

CHAPTER III

METHODS

Introduction

Two sections of first grade students were studied. One section of students received geometry instruction as outlined in Chapter 8 of *Math Central*. All of the student practice activities were recommended in the math text. The other group of students used the same text for their primary source of instruction, but their practice activities were replaced by *MarcoPolo* created and reviewed web-based geometry activities. If a corresponding web-based activity was not available, the students completed the text-based practice. Each student had a Macintosh® iBook® laptop computer that was connected to the Internet via a wireless network. When available, the web-based activities were pre-loaded on their local hard-drives to prevent loss of practice time due to any unforeseen Internet connectivity problems. This study was conducted from May 6, 2002 through May 17, 2002. This corresponded to the instructional timing and sequence planned by the classroom teachers for the geometry chapter.

Data collection was conducted by utilizing the *Math Central* assessment activities and tests. A pretest was given prior to any geometry instruction to establish baseline data. Individual practice assignments were used to assess the effects of specific online activities. The chapter assessment was utilized at the end of the geometry chapter to test for overall effects. To accommodate possible ceiling effects of the pretests and posttests, both first grade and second grade versions of the tests were used.

The treatment group classroom teacher wrote a daily journal to record her impressions regarding student time-on-task, work behaviors, effectiveness of the activities, and overall thoughts on the process.

Population and Sample

The population for this study was first graders who receive geometry instruction. The sample of this population was the 31 first grade students enrolled during the 2001-02 school year at an urban, midwestern elementary school. The classroom teachers involved in the study had comparable academic backgrounds. The control group teacher held a Bachelor's degree in Elementary Education plus 18 hours of graduate credit. She had taught for nine years. Her mathematics teaching preparation included a university elementary math methods course as well as district staff development courses. The treatment group teacher held a Bachelor's degree in Elementary Education with an endorsement in special education plus 24 hours of graduate credit. She had taught for seven years. Her mathematics teaching preparation included a university elementary math methods course as well as district staff development courses. For reporting purposes, the pseudonym of the treatment group teacher was Karla.

Variables and Measures

Prior knowledge of geometry concepts such as patterns, shape identification, and symmetry was measured for each child using the Grade One Form A and Grade Two Form A assessment tests from *Math Central*. These assessments were delivered as a pretest during the first class period of the geometry chapter. A corresponding Grade One Form B and Grade Two Form B assessment test was delivered as a posttest on the final day of the geometry chapter, following all of the instruction and practice activities.

The classroom teacher of the treatment section recorded and emailed her daily thoughts to the researcher regarding the teacher's observations and impressions regarding student attitudes, behaviors, and interactions, effectiveness of the activities, use of technology, and overall thoughts on the process.

Procedural Steps

This study was conducted using the following procedures:

1. The classroom teachers and school principal were asked to participate in the study.
2. Approval was obtained from the school district. (Appendix A)
3. Approval was obtained from UNL IRB. (Appendix B)
4. A letter from the principal and classroom teachers was sent to potential participants encouraging their participation in the study. (Appendix C)
5. Parent consent and child assent forms were collected from the participants. Informed consent forms were collected from teachers. (Appendix D)
6. A coin toss determined which teacher was assigned to the control or treatment group.
7. Students were randomly assigned to the treatment or control groups.
8. Prior to the two weeks of geometry instruction and practice activities, the students took Grade One Form A and Grade Two Form A of the assessment test.
9. A brief survey regarding home computer and Internet access and use was distributed to parents and guardians. (Appendix E)
10. The teacher of the text-based activity classroom conducted geometry instruction and student practice activities according to the chapter plan recommended in the

Math Central textbook. The teacher of the web-based activity classroom conducted the same instruction, but the student practice activities utilized the web-based geometry activities. If a corresponding web-based activity was not available, the students used the same practice activities as the control group.

(Appendix F)

11. Following the completion of an objective or a set of related objectives, a short assessment was given to both sections to collect data on the students' performance related to use of the applets.
12. Following the two weeks of geometry instruction and practice activities, the students took Grade One Form B and Grade Two Form B of the assessment test.

Treatment

The objectives covered in the two week geometry chapter were that students would be able to: identify spheres, cylinders, rectangular prisms, cones, and pyramids; copy a plane shape and be able to transform a shape into a larger/smaller shape; draw a plane shape with a given number of sides; draw a shape with a given number of corners; identify and draw plane shapes that are the same size and shape; state a rule for a given pattern; use problem solving strategies to continue a pattern; draw lines of symmetry; identify and show equal parts in a plane shape.

