

Teacher Training in Multiple Environments: Microteach Versus Virtual

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This study sought to examine the merits of microteaching and TeachME – an innovative virtual teaching environment for teacher training – in teacher education programs and extends previous studies by enhancing microteaching methodology and proposing an alternative preparation process through the use of virtual environments. In a semester-long methods course, prospective secondary mathematics teachers developed and taught lessons in micro or virtual environments. In these collaborative training environments, the prospective teachers had different teaching experiences. The micro groups focused on how to interpret and respond to unexpected student work and guide the students to correct answers, whereas the virtual groups focused on how to accommodate the diversity of students and how to manage the class. Our results suggest that these collaborative teaching environments are complimentary processes that can enhance teacher education programs and enable us to better prepare prospective teachers for teaching diverse students in urban schools.

Teacher Training in Multiple Environments: Microteach Versus Virtual

It has been said “You can’t teach what you don’t know”; however, you also can’t teach students you can’t manage. Without adequate management of student behavior the

content knowledge of the teacher becomes irrelevant. Traditional teacher training programs focus primarily on developing prospective teachers' content and pedagogical knowledge – what to teach and how to teach it in ideal environments. Environments for teacher training often include field experiences, microteach experiences, and internships. These are widely used and accepted methods for training prospective teachers for the classroom, yet teachers in their first years of teaching often face difficulties related to classroom management. This begs the question as to whether there may be an additional method for teacher training which could assist beginning teachers, particularly in classroom management. The study reported here sought to begin to answer the question: How are the experiences of prospective teachers in a microteach environment similar or different from those in a virtual environment? We begin to attempt to answer this question by first discussing student teaching and supervision, followed by issues of teacher attrition, the design of the study, and results related to each teaching environment.

Student Teaching and Supervision

Student teaching in general and guided teaching in particular provide real-life experience to the student teacher by connecting three communities: student teachers, university supervisors and cooperating teachers (Borko and Mayfield, 1995). Over the past years there have been many studies aimed at improving student teaching which focused on various aspects such as duration, timing, requirements, connection to university courses and seminars, and the type and intensity of supervision (Cochran-Smith, 1991). These studies encouraged student teachers to use standard curriculum, helped them extend their knowledge of methods and children and resulted in various

models that support teacher education (Frykholm, 1998; Bullough et al., 2003, Carter, 2005).

Previous studies focused on the effective dialog and relationship between the three communities. Mainly, both supervisors and cooperating teachers provide feedback about specific lesson plans, suggest new ways to think about teaching and learning, and encourage student teachers' practice. Several problems have also been encountered such as the time restrictions of the supervisors and their area of expertise being different from the student teachers. This posed difficulties for them to give feedback on content knowledge (Borko and Mayfield, 1995). Another important finding was that since many student teachers were placed with cooperating teachers who used traditional teaching systems, they practiced in a traditional setting instead of a reform-based system (Frykholm, 1998). Finally, the lack of communication between cooperating teachers and university supervisors is also observed as an important problem (Zeichner, 2002).

From the preceding review of literature, it is clear that prospective teachers generally work with their cooperating teachers and rarely have the opportunity to receive continuing feedback from their university supervisors during their student teaching. Moreover, student teaching and supervision focus mainly on improving content knowledge of the student teacher rather than behavior management, a crucial topic of teacher education. Although content knowledge is one of the major factors affecting teaching performance, we argue that content knowledge supports but does not guarantee effective or quality instruction. Prospective teachers often lack an understanding of positive behavior management strategies, and thus they spend an excessive amount of

time dealing with behavior problems rather than engaging student in learning mathematics.

Managing the behavior of students in classrooms has become a critical aspect of teaching. In several studies, prospective teachers report being faced with problems which revolve around behavior management (Goodell, 2006; Van Zoest, 1995). Prospective teachers' observation reports showed behavior problems of students and control of classroom environment were the problems mostly frequently discussed (Van Zoest, 1995).

Beginning teachers report having difficulty transitioning between teacher training and first-year teaching responsibilities. One third of teachers leave the field in their first 5 years (Darling-Hammond, 2003). Several studies report that the most common reasons for leaving the teaching profession are related to behavior management (Veenman, 1984; Hollingsworth, 1988). The strategies widely used thus far in teacher training programs fall short in this critical area (Oberski, Ford, Higgins & Fisher 1999; Reid, 1989; Merrett and Wheldall, 1993; Davies and Ferguson, 1997). This begs the question "Is there a way to prepare teachers for both content delivery and behavior management during initial teacher training?"

