The challenge of visualising science: Some research findings

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Abstract: *We know that many misconceptions in science stem from an inability to relate its abstractions – mathematical relationships, concepts, and symbolism – to accurate, meaningful, mental models of invisible phenomena. We also know that you cannot create or change a student's model simply by showing them a scientifically acceptable one, particularly if it conflicts with their own.*

In this presentation we will critically analyse the strengths and weaknesses of a number of visualisations from a range of scientific disciplines. Then we will use an evidence-based cognitive model for how we learn from audiovisual information, to inform best practice in using visualisation for teaching science. This will be illustrated with an example from our own research on the effectiveness of animations to assist students to build mental models of chemical substances and reactions.

Agent-augmented multi-user virtual environments and computational agent-based models: Beyond heat from a burning fire?

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Unlike standing next to a fire, where one automatically gets warm, student experiences in immersive, computational modeling, and advanced visualisation environments do not automatically result in enhanced learning of challenging scientific knowledge and skills. Two design research studies are discussed. The first study involved an agent-augmented multi-user virtual environment in which students engaged in science inquiry activities to determine why the virtual 19th century agents were getting sick. The second study explored learning activities that varied the degree of scaffolding provided for using agent-based models of the physics of electricity. The learning sciences theoretical grounding and significant empirical findings for each study are presented and implications discussed.