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## Mixed-Reality Teaching Experiences Improve Preservice Special Education Students' Perceptions of their Ability to Manage a Classroom

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### Abstract

Classroom management is an important skill for classroom teachers that they typically learn while completing their teacher preparation program. Traditional ways of teaching classroom management skills, such as practicum and internship experiences, may not provide the intensity of instruction needed for preservice teachers to develop the classroom management skills needed to be successful in the classroom. An alternative to these traditional methods of teacher preparation is Mursion. Mursion is a mixed-reality environment that allows preservice candidates to practice teaching specially designed scenarios (simulations) with student avatars. In this mixed methods study, we evaluated the effects of Mursion teaching experiences on undergraduate special education juniors' perceptions of readiness to manage a classroom. Twenty-five undergraduate students aged 18-29 participated in the study during the first semester of their junior year. Results indicated that following the Mursion experiences, most participants perceived that: they were better prepared to teach, Mursion was an effective way to practice new skills, the avatars seemed like real students, they had more confidence to manage undesired behaviors, and they felt like they were in a real classroom. Implications for practice indicate that Mursion provides a safe environment for preservice teachers to learn complex skills such as classroom management. Additional research is needed to evaluate how much time is optimal for learning in mixed-reality environments and the efficacy of using Mursion with distance education learners.

## 1. Introduction

### 1.1. Efficacy and Theoretical Support for Mixed-Reality Environments

Classroom management skills are some of the most important skills preservice teachers learn in their teacher preparation programs, yet many novice teachers report they do not feel adequately prepared to manage a classroom (Markow, Moessner, & Horowitz, 2006; Scott, 2017). As a result, when novice teachers feel unprepared to manage a classroom, they are more likely to be dissatisfied with their teaching job and leave the teaching profession (Ingersoll & Smith, 2003). Learning classroom management strategies is more effective if the skills are learned in real-life situations (Speed, Bradley, & Garland, 2015). For preservice teachers, real-life experiences in classroom management are typically acquired by teaching K-12 students in actual classrooms during practicum and internship experiences.

The opportunities in practicum and internship experiences, however, may not provide the rigorous training needed by preservice teachers to acquire classroom management practices (Simonsen, Fairbanks, Briesch, Myers, & Sugai, 2008). There may be several reasons for this. First, the amount of time spent in practicum and internship experiences varies between teacher preparation programs and, as a result, some preservice teachers might not have enough time to develop adequate behavior management skills because they are not in the classroom as much. Second, the variety of behaviors that students can exhibit, as well as the situations in which they are being demonstrated, are numerous, adding to the challenge of learning to manage a classroom effectively. Third, the frequency of high-intensity behaviors (e.g., cursing, bullying) is low in real classrooms, which limits the number of opportunities preservice teachers may have to improve their skills in managing these behaviors. Finally, during practicum and internship experiences, situations requiring classroom management do not happen on demand and cannot be interrupted to have a teachable moment with the preservice teacher. For these reasons, practicum and internship experiences may fall short of providing the opportunities needed for preservice teachers to gain the classroom management skills they need.

Perhaps a better way to help preservice teachers gain the skills they need to manage a classroom successfully is to supplement traditional practicum and internship experiences with the use of mixed-reality environments (Dieker, Rodriguez, Lignugaris/Kraft, Hynes, & Hughes, 2014; Kaufman & Ireland, 2016). A mixed-reality environment is a blending of real and synthetic content to create an environment where preservice teachers can interact with a group of virtual students. Recent research has focused on the use of mixed-reality environments for improving teaching skills. For example, Garland, Holden, and Garland (2016) used individualized clinical coaching in a mixed-reality environment to teach graduate students to implement a system of least prompts strategy with learners with autism. In this study, participants received training on the use of the prompting strategy in real-time in a virtual classroom laboratory. The participants taught a virtual student avatar (Austin) that was remotely controlled by a trained interactor during the sessions. In the learning scenario, Austin was a middle school student with autism spectrum disorder and an IQ of 55 who was just beginning to learn to read. After receiving training in the virtual setting, all participants were able to deliver the system of least prompts strategy with fidelity.

