Abstract

This project seeks to address one area affecting student outcomes, the nature and role of discipline-specific discourse and argumentation. The goal of the project is an empirical exploration of immersive classroom simulation activities (ICSAs) on pre-service elementary mathematics and science teachers' competence and confidence in discourse use. This longitudinal, mixed methods study will measure the impact in methods courses, practica, and internship placements from the use of Mursion with emphasis on discourse skills to promote learning and engagement.
Project INTERSECT: Year 1 Implementation and Preliminary Data

The purpose of Project INTERSECT is to determine whether integration of interactive classroom simulation activities (ICSA) into math and science education pre-service teacher candidate curriculum improves teacher candidate performance, particularly how teacher candidates learn to talk and facilitate talk in math and science classrooms. The project evaluates teacher candidate use of discourse utilizing the Analyzing Teaching Moves (Correnti et al., 2015) instrument to measure and quantify teacher candidates' discourse practices. Project INTERSECT aims to develop a curricular model for math and science pre-service teacher education that expands opportunities to master teacher discourse, measure the effects of curriculum change and increased discourse engagement on pre-service teachers' use of discourse in the classroom, and disseminate the study results.

Research Questions

These questions and numerous tertiary questions will be addressed by research team members. Each member will take the lead on a specific question and design appropriate methods in consultation with the other team members. All tertiary questions will be directly tied to one or more of the sub-questions.

How does the inclusion of ICSAs into math and science instructional methods courses impact pre-service teachers’ (PT) acquisition and effectiveness of the constellation of discourse as measured by ‘teacher moves’?

a) How do pre-service teachers use initiating teacher moves (i.e, launch, redirect, think aloud, and provide information) to initially engage students in STEM classroom discourse?
b) How do pre-service teachers use rejoinder teacher moves (i.e., uptake, push-back, collecting, and connection) to position students as participants who actively engage in STEM discourse to understand and apply core science and math competencies?

c) How does the integration of teacher moves enhance pre-service teachers' capacity to engage with a diverse student population to create an inclusive STEM classroom environment?

**Talk Moves (Chapin, O'Connor, & Anderson, 2013)**

The elementary math methods course focuses on five “talk moves” to prepare candidates to lead students in discussion of mathematical concepts. The Analyzing Teacher Moves (ATM) framework, developed by Correnti et al. (2015), further classifies how a teacher positions students when using the talk moves.

Table 1

**Talk Moves and Teacher Moves.**

<table>
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<tr>
<th>Talk Move</th>
<th>Teacher Moves</th>
<th>Example</th>
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<tbody>
<tr>
<td>Wait Time</td>
<td>“I will wait for everyone to think this through.”</td>
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<tr>
<td>Revoicing</td>
<td>repeat, provides information, connection, pushback</td>
<td>“Let me see if I understand. You are saying...?”</td>
</tr>
<tr>
<td>Restating</td>
<td>connection, pushback literal, uptake, literal, uptake</td>
<td>“Can you repeat what he just said in your own words?”</td>
</tr>
<tr>
<td>Prompting for further participation</td>
<td>uptake-literal, connection, pushback</td>
<td>“What do you mean when you say…?”</td>
</tr>
<tr>
<td>Applying reasoning of another</td>
<td>uptake, connection</td>
<td>“How does what ____ said fit into what ____ said?”</td>
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**Number Talk Scenarios**
A five- to ten-minute classroom conversation around purposefully crafted computation problems that are solved mentally. These daily exercises are used to build students’ number sense and flexibility with numbers. Scenarios were created using number talks with multi-digit multiplication problems (i.e., 12x8, 12x16, 35x4) to strengthen the preservice teachers’ number sense and allow them to rehearse facilitation of number talks.

Possible student responses to the computation problem were embedded within the scenario and based on research-based learning trajectories. These trajectories with multi-digit multiplication allowed for inclusion of different student strategies and misconceptions. For example, when solving 12x8 a decomposition strategies was included in that a student first used 12x5=60 and then 12x3=36 to combine the partial products to arrive at 96 as the product. A compensation strategy could also be used in that 12x10=120 and then take away the 2 extra groups of 12 (24) to arrive at 96.