Traditionally, teacher preparation programs incorporate field experience, student teaching, and often microteaching environments. These are valuable experiences for prospective teachers to see and experience what they need to know to be effective teachers but it is not the only way. This study suggests that there is a complementary environment for teacher preparation which can add to the existing methods for teacher training, TeachME (Teaching in Mixed-reality Environments).

Development of TeachME

Given high teacher attrition and turnover in public school settings due to difficulty managing classroom behavior (Swan, 2006; Veenman, 1984; Hollingsworth, 1988), a discussion began amongst the education faculty at a large university in central Florida. The question became, “How can we prepare teachers to manage the classroom and student behavior without putting teachers and students at risk?” The answer was a mixed-reality teaching environment for teachers to practice their skills prior to entering the classroom (Hughes, Stapleton, Hughes, & Smith, 2005).

The mixed-reality environment is called TeachMe (Teaching in Mixed-Reality Environments) at the University of Central Florida (UCF). TeachMe is the result of a unique collaboration rarely seen in education to develop the education technology for teachers of the future. The outcome of this collaboration between education, computer sciences, and simulation technology provides a path to address the problem of teacher attrition by creating a working, mixed-reality environment to train beginning teachers (Dieker, Hynes, Hughes, & Smith, in press).

The initial prototype focused on behavior and classroom management two areas of concern for most beginning professionals (Goodell, 2006; Van Zoest, 1995). One goal of the mixed-reality environment is to create an interactive, simulated environment to train beginning teachers in mathematics, science and special education before they enter the teaching force. The methodology for developing the virtual environment was built on strong, scientifically based-research related to the training of people in the military and corporate America, made possible through UCF’s long-standing record as a leader in simulation technology (Dieker, Hynes, Hughes, & Smith, in press). In order to have a

successful virtual environment, students in the virtual classroom must be representative of real middle school students. The characters were developed using the American Academy of Child and Adolescent Psychiatry's description of adolescent development, William Long's classification of adolescent behavior, Rudolf Driekurs' theory of understanding adolescents maladaptive behavior, and the work of other early theorists in human development such as Piaget, Freud, Kohlberg, Erikson and Maslow (Dieker, Hynes, Huges, & Smith, in press). The result is five students who have distinct and specific personalities designed using the conceptual framework for adolescent development of William Long.

One interactor is the human avatar for all five students. The interactor can escalate or de-escalate the level of behavioral responses depending on teacher interaction. Furthermore, the interactor can create behavior issues between students if the specific needs of students are not addressed, creating a simulated classroom with real student-to-student interaction. The teacher faces a large screen that displays all of the students. By stepping towards the screen and leaning towards the child, the teacher can interact individually with each student, or stand in the front of the room to address the group.

In the mixed-reality environment, the teacher feels a sense of realism in trying to get the students to stay on task and complete a lesson, yet also has the ability to go back and try again as the virtual students can be reset, unlike a real classroom environment. This puts a safety net under the novice teacher and protects actual children from any harm. Teaching in a simulated classroom environment allows for teachers to deliver instruction, self-analyze the teaching experience, make changes in the lesson based upon

the teaching results, and re-teach the lesson to increase mastery of teaching and learning concepts in a way that does not put children at risk.

Design of the Study

We sought to examine the merits of microteaching and TeachME in teacher education programs through a mixed study with thirty prospective secondary mathematics teachers. Data were collected in a semester-long methods course for prospective mathematics teachers through videos of the teaching episodes and classroom discussions, interviews, classroom observations, students' lesson plans and reflections. Analysis and data collection were an ongoing process throughout the study, and the research team held weekly meetings during the study.

All teaching episodes in both environments were video-taped and student reflections and lesson plans were collected for each teaching cycle. Additionally, members of the research team observed the teaching episodes in both environments. Student conversations during class time in which the groups were discussing their teaching episodes were audio-taped. Video and audio tapes were transcribed by members of the research team.

