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ABSTRACT

This study investigated high school students' conceptions of genes during a two-week study on inheritance using a multidimensional framework of conceptual change from ontological, socially effective and epistemological perspectives. Specifically, the study attempted to establish students' ontological perspective of the concept of the gene, investigated conceptual change about genes from the students' cognitive framework, and then examined this ontological conception from both social/affective and epistemological perspectives.

The sample for the study consisted of three high school biology classes in two different schools in Zamboanga City. These are two public urban nonscience high schools with special science classes and a private nonsectarian coeducational science high school. The three classes consisted of mixed-ability second-year high school students (ages 14-15) who do not study genetics previously and who were taught by experienced biology teachers.

The research design is qualitative-quantitative. The data were gathered through student worksheets given before and at the end of the unit, observations of lessons, videotape and audiotape recordings of classroom discourse and detailed student interviews at the end of the unit.

Data analysis revealed that students' ontological conceptions of genes developed from the idea that a gene is a passive particle passed from parents to offspring. Subsequently, there are ontological shifts in the way that students viewed genes — from being passive to active, from being particle-like to like a "sequence of instructions" and to being associated with the process of protein synthesis. However, these shifts are not substantial. At the end of the unit, many students still see genes as did Mendel, simply as units or particles passed from parents to offspring. Most students failed to fully comprehend the process and expression aspects of genes and did not view genes as being code or a "sequence of instructions" for the production of proteins. Moreover, the Proposition Generating Task (PGT) revealed that majority of the students had difficulty in connecting genes with protein synthesis. There was a limited awareness as well of the nature of the relationship between genes and DNA and genes and chromosomes.

From a social/affective perspective, it was evident that even though the students enjoyed the genetics unit and participated in classroom activities, they often were uninterested in the molecular explanatory mechanisms of genetics. The teaching approaches did not encourage a sophisticated conception of a gene in the minds of the majority of students.

From an epistemological perspective, it was possible to classify the students' ontological conceptions as being intelligible, plausible, or fruitful. This provided valuable information about the extent to which conceptual change had proceeded.

It is concluded that student learning about the concept of the gene is an evolutionary process that is more like weaker descriptions of conceptual change such as assimilation and conceptual capture than stronger forms such as accommodation and conceptual exchange.