In another study, Judge, Bobzien, Maydosz, Gear, and Katsioloudis (2013) taught preservice teachers to use differential reinforcement of incompatible behavior (i.e., DRI) strategies during teaching sessions in a mixed-reality environment as part of their course work. During intervention, participants implemented DRI strategies to manage student avatar behavior and received either no feedback, emailed feedback, or peer feedback on their implementation of the DRI strategies. Results indicated that participants improved their skills in administering DRI strategies and that the participants receiving feedback demonstrated the greatest gains. As these studies illustrate, mixed-

reality teaching environments provide preservice teachers opportunities to learn important teaching skills with virtual students using a more clinical and enhanced approach to the art of teaching (Judge et al., 2013).

## 1.2. Introduction to Mursion Mixed-Reality

The original technology, TLE TeachLivE™, was developed at Central Florida University to strengthen teacher recruitment, preparation, and retention in education (Dieker, Hynes, Hughes, & Smith, 2008). In 2015, TeachLivE™ was commercialized as a new company, Mursion. Since then, Mursion has been used for teacher preparation at universities (Dieker, Hynes, Hughes, Hardin, & Becht, 2015; Kaufman & Ireland, 2016) and professional development with in-service teachers (Pas, Johnson, Larson, Brandenburg, Church, & Bradshaw, 2016). In the Mursion mixed-reality classroom environment, student avatars have unique personalities based on adolescent development research (Long, 1989). These personalities include four general categories: (a) aggressive-independent, (b) aggressive-dependent, (c) passive-independent, and (d) passive-dependent which can be supplemented with other traits as well (i.e., phobic, hysteric, obsessive/compulsive, and impulsive) at different levels of intensity. When combined with research on facial expressions, body language, motion capture, and artificial intelligence, the resulting “class” of typical adolescent student avatars and virtual reality environment provide a convincing virtual experience (Bautista & Boone, 2015; Judge et al., 2013).

Scenarios (i.e., simulations) are developed around a desired outcome behavior. For example, if the desired outcome is for preservice teachers to learn how to develop a set of classroom rules with students on the first day of class, the scenario describes this outcome and the teacher behaviors that hit and miss the target. Scenarios are provided to the interactor in advance of the scheduled Mursion session and include a brief summary of the situation (including background knowledge, a synopsis of the targeted experience, teacher objectives, and types and levels of student behaviors). Scenarios are individualized based on the needs of the individuals participating to allow practice and refinement of professional skills (Dawson & Lignugaris/Kraft, 2017).

The avatars are controlled by artificial intelligence and a human interactor. The interactor wears an exoskeleton suit that enables manipulation of the avatars. He sees the individual’s reactions as the scenario unfolds and makes the avatar respond in a way that both matches the scenario and the teacher’s behaviors in real-time. The interactor knows each avatar’s characteristics and personalities, as well as the purpose and goals of the lesson, and can respond consistently and uniquely to each individual (Ludlow, 2015). The student avatars are visible on a computer monitor, Smart Board, or projection screen (see Figure 1).

## 1.3. Purpose of this Study

The mixed-reality classroom, as presented with the Mursion technology, is a place where preservice teachers can try out classroom management and instructional techniques in a risk-free, technology-driven environment (Dieker et al., 2014). However, there is a need for additional evidence on its efficacy to be gathered through empirical research. Therefore, the purpose of this research study was to explore the effects of mixed-reality teaching experiences, specifically on participants’ perceptions about their ability to manage student behaviors in a classroom setting.

## 2. Method

### 2.1. Participants

Twenty-five undergraduates (i.e., participants) from a university located in the southeast United States participated in the study during the first semester of their junior year. Participants were pursuing a K-12 special education teaching license in a special education general curriculum (i.e., mild disabilities;  $n = 16$ ) or adapted curriculum (i.e., moderate or severe disabilities;  $n = 9$ ). Participants were aged 18-29 years, 24 were female ( $n = 96\%$ ), one was male ( $n = 4\%$ ), 24 were Caucasian ( $n = 96\%$ ), and one was African American ( $n = 4\%$ ). In previous courses, participants had observed in-service special education teachers and taught lessons to students with and without disabilities during brief clinical placements, but this was the first course where participants focused on learning and applying classroom management techniques to support students with disabilities.

