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A Formal Reasoning Ability and Misconceptions Concerning Genetic in Middle School Students

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Abstract
The aim of his study was to detect the misconceptions about heredity in secondary school (Middle school) 8th Grade pupils' Science courses. In order to perform a beneficial and useful science education it was necessary. The space of study was 8th grade pupils that the data obtained from research assessed via appreciated statistical methods.As a results the findings of this research has been shown that pupil generally have many misconceptions could come from environment and family effects. To detect students' alternate view just before starting in the science education in the class may be useful for teaching and learning activities. Also a constructive approach designated according to students' misconception could be useful for education.
Keywords: Heredity, DNA, misconceptions, biology education

1. 1. Background/ Objectives and Goals

Based on everyday experience, students have their own conceptions on different subjects of science education, and they bring these conceptions along to the classroom. Students' alternative conceptions are based on "*personal experiences*" and, especially in the area of genetics, are influenced by the students' social environment. The study of genetics centers on unseen processes at different organizational levels, such as proteins, genes, chromosomes, cells, tissues, and organs. It is well known that many high school students, as well as students at the undergraduate level, find the topic abstract and difficult (Tsui & Treagust, 2007). It is important for educators to determine how students make connections between complex ideas and use this knowledge as evidence to inform the design of instructional aids that support an integrated understanding of genetics.

Furthermore, research shows that students of all ages often have considerable no normative ideas about genetic inheritance (Lewis & Wood-Robinson, 2000). Students also have difficulties delineating connections between concepts of cell division such as mitosis and meiosis, which are crucial, yet distinct, processes linked to the passage of genes to off springs.

Although there is an extensive body of research on secondary students' understandings of genetics, as well as lower primary children's understandings of inheritance, research is needed on how upper elementary and middle school students understand genetics concepts (Venville et al., 2005). We need to better understand how students make sense of genetics when they are first introduced to this content.

2. Methodology

A total of 30 seventh-grade students of an urban school district participated in the study. The middle school principal and the district administrators and class teachers agreed to use a genetic inheritance instructional materials as a means of teaching the core science topic genetic inheritance and of integrating technology into their instructional practices. After one week teaching a questionnaire applied .

The purpose of this study was to investigate middle class (Grade 8) students' understanding of genetic conceptions related to cell division, reduction division, reproduction, and genetic information transfer (Fig. 1). The Questionnaire previously developed by Lewis et al. (2000) has been used for assets the basic knowledge of students. The questionnaire included the genetic knowledge information and reproduction in animal/plant. It combines both fixed- and free answer–type questions.

The research questions that guided the study were:

- What is the basic knowledge of 8th grade students' meiosis and mitotic division concepts?
- What is the nature of 8th grade students' conception of asexual and sexual reproduction in animals and plants?
- What is the nature of 8th grade students' conception of the relationship between reproduction and genetic information transfer from one generation to another?

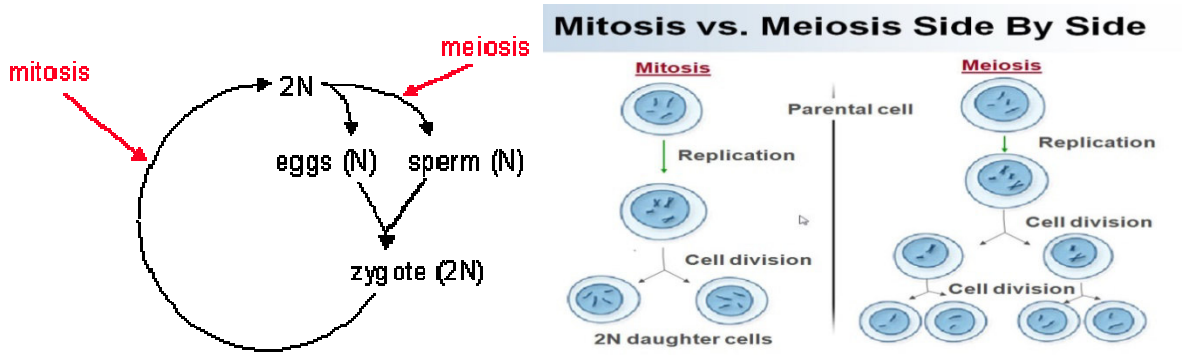

Figure 1. Mitosis, meiosis and reproduction cells.

3 .Results

To determine the nature of students 'conceptions, we used frequencies and percentages of the appearance of the wrong alternatives among students in the sample. If the percentage of the frequency of the wrong alternative is 25% or more, we consider that students hold alternative conceptions about the concept.