The prospective teachers were randomly divided into 10 groups which were then randomly assigned to microteach or virtual environments. All groups wrote lessons for the same problem, an algebraic reasoning problem involving generalizing a non-linear pattern, which they had previously solved in class. In order to better imitate an actual classroom environment and deepen the prospective teachers' thinking about various solutions to the problem, eleven correct, incorrect, and incomplete student work samples for the problem were created by the research team. All groups received the same work

samples in each teaching cycle, and the prospective teachers were asked to discuss these work samples during their 15-20 minute micro– or virtual–teaching sessions.

In the microteach groups, one prospective teacher implemented the lesson with the other two group members playing the role of students. In the virtual environment, one prospective teacher taught the lesson to five virtual students while the other group members observed and took notes. During virtual teaching sessions, an interactor behind the scenes acted for the virtual students and provided realistic interactions. The virtual students were programmed to be typical urban middle school students with varying personalities.

All sessions, both microteach and virtual, were videotaped. After each teaching session, each group member in micro– or virtual–teaching groups wrote a reflection based on his/her role in the teaching cycle (i.e., teacher, student, or observer). During the next class session, the groups watched their own videos and revised their lesson plans in preparation for the next cycle of teaching.

Data Analysis

The prospective teachers developed and taught lessons in microteaching or TeachME environments. From these thirty teaching episodes, one microteaching and one virtual teaching episode illustrating differences between the two environments will be presented. First, excerpts from a microteaching episode will be presented to describe interactions between the teacher and the students while discussing student work samples, difficulties the teacher experienced, and the attempts of the students to help the teacher in deriving the formula. Later, excerpts from virtual teaching episodes will be presented. In the next section, we analyze the microteaching of the prospective teacher, whom we call

Ms. Melody followed by an analysis of prospective teachers in TeachME, whom we call Mr. Jeffrey and Ms. Jennifer respectively.

Microteaching

In this microteach session, the students, whom we call Mary and Mike, were given two student work samples one of which contained a recursive solution strategy without a formula, and the other work sample had a general formula derived from the sum of the number of blocks (see Figures 1 & 2). The teacher was asked to focus on the class discussion of the problem, and the students were asked to pretend as if these solutions were theirs.

Ms. Melody asked the students to share their solutions with the class. As Mary described her solution, Ms. Melody drew the table on the board to discuss her solution (see Figure 1). Ms. Melody recognized Mary's recursive strategy. In an attempt to explain why it was necessary to generalize the pattern, she first asked Mary how she could determine the number of block in the tenth figure. Then, she asked if there was an easier way to find the number of blocks. However, Ms. Melody was reluctant to elicit her thinking. From her remarks, we inferred that Ms. Melody did not know how to help the student generalize the pattern or how to link her recursive strategy

| figure # | # blocks |
|----------|-------------------|
| 1 | 1 |
| 2 | 1 + 2 |
| 3 | 1 + 2 + 3 |
| 4 | 1 + 2 + 3 + 4 |
| 5 | 1 + 2 + 3 + 4 + 5 |

You add the figure number to the number before, so to find figure 6, you add 6 to figure 5's number of blocks.

Figure 1. Mary's student work sample

| figure | # of blocks |
|--------|--------------------|
| 1 | 1 |
| 2 | 1 + 2 |
| 3 | 1 + 2 + 3 |
| 4 | 1 + 2 + 3 + 4 |
| n | $\frac{n(n+1)}{2}$ |

Figure 2. Mike's student work sample

to the general formula. At this point, Mike stepped in to help the teacher and described how he solved the task using the formula for the sum of consecutive numbers (see Figure 2). When asked why they would multiply n and $n + 1$, the students did not respond to her question, and Ms. Melody did not think of using a numerical strategy or grouping the numbers into pairs (i.e., Gauss's consecutive integer sum) to derive the formula. As a result, she decided to approach the problem visually. First she drew the fourth figure in the pattern (see Figure 3) and wrote the formula for the number of blocks on the board. From her remarks it became clear that Ms. Melody was having difficulty representing $n + 1$ or division by 2 visually. At this point, although Mary was given a student work sample with a recursive strategy and asked to pretend that she did not how to generalize the pattern; she first suggested transforming the fourth figure into a square to help the teacher, then explained where the 2 in the formula came from as the following excerpt indicates.

