Research Proposal:  
Developing Generalizing Strategies

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1 Introduction

My thesis will explore how a student’s learning is influenced by bottom-up versus top-down approaches. In my education, most of my mathematics instruction was top-down. We would be given a situation and a relevant equation. As students, whenever we encountered the situation, we were expected to apply the memorized equation. A different approach is to have students investigate why the equation is appropriate for that situation or even to come up with the equation on their own. This is a bottom-up approach. This made me curious if elementary students could use a bottom-up approach in order to learn new concepts.

2 Proposed Research

I plan to work with the advanced 5th or 6th graders at Sycamore Elementary School in Claremont, California to explore their mathematical thinking. I have worked with children at Sycamore before as part the Math for Teachers courses at Pitzer, and have volunteered at Sycamore for a semester as a teacher’s aid. Through the classes I had participated in last year, I was able to build a relationship with Sycamore Elementary. As part of class, I was able to create short lesson plans dealing with mathematical operations during the fall semester and geometry during the spring.

I will focus my research on the students’ comprehension and interpretation of mathematics, concentrating on pre-algebraic methods and pre-geometric concepts, utilizing ideas they already know.

Following approval from Sycamore, the IRB, and parents, in the fall semester, I plan to meet with students once a week for 45 minutes to 1 hour sessions for at least six weeks. The tasks I plan to use include a table-seating problem, handshake problem, ordering in a line/table, and combinations of outfits. I want to use tasks that are rich in mathematics to elicit as much thinking as possible.

The focus of my thesis is to determine how well students can utilize generalized solutions to specific situations (top-down approach) and how they
formulate general solutions given specific situations (bottom-up approach). The flow of the meetings with students will be me introducing one of the topics followed by ample time for them to explore the problem, with me acting mostly as a facilitator. I will also leave time near the end of each meeting for the students to convey their findings.

Since I will be working with many students at once, potentially in small and separate groups, it will be difficult for me to catch everything they come up with on my own. To compensate, I plan on having video equipment to monitor their work and discussions. The parents of the participating students will be informed of my plans and will be asked to sign a release form. I will ask for their permission to work with and record their children, and whether I can show some appropriate recording during a professional presentation. If requested, I will present them with the material pertaining to their child before it is showed publicly. In presenting my findings in my thesis, I will assign an alias to each child if I absolutely must make a direct reference to them. All video footage will not be use for any other public means or posted online, and all videos not approved for professional presentation will be destroyed after my thesis is completed.

3 Prior Research

I am having difficulty finding prior research material on this specific topic. While there is much literature on promoting self-efficacy and the teaching of algebraic reasoning at the elementary school level [1], my investigation lies elsewhere. However, I have arranged to meet with both Kimberly Franklin and Dr. Stacy Brown, both of whom are very familiar with the work done on education.

References