Chapter 2
Review of Related Literature

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Archaeology of knowledge always provides the basis from which new knowledge is generated. The aim of the present chapter is to analyze the accumulated knowledge of the past in the field of understanding of biological science concepts. Since the author is trying to see the impact of gender, location and language on achievement then first we look at these all really matters after that we will see the findings of different previous studies.

Diane F. Halpern, Camilla P. Benbow, David C. Geary, Ruben C. Gur & Janet Shibley Hyde, and Morton Ann Gernsbacher in their detailed research paper entitled ***The Science of Sex Differences in Science and Mathematics*** **writes** Psychologists often look for sex differences very early in life as clues to the relative contribution of biological and environmental contributions, reasoning that newborns have had fewer social interactions, so the earlier that sex differences are reliably found, the more likely they are assumed to be biological in origin. This assumption is not fully supported by the biological literature because, for many species, sex differences are not evident in infancy and often do not emerge until the age of reproductive maturation. The simple distinction between cognitive sex differences that emerge early in life and those that emerge later does not rule out environmental effects, because the uterine environment affects the development of a fetus. The role of prenatal environmental factors is an excellent example of the interaction of biological and environmental variables, which often become indistinguishable in their effects. It does not necessarily follow that differences found later in life are caused by social or environmental factors.

Substantial evidence suggests that the male advantage in mathematics is largest at the upper end of the ability distribution, a result that could provide important clues to the origin of this sex difference. In addition, a "tilt" favoring visuospatial or mathematical abilities compared to verbal, regardless of level of ability, is more frequently exhibited by males than by females. Females tend to be more balanced in their ability profiles, which may lead them to choose mathematics or science careers less frequently than their male counterparts do. These differences can be seen as early as adolescence, and, therefore, a greater number of males than females may qualify for advanced training in disciplines that place a premium on mathematical reasoning and/or visuospatial abilities. Any differences that exist are increased if interests and activities that are correlated with abilities are considered.

Odagboyi Isaiah Amedu, in his study entitled ***The Effect of Gender on the Achievement of Students in Biology Using the Jigsaw Method*** also found some important points. The objective of his study was to investigate whether the jigsaw method will enhance achievement in biology, and to find out if gender will affect the rate of achievement. The finding of this study shows that the boys achieved significantly higher than the girls when taught using the Jigsaw method. The reason for this significant difference cannot be arbitrarily contended. There would be a need to research more into other variables like grouping methods, group dynamics and to use other techniques of gathering data especially from girls to find out how they fared during the lessons. It will be nice to find out the effect of culture on the achievement of girls. If girls come to school with the cultural image created that boys are superior to girls, it might affect their zeal to learn.

Anna J. Egalite in her study entitled "***How Family Background Influences Student Achievement" writes***

To the dismay of federal officials, the Coleman Report had concluded that "schools are remarkably similar in the effect they have on the achievement of their pupils when the socio-economic background of the students is taken into account." Or, as one sociologist supposedly put it to the scholar-politician Daniel Patrick Moynihan, "Have you heard what Coleman is finding? It's all family."

The Coleman Report's conclusions concerning the influences of home and family were at odds with the paradigm of the day. The politically inconvenient conclusion that family background explained more about a child's achievement than did school resources ran contrary to contemporary priorities, which were focused on improving educational inputs such as school expenditure levels, class size, and teacher quality.

So what exactly had Coleman uncovered? Differences among schools in their facilities and staffing "are so little related to achievement levels of students that, with few exceptions, their effect fails to appear even in a survey of this magnitude," the authors concluded.

Ansuman Chattopadhyay is his study entitled ***Understanding of Mitosis and Meiosis in Higher Secondary Students of Northeast India and the Implications for Genetics Education*** *writes* The goal of science teaching, as a result of last 30 yrs science education reform movement has shifted from simply creating a knowledge base scientific facts to students developing deeper understanding of major concepts within a scientific discipline. Concept of genetics is related to good foundations of other topics like cells (structure and function), cell division, fertilization etc. Cell division (particularly the chromosome movement in the prophase I of meiosis) is difficult to teach by

secondary school teachers. Previous study using the same questionnaire among secondary school students revealed the following observations:

i. The understanding of cell division was "limited, con-fused and inconsistent."
ii. Though part of the cell division process was understood by different students, they had no "coherent conceptual framework."
iii. Although some awareness of the significance of mitosis and meiosis was present, the students did not seem to have the idea, how these are 'achieved'.
iv. Students were not clear about the nature of difference between mitosis and meiosis. They were also seemed to be confused by the closely similar words, like 'mitosis' and 'meiosis'.
v. Meiosis appeared to be linked with reproduction and confused with 'fertilization'.
vi. Students were also confused by the contradictory words like 'replicating, dividing copying, splitting, multiplying, sharing'.
vii. Many students have little awareness of the relationship between chromosomes and genetic information. The present study with higher secondary students reflected similar types of confusions and difficulties in understanding the cell division processes as noted by Lewis and her group among middle school students. Therefore, it can be presumed that misconceptions among the higher secondary students have been carried from their school level.