There are two types of students' answers; the first type is their choice from several alternatives (multiple choice). The second type is a written response, where students were required to justify or write a reason for their choices, for each question. The questions were about cell division and genetic information transfers. The results of data analysis of students 'answers are analyzed and shown Table 1.

Questionnare		***n***	***%***
1.According to your knowledge if a cell divide via mitosis, how many new cells are produced?	Only Only two Four Don't know	7 18 2 3	23.33 60.00 6.6 10
2.After mitosis are the off spring cell/cells have same genes?	Same Different Don't know	21 7 2	70.0 23.33 6.6
3.Do you think plant and animal cells divide in the same way?	Same Different Don't know	10 14 6	33 47 20
4.After meiotic division, what is the number of chromosomes in the new sperm or egg cells?	Only One Only two Don't know	12 16 2	40 53 6.6
5.Would the new egg and sperm cells contain the same or different genetic information of their parents?	Same Different Don't know	21 8 1	70 26 3.3
6.If you take a branch of plant and growth it what reproduction could say for it?	Mitosis Meiosis Asexual	10 14 6	33 46 20
7.How you think plants reproduce?	Via mitosis Via meiosis Via Asexual Via All of them	6 12 9 3	20 40 30 10
8.If you take a cell from your cheek and your leucocyte genetic information be:	Same Different Don't know	11 16 4	36 53 13

Table 1: The analysis of students 'answers about cell division and genetic information transfers.

The question of "According to your knowledge if a cell divides via mitosis, how many new cells are produced? Answered as 60.00 % correct. The other question "After mitosis is the off spring cell/cells have same genes? Was answered 70 %, the rest of students answers were wrong. This might indicate, apparently, that most of students understand the concept, but this is not really the case, possible there were some misconceptions. This conclusion is backed by students 'written responses.

Most of the students choose wrong answers and wrote incorrect explanations for "Do you think plant and animal cells divide in the same way?" (Question 3). Most of student not know exactly plant and animal cells divide, basic they follow the same route, but there is some different between them. This could put student a crossing way for answer.

"After meiotic division, what is the number of chromosomes in the new sperm or egg cells?" (Question 4) mostly answered wrong. Because students not know exactly the nature of meiosis and mitosis that this may drag them into mess.

Regarding their answers to the question 5 that asked "Would the new egg and sperm cells contain the same or different genetic information of their parents?" about 70 % of the sample chose the incorrect answer "the same", and only 26 % of them gave correct answers (different genetics). This indicates that most of the students hold alternative conceptions about the concepts related to indirect meiotic cell division.

The question 6 asked to understand students' basic knowledge about asexual reproduction "If you take a branch of plant and growth it what reproduction could say for it? That most of their answers were wrong. Only 20 % of them answered the question correctly. These results might also indicate that most students do not know the concept. This means that most of the students in the sample do not clearly understand the concepts related to reproduction and genetic information transfer.

On the question (question 7) been asked "How plants reproduce?" The answers showed that the percentages of the sample students who were able to provide the correct answers were 10% for the "Via All of them". These findings showed that students do not know in plants, meiosis, mitosis and asexual reproduction seen.

Regarding students' answers to the question which asked whether "If you take a cell from your cheek and your leucocyte genetic information is:" 36 % of the sample chose the correct answer "". It has been indicated that students have difficulty in differentiating about cell division and genetic knowledge transfer. They also have difficulties differentiating between the animal cells and plant cells.

4. Discussion

Genetics is the science that examines the nature and behavior of the genes, and the fundamental hereditary units. It is the study of how DNA is passed down from one generation to the next. Genetics and heredity include difficult concepts in the biology curricula at the secondary school and even at college and university levels (Kindfield, 1994).

Students'lack of understanding about genetic relationships is the main obstacle to building a coherent conceptual framework'. Recent studies have shown that the understanding of genetics and its various aspects is poor among students of various levels and among the population in general (Lewis & Wood-Robinson, 2000). Studies indicated also that students of all ages have difficulty understanding heredity and genetics, and reproduction concepts. Therefore, it is important to identify students' alternative conceptions, especially in genetics and heredity.

The meaningful learning of biological concepts would enable students to apply knowledge in their future life. Ausubel (1968) indicated that meaningful learning takes place if the learning task can be related in a non-arbitrary, substantive (non-verbatim) fashion to what the learner already knows'.

Conceptual misunderstandings arise (Miller et al., 2007) when students are taught scientific information in a way that does not provoke them to confront paradoxes and conflicts resulting from their own preconceived notions and nonscientific beliefs. To deal with their confusion, students construct faulty models that are usually so weak that the students themselves are insecure about the concepts.

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