Teaching-to-Learn:
Its Effects on Conceptual Knowledge Learning in University Students

Melissa McConnell Rogers, Whitworth University, USA

ABSTRACT

Students report poor learning goals and study strategies. Educators may encourage better learning by requiring students to complete assessments that promote generative learning. The benefits of engaging in generative processes suggest encouraging them through teaching-to-learn assignments may be helpful. There is little research examining the benefits of teaching-to-learn conducted as part of a classroom curriculum with appropriate control conditions. The current study examines the benefits of teaching-to-learn on conceptual knowledge learning by requiring 53 students to prepare and deliver a lecture in one unit and write a paper in another unit. Students then answered questions covering their lecture and paper topics on both a unit and surprise final exam. Analyses on exams revealed students answered a greater percentage of the questions about their lecture topic correctly (84.91% and 76.23%) than their paper topic (76.98% and 67.92%) on both the unit and final exam respectively.

KEYWORDS

Elaborative Rehearsal, Learning, Learning by Teaching, Pedagogical Research, Teaching Strategies, Teaching-to-Learn

INTRODUCTION

When students decide how to study, they may choose from a variety of study strategies with varying degrees of effectiveness (Dunlosky et al., 2013; McConnell Rogers, 2020). Some strategies encourage students to use deep processing as they study the material. When processing material deeply, students use elaborative rehearsal strategies that encourage students to manipulate the material and think about the meaning of the material (Craik 2002). These strategies tend to lead to better long-term retention and greater conceptual knowledge than more shallow strategies (Bartoszewski & Gurung, 2015; Koster & Vermunt, 2020; VanZile-Tamsen & Livingston, 1999). When students use shallow strategies, like highlighting, they tend to focus on memorization rather than understanding the material. These shallow strategies require the students to minimally process the material and result in minimal gains in test performance (Dunlosky et al., 2013).

When students study material they often create a learning goal (Nelson & Narons, 1990). For example, a student's goal may be to memorize the material, or it may be to understand it. Unfortunately, often student's goals focus more on memorization, which typically results in minimal performance (Bartoszewski & Gurung, 2015; Dunlosky et al., 2013). Educators may promote better learning using assessments that encourage students to monitor their learning and focus on understanding important concepts. For example, when learners engage in assessments such as collaborative testing (LoGiudice et al., 2015), writing-to-learn (Gingerich et al., 2014), and knowledge-in-use assignments

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(Harris et al., 2019) they typically show better performance on classroom exams. Mayer's (2014) Select-Organize-Integrate model of generative learning provides a helpful guide for thinking about learning and how to develop assessments that might promote it. According to this model, the most important aspect of successful learning is how students make sense of new learning. As students engage in generative learning they must select relevant content, organize the selected material, and integrate it into existing knowledge (Fiorella & Mayer, 2016; Mayer 2014). The benefits of engaging in these generative processes suggest encouraging them through course assignments should benefit student learning and requiring students to engage in teaching-to-learn may be particularly helpful.

Typically, when students engage in teaching-to-learn practices they receive the role of teacher tasked with teaching academic content to other students. Educators have many options for incorporating teaching-to-learn into their courses, such as using peer tutors, providing peers feedback on assessments, using students as co-teachers, and requiring students to develop educational materials (Duran 2017). Previous studies support the benefits of teaching-to-learn. Students who engage in reciprocal peer tutoring perform better on exams (Dioso-Henson, 2012; Peets et al., 2009; Roscoe & Chi, 2007), participants who prepare a lecture perform better on a surprise memory test than participants who do not (Annis, 1983; Fiorella & Kuhlmann, 2020; Fiorella & Mayer, 2013; Muis et al., 2016), and participants who teach a lecture perform better on a surprise test than participants who do not (Annis, 1983; Fiorella & Mayer 2013). A recent review of 28 studies with Japanese students confirmed the benefit of teaching-to-learn and suggests students may benefit from teaching in multiple educational and cultural settings (Kobayashi, 2019b).

THEORETICAL EXPLANATIONS

The Select-Organize-Integrate model of generative learning provides a good theoretical explanation for why incorporating teaching-to-learn into a course should promote student learning (Fiorella & Mayer, 2016). Students can use various generative techniques when studying. For example, many students report summarizing the material, which is a process that requires students to generate content (Bartoszewski & Gurung, 2015). However, a technique like summarization does not necessarily encourage students to check whether they understand the information during the learning process. Another technique, self-explaining, is generative and encourages reflection and monitoring of learning (Fiorella & Mayer, 2016). Learners can use this strategy when studying alone or with peers, and studies show this approach leads to better exam performance than less generative and reflective strategies (Dunloksy et al., 2013). Teaching-to-learn is a similar generative strategy that requires learners to explain content and should be more likely to encourage them to intentionally employ the selecting, organizing, and integrating generative processes. As learners prepare to teach others, they must select the relevant content to teach, organize the content in a meaningful way, and consider how examples and applications should integrate the content into existing knowledge. Teaching-to-learn may also differ slightly from self-explaining as a generative strategy because the learner needs to anticipate questions when preparing to teach, and recent studies suggest anticipating questions may be important in explaining the benefits of teaching-to-learn (Hoogerheide et al., 2016; Kobayashi, 2019a; Muis et al., 2016).

LABORATORY VERSUS CLASSROOM STUDIES

When examining the literature supporting the benefits of teaching-to-learn, many studies examined the benefits of teaching as a part of a laboratory study, and only a few studies required students to teach material as part of an actual course curriculum. These laboratory studies included specific controlled conditions that do not necessarily suggest they would translate to success in a classroom. In many of these studies, participants studied unfamiliar material for a brief time in a controlled setting (Hiller et al., 1973; Hoogerheide et al., 2016, Nestojko et. al, 2014). For example, in Hoogerheide et