

On the Effect of Gender Differences in the Formation of Conjunctive Concepts in Biology

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Abstract

Biology is an important discipline of scientific knowledge dealing with a large number of different types of concepts which differ in their extent, number and values. Perhaps, no one would deny the importance of Biological achievement in a child's life. There are various factors which influence the student's achievement in Biology. Conjunctive concepts seem to be one of them. It is important predictors of student's achievement in Biology. The present study was carried out by the investigator on a sample of 300 students of grade XIth at formal operational stage. The effect of gender was investigated on Conjunctive concepts in Biology. Statistical analysis was made by calculating mean, standard deviation and t-test. The finding of the study indicates that male and female have equal level of Conjunctive concepts in Biology at formal operational stage.

Keywords: Conjunctive concepts, Biology, Scientific Knowledge.

Introduction

Biology is a natural science subject consisting of contents from microscopic organisms to the biosphere in general, encompassing the earth's surface and all living things (Wyner and Desalle¹, 2010). Considering its fundamental

characteristics and importance, Biology is today a standard subject of instruction at all levels of our educational systems, from pre-primary to tertiary. It is not only the core science subject at higher secondary school level students, but its study and understanding is very relevant to man's successful healthy living (Taylor and Meyer², 2009). It is a key subject of the school curriculum but, the philosophy behind subject is to produce knowledgeable, highly motivated, and effective learners who will be able to develop himself as a professional in this subject.

It is a science in which the curriculum continuously changes. New knowledge and emerging content have an enormous impact on our lives. With each new discovery, biologists develop new questions, which lead to more new knowledge.

In the last century, revolutionary changes were made in the concepts and theories of Biology. The educational objective of Biology has been shifting its focus from knowledge or factual information to understanding and concept formation and concept attainment. The ages of old chalk and talk method of teaching Biology is getting modified and is being supplemented by new techniques such as various information and communication technology.

Achievement has been considered as an important factor in life. In this rapidly changing world and with the growing advancement in science and technology the role of education has become vital. At the time of admission, for entrance in job, for scholarship, for further studies, academic achievement is the only criterion.

It is important as it helps the students to understand the hierarchy based on academic achievement i.e. higher the achievement more are the openings for the students and they can go for better lines and better jobs in all fields like science and technology, medicine, management, literature, education etc.

In fact, the whole system of education revolves around the academic achievement of students through various other

outcomes are also expected from the system. Thus a lot of time and effort of the school are used for helping students to achieve better in their scholastic endeavours (Ogundokun and Adeyemo³, 2010).

Since Biology is a subject of Conceptual understanding with lots of discrete facts and theories. At the higher secondary stage, students often have misconceptions (which may have arisen prior to and/or because of formal instruction) in that particular subject that affect their academic progress (Meyer and Land⁴, 2005).

Rationale and review of the study

Now-a-days, changes of curriculum, methodology of teaching and learning processes have undergone remarkable changes to cope with the changes of the objectives of Biology teaching and learning (Osborne and Collins⁵, 2000). The Biology teaching has begun to shift its focus from teacher centric approach to student centric approach, from knowledge based teaching- learning to understanding and discovery based teaching learning. Constructivism in its real sense has dominated the teaching – learning processes of Biology.

In traditional system of teaching-learning process, the teacher uses mostly the lecture method for teaching and learning and fills the students mind with lot of discrete facts and theories without developing any meaningful concepts and learning.

A student is benefited in his / her educational life and scores good marks in an achievement test if he / she develops good generalized concept in the subject of study. Since Biology is one of the subjects that has a meaningful conceptual scheme. It should be taught suitably by developing the concepts among students.

At the higher secondary level, Biology has many concepts which differ from one another either in number or extent or values. If

the differences are presented in terms of conjunctive concepts, the subjects become clearer to the students.

