**Notes for Practicum Assignment**

**May 2012**

Learning about children’s reasoning using videos as a tool in a pre-service mathematics course

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**Abstract of Dissertation Proposal:**

Mathematical reasoning is a central aspect of doing mathematics. Reasoning and proof is one of the five process standards for all grade levels set forth by the NCTM. In order for children to learn to mathematically reason, teachers will need to learn what it means to mathematically reason and to be able to recognize reasoning when it occurs. Studies have shown that by analyzing and studying episodes of children working on mathematical tasks, prospective and practicing teachers can improve their ability to recognize children’s ability to mathematically reason (Francisco and Maher, 2011; Maher, 2007; Sherin 2007; Kazemi and Franke, 2004).

This study takes place in a mathematics course in an independent university in New Jersey. The six students in the class are pre-service teachers in their junior year. This study is a component of a design study in the third year of a grant funded by the National Science Foundation (NSF) at Rutgers University and University of Wisconsin, Madison [award DRL-0822204] directed by Carolyn A. Maher. A component of the project is an intervention for pre/in-service teachers that utilizes video data from earlier NSF funded projects. This intervention involves “(1) teachers studying mathematics by working on strands of tasks; (2) teachers collectively studying their own solutions; (3) teachers viewing and analyzing video recordings of children working on the same or similar tasks; and, (4) teachers implementing and analyzing, together, the same or similar lessons in their own classrooms.” (Maher, 2007, p. 71) This study extends the work of the grant by collecting and analyzing video data of students engaged in doing the mathematics before studying the videos of the children’s reasoning.

The questions that will guide this study are:

1. How, if at all, do pre-service teachers in an undergraduate math class build their justifications to the problems they investigate? Specifically, what forms of reasoning do they use?
2. What is the relationship, if any, between the participants’ problem solving and justification and what they note in the videos of the children? Are the pre-service teachers using the same arguments as the children? Is there any evidence of growth in identifying arguments provided by the children after analyzing the videos of the children?
3. Is there any evidence of a change in pre-service teachers’ beliefs about teaching and learning after studying the videos of children justifying their solutions?

To answer the research questions, data will come from videos, assessments, student’s written work, and weekly interviews with the teacher. The assessments include pre and post tests on identifying student reasoning from videos and pre and post tests on beliefs about teaching and learning. These assessments will be scored and analyzed consistent with the larger project. The data from videotaped problem-solving sessions will be analyzed. Since the sample in this study is small (*n=6*), the analysis will be descriptive. A qualitative case study will be used to describe the participants’ own problem-solving and to provide triangulation of the data. Since this study is part of a larger data collection, this analysis could possibly provide insights to the larger collection.

**Summary of Assignment:**

Basically, we will want to transcribe critical events. The critical events we will focus on will answer the first research question:

1. How, if at all, do pre-service teachers in an undergraduate math class build their justifications to the problems they investigate? Specifically, what forms of reasoning do they use?

That is, we will be looking for mathematical reasoning and how the students build their ideas and arguments. I also want to flag any moments when the pre-service teachers reference the children working on the same problem. That might help in answering part of the second research question.

More specifically, I thought we could break up the work as such:

1) We will both find critical events from the first session and discuss. Ryan will then transcribe these events. (This is February 11, 2011 - 1 hour and 2 minutes)

2) At the same time, Anna will be finding critical events and transcribing the second session. (This is February 18, 2011 - 1 hour and 9 minutes)

3) Anna will then ask Ryan to find critical events from the second session (to verify what Anna has found) and verify Anna's transcripts from the second session.

4) Anna will verify Ryan's work on the first session

5) Ryan will find and transcribe critical events from February 23, 2011 (28 minutes)

6) Anna will verify Ryan's work on Feb. 23rd.

The students work on three problems (and variations of). These problems are the towers problem, the pizza problem, and the taxicab problem. Below is a summary of the discs and the problems being solved during each session.

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| --- | --- |
| **Date of Session** | **Problems Worked on By Students** |
| February 11  1 hour | * Towers 4-tall choosing from 2 colors (In trying to come to the answer to this problem, they also work on 3-tall towers choosing from 2 colors and 2-tall towers choosing from 3 colors) * Ankur’s Challenge – How many 4-tall towers can be built when choosing from three colors and each tower must contain one of each color. * They are given an assignment for homework at the end of the tape – the professor shows them her initial incorrect solution to Ankur’s challenge and she wants them to find the error. |
| February 18  1 hour | * Towers 4-tall choosing from 2 colors and towers n tall choosing from m colors * The Pizza Problem – How many different pizzas can you make choosing from 4 toppings? * They investigate the isomorphism between the towers and the pizza problems |
| February 23  30 minutes | * They continue to investigate the isomorphism between the towers and the pizza problems * They investigate the isomorphism between towers, pizzas, and the binomial expansion * They briefly work on the family problem – how many different ways can a family have four children? |
| March 4  1 hour | * The work on explaining Pascal’s identity in terms of the pizza and towers problem. * Then they are to come up with the formula using combinatoric notation. (Pascal’s identity or the addition rule) * They begin to work on the Taxicab problem. |
| March 16  40 minutes | * They discuss the professor’s incorrect solution to Ankur’s problem. * They continue to work on the Taxicab problem. * They work on explaining the isomorphism between the taxicab problem and the towers problem. |

Below you will find an excerpt from my dissertation proposal describing the process of identifying critical events and transcribing.

**3.6.3 Identifying Critical Events**

At this stage of the study, the researcher identifies *critical events*. Critical events were first defined by Maher and Martino (1996a) as episodes that provide mathematical insights (p. 196). Powell et al (2003) on page 417 describe these events as events that may “either confirm or disaffirm research hypotheses; they may be instances of cognitive victories, conflicting schemes, or naïve generalizations; they may represent correct leaps in logic or erroneous application of logic; they may be any event that is somehow significant to a study’s research agenda.”

As mentioned, critical events are significant to the research agenda. When viewing data, different events will be labeled as critical dependent on the lens of the viewer. It is ideal to have two or more researchers with the same lens independently identifying critical events. Identifying critical events is important because it enables the researcher to chart the development of ideas and to understand how these events influenced later thinking (Maher, 2002).

**3.6.4 Transcribing**

All the data will be transcribed to allow a more detailed analysis of the video. The transcripts will be as close to exact as possible including, not only verbal expressions, but gestures and descriptions of written work. Appendix A of the report *Guidelines for Conducting Video Research in Education* (Derry, 2007) provides a list of choices on how to transcribe common occurrences in speech and gestures along with providing strengths and weaknesses of each choice. This guideline will be followed to provide consistency throughout the transcripts. Transcripts will be verified by one or more graduate students for greater accuracy.

**Other Documents I will provide for you:**

1. My proposal
2. Summary of each disc in 2-5 minute intervals
3. Anything else?