Mary: What if we made it a square? Could we do that?
 Ms. Melody: We can do that. If we double it, [pause].
 Mary: Then, we'll take the half of it and that would be where 2 came from I think.

With Mary's suggestion, Ms. Melody decided to transform the blocks to represent $n + 1$ visually but instead of a square, she drew a rectangle (see Figure 4) to double the number of blocks. The use of rectangle in generalizing the pattern had been discussed in class, and we believe that this exerted influence on her decision and thinking. After labeling the base and height of the staircase in Figure 4, Ms. Melody discussed the

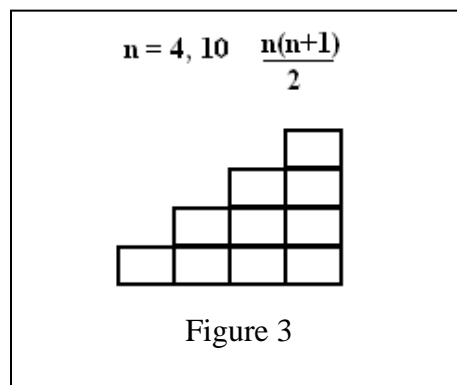


Figure 3

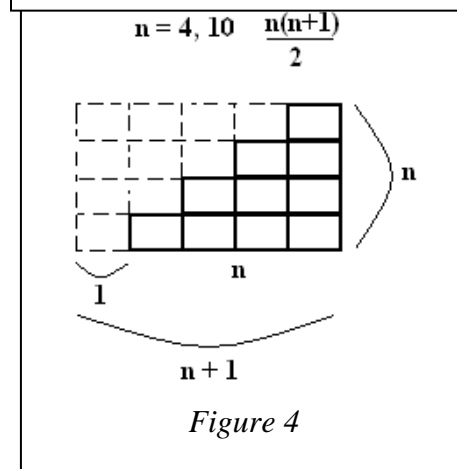


Figure 4

components of the formula and how it was related to the area of the rectangle: Consider the following passage:

- Ms. Melody: This one is 1 [writes 1 and $n + 1$ on the board. See Figure 4]. Then, we have the $n + 1$. So why do we multiply it?
- Mary: Because that's the formula for the rectangle.
- Ms. Melody: That's the total number of blocks we have [writes $l \times w = n(n+1)$ on the board], then to get the original staircase?
- Mary: We have to take half of it.
- Ms. Melody: Take half of it [divides $n(n+1)$ by 2] to get that one. Do you understand this?
- Mary: Uh-huh
- Ms. Melody: Do you understand what you got Mike? Why you got that formula?
- Mike: Yes, just by looking at the picture really helped.

Mike has just said that the picture helped him understand how he derived the formula although at the beginning of the teaching episode, he described how he added consecutive numbers to generalize the pattern without making any reference to the use of visual strategy.

In order to analyze Mary's solution, Ms. Melody drew the table containing the figure numbers and the number of blocks and asked Mary how she could generalize her solution. Mary added the numbers diagonally from right to left to represent n and $n + 1$ in terms of the number of blocks and the figure number, but this strategy did not work for the next row. Ms. Melody abandoned this numerical approach and resorted to another numerical method that had been discussed by the instructor; that is, she determined the increase in the number of blocks as the figure number increased.

Consider the following passage:

- Ms. Melody: [Long Pause] what if, [writes the differences between blocks. [See Figure 5].
- Mary: It is always going up by 1 . That's where we get the $n + 1$.

| figure # | # blocks |
|-----------|----------|
| 1 | 1 |
| $n + 1$ | 3 |
| $n + 1$? | 6 |
| 4 | 10 |

