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אפיון השימוש של תלמידים בחטיבת הביניים בהנמקה מנגנונית בהסבירם יחסים בין אללים

Characterizing students' use of mechanistic reasoning to explain allele relationships

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1. Abstract

Mechanisms have been given attention in science education but the field of genetics education can be viewed as a special case, calling for the development of mechanistic reasoning. The genetics curriculum, as it is taught today, were previously divided into three conceptual models: *meiotic*, *molecular* and *genetic*. A special difficulty exhibited by students is the creation of one coherent image from the three models. Hence, the overarching goal of this thesis was to examine the teaching of allele relationships, e.g. allele dominance, as a tool to link the genetic and the molecular model in the classroom. Eight 9th grade students were introduced to an inconsistency in the symbols of alleles, due to the activity of the same gene in two different tissues. This was done in an attempt to examine whether this will promote their ability to discuss the gene entity involved in this phenomenon. Interviews following this introduction revealed a difficulty in some students' ability to link between the inconsistencies and the genetic phenomena they symbolize. Following, an attempt was made to characterize students' use of the molecular model when asked to explain allele relationships. Towards this end, 52 9th grade students were introduced to a computerized learning environment, holding information about the mechanisms underlying allele relationships, and were asked to explain the phenomena. Furthermore, the students were presented with three different scientific problems in three different contexts, and were asked to choose which model best fits the solution of such problems: the genetic model or the molecular model. Students were also asked to justify their choices and discuss them with their peers. Using mechanistic reasoning frameworks, data, pertaining to the occurrence and quality of molecular model answers, was collected in a mixed method approach. Students' use of the molecular model was sometimes erroneous, but even when used correctly, students' preference to use it seemed random. However, a bottom-up analysis of students' justifications revealed that students can use the context presented to them when choosing between a genetic or a molecular model approach. Following this, data were from students' answers was used examine how students perceive the differences and relationships between the genetic and the molecular models. Students displayed a preference towards the genetic model as a predictor of allele distribution in progeny and the molecular model as a means to manipulate genetic phenomenon. Students also described the genetic and the molecular models as complementary in certain scientific situations. These results indicate that students are able to appreciate each model's merits and constraints when debating model productiveness. Implications for this, pertaining researchers, educators and learning-material designers are further debated.