Students in the control group used their student textbooks and corresponding worksheets for practice. The treatment group used the same books for instructional purposes, but used the applets described below for practice. Sun Microsystems (Applets, 2002) defines an applet as, “a program written in the Java™ programming language that can be included in an HTML page, much in the same way an image is

included. When you use a Java technology-enabled browser to view a page that contains an applet, the applet's code is transferred to your system and executed by the browser's Java Virtual Machine (JVM).” If a corresponding applet was not available for an objective, the students completed the same practice activity as the control group.

Shape Spinner

The Platonic solids applet or shape spinner (Cannon, Dorward, Heal, & Edwards, 2001) allowed students to rotate three-dimensional shapes (Figure 3.1). This tool also permitted students to color-code the faces of the shapes, highlight edges and corners, and increase or reduce the size of the shape. With the accompanying online worksheet (NCTM, 2002) the students could record their observations as they noted properties of shapes such as number of edges, corners, and faces, and could practice shape identification. This applet was used for Objective 8.4.

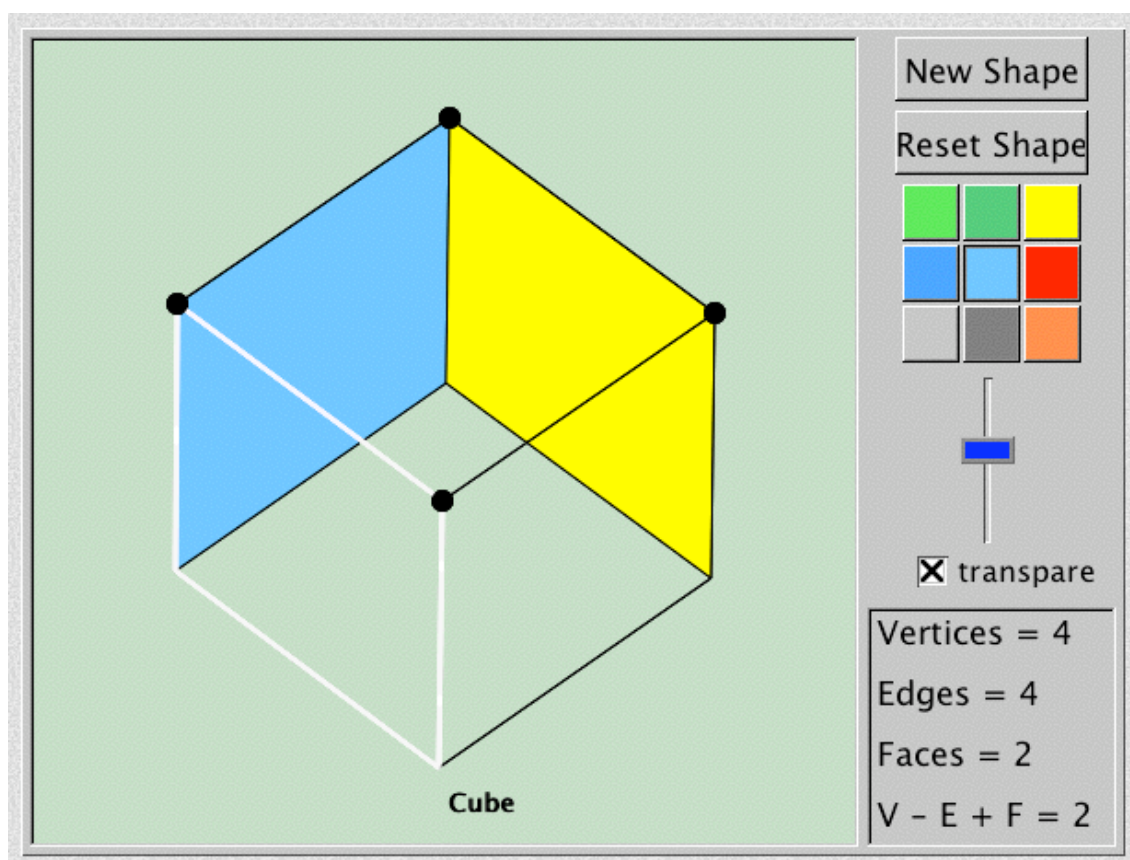


Figure 3.1: Shape Spinner

Geoboard

The geoboard applet (NCTM, 2002) allowed students to identify simple geometric shapes, describe their properties, and develop spatial sense (Figure 3.2). The geoboard was also used to identify lines of symmetry, and to transform shapes into larger or smaller shapes. This applet was used for Objectives 8.2, 8.3, and 8.9.