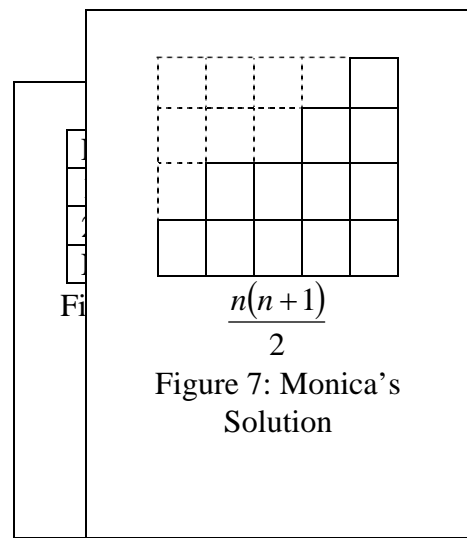
Figure 5

Again, Mary tried to help the teacher. Without waiting for Ms. Melody’s question, she verified that $n + 1$ represented the one-unit change in the increase in the number of blocks. The increase in the number of blocks begins with 2 and goes up by 1 (e.g., 2, 3, 4, 5); however, this numerical and recursive sequence indicates that the pattern is non-linear and is not directly related to the sum of consecutive numbers $n(n + 1)/2$. We observed that the students, especially Mary, were excessively helpful and pretended as if the teacher’s examples and explanations were sufficient and relevant despite the teacher’s effort to link their solutions to the ones that had been discussed in the class.

In her reflection after the teaching episode, Ms. Melody said that her goal was to encourage the students to explain how they solved the problem and learn the generalization of the staircase problem on their own. She also mentioned how the students took an initiative in explaining their work and had allowed her to explore different ways of solving the problem. Similarly, the students focused on the strengths of the lesson and did not provide the quality of feedback on the microteaching episode. For instance, Mary praised the teacher for her indirect teaching strategy and wrote, “Ms. Melody did an absolutely great job teaching the problem. She knew her stuff and understood exactly what myself and Mike had done on our work.” Mike wrote that the microteaching session was difficult due to the work samples provided by the instructor, but in general, his remarks about her teaching were positive, despite the difficulties Ms. Melody experienced.

TeachME

In this TeachME episode, the teacher, Mr. Jeffrey, interacted with the five virtual students, whom



we will call Monica, Michael, Victor, Michelle, and Freddy, during the first teaching cycle. Each student had a different solution and, just as in the microteach environment, Mr. Jeffrey was asked to teach the classroom discussion portion of the lesson. At one point in the episode, Michael had an incorrect solution as shown in Figure 6. This forced Mr. Jeffrey to interact with Michael's incorrect solution. Mr. Jeffrey asked Michael what would happen if he used his formula in figure number 3. Despite Mr. Jeffrey's encouragement that Michael had done good work, Michael's response was concern and frustration that his work was wrong. Mr. Jeffrey was required to deal with Michael's attitude and he continued to encourage Michael to keep working to find a generalization that would work for all the figures. As the teaching episode continued, Mr. Jeffrey then interacted with Monica related to her solution. Monica had a correct solution as shown in figure 7. Monica is a high achieving student but she does not like to participate in class discussions. As Mr. Jeffrey worked to elicit her thinking, Monica was uncooperative and responded that she "learned this in 6th grade". Mr. Jeffrey had to continue to work on eliciting Monica's thinking and then, when Mr. Jeffrey asked Monica to explain her thinking to the rest of the class, she was resistant, saying "I just told you". When asked to tell the whole class, she explained her work in an extremely concise way and only provided discussion when directly asked.

As the episode continued, Mr. Jeffrey continued to have to deal with the management of the classroom, particularly in leading a whole class discussion. As he worked with Victor and Michelle, Mr. Jeffrey's goal was to get Victor and Michelle to understand Monica's method for generalizing the formula. Victor and Michelle

interpreted the discussion as their solutions being wrong and Monica's being correct, even though their solutions were correct.

Mr. Jeffrey: Michelle, can you tell us about the solution you got?
Michelle: Um, yeah, my solution, I got the same answer I just did a lot more adding and Monica did multiplication and division and adding and I just did straight adding, but I got the same answer.
Mr. Jeffrey: Very good. Did you understand the way Monica did it?
Michelle: Does that mean I am wrong because I didn't do it the way Monica did it?

A similar interchange occurred between Mr. Jeffrey and Victor, with similar thoughts stated by Victor when he said "So I should have done it like Monica?" Both Victor and Michelle knew that Monica usually had a correct answer and interpreted the efforts of Mr. Jeffrey to get the students in the class to make sense of other students' solutions as their solutions were inferior or incorrect. Mr. Jeffrey was forced to manage this situation and to encourage the students that their solutions were as equally valued as Monica's solution.

