Scaffolding information problem solving in web-based collaborative inquiry learning
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Abstract
Research indicates that information and computer technology can support learning, more specifically with regard to the development of higher-order skills such as critical thinking and scientific inquiry (Linn, Clark, & Slotta, 2003; Roschelle, Pea, Hoadley, Gordin, & Means, 2000). However, these learning outcomes cannot be taken for granted. Particularly germane to web-based science inquiry projects are the skills and processes associated with searching, evaluating, and understanding information sources to learn about complex and challenging science topics which require regulation (Brand-Gruwel, Wopereis, & Walraven, 2009). However, students’ inability to regulate their learning and perform metacognitive activities often gets in the way of learning challenging topics and results in lower learning outcomes (Azevedo, Moos, Greene, Winters, & Cromley, 2008).

This study investigated the impact of different scaffolding conditions on students who are learning science through a web-based collaborative inquiry project. This project aimed to improve conceptual knowledge, as well as information problem solving (IPS) skills (strategy use and scientific explanation), and metacognitive awareness (knowledge about cognition and regulation of cognition) (Schraw & Dennison, 1994). Three experimental conditions (human tutor as an external regulating agent, embedded question prompts, and both forms of support) were compared with a control condition in a two-by-two factorial quasi-experimental design. The provided scaffolds were based on the BIG6 model (Eisenberg & Berkowitz, 1990) that served as an instructional script. In a four-week field study in secondary science education that involved 347 students from 18 secondary school classes pretest-posttest differences were measured. Findings revealed that students in all conditions make significant improvement in terms of conceptual knowledge ($t = 23.726$, $df = 336$, $p < .001$), strategy use ($t = 6.682$, $df = 333$, $p < .001$), scientific explanation ($t = 6.375$, $df = 333$, $p < .001$), knowledge about cognition ($t = 10.287$, $df = 325$, $p < .001$), and regulation of cognition ($t = 13.739$, $df = 325$, $p < .001$). Analyses of Covariance show that conditions differ significantly on conceptual knowledge ($F(3,332) = 12.592$, $p < .001$), knowledge of cognition ($F(3,321) = 4.957$, $p = .002$), and regulation of cognition ($F(3,321) = 7.163$, $p < .001$). No significant differences are found for strategy use and scientific explanation. Regarding conceptual knowledge and knowledge of cognition, pairwise comparisons confirm that students from the condition provided with multiple scaffolding (human tutor and embedded prompts) outperform students from the conditions only provided with one mode of support and the control condition. Yet, with respect to regulation of cognition the condition with the embedded prompts does not significantly differ from the condition with multiple scaffolding. But both conditions outperform significantly the human tutor and control condition. In this respect, our findings support the notion of multiple, distributed scaffolding as an approach to enhance web-based inquiry learning in complex classroom environments (Puntambekar & Kolodner, 2005; Tabak, 2004).

References


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