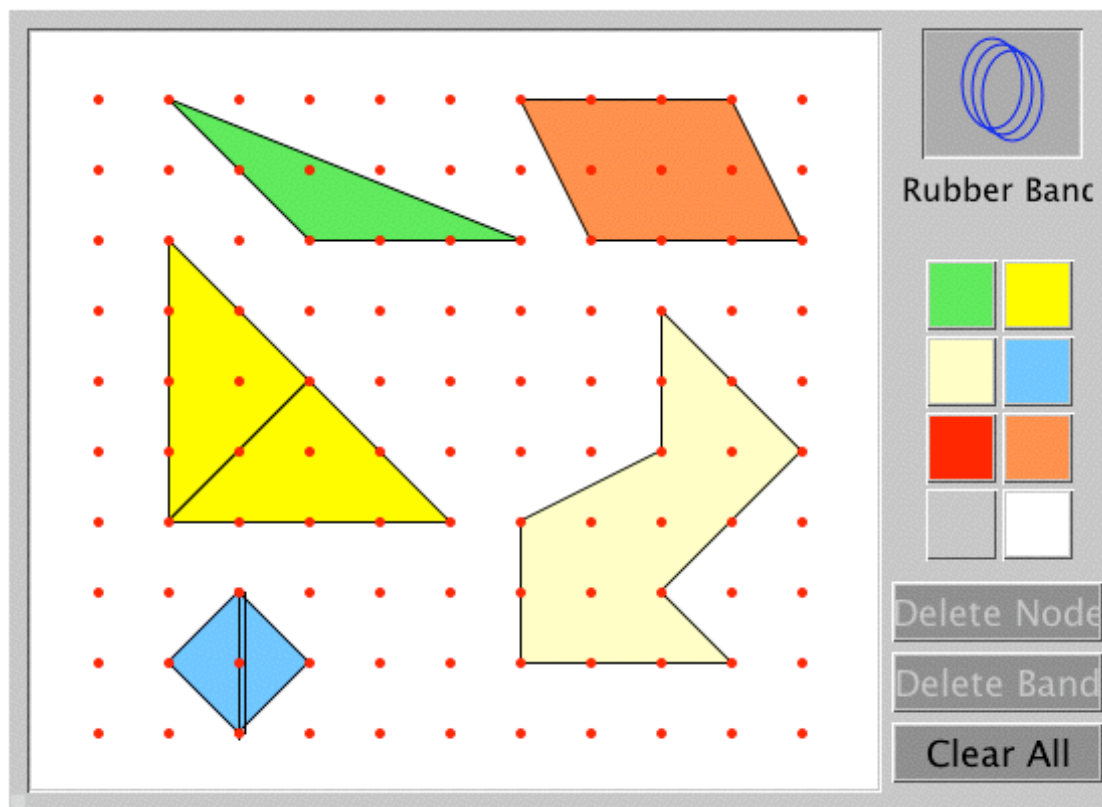


Figure 3.2: Geoboard

Pattern Maker

The pattern generator applet (NCTM, 2002) allowed students to create, compare, and view multiple repetitions of pattern units (Figure 3.3). Students created pattern units of squares, then predicted how patterns with different numbers of squares would appear when repeated in a grid and checked their predictions. This applet was used for Objective 8.7.

