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Using Intuitive Interaction Technology to Promote Learning of Mathematics in Young Children

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Using Intuitive Interaction Technology to Promote Learning of Mathematics in Young Children

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Abstract: Modern technology has changed our ways of learning. It makes learning more interesting and more effective. The purpose of the study was to explore the effectiveness of a project designed to improve learning of mathematics in young children using intuitive interaction technology. While playing with this learning system, children can use their hands to point to the virtual objects or move them on the screen. Young children need things they can see, hear, touch or feel to help them learn new things. The system in this project contains these features to promote learning for young children. Until now, relatively little was known about the potential of this technology to support teaching and learning with young children. Therefore, it is important this research is conducted. The instruments utilized in this study included: pretest, posttest and interview.

Introduction

In recent years computers are increasingly a part of the lives of young children. Old concerns are about whether computers are appropriate for children (Clarke, 1990; Healy, 1998). However, what is more concern today is about whether computers can provide experiences that facilitate children’s learning.

Research has substantiated that computers can contribute to mathematical learning for young children (McCollister et al, 1986; Kromhout & Butzin, 1993; Clements & Nastasi, 1993). For example, a study which compared the effects of computer-assisted instruction and teacher assisted instruction showed that kindergarteners in a computer group achieved higher scores on arithmetic task (McCollister et al, 1986). Computer-assisted instruction can help children practice arithmetic processes. Drill and practice software can help young children improve their sorting and counting skills (Clements & Nastasi, 1993). Some computer programs can improve kindergarten children’s analogical thinking (Klein & Gal, 1992).

Multimedia provides active engagement with multi-presentations such as texts, voices, pictures and
animations. There is growing research showing that students can learn more deeply from well-designed multimedia with words and pictures than from traditional learning (Mayer, 2001; Weiss, Kramarski & Talis, 2006).

A joint position statement of National Association for the Education of Young Children (NAEYC) and the National Council of Teachers of Mathematics (NCTM) have affirmed that high-quality, challenging, and accessible mathematics education for 3- to 6-year-old children is a vital foundation for future mathematics learning (NAEYC, 2002). It has been widely accepted that mathematics development in the early years is critical to success and achievement in both school and life-long term (Bowman, 1999; Kilpatrick, Swafford, & Findell, 2001).

The purpose of the study was to explore the effectiveness of a project designed to improve mathematics learning of young children using intuitive interaction technology. While playing with this learning system, children can use their hands to point to the virtual objects or move them on the screen. The screen was 140cm high and 245cm wide. Young children need things they can see, hear, touch or feel to help them learn new things. The system in this project contains these features to promote learning for young children. Until now, relatively little was known about the potential of this technology to support teaching and learning with young children. Therefore, it is important this research is conducted. The instruments utilized in this study included: pretest, posttest and interview.

Method

The participants were 43 students (12 girls and 31 boys) learning at the same kindergarten (ages from 5 to 6.5 years old). The students were randomly assigned to either an experimental group or the control group. The experimental group included 21 students (7 girls and 14 boys), the control group 22 students (5 girls and 17 boys). A pretest was given to all subjects before the treatment. The pretest was helpful in assessing students’ prior knowledge of mathematics and in testing initial equivalence among groups. A posttest was given to measure treatment effects. Both the experimental group and control group received a pretest and posttest. The contents of the pretest and posttest were the same. They included 12 items representing 8 different skills: addition and subtraction with concrete objects, distribution, shape corresponding, spatial corresponding, sequence knowledge, dividing a circle and a rectangle, identifying left and right. Each item was scored as correct or incorrect. The pretest and posttest are conducted with teaching materials and concrete objects. Between pretest and posttest the experimental group received the chance to play digital games using intuitive interaction technology to learn mathematics 4 times. Each time every student has the chance to play for about 10 minutes. At the same time the control group received the mathematics curriculum from the researcher.
**Procedure**

The study was conducted for 3 months on 43 students. A pre-/post-training mathematics test was given individually to each student by the experimenter in a quiet room. The students were randomly assigned to either an experimental group or the control group. The experimental group students were interviewed after they had played the digital games. The contents of the interview included six items assessing students’ preference for the digital games, and their attitudes toward using intuitive interaction technology to learn mathematics instead of traditional instruction. Two items referred to students’ preference for the digital games in the training (for example, Do you like the mathematics game? Why (or why not)? / What do you like the most about the game? And what don’t you like the most about the game?) Four items referred to the comparison of learning using intuitive interaction technology and learning the traditional curriculum.

**Intervention**

For the experimental group, the children attended the intervention session in groups of 5 or 6. They took turns playing mathematical games in front of the big screen. While one child played with the machine, the other children sat behind and waited. Each session lasted roughly 60 minutes. Each child attended 4 intervention sessions taking place over four weeks. The mathematical games were designed by the researcher.

The computer games were divided into an easy version (with numerals up to 5 or 6) and a difficult version (with numerals up to 12). For 5-year-old children, the computer games began with the easy version. For 6 to 6.5-year-old children, the difficult version was used. If the difficult version was too hard for some children, the researcher would change the game to the easy version. The children in the control group were given the mathematic curriculum by the experimenter.

**Results**

The chief purpose of the present study was to examine the effects of digital games with intuitive interaction technology on kindergarten children’ mathematical achievement. First, the results of the total score and the items with significant values were analyzed. From 12 items, three yielded the significant values. Next, the items with the results that were not significant will be discussed.

Table 1 indicated the interaction between the independent variable (scores of the posttest) and the covariate (scores of the pretest) was not significant, F=0. 629, p=0.432> .05. The slope in the treatment group is not significantly different from the slope in the control group. Therefore, the ANCOVA was allowed to run.

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of df</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
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</table>
Table 1: The effects of learning with intuitive interaction technology on children’s mathematical achievement.

Tests of between-Subjects effects. Dependent Variable: Total Score of posttest

After removing the effects of the covariate, the ANCOVA analysis (table 2) showed it is significant, F=4.640, p=0.037<.05. The results showed the scores differed after different treatment. The adjusted mean score of the experimental group (21.56) was better than the control group (20.44). The result showed the level reached with the computer games was better than the traditional curriculum.

Table 2: The effects of learning with intuitive interaction technology on children’s mathematical achievement

References


