Title	How preparation activities affect the process and learning outcomes of peer collaboration
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Source	*12th International Conference of the Learning Sciences (ICLS 2016), Singapore, 20-24 June 2016*
Published by	International Society of the Learning Sciences

How Preparation Activities Affect the Process and Learning Outcomes of Peer Collaboration

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Introduction

My interest in investigating how peer collaboration affects learning first grew from my experiences as a university instructor of introductory educational psychology courses. I believed that engaging in conversations was a powerful way to learn, so I created classroom activities and assignments that required students to explain ideas to one another, critique and evaluate each other's claims, and reflect upon how other's contributions changed their thinking. Before researching some of the practices that foster collaborative learning, I was already doing them. I watched my own students experience the learning benefits of peer collaboration, and I became driven to understand how the design of collaborative activities could invoke the mechanisms of learning.

The research that I conducted during my graduate program showed that designing tasks to cognitively engage students in different ways affected both how they collaborated and how much they learned from the collaboration. I manipulated the design by requiring students to generate ideas around concepts not formally learned or use given concepts in an application task, and by differentiating the structure of the activities within the task. Examination of learning outcomes pre, during, and post the learning intervention showed that the extent to which students learned the concepts varied at different stages depending on the design. This work has led to my current focus, which is to address how different individual "preparation" activities affect the process and learning of collaboration in authentic classroom settings.

Developing a theoretical framework

I am currently investigating how task design invokes the mechanisms of preparatory activities, and how those activities invoke collaborative learning mechanisms and ultimately affect learning outcomes. This work takes place within a program of research that I am developing in Singapore, which I call Preparation for Future Collaboration (PFC). As Principle Investigator of a project focused on PFC, we are assessing how different preparatory task designs affect collaborative problem-solving and learning of upper primary students in classroom lessons on environmental sustainability. In another set of studies, we plan to examine the how the degree of generativity of preparation tasks affects learning after collaborating of secondary students in mathematics classes. The development of the PFC theoretical model aims to further unpack how preparation activities impact the collaborative learning process.

This theoretical focus is grounded in two related, but distinct, conceptions of learning: the Preparation for Future Learning (PFL) paradigm (D. Schwartz & colleagues) and Productive Failure learning design (M. Kapur & colleagues). Although the PFL work is centered on preparation to learn from future lecture, it provides the theoretical foundation for my work on preparing for learning from future collaboration in the following ways. 1) The act of generating knowledge in a preparation phase (e.g., via invention, Schwartz & Martin, 2004; contrasting cases, Schwartz & Bransford, 1998) requires a learner to activate existing knowledge that is relatable to the concepts yet-to-be learned, which then 2) promotes a "readiness" for future learning by priming the learner to incorporate relevant information from the subsequent task into existing knowledge structures (Schwartz, Sears, & Chang, 2007). One major difference in learning from a future collaborative task is that the canonical representation(s) of a target concept may or may not arise from discussions of learners with naïve representations. This is one facet that is precisely of interest. My prior work has shown that students can individually solve difficult problem tasks after collaborating to the same degree as those who are initially provided the canonical forms, without ever receiving explicit instruction of the forms. This leaves an open question of how the inclusion of direct instruction, after preparing by generating knowledge then collaborating, affects learning.

The learning design incorporated in my work is closely aligned to Productive Failure. Kapur and Bielaczyc (2012) explicated their design principles, asserting that there is a two-phase process to learning from Productive Failure. 1) *Exploration and generation* creates opportunities for students to recognize what they do and do not know, tinker with ideas, engage in problem-solving, and discuss ideas and solutions with peers, followed by 2) *knowledge consolidation and assembly*, in which the canonical solutions to problems are presented in direct instruction, offering students the chance to compare their own solutions and conceptions with the correct ones and refine their representations of the target concepts. The PFC learning design invokes these

learning mechanisms in similar ways, however, across three rather than two phases of instruction as shown in the figure below:
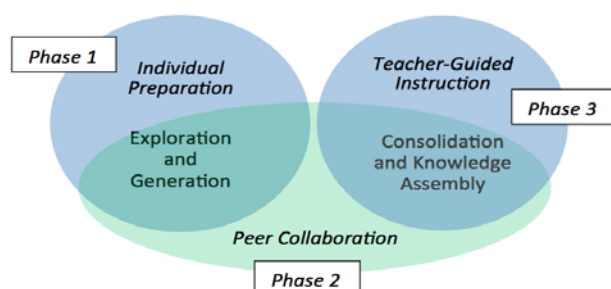

Figure 1. Preparation for Future Collaboration learning design.

Research design and methods

I am investigating the PCF model through design experiments (Brown, 1992), to which we test and evaluate our instructional interventions in real classrooms, redesign for improvement, and reexamine their effectiveness, in close partnership with and involvement from teachers, all while aligning with existing school curricula. I use experimental designs (and also plan to use quasi-experimental designs) to compare instructional conditions, and mixed methods analyses to assess and quantify qualitative student productions (including student-generated solutions to problem tasks, discourse during collaboration, and written reflections and ideas). The goal is to shed light on both the learning mechanisms at play in our activities, from preparation to collaboration to teacher-led instruction, and the learning outcomes across all instructional phases.

Final words and conclusion

All of my current work is begin done with at-risk students, as a point of personal advocacy. This population of students can be particularly vulnerable to the impact of classroom experiences, whether positive or negative (Finn & Rock, 1997; Rumberger & Lim, 2008). The PCF model and corresponding learning activities are designed in consideration of affective supports. For instance, they encourage students to voice their own ideas and be heard by others, which tells them that their ideas matter and that they are valued in the classroom community (Toshalis & Nakkula, 2012). I believe that using design experiments and mixed-methods approaches allows me to address my research questions through the lens of the student-as-learner, while considering the practical challenges that teachers face when teaching and managing a classroom.

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Acknowledgments