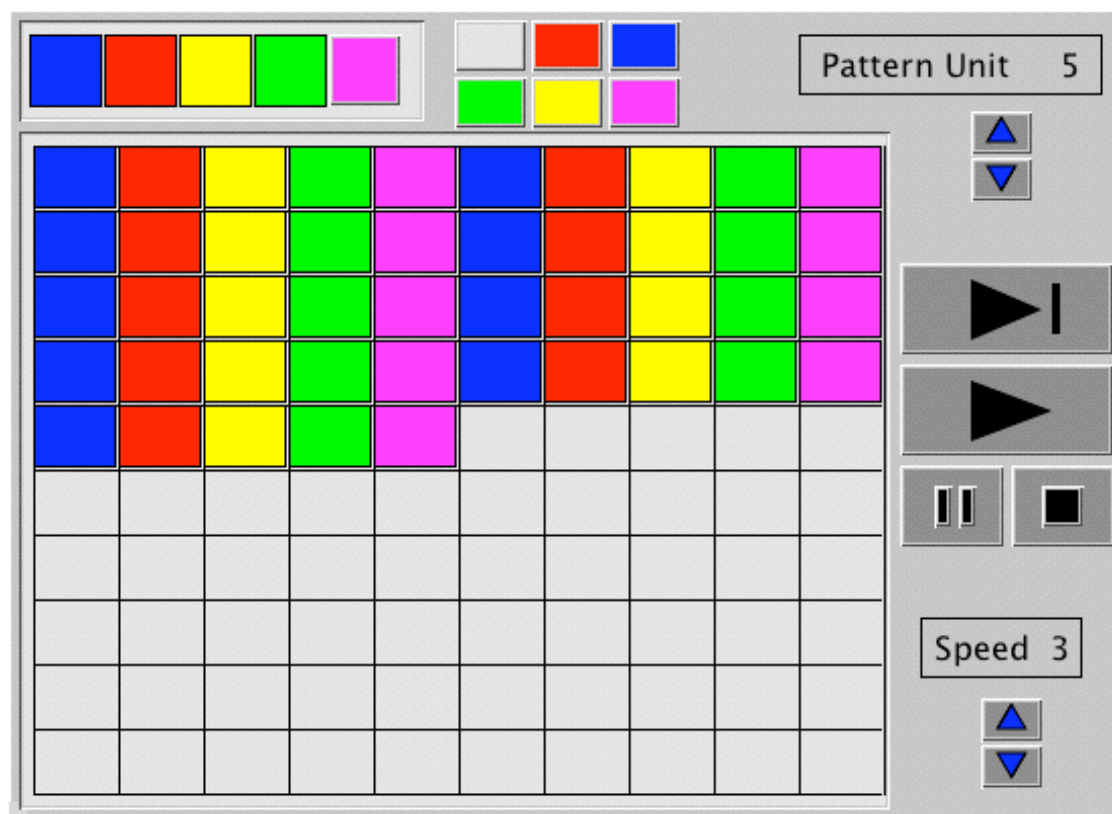


Figure 3.3: Pattern Maker

Pattern Blocks

The pattern blocks applet (Bulaevsky, 1998) allowed students to manipulate different shapes in several ways (Figure 3.4). Students could move, rotate, and repeat shapes to create patterns. This applet was used for Objectives 8.5 and 8.7.

