Using an Immersive Classroom Simulated Environment for Math and Science Discourse Development in Pre-service Teachers

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Abstract
An interdisciplinary team of researchers from East Carolina University (ECU)’s College of Education and College of Engineering and Technology were funded in 2017 by a three-year, $599,939 grant through the Improving Undergraduate STEM Education (IUSE) program (Grant #1725707). This project focuses on the development of discourse on math and science topics using an immersive classroom simulator to practice math and science methods with student avatars. This project follows cohorts of students through a mathematics methods course or a science methods course, and into their internship in schools. The goal of the project is to determine if the integration of interactive classroom simulation activities (ICSAEs) in math and science education courses improves teacher candidates’ ability to communicate and to facilitate discussion on math and science topics. Pre-service teacher candidates exposed to the immersive classroom simulator are compared to a control group of pre-service teachers who practice math or science methods through peer roleplay.

Methods
Video recordings were captured from both an Intermediate Elementary Mathematics Methods course and a Life and Environmental Science course. Students in each of these courses were divided into sections using Mursion and sections using traditional role play. In both courses, students were assigned to prepare a short talk to lead the class in either developing an experiment/analyzing data or solving a math problem. After each session, the students received feedback from the course instructor and their peers regarding their classroom leadership and techniques used to facilitate discussion. Students were also given feedback on the math or science content of their lessons. Videos are currently being coded and sessions transcribed for more detailed quantitative analysis.

Observations
• The Mursion classroom provided a great environment for PSTs to practice discourse development and to gain feedback on their ability to lead a class of students through a math or science lesson.
• As was expected, students were generally anxious about delivering their first talk in both the traditional and Mursion classrooms.
• Content knowledge varied considerably amongst PSTs; many struggled to explain science and math concepts such as gravity, volume, mass, weight, outlier, independent / dependent variable. In role-playing classes the lack of content knowledge was often not discussed until the end of the lesson, but in the Mursion classroom, the virtual students raised questions and generally acted more like children.
• The PSTs made effective use of talk moves encouraging participation by all students.
• Possible implicit bias was observed in the Mursion classroom. It was generally observed that the PSTs almost always called on either a student on the end of the row or the Caucasian female student first. Rarely did the teachers begin classroom discussions by calling on the African American female student. This observation is leading to further research to quantify how often specific students are called on. This phenomena was unable to be observed in the traditional role-playing classes as the sections recorded were all female and over 90% Caucasian.
• The Mursion classroom was able to effectively simulate emotions students may express during learning a new task, such as being frustrated by not knowing the right answer to a problem. This was generally not observed in the traditional role-playing classroom as students were not actually learning new content.

Future Work
• The PI team plans to code videos to investigate implicit bias
• In addition to current math and science talks, a talk involving the engineering design process is planned
• Video coding is underway and will continue to be performed to analyze trends
• In addition to teacher moves, scientific knowledge will be evaluated.

Coding Strategy
Each session was transcribed and the interactions were coded by teacher moves as follows:

- **L**: Literal-question looking for a direct short answer
- **R**: Repeat-teacher echoes back a student’s answer
- **C**: Uptake-teacher deepens / expands conversation based upon a student’s answer / statement
- **T**: Uptake literal-teacher prompts for a direct/short answer based upon a student’s answer / statement
- **C**: Connection-teacher directs students to connect two concepts / ideas
- **T**: Terminal-move made by a teacher to end discussion or move conversation in a different direction

One avatar becomes visibly frustrated due to not knowing how to solve a math problem.