Conjunctive concepts represent a class or category of objects or phenomena having some common characteristics or attributes (De Cecco and Crawford⁶, 1988). A student attaining concepts in Biology is likely to reduce the different isolated observations, information and facts etc. to a manageable number of distinct classes and acquire a quick mastery over the subject. Generally, conjunctive concepts include concept attributes and attributes values. It refers to a class of objects having more than one feature in common. Sometimes called “and” concept. It is a concept that is formed by grouping together the individual attributes of something to form a whole.

Since, Biology is an important discipline of scientific knowledge dealing with a large number of different types of concepts. Conceptual understanding is important from the point of view of the learning of the subject. At the higher secondary stage, one has to deal with different types of concepts, which often creates problems in proper understanding of the subject. But on the other hand their achievement in this particular subject is very much necessary because it provides the platform for the students in future life at formal operational stage. Many studies have been conducted in Biology by taking Bruner’s Concept Attainment Model (Bagchi⁷, 1982; Skaria⁸, 1984), Understanding of concepts (King⁹, 1966; Buchholz, Dilek¹⁰, 2000; Bickerton and Gillian¹¹, 2001; Kimberly, Tanner and Deborah, Allen¹², 2005) etc. which are related with the achievement of students in Biology. It seems that Conjunctive concepts affect achievement of students in Biology. In this, particular Biological concepts have been represented in addition of multiple attributes (shape, size, function and morphology etc.) and one attributes is specific for specific concept, which can easily be distinguished from another similar concepts. Therefore, it was considered as an important factor which may be affecting student’s achievement in Biology.

For many years psychiatrists, psychologists and Biologists have stressed the importance of gender in concept. Genetical studies have shown that competency in certain subjects, acquisition of concepts and skills is greatly determined by sex of the students (Golub¹³, 1971). Apparently schools further contribute to this situation. Boys are more strongly encouraged to enroll in mathematics and sciences courses; girls are encouraged to enroll in Biology and literature courses. Findings suggest that perhaps parents, by reinforcing the traditional sex stereotype and the “education for me” attitude, may as a results affect females ‘ acquisition of concepts and educational aspiration.

Scott¹⁴ (1964) conducted a study to determine the achievement of science concepts in relation to several learner variables which were cognitive style, sex differences, and age differences. He noted that age and sex differences should be considered when grouping children in regard to activities involving learning of science concepts.

A review of the related studies on gender differences provides contrasting findings. Some studies indicated that boys and girls differ in their conceptual understanding (Bachan¹⁵, 1992; Simonneaux¹⁶ et al., 2005) where as other show the reverse of it. However, the factors behind these differences are not clear. Hence, gender differences on Conjunctive concepts require further study, especially within Indian classroom. Here, the investigator has taken the sample at formal operational stage of Piaget,¹⁷ 1960. The present study takes supposition that there is a role of gender in Conjunctive concepts in Biology among secondary school students in India.

Research Question

The following research question was in mind of the investigator while dealing with the problem:

1. How gender as a demographic variable play a significant role in the Conjunctive concepts in Biology.

Operational Definition of the Term

Conjunctive Concepts: It refers to the joint presence of appropriate value of several independent attributes or characteristics. In conjunctive concepts, different unrelated characteristics or attributes are grouped together to give a resultant impression of the scientific concepts. More simply, attributes and value are added together to form conjunctive concepts.

In this study, the term Conjunctive Concepts in Biology has been conceptualized in terms of five areas of Biology viz;

- i. Diversity in the Living World
- ii. Structural Organisation in Plants and Animals
- iii. Cell: Structure and Functions
- iv. Plant Physiology
- v. Human Physiology

Objective of the Study

The main objective of the study was as follows:

1. To find out the role of gender in the development of Conjunctive concepts in Biology of XIth grade students.

Research Hypothesis

The following hypothesis was framed for the present research study:

H_{R1}: There is a difference between Conjunctive concepts of Biology of male and female students.

Null Hypothesis

The following null hypothesis was tested at 0.05 level of significance:

H_{o1}: There is no significant difference between Conjunctive concepts of Biology of male and female students.

