APS poster abstract (500 word limit, current count = 473)

Type: Standard poster

Title: Mental Models of Viruses, Vaccines, and the Causes of Infectious Disease

Subject area: Cognitive psychology, knowledge representation, and education

Abstract: Viruses have a substantial impact on our health. The present study examined the structure and coherence of people's mental models of viruses through in-depth clinical interviews. Analyses revealed topics that were well-understood, as well as misconceptions and gaps in people's knowledge. Findings will contribute to biology and health-related instruction.

Supporting summary: Humans are exposed to viruses on a daily basis, and these viruses can have a substantial impact on our health. Viruses are invisible, and their effects, though often experienced, arise through mechanisms that may be poorly understood by many people. The purpose of the present work was to examine people's mental models of viruses, vaccines, and the causes of infectious disease at the microbiological level. This research explored not only the accuracy of people's beliefs, but also attempts to capture the structure and coherence of their intuitive mental models. We conducted detailed, semi-structured clinical interviews with a group of middle school students (n=13), teachers (n=18), and expert virologists (n=7). The sample was selected on the basis of their participation in a two-week immersive program in which students and teachers created videos and radio programs while spending time in virology research laboratories. The interview questions included, (a) what is a virus?, (b) how do viruses infect living things?, (c) how do viruses spread between living things?, (d) how does the body respond to infection?, (e) how can viruses be prevented and treated?, and (f) how do vaccines work? The interview responses were coded for the presence of structural, behavioral, and functional descriptions (cf. Hmelo-Silver & Pfeffer, 2004). For example, if a participant mentioned the specific contents of the virus (e.g., "nucleic acid, DNA, and RNA"), then they were given credit for a structural description. If they described how the contents acted (e.g., "DNA uses the enzymes of the host cell"), they were credited with a behavioral description. Finally, if the participant described the purpose or role of a behavior or structure (e.g., "the virus DNA uses the host DNA to replicate"), this was coded as a functional description. In describing microbiological processes, expert virologists were found to use each of these levels of description more often than teachers and students. Thus, experts not only described more of the entities involved in microbiological processes, they also described how these entities behaved and why. Qualitative analyses were used to capture and compare the different mental models common to each group. These analyses revealed several distinct mental models for infection, vaccination, and immune response across our participant groups. For example, almost half of the students believed that vaccines work by directly attacking viruses present in the body, much in the way that chemotherapy kills cancer cells. We will report additional findings about how students' and teachers' mental models are similar and different, and how they compare to experts' models. Our findings build on prior research that has found that people's beliefs about viruses can have an important impact on their health practices (Au et al., 2008). A better understanding of the structure and content of people's mental models can help to improve the

effectiveness of programs to educate students and the public about virology and infectious disease.

References:

Au T. K. F., Chan, C. K. K., Chan, T. K., Cheung, M. W. L., Ho J. Y. S., & Ip, G. W. M. (2008). Folkbiology meets microbiology: a study of conceptual and behavioral change. *Cognitive Psychology, 57(1),* 1–19.

Hmelo-Silver, C. E., & Pfeffer, M. G. (2004). Comparing expert and novice understanding of a complex system from the perspective of structures, behaviors, and functions. *Cognitive Science, 28,* 27–138.

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