Process-Oriented Worked Examples in the Training for Transfer of Electrical Circuit Troubleshooting Skill

Tamara van Gog
Educational Technology Expertise Center, Open University of the Netherlands

Research inspired by cognitive load theory has shown that studying worked examples is more effective and efficient than conventional problem solving. However, this research has mainly used product-oriented worked examples that show students which solution steps to apply to get to the goal state (the product), but do not explain the rationale behind these solution steps. In the domain of electrical circuits troubleshooting this study investigates the hypothesis that process-oriented worked examples can foster understanding and transfer performance more than product-oriented worked examples. Process-oriented worked examples show a learner not only the solution steps, but also the strategic (heuristics, systematic approaches to problem-solving) and domain-principled information used in selecting the steps. A 2 x 2 factorial design is used, with 'solution worked out' (yes/no) and 'process information' (yes/no) as between-subject factors. In the resulting four conditions, electrotechnics students of senior secondary vocational education have to solve conventional problems, solve conventional problems with process information, study product-oriented worked examples, or study process-oriented worked examples. Dependent variables are time on test, perceived mental effort during training and test, and transfer performance.

A Cognitive Load Approach to Learning from Dynamic Visualizations

Fred Paas
Educational Technology Expertise Center, Open University of the Netherlands

Although, animations seem theoretically and intuitively a better instructional format for representing change over time than static graphics, research comparing static to dynamic visualizations failed to establish this advantage. In this presentation a cognitive load theory-based approach is used to show that dynamic visualizations can be effective educational tools provided they are designed with sensitivity to the capacity and duration limitations of working memory and learner expertise. According to this perspective, animation has two critical characteristics that are frequently overlooked when considering it for instructional use. First, the information presented through animation is transient and, secondly, it consists of a series of successive elements. Important information, which was briefly present, disappears before it can be retained in long-term memory. Attempts to keep such information active in working memory while simultaneously receiving new information leads to cognitive overload and retroactive interference. Two studies are presented that aim at improving the learning effectiveness of animations by using instructional methods that deal with the extraneous load associated with the limited duration working memory and retroactive inhibition.