

# Teaching “species” in class VIII

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Developing an idea about species in the middle and high school science classroom is very important for several reasons. The study of evolutionary biology and diversity of the living world relies on an understanding of species. Interestingly, there is no consensus among biologists about the definition of species. There are more than 22 concepts of species and that too incomplete and inadequate.

In NCERT textbooks, the concept of species is introduced in detail for the first time in the class VIII science textbook. In this article I will discuss a possible strategy to introduce species to students of class VIII. The discussion includes a brief analysis of textbook content, scope and limitations of the concept as given in the textbook, Indian students’ ideas of species, and a lesson plan for introducing species.

## Textbook analysis

In the NCERT textbooks, the word ‘species’ first appears in Class VI: Geography, in the context of Biosphere. In the science textbook of class VIII, the

idea of ‘species’ is discussed in detail for the first time in the chapter “Conservation of plants and animals.” The chapter discusses about endemic, endangered, and extinct species with several example of plants and animals against each case. The chapter states that “Species is a group of populations which are capable of interbreeding. This means that the members of a species can reproduce fertile offspring only with the members of their own species and not with members of other species. Members of a species have common characteristics.”

The first part of this idea is famously known as Biological Species Concepts (BSC). Obviously, BSC fails to account for the asexually reproducing organisms. Moreover, this definition does not provide any clue if members of two different species reproduce and give birth to fertile offspring. For example, the tiger and the lion belong to the same genus *panthera* but are different species. However, the hybrid between these two species produces fertile offspring. Similar cases are found in other animal families like *felidae*, *bovidae*, and *canidae*. Having fertile hybrid among different species is more



Female (left) and male (right) ligers at Everland amusement park, South Korea.

common in plants though. Some of the examples include wheat and mustard plant.

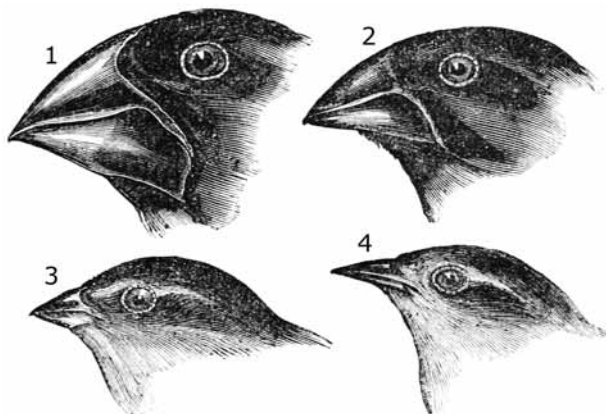
In some disciplines of biology like palaeontology, the BSC cannot be applied. While studying fossil evidences of extinct organisms we have to rely on the similarities in characteristics between the organisms under study and those that are living. This approach is also useful in identifying organisms which do not reproduce sexually and those which cannot be examined using BSC due to various non-biological reasons like geographical barriers, inadequate population size, non-availability of the organism under study, etc. Therefore, the two ideas, viz., BSC and similarities in characters do not necessarily flow from one another but provide alternative approaches to deal with the ideas of species.

We need to appreciate the multiplicity of the concept of species and prepare to welcome students' concepts that differ from BSC.

### Indian students' ideas of species

In the Indian context, there is only one reported study that mentions about Class VIII students' (of CBSE board) understanding of species (Shome, 2013).

Some students think that species are individuals who share the same habitat. This idea is incomplete but can be used as an opportunity to introduce the idea of the concept of Ecological Species. According to some students, "species" are varieties of the living world. Charles Darwin conceptualized "species" as varieties and tried to avoid the debate on defining what a species is! It is heartening to note that one student responded, "Species are a particular group of living beings ... born through a same kind of source". This response reminds us of Buffon's quote:



1) *Geospiza magnirostris*, 2) *Geospiza fortis*, 3) *Geospiza Parvula*, 4) *Certhidea olivasea*

*"We should regard two animals as belonging to the same species if, by means of copulation, they can perpetuate themselves and preserve the likeness of the species; and we should regard them as belonging to different species if they are incapable of producing progeny by the same means."* (Buffon, as translated in Lovejoy 1968 as cited in Mallet, 2010).

