Chapter 7.18

Pask and Ma Join Forces in an Elementary Mathematics Methods Course

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ABSTRACT

This chapter introduces conversation theory as a means of creating an active learning environment in an elementary mathematics methods course. It argues that such an environment, designed for undergraduate candidates in teacher education, will engage the learners in the task of developing deep conceptual understanding to support and give rationale to the procedural knowledge most of them already have. Furthermore, the authors hope that an understanding of conversation theory as applied to teaching mathematics will help instructors and instructional designers to facilitate preservice teachers' engagement in reaching a deep conceptual understanding of the mathematics they are preparing to teach.

INTRODUCTION AND BACKGROUND

This chapter addresses issues and technologies arising from a consideration of conversation theory. The concepts covered include developing a mathematics methods course for preservice elementary teachers that focuses on conceptual understanding. Two strands are woven together to create the needed scaffolding for learning in this course. The work of Liping Ma, noted mathematics educator and scholar, and a proponent of deep conceptual understanding, suggests that a sophisticated understanding of measurement, functions, geometry, algebra, probability, statistics, and arithmetic can only be developed through strong conversation and reflection. The use of dialogue for learning is well supported by Pask's conversation theory, based on the use of high-level

cognitive question strategies, that begins with "why" questions and moves into "how" questions.

Most mathematics educators will agree that preparing mathematics teachers is a challenging and difficult assignment. A careful application of Pask's conversation theory will facilitate the development of deep conceptual understanding of mathematics, as espoused by Ma.

CONVERSATION THEORY AND MATHEMATICAL DISCOURSE

According to Gordon Pask, "Learning depends upon the strategies used by a student" (Pask, 1975). Breaking the learning goals into separate and smaller subgoals allows students better to focus their attention on the learning tasks at hand. In this way, educational objectives are partitioned into smaller more manageable units to ease acquisition and mastery of the content. By splitting learning into these smaller units, students will not feel overwhelmed when trying to solve learning problems while working to gain proficiency. In breaking the learning goals into separate and smaller subgoals, it is essential that preservice teachers understand that the instruction should not jump directly to the selection of an algorithm or solution strategy—as can so easily happen if, for instance, the subgoal is "key words." If a subgoal is to learn that "how many" means to add or that "how many more" means to subtract or that "of" always means multiplication, then instruction has neglected the steps of understanding and modeling. Jonassen (2003) cites research supporting the negative impact that a direct translation strategy (of key words) has not only resulted in a lack of conceptual understanding but the inability to transfer any problem-solving skills that are developed. Appropriate subgoals for problem solving, for instance, would include modeling the problem, determining the relationships among the elements of the problem, developing a meaningful repre-

sentation of the problem, using those elements to select a strategy, and then apply the strategy. Leaping to the strategy without conceptual understanding of the problem solving process also leads to students accepting solutions that do not make sense. A familiar problem illustrating this point is the one that goes like this:

A class is preparing to go on a field trip. There are 120 fifth grade students who will be going on the field trip. Busses have been hired to take the students. If each bus holds 36 students, how many busses will be needed?

Too frequently, students turn in the answer "3 1/3 busses."

Pask also pointed out, "At the other extreme, the strategies may be imposed upon the student as teaching strategies" (Pask, 1975). The teacher directs the learning activities towards reaching desired learning goals, objectives, or benchmarks. Instructors implement teaching strategies in an effort to target specific learning deficiencies thus assisting students in successfully acquiring new content to be learned. In these situations, students who attempt to offer another way of solving a problem will be met with "that's not the way you've been taught to do them" or something similar. A teacher with deep conceptual understanding of the mathematics being learned and who has an understanding of Pask's conversation theory is much more likely to be a facilitator, "a guide on the side," of students' learning rather than imposing a "one way fits all" or "this is the right way to do it" strategy.

Pask commented, "Many real situations lie between these extremes. One of them is a tutorial conversation in which methods of learning are open to discussion and in which the strategy is selected as a result of a compromise between the student and teacher" (Pask, 1975). In this situation, learning becomes more of a matter of give and take, or a shared responsibility for learning, requiring efforts to be made by both the teacher and the student. Conversational instruction allows

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