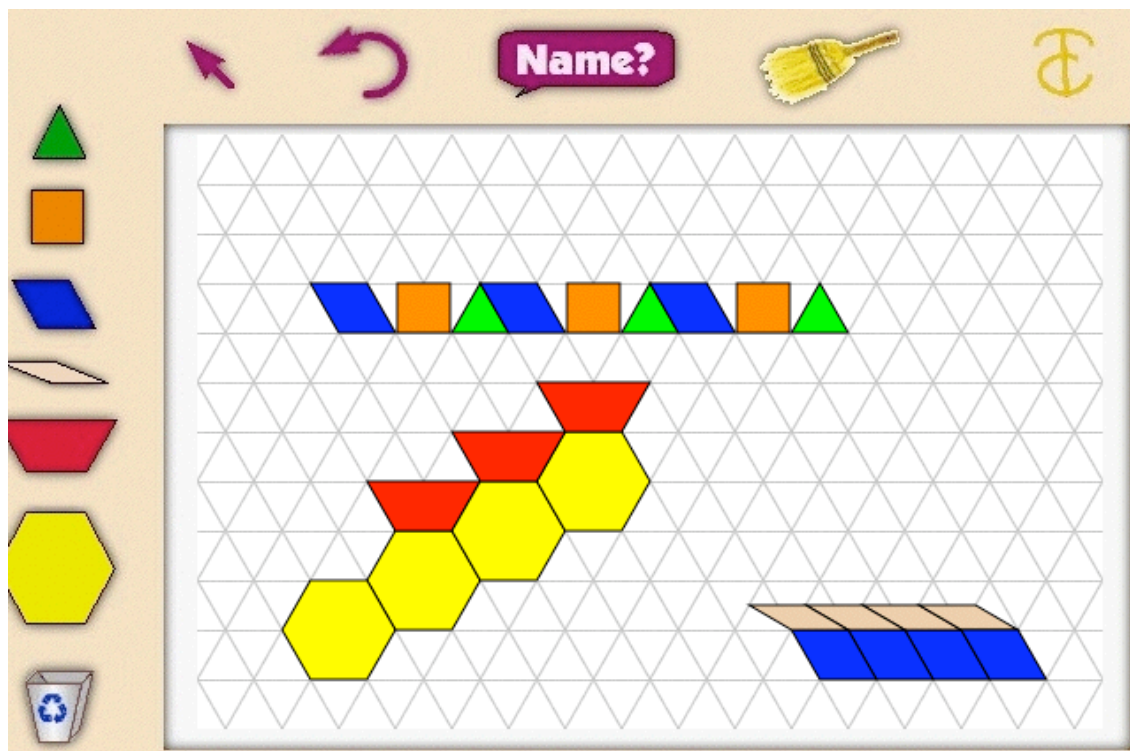


Figure 3.4: Pattern Blocks

Tangrams

The tangrams applet (NCTM, 2002) allowed students to describe figures and visualize what they look like when they were transformed through rotations or flips or were put together or taken apart (Figure 3.6). Students could choose a picture and use all seven pieces to fill in the outline, or students could use tangram pieces to form given polygons. This applet was used for the World Games activity.

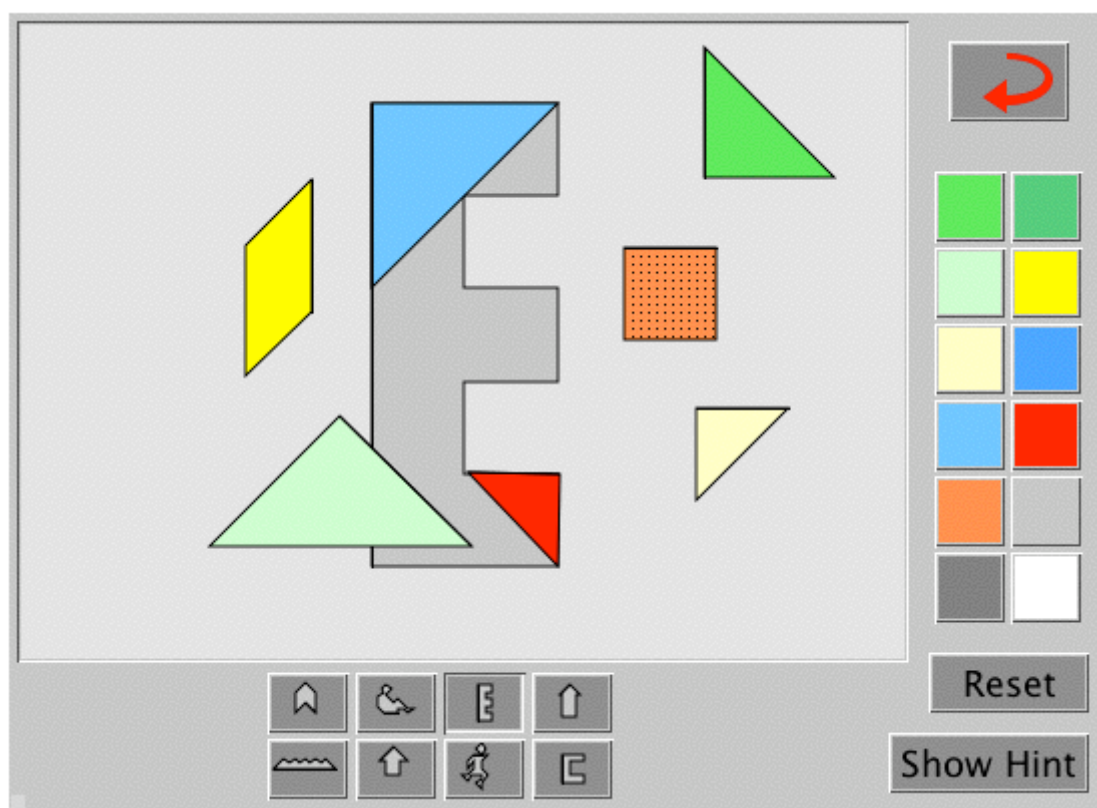


Figure 3.6: Tangrams

Polygon Playground

The polygon playground applet (Petti, 2000) allowed children to explore and create designs using multicolored triangles, squares, pentagons, hexagons, and octagons (Figure 3.7). Students could create patterns or pictures using the geometric shapes. This applet could also be used to practice recognizing and naming shapes, and to create pictures that illustrate symmetry. This applet was used for Objectives 8.5 and 8.9.

