

## CHAPTER III

### METHODS

#### **General Overview**

The purpose of this study was two-fold. First, this study examined the practice of reteaching mathematics to elementary students who were identified as having deficiencies in achieving specific mathematics objectives. This study also examined the effectiveness of using Web-based materials for additional practice with younger students. The union of these two perspectives has provided a better understanding of the complexities in learning mathematics during the transitional phase between elementary and middle school.

Since this study is about an undefined body of research, Creswell (2005) describes three types of case studies that one could utilize to further explain the possible underlying issues within the environment. Those include: the intrinsic case study, which describes rare and unusual situations; the instrumental case study, that examines a singular case in order to provide insight into a bigger issue; and the collective case study, that examines multiple cases in an effort to find similar connections to an issue. The practice of reteaching within a mid-size school district is not uniform. Therefore, the collective case study research design was selected.

The collective case study design utilizes an extensive data collection that includes multiple forms of data (Creswell, 2005). To focus on the second objective of this study, a more traditional research design element was employed where a control group utilizing traditional paper-pencil practice opportunities for the individual learner was compared to an experimental group that utilized the online testing system, EDU, for practice.

Classroom observations considered the instructional environments of both control and experimental groups. This approach provided a better understanding of how students and teachers engage in reteaching practices, thus providing a foundation to develop further online cognitive tools to improve students' understanding as they transition into more advanced subject matter.

This chapter will present a detailed description of the overall methodology used in this study and a rationale for the decision to select a collective case study design. Additionally, this chapter will clarify the participant selection process, describe the online testing tool used, and discuss the analysis of data - addressing both reliability and validity concerns within the scope of the study. Finally, this chapter will provide a basis for discussing the results of the study.

### **Participants**

The primary participants of this study were the students and teachers in five fifth grade classrooms located in a mid-sized, Midwestern school district. Currently, classrooms in this school district utilize a method of instruction termed "reteaching" to address deficiencies identified through the assessment of predefined mathematical objectives. Generally, this method of instruction is delivered at the end of an approximately two-week period during which students are taught using a variety of instructional methods and materials to prepare for end-of-unit examinations. All students are assessed for knowledge acquisition using traditional instruments provided with the course materials. Classroom teachers then use item analysis of the assessments to identify specific objectives for which individual students need reteaching. This analysis results in

an intervention in which the classroom teacher breaks the class into two groups – those students meeting all the objectives and those who need some reteaching. All students are given an instructional task for the class period, but those who were identified for reteaching move to an area of the room where the teacher can work with individual students and revisit the instructional objectives. After a brief lesson, students are given additional practice materials in an effort to use repeated practice to build the necessary skills to succeed in those objective areas.

Many teachers enjoy using this approach for identification because of the nature of their class and the structure of the curriculum. With class sizes of twenty or more students, this method is viewed to be helpful, especially when a larger number of students require reteaching on a regular basis (H. Poore, personal communication, November 20, 2006).

Individual teachers do have the freedom and flexibility to address students' needs anytime during instruction, however, and to use reteaching to build the necessary skills. In one case, a class focuses thirty minutes every day on improving mathematics skills. Students work in unique centers with their peers to enhance their abilities and use a social dynamic to reinforce learning. This creates a more "proactive" approach towards reteaching from both the teacher and student perspective (L. Parn, personal communication, February 22, 2007).

These different versions of reteaching indicated a need for closer examination of the fifth grade students who required additional instructional materials to improve academic performance. Furthermore, an examination of the instructional interventions by the teachers and how they used the intervention materials provided a clearer vision into

the effectiveness of repeated practice by the student. Initial approval for the study was obtained from the District Curriculum Specialist followed by e-mail requests distributed to all identified fifth grade mathematics teachers within the school district. This personal e-mail process identified five teachers in different schools who participated with about twenty students at each location.

### **Design**

The literature review notes limited research regarding mathematics interventions of elementary students who were participating in traditional classrooms. This missing information provided a framework for examining materials and strategies used for additional practice. Thus, the five schools chosen for this study were separated into pseudo experimental and control groups – where three of the sites utilized the online materials for repeated practice while the other two continued to use only the existing, traditional instructional materials. That is, there is pretest/posttest data for students using conventional versus online practice. This nature of the remediation was such, however, that conventional statistical analysis was not possible.

Additional data was examined regarding the use of EDU materials, including the number of trials within each objective area, the proficiency within those units, and overall time-on-task. Statistical analysis of this data provided additional baseline evidence as to the impact and use of the intervention materials.