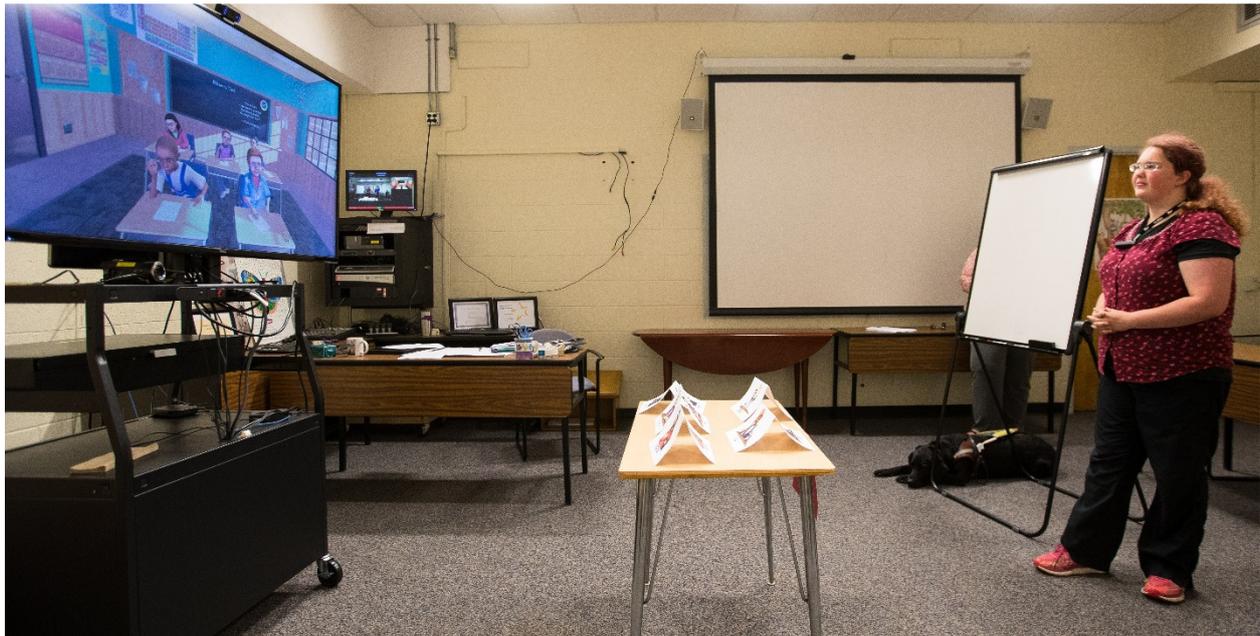
**Sampling procedure.** Purposeful sampling was used to select the participants. All students enrolled in junior-level face-to-face sections of a special education course on classroom management (i.e., SPED 3004: Managing the Learning Environment) were included in the study. These participants were selected because they were enrolled in the course in which the mixed-reality teaching experiences were embedded and had met the program's requirements to take upper level courses (i.e., a minimum GPA of 2.5 and successful completion of the upper division interview process).

### 2.2. Research Design

A triangulation mixed-methods design was used. This design used both qualitative and quantitative data which were collected concurrently and given equal priority. The results from both sources were analysed to determine similarities in the findings. A triangulation mixed methods design is advantageous in that strength of one design can offset a weakness of the other (Gay, Mills, & Airasian, 2009). For instance, the rich contextual information provided by qualitative data can offset the ecological validity often lacking in quantitative data. Likewise, the generalizability of quantitative data can offset the context dependency of qualitative data.

### 2.3. Mixed-Reality Lab

The mixed-reality lab (i.e., Mursion lab) was in a renovated classroom in the College of Education building at the university. On one wall, a large computer monitor was mounted and when the teaching sessions were in progress, five middle school-aged avatars appeared on the monitor as being seated at desks in a classroom. Each avatar had a unique persona, including gifted, teacher pleaser, shy, outgoing, and oppositional defiant. Participants stood in front of the computer monitor to teach lessons and interact with the avatars. Just as the participants could see the avatars, the interactor controlling the avatars virtually off-site could see the participants in the lab via a camera mounted on the monitor, as well as other equipment and materials used by participants in their lessons (e.g., large paper for writing class rules). In addition, microphones placed throughout the lab allowed the interactor to hear the participants teaching.