Method of the Study

The Descriptive Survey method was used in this research study.

Tool of the Study

Relevant data were gathered with the help of following tool:

1. Conjunctive Concept Test in Biology (CCTB); constructed by the investigator himself.

Population of the study

Students belonging to XIth grade of Biology group of different higher secondary school affiliated to C.B.S.E. Board and under the administration of either C.B.S.E. Board or Banaras Hindu University of Varanasi city constituted the population of the study.

Sample of the Study

The sample of the present study consisted of 300 students of grade XIth of six different higher secondary schools of Varanasi city affiliated to C.B.S.E. Board and under the administration of either C.B.S.E. Board or Banaras Hindu University. The males and females both were included in the sample. The sample was selected by random sampling technique.

Delimitations of the Study

The present study was delimited in terms of content, area and sample.

1. Only higher secondary school students of XIth grade affiliated to C.B.S.E. Board of Varanasi City were taken as a sample of the study.

2. The content area for the Conjunctive concepts test has been selected from five dimensions of the syllabus of XIth grade of Biology.

3. Among many demographic variables only gender was taken. The study of other variable was dropped because of the complexity of the problem.

Findings of the study

The finding of the study in relation to the objective is presented below:

Objective 1: To find out the role of gender in the development of Conjunctive concepts in Biology of XIth grade students.

Hypothesis tested- Hypothesis H₀₁ was tested to meet the objective 1.

Table 1 Mean and S.D. of Total sample for Data Variables

S. No.	Variables	Mean	S.D.	N
1.	Conjunctive concepts	252.63	36.71	300

Table 1 shows the mean and standard deviation of total sample (N=300) for data variables.

Table 2 Mean and S.D. of Male students for Data Variables

S. No.	Variables	Mean	S.D.	N
1.	Conjunctive concepts	253.30	37.08	202

Table 2 shows the mean and standard deviation of male students (N=202) for data variables.

Table 3 Mean and S.D. of Female students for Data Variables

S. No.	Variables	Mean	S.D.	N
1.	Conjunctive concepts	251.27	36.08	98

Table 3 shows the mean and standard deviation of female students (N=98) for data variables.

Effect of Gender on Conjunctive concepts

To find out the effect of gender on conjunctive concepts, t-test was used. Mean and S.D. of XIth grade male / female students for conjunctive concepts scores and results of t-test are given in the Table 4.

Table 4 Significance of the difference between Mean scores of Conjunctive Concepts of Male / Female students

S. No.	Gender	N	Mean	S.D.	t-value	L.S.
1.	Male	202	253.30	37.08	0.452	p>0.05
2.	Female	98	251.27	36.08		

From the Table 4, it is evident that mean scores of male (253.30) and female (251.27) for the scores on conjunctive concepts do not differ significantly at 0.05 level ($t' (298) = 1.97, p < 0.05$). Therefore, the null hypothesis that there is no significant difference between conjunctive concepts of male and female students is not rejected.

Conclusions of the Study

On the basis of above findings, following conclusions may be derived:

1. Gender does not seem to affect Conjunctive concepts in Biology.
2. The study concludes that the Conjunctive concepts of male and female students in Biology are nearly the same at formal operational stage.

Thus, it may be concluded that the formation of Conjunctive concepts in Biology is free from gender bias.

Educational Implications of the Study

A few educational implications of the study are described below:

1. This study may help to differentiate different unrelated concepts in Biology based on concepts attributes and attributes value.

2. It may help to reduce vast curriculum of Biology into some manageable numbers of items (concepts) which can easily be mastered by the students.
3. It may help to minimize learning gap and misconceptions among students in Biology.
4. It may promote meaningful, purposeful and conceptual based teaching-learning process and thus, improving achievement of students in Biology.
5. This study may be very much effective for teacher, teacher-educator and policy maker in framing curriculum based on Conjunctive concepts.

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