Involving Future Teachers as Teacher-Researchers in Math Education

Sally Moomaw, EdD

Jennifer Cao
Chelsea Myers
Deondre Drakeford
Shannon Knutson-Jones
Brandy Marshall
Purpose and Collaboration

The purpose of this study was to determine the effectiveness of preservice teachers (college seniors in early childhood education) in applying aspects of research to their teaching practice in mathematics: careful lesson design and observation, questioning students to determine their learning needs, and adjusting instruction based on this information.

The student researchers were 5 seniors in their final practicum experiences who volunteered to participate in the research. They were lead teachers in 1st, 2nd, and 3rd grade classrooms.
Background

• Research has identified benefits to undergraduates who participate in research: increased confidence, self awareness, and interest in pursuing a post-baccalaureate degree (Russell, S.H., Hancock, M.P., & McCullough, 2006).

• National Council of Teachers of Mathematics defines systematic inquiry into the mathematical thinking of students and systematic self-evaluation of instruction by classroom teachers as “teachers as researchers” (Smith, SZ & Smith, ME, 2006).

• There are emerging concerns about the effects of technology on young learners (Plowman, L., McPake, J., & Stephen, C., 2010).
Research Questions

For Teacher-Educator (Me😊)

1. How do primary education majors apply research methods to their own practice of teaching mathematics?
2. Do teachers feel that application of research methods improves their teaching?
3. Would a “teachers-as-researchers” assignment be appropriate and beneficial to include in the Primary math methods course?

For Teacher-Researchers

1. How effective are math manipulative materials, both physical and virtual, in helping primary children understand math concepts.
2. Is one type of manipulative, physical or virtual, more effective for particular children in helping them understand math concepts?
What Happened?

Brandy (1st grade) compared physical and virtual geometry manipulatives.

Shannon (1st grade) compared physical and virtual place value blocks.
Deondre (2nd grade) compared physical and virtual coins for conversion and addition.

Jennifer’s participation was limited because her school followed a prescribed curriculum.

Chelsea (2nd grade) compared physical and virtual place value blocks for addition and subtraction of 3-digit numbers, such as:

153 + 74
143 - 69
Sally used a questionnaire and interviews to obtain information.

1. Give a brief description of the activity you investigated.
2. What were your learning objectives for the activity?
3. What type of physical and virtual manipulative did you use?
4. How did you evaluate students’ learning for each type of manipulative?
5. How effective was the physical manipulative in helping children understand the math concept?
6. How effective was the virtual manipulative in helping children understand the math concept?
7. How would the results from this experience guide your future teaching? (For example, would you use one type of manipulative for the activity vs. the other? Would you use one to reinforce the other?
8. Do you feel that engaging in classroom research improved your teaching in any way?
9. Would this be an appropriate and valuable assignment for students in Primary math Methods?
Seniors as Teacher-Researchers Results

1. Brandy found that the physical manipulatives were more open-ended and therefore encouraged students to be creative with math, understand composition and decomposition of shapes, and understand fractional relationships. They were also more challenging. The virtual manipulatives were too specific to yield this depth of learning.

2. Shannon found the physical manipulatives to be very effective. Students made meaningful connections between tens and ones. Students had to focus more on counting with the physical manipulatives. Students who excelled with the virtual apps were those who already understood place value. They used the virtual apps to compose and decompose groups of five to equal various numbers – e.g. 5 + (5 – 3) = 7.
Seniors as Teacher-Researchers Results

3. Deondre’s class used physical money and Ipad apps in learning centers. He felt that both were effective in supporting learning, but there was no way to separate the effect of one vs. the other since they were intermixed.

4. Chelsea’s results were interesting. She found 90% accuracy in children’s ability to obtain the correct answer and explain the regrouping process when they used physical place value blocks, but only 50% accuracy with the virtual place value blocks.

At first children were enthusiastic about using the Ipads. However, they became frustrated because it took them 10-15 minutes longer to work the problems with the Ipad app, and their answers were often wrong. The children complained that it took too long on the Ipad to drag and delete and asked to return to the physical place value blocks.
Teacher-Educator Results

1. Seniors were able to plan, document, and explain their results.

2. They made valid arguments as to when and why they would select a physical or a virtual manipulative.

3. All felt that the research process improved their teaching.

4. Seniors felt that this would be a valuable component of the Primary Math Methods course but made these suggestions:

   - Provide physical manipulatives and a list of recommended virtual apps. iPads may need to be provided for some students.
   - Break the research steps into smaller components with check points along the way.
   - Allow students to work together in small groups to develop their research objectives.
1st graders using physical and virtual manipulatives for math.
Questions?

Sally Moomaw, EdD
Edwards One, PO Box 210105
University of Cincinnati
Cincinnati, OH 45221-0105
Email: sally.moomaw@uc.edu