RECENT DISSERTATIONS

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Visual Thinking, visual speech - a Semiotic Perspective on Meaning-Making in Molecular Life Science.

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Abstract

Molecular life science has become one of the fastest-growing fields of scientific and technical innovation. An important issue for tomorrow's education is to meet the challenge posed by various facets of molecular life science. This thesis highlights four aspects of molecular life science education: the rapid production and flow of information, its multi- and interdisciplinary character, the complexity of life phenomena and our knowledge of them, and the high level of abstraction of the knowledge produced. Images, diagrams and other forms of visualization are playing increasingly important roles in molecular life science teaching and research, both for conveying information and as conceptual tools, transforming the way we think about the events and processes the subject covers. This study examines how upper secondary and tertiary students interpret visualizations of proteins. The participating upper secondary students were taking different variants of the natural science program in the second (grade 11) or third (grade 12) year. A set of 20 upper secondary students were interviewed in semi-structured, revised clinical interviews. Furthermore, 31 university students participated in a group discussion and answered a questionnaire, and four third-year biochemistry students were interviewed. The interviews were structured around 2D illustrations of proteins and an animated representation of water molecules being transported through a channel in the cell membrane. Three critical features of the ability to visualize biomolecular processes were identified: the complexity of biomolecular processes, the dynamic and random nature of biomolecular interaction, and extrapolation between 2D and 3D. The results also indicate that the students may possess an understanding of a process which they cannot express in words. Furthermore, the results indicate that beginner students use a kind of intermediate language when learning a new content area, frequently making use of metaphors, some that they have obtained from their teaching and some that they create themselves, i.e. spontaneous metaphors. They also make use of words that seemingly have no meaning, such as "plupp" and "flopp". These words are here referred to as *help-words*. The results from this study indicate that spontaneous metaphors and help-words do take on a meaning in learning situations and that they play a role in the meaning-making of the students. Moreover, the results indicate that difficulties in science education may to a large degree be connected to the problems of communicating the preciseness of scientific terms.

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