In leading a whole class discussion, Mr. Jeffrey had to deal with the emotional aspects of teaching children in dealing with Victor's and Michelle's reactions to his asking them to make sense of Monica's work. In contrast to the microteach environment, these interactions provided for a more realistic picture of classroom dynamics.

In a second teaching episode, Ms. Jennifer was teaching in TeachME with the same virtual students. Ms. Jennifer began teaching and immediately encountered a confrontation with Michael who had been throwing virtual spit balls at Michelle. Michael admitted to throwing the spit balls and a confrontation ensued as to who was in charge of the classroom.

Ms. Jennifer: Are you throwing spit balls at Michelle?
Michael: Yeah.
Ms. Jennifer: Why?

- Michael: Because this is my classroom and that's what I felt like doing.
 Ms. Jennifer: Oh, I thought this was my classroom.
 Michael: Well you thought wrong, now didn't you.
 Ms. Jennifer: Oh, really? Well, we are going to work on our staircase problems and, this is my classroom, and that is what we are going to do.
 Michael: Ha. Your classroom! Did you hear that Victor? She said this is her classroom.

This interaction began the lesson which proved to be difficult for Ms. Jennifer. As Ms. Jennifer continued to interact with the other students in the class, the confrontation which began with Michael contaminated the entire classroom, as it often does in reality. The inability of Ms. Jennifer to manage the behavior and respond appropriately to Michael's claim that it was his classroom undermined Ms. Jennifer's authority and affected her interactions with all the other students in the class. The students became hostile and Ms. Jennifer tended to be hostile as well. As Ms. Jennifer interacted with Monica, for example, Monica's response was not only unmotivated as in the episode with Mr. Jeffrey, but was also disrespectful.

- Ms. Jennifer: How's it going with the staircase problem? Do you have an answer?
 Monica: Yep.
 Ms. Jennifer: Can I see it?
 Monica: Yep.
 Ms. Jennifer: Can you explain to me what you did?
 Monica: Used the formula that we learned in sixth grade.
 Ms. Jennifer: And how did you get that formula?
 Monica: We learned it in sixth grade.
 Ms. Jennifer: Okay, so then you can tell me what this means.
 Monica: You plug the numbers into the formula and you get the right answers depending on what number you want.
 Ms. Jennifer: No. What does the formula mean? What does n^2 over $2 + \frac{1}{2}n$ mean?
 Monica: You don't know? I thought you were the teacher.

Not only did Ms. Jennifer have to deal with Monica's behavior, she also had to deal with the impact of her inability to manage Michael's behavior and its impact on Monica who challenged Ms. Jennifer's authority in the classroom. The focus of the lesson became managing behavior and the content was left to the wayside. Without the ability to manage the behavior of the students, the content involved in the lesson became irrelevant.

Conclusions

The teaching environments examined were microteach and virtual teach. In both instances, the teachers were required to make sense of student work and to teach a lesson dealing with an non-linear algebraic pattern. In the microteach environment, the “students” were helpful and respectful. This environment provided for a “safe” environment for prospective teachers to practice delivery of content. As shown in the episodes shared, the students were ideal, respectful and friendly, overly helpful, highly motivated, and didn’t doubt the teacher’s decisions or question his/her authority. This provides for a somewhat manufactured delivery of content, which, however, can be important in honing skills in delivery of content.

By contrast, the virtual teaching environment, TeachME, the students were real, sometimes disrespectful, unmotivated, and unenthusiastic. The teacher could not rely on anyone but him/herself for delivery of content and the added component of behavior management, even on a small scale as in Mr. Jeffrey’s case, provided for an enhanced and realistic environment for learning to teach, particularly with aspects of management of behavior.

We conclude that there are potentialities in TeachME for not only deepening content knowledge, but also from developing behavior management strategies. The virtual teaching environment sharply differs from the microteaching environment. The former, rather than teaching content, focuses on managing student behavior. This is by no means to say that microteaching is not useful in teacher training, but rather that we as teacher educators must see the weaknesses and strengths of the teaching to their peers in groups and find ways to enrich student teaching experience. Moreover, we argue that the

realistic aspects of the virtual environment can, in fact, enhance prospective teachers' preparation for classrooms, particularly in urban schools. The incorporation of the virtual in complement to the microteaching provides for multiple experiences which can focus on both mastery of content and its delivery as well as behavior management strategies which can be effective in schools.

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