Rajendra L. Chavan & Dr. P S Patankar in their study entitled "***Perception of Biological Concepts among Higher Secondary Teachers: A Study" writes***

1) It is found that higher secondary Eleventh grade biology textbooks consist of 14 chapters and by the selected content analysis criteria's each chapter consists of biological facts, terms, attributes & concepts. It is concluded that biology textbook content is made up of facts, terms, attributes, concepts, characteristics, generalizations, rules, laws, principles, signs, diagrams, formulae, arrangements, process, method, theories etc. The similar findings reported by Hsing Wang (1998), Myint Khine (2013) that content analysis is helpful for identifying the important concepts , facts, theories, principles included science textbooks and content analysis increases the conceptual understanding of students and teachers.

2) Sampled higher secondary biology teachers among them most of the teachers are not aware about the biological concepts, they are unable to identify & differentiate between the biology facts, terms, attributes and concepts included in biology textbook content which supports the conclusion of James

David Williams (2013) that the pre–service science teachers failed to identify and differentiate the key scientific terminology i.e. theory, fact, law, hypothesis. They were unaware about the scientific meaning of it.

3) Sampled higher secondary biology teachers among them very few teachers are aware about the biological concepts & they are able to identify & differentiate between the biology facts, terms, attributes and concepts included in eleventh grade biology textbooks. It supports Lenton & McNeil (1993) in their research they found that some science teachers are able to differentiate in important concepts and categories and scientific facts.

Atilla Çimer in her research paper entitled "***what makes biology learning difficult and effective: Students' views***" writes the factors affecting biological science understanding. Here are her conclusions

Overall her study sought to determine the biological topics that students have difficulties learning, the reasons students have difficulties learning biology and the ways students could learn biology more effectively. Each student chose five biological topics that were the most difficult to learn. The five most prevalent topics were matter cycles, endocrine system and hormones, aerobic respiration, cell division, and genes and chromosomes. The students listed several reasons for having difficulties learning biology. Among these, the nature of the topic, teachers' style of teaching biology, students' learning and studying habits, students' negative feelings and attitudes towards the topic and lack of resources predominated. To overcome these difficulties and make their biology learning effective, the participants suggested that teachers teach biology through the use of visual materials, conducting practical experiments, connecting the topics with daily life, and making biology teaching interesting. They also proposed that the content of biology curricula be reduced and that the number of biology questions in the university entrance examination be increased. Finally, they also suggested that students use various study techniques in order to be successful in biology.

Prajna Paramita Behera in her research paper entitled "***Students' Understanding of Heredity and Variation***" concluded that the reason for presence of misconceptions is teachers' unresolved misconceptions.

The present study involving the students of school level and undergraduate level has clearly shown that many students have less understanding of Mendelian concepts in the field of heredity and variation. The nature of students' misconceptions at different classes and source of alternative conception were analysed. The learning of misconceptions has been understood as a result of the simultaneous exposure to an extensive variety of genetic subjects and the inability to reason on ontologically distinct levels of genetic

phenomenon (Duncan and Reiser, 2007; Shawet al., 2008). Efforts must be made to analyse the contribution of prior knowledge mediated by secondary education to students' performance and professional development (Infante-Malachias et al., 2010). Despite the efforts made in application of alternative strategies to transmit genetic knowledge, these difficulties to teach and to learn genetics are continuously described and remain a problem of students' comprehension (Banet and Ayuso, 2000; Orcajo and Aznar, 2005).

The concept about Mendelian inheritance and the terms related to that are explained clearly in the NCERT textbook of Class X. The analysis of results showed that the pre-service teachers during their study time were not aware of their future role as a teacher in their professional life. If they carry the alternative conceptions about basic genetic concepts from school to undergraduate level then its application will influence the science and technology and its application for betterment of the society. Therefore, it is necessary to think critically and to develop methods to improve education in genetics. There must be a correlation between curriculum and its implementation in the professional career.

In his thesis entitled '***A Study of productive efficiency of Intelligence and creativity and understanding of biological science concept at intermediate level students of Gonda district***' *Rakesh* kumar concluded that there is no significant difference in understanding of biological science on the basis on Gender locality and medium of instruction.