**Figure 1.** Participants interacted with the avatar students in the Mursion lab. The avatar students were visible to the participants on a large computer monitor and were controlled by an off-site interactor. The interactor could also see the participants and the materials they used, such as the dry erase board in this photograph. This particular participant was legally blind and could not see the avatar students clearly on the screen. As an accommodation, enlarged cards with the avatars' pictures were displayed on the table in the center to help the participant understand what was happening on the screen.

## 2.4. Materials

**Classroom scenarios.** Three unique scenarios were developed for the study and carried out in the Mursion lab. The purpose of the first scenario was to give participants an opportunity to get to know the avatar students by finding out their names and favorite subjects in school. The level of behavior demonstrated by the student avatars was set at level one (minimal), meaning that the avatars might talk out of turn, but were generally compliant to teacher direction. The first scenario was shorter than the other two (3 min instead of 5 min) because the purpose was only to familiarize the participants with the mixed-reality environment, not teach. Additionally, it was early in the semester, and the participants had not yet learned any classroom management strategies in their university course. In the second scenario, participants were asked to develop classroom rules with the avatars and to teach a group alert strategy (e.g., a type of strategy designed to increase on-task behavior). The level of behavior demonstrated by the student avatars during the second scenario was set at level two (minimum-medium), meaning that the avatars might use a cell phone, make rude comments, initially resist teacher redirection, or sleep in class. In the third scenario, participants introduced a new unit of study of their choice. The level of behavior demonstrated by the student avatars was set at level three (medium), meaning that the avatars might not respond immediately to redirection and escalate the frequency and intensity of lower level behaviors. The second and third scenarios were 5 min in duration.

**Perceptions and demographics questionnaire instrument.** A questionnaire was adapted for the participants in this study from previous TLE Teach Live™ research (Bautista & Boone, 2015) to measure participants' perceptions of their readiness to manage a classroom. Participants indicated their level of agreement or disagreement to 11 statements using a 5-point Likert-type scale (i.e., 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree). Table 1

includes a list of these statements. In addition, participants answered four demographic questions about themselves (i.e., age range, gender, ethnicity, and special education teacher track).

**One-minute videotaped reflections.** Individual participant reactions to experiences with Mursion were captured on video immediately following each teaching scenario. Participants privately responded to two questions (i.e., What went well in the lesson? What would you change in future lessons?). The videotaped reflection session lasted for 1 min. The words from the videotaped recordings were transcribed and used to generate common themes about the participants' experiences using a constant comparative method (Glaser & Strauss, 1967). To accomplish this, the reflection transcriptions were read through entirely, and initial themes were derived. Next, the transcriptions were read through again, and entries supporting the initial themes were color-coded (e.g., green represented statements that supported theme one – Participants felt the mixed-reality experience was like a real classroom.) Finally, a third reading of the participant reflections was conducted. At this point, new themes were created and/or other themes changed to more accurately reflect the participants' experiences. In all, 10 themes were generated. Table 2 describes the themes and the number of entries supporting each.

## 2.5. Procedures

Participants completed three mixed-reality teaching sessions in the Mursion lab over the course of the semester. The sessions occurred at different points during the semester (e.g., beginning, middle, end) and the frequency and intensity of the avatars' behaviors increased across sessions. For each teaching session, participants were divided into small groups of 5-6 to teach the scenarios in the Mursion lab. When participants were not teaching, they collected frequency data on the behaviors of the student avatars (e.g., interrupts teacher, off task, uses a cell phone) and the participant teaching (e.g., responds with positive behavior strategy).

After all participants in the small group completed the teaching experience, a 10-min group debrief session led by the instructor was held. Specific positive praise and constructive criticism were shared by the instructor and the participants relative to the objectives of the teaching experience. While led by the instructor, participants were encouraged to discuss their thoughts about the experience during this time as well, including what they noted about their own and their peers' performance.

After the second and third teaching experiences (and prior to the group debrief session), participants went individually to a private room to reflect on their experience immediately following their Mursion experience. Participants did not reflect after their first experience because the goal of that session was simply to get to know the avatars and to familiarize themselves with the Mursion lab. A research assistant stated the question prompts (i.e., What went well in the lesson? What would you change in future lessons?), started the video camera, and then exited the room, leaving the participant alone to reflect on the experience into the video camera. After 60 s, the research assistant stepped back into the room and stopped the video recording. Additionally, participants completed the Perceptions and Demographics Questionnaire after they finished reflecting on their third Mursion experience.