However, the study also reports the students' incomplete understanding about species. Just less than half of the students (about 47%) consider species as only animals. While asking to cite some example of species, students give interesting responses. Some of them mention that only wild animals are example of species. A few of them even think that rare or imaginary animals like the white tiger or white elephant are species. Several students misinterpret the textbook content on concepts of endemic, endangered, extinct species as exclusive classification scheme of species.

### Teaching-learning plan

In designing this teaching-learning plan I have followed the social constructivist paradigm. In this paradigm, learning is viewed as a social process where an individual constructs knowledge, based on his or her prior understanding and knowledge, in a mediated social context.

### Setting the context

The session can proceed in the following ways:

1. Individual students will write down at least ten names of species found in their locality.
2. They will compare their lists with four neighbouring friends and make a consolidated list.
3. Each group will read out the names of species, and the teacher will write down these names on the board.

**Initiating the discussion:** Now the teacher can ask the students, whether they have similar organisms on their list. There would be categories like plants, animals, flowering plants, non-flowering plants, vertebrate, and invertebrate animals, etc. etc. It would be interesting to find out how many organisms are there in each category. It would be important to highlight at this point about the estimated number of species in each category and relative proportion as listed by the students. The extended discussion can form a list that includes all kinds of organisms.

**Finding the characteristic properties:** It is possible that in certain cases students could mention only a common name. For example: students may simply mention grass, algae, insect, bird, fish, etc., instead

of a specific name such as coconut tree, catla, etc. In such cases, it is important to ask whether there is only one kind of insect or bird or fish. If there are more than one kind of bird or fish, then, are they different and how are they different? If the students do not mention the specific names, it is necessary to explore these ideas further by asking them to think whether all insects, birds, grass, creepers belong to same species? Whether all ants are of the same species? Whether all sugar cane are of same species?



**Observational activity followed by discussion:** Students can be given the task of observing and listing all the similarities and differences they find between the dog, the cow, and the buffalo; and between the rose, the hibiscus, and the bitter gourd. They should also record the similarities and differences observed between the individuals in each species. In the classroom, students can be introduced to two familiar plants of different species, and of different varieties: like five kinds of hibiscus and five kinds of roses. Similarly, in insects, five different kinds of ants can be observed.

**Introducing endemic, endangered, extinct species:** We have discussed that some students misread the textbook and consider that species can be classified as endemic, endangered, and extinct species. It is important to emphasize in the classroom with examples from both the plant and the animal world that a species is not exhaustive in these three categories. Further, these three categories are not exclusive. For example, an endemic species can be endangered, but all endangered species are

Male Asian elephant in the wild at Bandipur National Park in India



not necessarily endemic. In discussing endemic, endangered, and extinct species it is observed that we tend to focus on larger animals and plants. It is important to discuss in this context that it is crucial to protect the organisms from all tropic levels. If we focus only on protecting the larger animals from secondary or tertiary tropic levels, then the organisms from lower tropic levels will be neglected and will reduce in number. This will have a negative compounding effect by creating food scarcity for organisms in higher tropic levels.

## Conclusion

This article attempts to introduce a pedagogic strategy to teach “species” at class VIII. It cannot happen within a 30-minute class period. There must be some rescheduling in existing class timing. It is assumed here that the students have already been introduced to biodiversity. However, if teaching “species” is integrated while students are introduced to biodiversity, time can be saved. Teachers also need to prepare for the possible questions that students might ask, and provide adequate resources.

The major claim here is that there is no single agreed definition of ‘species’ and therefore there is no point in introducing only one or two ideas of species. However, this does not imply that we have to introduce students to the entire philosophical and scientific debate related to this particular concept. We have to acknowledge the ideas of students as legitimate knowledge for classroom discourse, and build on the basis of what they already know. Similarly, it is important to explore students’ concepts of species in detail, and not in a fragmented way. The classroom discussions need to be structured to bring out students’ conflicting ideas. Each of the students’ concepts can be a potential discussion topic to develop a better idea about species.

## References

- Mallet, J. (2010). Group selection and the development of the biological species concept. *Philosophical Transactions of Royal Society B*, 365 (1547); 1853-1863.
- Shome, S. (2013). Exploring students’ understanding of species: a study with class VIII students. In Nagarjuna G., Arvind Jamakhandi, & Ebie M. Sam (Eds.) *Proceedings of epiSTEME – 5*, p. 158-164. Mumbai: HBCSE, TIFR.

## Resources

A list of resources is available at <http://continuinglearning2teach.wordpress.com/e-r/d-p/r-l-c-of-s/>.

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