Effects of Innovation versus Efficiency Tasks on Collaboration and Learning

David A. Sears
Stanford University
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What makes for a naturally productive collaborative task? Some researchers have suggested that optimal tasks for productive collaboration are ill-structured and allow for exploration and construction of multiple possible solutions (e.g. Cohen, 1994). Others have suggested that tasks should have one solution and be well-defined such that everyone can agree on their answers (e.g. Steiner, 1972). In a search for a way to reconcile this dilemma, two dimensions—innovation and efficiency—were examined for their effects on collaboration and learning in two experiments with university students.

Innovation involves the use of prior knowledge to construct solutions to unfamiliar problems. The goal is to prepare students to perceive and appreciate how an expert solution works when they receive instruction on it. Efficiency involves being given the canonical solution and then having an opportunity to practice it. The goal of efficiency is to promote speed and accuracy in applying the expert solution.

These dimensions were recently found to be informative to the field of transfer. Transfer is the generalization of learning from one situation to another. Schwartz, Bransford, and Sears (2005) suggested that optimal instruction for promoting transfer involves cycles of innovation and efficiency, rather than just one or the other approach. Thus, rather than viewing these dimensions as polar opposites, they described them as complementary components for promoting thorough understanding.

For the two experiments reported in this dissertation, it was hypothesized that tasks with an innovation component would yield more productive interactions and learning than tasks with strictly efficiency components. The first experiment compared dyads working on an Innovation version of a concept-mapping task to dyads working on an Efficiency version of that task. It was an exploratory study designed to be an initial test of the Innovation and Efficiency framework. While it found few significant learning differences between conditions, it revealed that the Innovation task promoted more

knowledge-sharing behaviors than the Efficiency task, as expected. Through a novel method of analysis, moment-to-moment interactions were related to learning outcomes.

The second experiment built upon the findings of the first. Individuals and dyads were randomly assigned to the Innovation condition or the Efficiency condition. Participants learned about the chi-square formula, and their understanding of it was assessed with basic calculation questions, comprehension questions, and difficult transfer problems. As part of the transfer problems, a preparation for future learning (PFL) assessment was used to measure participants' ability to adapt their knowledge of the chi-square formula (Bransford & Schwartz, 1999).

PFL assessments include a resource question and a target question. The resource introduces a new type of problem that is related to the initial instruction. The target builds upon the resource. If instructional conditions vary in their effects on students' abilities to learn from the resource, these difference should appear on the target problem. Participants in the Innovation condition scored significantly higher on the transfer problems, and Innovation dyads showed the greatest performance on the target PFL question. The strongest indicator that tasks with innovation components might naturally support collaborative learning came from the finding that Innovation dyads exceeded nominal dyads (dyads modeled on individuals' scores) on the PFL problem.