![Sample Number Talk Problems](image)

*Figure 1. Sample Number Talk Problems.*

**Course Logistics**

Preservice teachers completed two number talks within Mursion and these sessions were integrated into regular class time. The preservice teachers were organized into number talk
groups and led their number talk with the simulation students as a part of a 3-4 step number string. That is, one preservice teacher would lead the first number talk (12x6) and the subsequent preservice teachers would lead a related problem that was strategically sequenced (12x6, 12x8, 12x15). Preservice teachers were explicitly practicing or rehearsing talk moves (Chapin, O’Connor, & Anderson, 2013) to facilitate the students’ discussion of strategies to solve the problem.

Analyzing Talk Moves

GoReact, an online video recording and feedback tool, is utilized to provide candidates an opportunity to reflect and comment on their teaching experiences in Mursion. GoReact is also used to code the individual videos for teacher moves aligning with the ATM instrument (Correnti et al., 2015).

![Figure 2. Mursion Simulation Recording in GoReact.](image)

Implementation Successes

The first year of the project proved to be a learning experience with many notable successes based on initial observations, participant feedback, and faculty reflections. The
incorporation of ICSAs provided participants with more opportunities to rehearse discourse skills. In addition, ICSAs allowed for instant debrief opportunities and opportunities to “coach” through video analysis and feedback. Participants were asked to reflect on their experience in the Mursion lab and offered positive feedback.

Table 2

**Participant Feedback**

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Participant Feedback on Reflection Activity</th>
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<tbody>
<tr>
<td>Math Cohort I</td>
<td>“Overall, I believe that the Mursion Lab was extremely beneficial to do first instead of just being thrown in the classroom to teach math for the first time.”</td>
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<td></td>
<td>“I was a little taken a back when first working with the Mursion children, but after the first introductions I felt pretty comfortable. I felt that I was able to help the students make meaningful connections among the different strategies. I think these number talks teach us that math can be looked at from different strategies and we have to be able to expand on these strategies so students can learn from each other and expand their math knowledge.”</td>
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<td>“The experience of teaching a number talk, in general, was very scary at first because I didn’t know what to expect from the Mursion Lab. After the first number talk, I felt a bit more comfortable because it felt like these were really my students, but not 100% yet. The only reason I was off about this whole experience was that these student’s behaviors were perfect, and they responded exactly to the numbers as I had wanted them to. I know that in a real classroom the students will need a lot more guidance on the problems and the strategies that I would want to see from them.”</td>
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Science Scenario Pilot Group

"The Mursion experience was super helpful in my opinion. I have never taught to younger students and have never had this type of experience."

"The Mursion experience was helpful because it gave me a taste of what it’s really like teaching younger children, which as the science talks its harder to get that experience since you are talking to people your age."

Best practices for incorporation of ICSAs into the course curriculum and class timeframe were also discovered. Finally, the implementation of Project INTERSECT led to the creation of several new math and science scenarios that can be utilized for future courses and serve as a catalyst for future scenario development.

**Broader Impacts**

The research design, implementation, and dissemination plan for Project INTERSECT has great potential to impact discourse skill development and professional development research, beyond not only the scope of the pre-service education program directly affected, but also outside the field of education. It will cross a wide array of disciplinary boundaries due to the new types of data collected and the relationships between the data, findings, and potential impacts on the heavily STEM-oriented workforce. Gaining a greater understanding of how teachers learn to talk with students and facilitate talk in their learning environments is also useful across public and private sector professions. The research project is designed to advocate for improving educator pre-service curriculum and professional development, particularly in areas that address key moments in students’ educational experiences. By extension, it will improve educators’ capabilities to inspire and prepare a successful 21st century workforce through more critically reflective attention to discourse analysis, and more focused practice on discourse skill development through a variety of mechanisms such as ICSAs.
References


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