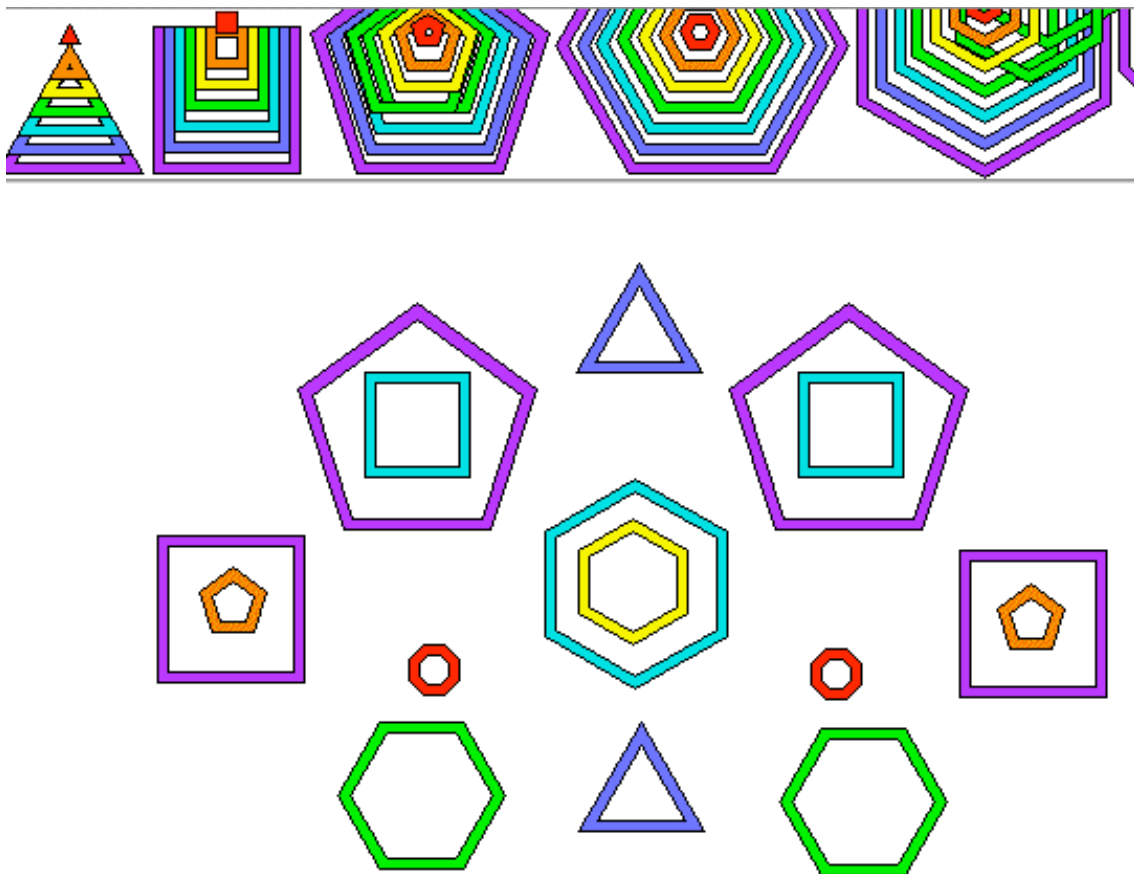


Figure 3.7: Polygon Playground

Statistical Analysis Plan

Group descriptive statistics, such as mean and standard deviation, were calculated to classify and summarize data. For the comparisons between individual practice activities, t-tests with $\alpha = 0.05$ were conducted. A corrected, more conservative value of $\alpha = 0.05/\text{number of tests conducted}$ was used when appropriate. A 2x2 (pretest-posttest by control-treatment) mixed model ANOVA with $\alpha = 0.05$ was conducted to examine changes from pretest to posttest.