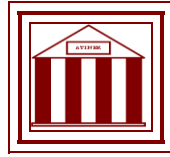


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**Using Virtual Environments to Promote Teacher  
Preparation**

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## **Using Virtual Environments to Promote Teacher Preparation**

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### **Abstract**

While virtual technology for training in the simulation field has had a long history in medicine and the military, the application of emerging and innovative technologies in teacher preparation and education has been limited. TeachME™ (Teaching in a Mixed Reality Environment) is an innovative mixed-reality environment (the blending of real and synthetic content) where prospective teachers can interact with a group of virtual students. The purpose of the virtual teaching environment of TeachME™ is to positively impact teacher recruitment, preparation, and retention in education by allowing teachers to improve their skills with virtual students, providing a more ethical approach to learning the art of teaching. This paper introduces the project, the mixed-reality environment, and the results of its effectiveness on pre-service teachers.

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## Introduction

In learning environments throughout education, the visual elements of courses, lessons, and presentations play an important role in learning. Well-conceived and rendered visuals help any audience understand and retain information (Wileman, 1993). According to Clark and Mathews (2000), the use of visual technology enhances learning by providing a better understanding of the topic as well as motivating the students. Visualization methods are widely credited for simplifying the presentation of difficult subjects as well as aiding cognition; their use in the power engineering industry and education is enjoying significant growth (Idowu, Brinton, Hartman, Nehard, Abraham & Boyer, 2006).

How might the use of virtual environments impact teacher preparation? The need to recruit, prepare, and retool our teaching force in today's schools is well documented in the literature, especially in critical shortage areas such as mathematics, science, and special education. Although teacher preparation programs and alternative certification programs are available, most of these programs rely on traditional methods of preparing teachers to work in today's classrooms. These methods include college courses, field experiences, and some type of culminating student teaching. Despite the history and creative ways that colleges of education and school districts are working together to create these experiences, most beginning teachers still report that they feel inadequately prepared (Darling-Hammond, 2003; Ingersoll, 2001). This lack of preparation permeates the voices of beginning teachers in education settings.

One attempt to recruit and retain highly effective teachers is the Old Dominion University-Teacher Immersion Residency (ODU-TIR) Project, <http://education.odu.edu/education/tir/index.shtml>, which is funded by the U.S. Department of Education as part of the *Teacher Quality Partnership* initiative. The goal for this project is to increase teacher retention and student achievement in high-need schools by rigorously preparing 60 participants, over the five-year grant, to teach within critical shortage disciplines (Math, Science, English, and Social Studies) determined by the partnering high-need school districts. In partnership with the University of Central Florida, we have implemented a mixed-reality simulated environment to prepare teachers in critical shortage areas. This paper introduces the project, the mixed-reality environment, and results of its effectiveness on pre-service teachers.

### Teacher Immersion Residency Project

The ODU-TIR project builds on successful teacher residency models that recruit candidates with undergraduate degrees in high-need content fields, immerse them in an induction program housed in an urban school, provide them mentoring and instruction founded on research, and continue to offer professional development during the early years of their careers. Each student completes 42-semester hours of graduate study, including a yearlong school-based residency in a high-need school, and education pedagogy and content courses. Students receive a living stipend plus tuition during their residency year and must commit to three years of teaching in the high-need school district after completing the program. As part of their residency, students participate in the virtual technology environment described below.

## **Virtual Technology for Teacher Preparation**

While virtual technology for training in the simulation field has had a long history in medicine and the military, the application of emerging and innovative technologies in teacher preparation and education has been limited. Current and past practices in teacher education are filled with prospective teachers interacting with school children as if they were the “real teacher”, thus using real students to help novice teachers become better. By contrast, in a virtual teaching environment novice teachers can make mistakes without impacting real students, and they can repeat the experience without the students’ remembering the initial encounter.

TeachME™ (Teaching in a Mixed Reality Environment) is an innovative mixed-reality environment (the blending of real and synthetic content) where prospective teachers can interact with a group of virtual students (Hughes, Stapleton, Hughes, & Smith, 2005). The purpose of the virtual teaching environment of TeachME™ is to positively impact teacher recruitment, preparation, and retention in education by allowing teachers to improve their skills with virtual students, providing a more ethical approach to learning the art of teaching. This novel approach of a mixed-reality-based realistic classroom experience addresses how to improve the effectiveness of managing adolescent behaviors while increasing students’ time on task and teachers’ instructional time in a way that does not put real students at risk.

In the mixed-reality environment, you enter a middle-school classroom but it is a virtual setting and the students in the classroom are virtual avatars. The attributes of these five adolescents are based on the adolescent development research of William A. Long (1985, 1989) and Rudolf Dreikurs (1958, 1968). As a result, a classroom can be created of virtual students that can act according to their indicated attributes. Using the attributes of adolescents together with the research on facial expressions, body language, motion capture, and artificial intelligence, the developers of TeachME™ were able to create immersive virtual reality environments that can be used to support the development of beginning teachers.

In the mixed reality environment, an interactor behind the scenes acts for all five virtual students. An interactor, a person trained in acting and improvisation, puppeteers the character of the adolescent currently being addressed by the pre-service teacher who is teaching a lesson. Each time a pre-service teacher speaks to a virtual student, the interactor takes the role of the virtual student and makes both nonverbal and verbal expressions that correspond to the attributes of the virtual avatar. Thus the virtual student comes to life with a unique and appropriate personality. One interactor can take the role of all five virtual students so that the small classroom represents the wide variety of behaviors seen in a typical classroom. The interactor is located in a simulation lab across campus at the University of Central Florida and her voice and actions are projected through Skype, free software that lets you perform video calls seamlessly with an internet connection. Therefore, only the virtual students are seen by the pre-service teacher on a projection screen.

