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Learning from Observing Tutoring Collaboratively

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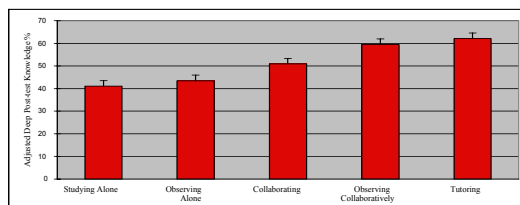
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A Novel Learning Environment

Learning can occur in various ways. Being tutored is most effective, followed by collaborating with a peer. A third potentially successful way to learn is from observing another student learn, although the results have not been consistent. Some studies show advantages of vicarious learning (as compared to the student who participated in the learning, Cox, McKendree, Tobin, Lee & Mayes, 1999), and others have shown less success (e.g., Schober & Clark, 1989). The discrepancies in the vicarious learning literature may be explained by how actively engaged the observers are. We refer to this as the *active observing hypothesis*.

We tested this hypothesis in a pilot study by having an observer self-explain while overhearing another participant being taught how to put a radio kit together (Chi, McGregor & Hausmann, 2000). The self-explaining observers did as well as the participants, suggesting that an active observer can learn by overhearing instructional dialogue. We leveraged the advantages of tutoring, collaborating, and observing, into a single learning environment that can overcome the limitation of inactive observers, and has the potential to be easily implemented. This environment consists of pairs of students collaboratively observing another student being tutored. Having pairs of students collaboratively observe ensures more active engagement.

This research pursues two goals. The pragmatic goal is to test the effectiveness of this novel learning environment and the accompanying *active observing hypothesis*. To this end, we compared it (Observing collaboratively) to four other learning conditions: Tutoring, Collaborating, Observing alone, and Studying alone. The Tutoring condition consists of an experienced physics instructor tutoring 10 tutees individually on how to solve three mechanics problems. Each tutoring session was videotaped, resulting in 10 tapes. The collaboratively Observing condition consists of 10 pairs of students trying to solve the same three problems while watching one of the 10 tapes. The Collaborating condition consists of 10 pairs of students collaborating to solve the same problems, with a text available. Observing individually and Studying alone served as controls, with either a tape or a text available. The theoretical goal of this work includes



testing three hypotheses of tutoring effect-

Figure 1: Average Posttest score adjusted for pretest.

iveness proposed in Chi, Siler, Jeong, Yamauchi and Hausmann (2001): a tutor-centered, a student-centered, and an interactive dialogue hypothesis.

Results

Figure 1 shows the post-test scores controlling for pre-test. The adjusted post-test on measures of deep knowledge were 62.1% for Tutoring, 59.5% for Observing collaboratively, 50.9% for Collaborating, 43.5% for Observing alone, and 41.1% for Studying alone. An ANCOVA revealed Tutoring and Observing collaboratively were not significantly different from each other, but were significantly better than the other three conditions. The *active observing hypothesis* is supported by comparing the better performance of the collaborative Observers with the lone Observers. Additional support for the *active observing hypothesis* can be gleaned from separating out those Observers in the alone condition who were more or less active (as determined by the frequency of videotape manipulations, blackboard writing, etc.). The active lone Observers approximated collaborative Observers (54.2%), but the passive lone Observers approximated the Studying alone condition (37.7%). Clearly, the success of vicarious learning depends on how actively engaged the observers are.

Analyses of the tutoring protocols gave additional insights into the effectiveness of learning from tutoring and observing. Correlational analyses show that Tutees learn primarily from their own constructive effort, but the collaborative Observers learn from overhearing coherent tutor-tutee dialogue. These results support both the student-centered and the interactive dialogue hypothesis, but little support is found for the tutor-centered hypothesis.

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