analysis technique provides reliable results (Dikmenli, 2010; Torkar & Bajd, 2006).

### 3. Results and Discussion

Participants' associations of the term "biological diversity" (a total of 960 word associations) were arranged into 8 categories. As a result, they were excluded from the results in Table 1. The remaining 63 different associations were divided into eight categories. These categories and the response words in each category are listed in Table 1. According to the results, the associations produced by participants are related to biological kingdoms (Category 1,  $f = 278$ ) and Ecosystem Diversity (Category 2,  $f = 271$ ). Other associations are Genetic Diversity (Category 3,  $f = 141$ ), Species Diversity (Category 4,  $f = 87$ ), Taxonomic Ranks (Category 5,  $f = 81$ ), Environmental problems (Category 6,  $f = 40$ ) and Lessons (Category 7,  $f = 32$ , others  $f = 30$ ) respectively. According to the results, the dominant category associated with biological diversity is the biological kingdom category (%29.1). In the study of Dikmenli (2010) on the conceptual structures regarding the biodiversity of the prospective biology teachers the ecosystem diversity was the dominant category. This difference resulted from the differences of curriculums of prospective science and biology teachers. In our study it has been revealed that science student teachers focused on animals, plants, living things, monera, insects, producers, consumers, protista, fungi and fishes in the dominant category.

These results indicate that the participants reduced the biological diversity in general to the animal kingdom. The previous studies also revealed the tendency of spotlighting the animal kingdom in the cognitive structures of the students of miscellaneous age groups (Lindemann-Matthies, 2002; Wandersee & Schussler, 1999). The reason of this interest toward the animal is connected to by the researches sometimes to study books and sometimes to zoo chauvinism (bias against plants in favor of animals) and also to the teachers and informal learning environments such as TV shows, animal gardens etc. The recent opinion on the biodiversity indicates that it includes concepts such as species, genetic, habitat and ecosystem diversity.

Especially the habitat diversity is accepted as a conventionally well fit subject in the schools in terms of supporting the population of quite different organism (Gayford, 2000). In a previous work, the participants exposed complex mental concepts regarding the biodiversity such as ecological balance, food chains dominance and the irreversible nature of biodiversity loss. The present study fits the general expectation in terms of having the close relations between the biodiversity and ecosystem diversity powerfully represented by the prospective teachers and it also backs up the results of the abovementioned studies. On the other hand, some other studies indicate that the science student teachers are interpreting the biodiversity only as a diversity of species rather than an ecosystem and genetic diversity (Menzel & Bögeholz, 2009). The other categories revealed that the science student teachers are associating the biodiversity with ecosystem diversity (habitats, ecosystem, population, food chain, community, ecological balance and other), genetic diversity (genetic variation, gene, DNA, chromosome, gene sequencing and other), species diversity (variety of species, extinct species, endangered species, endemic species), taxonomic ranks (species, phylum, genus, class, family, order), environmental problems (environmental pollution, acid rains, global warming, erosion) and lessons (biology, science, geography and others).

These results indicate that, in line with the general expectations, the participants associated the biodiversity with ecosystem diversity, genetic diversity and species diversity. Also the participants associated the biodiversity with taxonomic ranks and environmental problems. Environmental problems such as, environmental pollution, acid rains, global warming, erosion are the main threats of biodiversity. Such kind of threats may result in extinction of any species. The extinction of a species leads to irreversible loss of the genetic codes. Nonetheless the corruption of the natural system threatens the ecosystem services which are supporting all the life on the earth. Thus it is considered that the biological education, alone, may achieve much more in terms of effects of the environmental issues on the biodiversity (Gayford, 2000). It is stated that in order to associate the behaviors and the attitudes, the education assumes a different role and that different methodologies are required, in general.

Table 1. Associations with the term “biological diversity” (categories and answers included in each category and the cumulative frequency of response words).

Categories		Associations included in categories and their frequencies	Total frequency of associations in this category	%
1.	<b>Biological Kingdoms</b>	Animalia (78), Plantae (65), Living things (58), Monera (17), Insects (14), Producers (16), Consumers (10), Protista (9), Fungi(8), Fishes(3).	278	29.1
2.	<b>Ecosystem Diversity</b>	Habitats (79), Ecosystem (62), Population (36) , Food chain (22), Community (14), Ecological balance (10), Mutualism (9), Commensalism (8), Ecological niche (7), Competition (7), Biosphere (5), Food webs (4), Food pyramid (4), Life form (4).	271	28.1
3.	<b>Genetic Diversity</b>	Genetic variation (46), Gene (19), DNA(15), Chromosome (10), Gene sequencing (10), Evolution (8), Mutation (7), Modification (6), Adaptation (6), Heredity (5), Crossing- over (5), Natural selection (4).	141	14.7
4.	<b>Species Diversity</b>	Variety of species (56), Extinct species (15), Endangered species (10), Endemic species (6).	87	9.1
5.	<b>Taxonomic Ranks</b>	Species (43), Phylum (12), Genus (7), Class (7), Family (7), Order (5).	81	8.4
6.	<b>Environmental Problems</b>	Environmental pollution (16), Acid rains (13), Global warming (7), Erosion (4).	40	4.2
7.	<b>Lessons</b>	Biology (14), Science (8), Geography (4), Environmental awareness (3), Biogeography (3).	32	3.3
8.	<b>Others</b>	Technology (6), Biotechnology (5), Scientist (4), Biogenetic (3), Genetically modified organism (3), Seeds (3), Darwin (3), Mendel (3).	30	3.1
<b>Total</b>			<b>960</b>	<b>100</b>

#### 4. Conclusion and Implications

The results of this study revealed at the miscellaneous levels the conceptual frameworks of the science student teachers regarding the biological diversity. The participants know and comprehend some of the basic aspect of the biological diversity to a certain extent. However, it has been observed that the conceptual frameworks of the participants are somewhat superficial and limited. The participants focused on certain aspects of the biological diversity although it is a multidimensional concept.

The biological diversity education in the school shall offer opportunities of learning the different meanings and interpretations on biological diversity and of critical questioning of the conceptual usage of the biological diversity in the environmental discussions. In addition, effective strategies would be the development of critical thinking and problem solving skills in order to be able to raise individuals who value and appreciate the natural environment. These strategies should be employed both pre service and during the teacher training in service.

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