As the pre-service teacher interacts with the five virtual students who are projected on a screen, the interactor can increase the level of chaos displayed by particular avatars. These behaviors can consist of the virtual students to get more disruptive or more withdrawn (depending on the character’s attributes). For that

reason, a unique teaching experience can be created for each pre-service teacher. Because of the interactor's ability to control the behaviors of the virtual students' academic and social characteristics, pre-service teachers think that they spent a half hour in instruction when, in fact, the instruction was typically only 5 to 10 minutes. As a result, an intense teaching experience can be conducted over a short period of time.

### **Teacher Immersion Residency Project**

One attempt to recruit, prepare, and retain highly effective teachers to meet current teaching challenges is the Old Dominion University-Teacher Immersion Residency (ODU-TIR) Project, <http://education.odu.edu/education/tir/index.shtml>, which is funded by the U.S. Department of Education as part of the *Teacher Quality Partnership* initiative. The goal for this project is to increase student achievement in high-need schools by rigorously preparing 60 participants over the five-year grant to teach within critical shortage disciplines (Math, Science, Social Studies, English) as determined by the partnering high-need school districts. In partnership with University of Central Florida, ODU-TIR has implemented a mixed-reality simulated environment to prepare teachers in critical shortage areas.

The ODU-TIR project draws from successful teacher residency models that recruit candidates with undergraduate degrees in high-need content fields; immerse them in an induction program housed in an urban school; provide them mentoring and instruction founded on research; and continue to offer professional development during the early years of their teaching careers. Each student completes 42-semester hours of graduate study on education pedagogy and content coursework designed to meet Virginia licensure requirements, including a yearlong school-based residency in a high-need school. Students receive a living stipend plus tuition during their residency year and must commit to three years of teaching in a high-need school district upon completion of the program. As part of their residency, students participate in the visual-based simulated technology environment described below.

### **Visual-Based Simulated Technology for Teacher Preparation**

While visual-based technology for training in the simulation field has had a long history in medicine and the military, the application of emerging and innovative technologies in teacher preparation and education has been limited. Traditional internship experiences in teacher education are rooted in the practice of having prospective teachers interacting with students as practicum students and student teachers, thus using real students to help novice teachers become better. By contrast, in a visual-based simulated teaching environment, novice teachers can shape their skills while practicing teaching and/or classroom management techniques without affecting real students. Additionally, novice teachers can repeat the experience without the classroom students' remembering the initial encounter.

TLE TeachLive™ (Teaching Learning Environment, Teaching in a Virtual Environment) is an innovative mixed-reality environment (the blending of real and synthetic content) where prospective teachers can interact with a group of virtual students (Hughes, Stapleton, Hughes, & Smith, 2005). The purpose of the visual-based simulated teaching environment of TLE TeachLive™ is to enhance teacher recruitment, preparation, and retention in education by allowing teachers to improve



their skills with virtual students, providing a more ethical approach to learning the art of teaching. This novel approach of a mixed-reality-based realistic classroom experience addresses the need to improve teachers' effectiveness in managing adolescent behaviors while increasing both students' time on task and teachers' instructional time in a way that does not provide risk to students.

In the mixed-reality environment, novice teachers enter a virtual setting designed to replicate a middle-school classroom to work with students in the classroom who are virtual avatars. The attributes of these five adolescents are based on the adolescent development research of William A. Long (1985, 1989) and Rudolf Dreikurs (1958, 1968). As a result, a classroom can be populated by a group of virtual students that respond in a variety of ways that typify the attributes and behaviors unique to the middle school-age student population. Using the attributes of adolescents together with the research on facial expressions, body language, motion capture, and artificial intelligence, the developers of TLE TeachLive™ were able to create immersive virtual reality environments that can be used to realistically support the development of beginning teachers.

In the mixed reality environment, a covert interactor controls the actions of all five virtual students. The interactor, a person trained in acting and improvisation, puppeteers the character of the adolescent being taught by the pre-service teacher. Each time a pre-service teacher speaks to a virtual student, the interactor takes the role of the virtual student and makes both nonverbal and verbal expressions that correspond to the attributes of the virtual avatar. Thus, the virtual student comes to life with a unique and appropriate personality. One interactor can control the actions of all five virtual students so that the small classroom represents the wide variety of behaviors seen in a typical classroom. The interactor is located in a simulation lab at the University of Central Florida and her voice and actions are projected through Skype, free software that allows video calling through an Internet connection. The interactor remains unknown to the pre-service teacher, who sees only the classroom and avatars on a projection screen.

As the pre-service teacher interacts with the five virtual students, the interactor can increase the level of misbehavior displayed by particular avatars. These misbehaviors can consist of virtual students presenting more disruptive or more withdrawn behaviors (depending on the character's attributes). For that reason, a unique teaching experience can be created for each pre-service teacher. Teaching sessions typically last five to ten minutes, but because of the interactor's ability to rapidly present a series of challenging behaviors through the five avatars, pre-service teachers typically view the sessions as intensive and demanding.

## **Outcomes**

Overall, pre-service teachers in ODU-TIR need added support during their resident year, and they cite classroom management as the primary area in which they need support. Developing ways to further teachers' classroom management skills, while learning the art of teaching strong content to increase their effectiveness at

working with students in the classroom, allows them to focus on teaching and learning simultaneously. In a virtual or mixed-reality environment teachers can manage their classroom, teach students any subject, and monitor their progress in learning. In an environment like this, prospective teachers can learn the skills of their profession and if they make mistakes or want to experiment with a new teaching idea, it poses no danger to the learning of any real student. If a pre-service teacher makes an error, he or she can reenter the virtual classroom and try again to teach the same students the same concept or skill. All of this is possible without impeding the learning of any real child.

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