The instructional materials provided a rich data set that suggested a framework for descriptive analysis. Once again, because of the limited research in this area, unforeseen issues within the environment that had not been anticipated beforehand emerged. For

example, the teacher played a vital role in identifying the necessary problem sets for practice. Traditional worksheets used within the interventions provided a broader problem set that spanned all the objectives for the entire chapter, whereas the online tool isolated an individual objective into a single problem.

It is this uncertainty in identifying outlier variables that provided a rationale to implement additional qualitative methods. This second method described the effectiveness of the materials used for the intervention by providing a more descriptive analysis of the reteaching process by the novice learner. Naturalistic inquiry methods were used to collect observational data in an effort to better explain the materials and classroom environments during reteaching, the student-teacher interactions, and the student-material engagement.

Both qualitative and quantitative data were collected simultaneously during three separate units of instruction. The use of both types of data provided a foundation for defining the issues affecting the learning of mathematics, particularly with novice learners.

### **Instruments and Materials**

Quantitative instruments included individual pre- and post-assessments distributed by the classroom teacher. Additionally, materials utilized after instruction were examined to evaluate the number of problems used by the students, the frequency of engagement before post assessment, and the success rate within the activities.

The online materials were distributed through a testing system called EDU. This system provided an opportunity for unlimited practice sessions for the learner; similar

data regarding frequency and accuracy was collected for comparative analysis.

Validity of the intervention materials was sought from the publishing company and reliability scores were evaluated between the experimental and control groups participating within the study.

The qualitative data were collected through site visits by the primary researcher. This naturalistic inquiry method identifies the primary researcher as the chief instrument, placing priority on collecting field notes of the observed interactions within the classroom and the transcription of these observations after each visit. In those classrooms using the online materials, additional assistance will be provided to aid the classroom instructor in setting up individual problem sets.

### **Procedures**

This study included the following procedures:

1. Classroom teachers were e-mailed to identify potential classrooms for study (Appendix A).
2. Approval was obtained from UNL IRB and the school district (Appendices B & C).
3. E-mail requests for permission to enter school approved by school principals (Appendix D).
4. Parental consent and child assent forms were collected from participants and informed teacher consent forms were collected (Appendix E & F).
5. Instructional intervention timetables were identified with individual teachers and online instructional materials were developed.

6. Data were collected during the timeframe of 1/1/2007 to 3/16/2007 but for similar mathematics content coverage in each classroom.

### **Data Analysis**

The quantitative analysis of this study compared pre- and post-assessment scores of both the control and experimental groups for those students identified for reteaching. Because the number of students participating in reteaching varied from topic to topic, comparative analysis looked only at class means for those participating students. Gravetter and Wallnau (2004) using a t-test hypothesis approach in order to determine any significant difference in overall scores because of the variability in the sample population.

The qualitative analysis focused on the transcription and coding of field notes and e-mail communications. This data provided a singular description for each of the five classrooms from which issues or themes were identified. The quantitative data were considered together with the qualitative data. Further analysis entailed using a within-case and cross-case analysis.

### **Validation Procedures**

Richards and Morse (2007) emphasize two general rules addressing the validity within qualitative research. The first rule is to pay close attention to the fit between one's research questions, the data collected, and the chosen methods. This ebb and flow between the guiding questions and examination of methods provides a foundation for the researcher, continually revisiting the priorities of the study and grounding the researcher

in the data collection process.

The second rule is that the researcher needs to ensure the proper accountability of data and interpretation of said data throughout the process. Though Richards and Morse clearly indicate that their overall message is intended for the researcher to focus on their chosen methods, their brief introduction to accountability within the data reminds the reader of the implications to both subjects and public policy when there is misinterpretation of such data. Stake (1995) further suggests that this validation of case study data should be held to the same high standards as quantitative research because of the ethical dilemmas in misinterpreting observational data, particularly in an educational setting.

Two forms of validity are the primary focus within this study (Merriam,1998). The first is to address the internal validity within the study. Creswell (2005) recommends the use of triangulation and member checks to increase validity. These further support Merriam's recommendations in that the triangulation of data will provide a more "holistic understanding" of the phenomena, and member checks will verify accuracy within the interpretation of data.

The nature of multiple case studies addresses the other form of validity - external validity. Merriam (1998) suggests that the interpretative process across the cases increases the overall external validity of the study. Through the examination of similar themes amongst each case broadens the scope of the entire study, creating footholds in the interpretative process.