## 3. Results

### 3.1. Perceptions Questionnaire

Nineteen of the 25 participants finished the third Mursion experience (i.e., scenario 3), and completed the perceptions questionnaire by indicating their level of agreement or disagreement to 11 statements. There were 6 students who did not complete the third experience and subsequently these

individuals did not complete the questionnaire. Frequency counts for responses to each statement are summarized in Table 1.

**Table 1: Frequency of Participant Responses to Questionnaire Statements**

	Strongly Disagree		Disagree		Neither Agree Nor Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%	n	%
	1. I feel better prepared to teach after my Mursion session.	1	4	2	8	2	8	11	44	3
2. Teaching in the Mursion lab is an effective way to practice new classroom skills.	1	4	1	4	2	8	10	40	5	20
3. My session seemed like a real classroom experience.	1	4	4	16	3	12	8	32	3	12
4. The avatar students seemed like real middle school students.	1	4	3	12	1	4	11	44	3	12
5. After my Mursion session, I am more confident that I can engage students in my class.	0	0	3	12	8	32	4	16	4	16
6. I was able to effectively manage the classroom during my Mursion session.	0	0	3	12	3	12	10	40	3	12
7. I felt my instruction was delivered effectively.	0	0	3	12	2	8	11	44	3	12
8. I have more confidence in my ability to manage undesired behaviors after my session.	1	4	2	8	4	16	9	36	3	12
9. I am better prepared to teach lessons after my Mursion session.	1	4	1	4	4	16	9	36	4	16
10. I felt like I was in a real classroom within the first 2 minutes of the session.	1	4	3	12	4	16	6	24	5	20
11. I was prepared with a plan to teach the avatar students.	0	0	0	0	2	8	8	32	9	36

### 3.2. Videotaped 1-Minute Reflections

In total, 44 reflections were recorded, 25 after the scenario 2 (i.e., taught class rules and conducted a group alert) and 19 after the scenario 3 (i.e., introduced a new unit of study). Participants’ words were transcribed and analyzed for themes. Ten themes were observed (see Table

2) that included seven positive aspects (i.e., themes 1, 2, 3, 4, 5, 6, 7) and three challenges (i.e., themes 8, 9, 10) to participants' mixed-reality experiences. These themes represented three broad categories: the mixed-reality environment (i.e., themes 1, 7, 10); behavior management and lesson implementation (i.e., themes 3, 5, 8, 9); and personal discovery (i.e., themes 2, 4, 6). The themes and selected entries follow and are discussed in sequence, with excerpts from the participants' comments separated by theme.

**Table 2: Themes from Videotaped Reflections and Entries Supporting Each**

	<b>Number of Entries</b>
1. Participants felt the mixed-reality experience was like a real classroom.	6
2. Participants practiced new behavior management skills.	6
3. Participants gained confidence in successfully planning and implementing a lesson plan.	7
4. Participants gained a deeper understanding of their own teaching and behavior management practices through reflection.	14
5. Participants benefited from multiple mixed-reality teaching experiences.	8
6. Participants became aware of important behavior management skills they were missing.	14
7. Participants found it helpful to speak with an avatar individually.	3
8. Participants found it challenging to manage disruptive behaviors positively.	5
9. Participants struggled with time-management.	8
10. Participants felt the mixed-reality environment limited their teaching plans.	2

### **#1 - Participants felt the mixed-reality experience was like a real classroom.**

It was really cool to be in a setting where there were students that would do and say actual things that an actual student would say.

[It was interesting] to see how classroom behaviors can vary between students - from very outgoing students to students being pretty reserved.

**#2 - Participants practiced new behavior management skills.** The mixed-reality teaching opportunities were embedded into a special education undergraduate behavior management course to provide participants with opportunities to practice the skills they were learning in the course. Though challenging, several participants found these opportunities helpful.

It was really good to get practice what to do when that student pulls a cell phone out and how to approach that situation one-on-one. I also liked how some students were more talkative and some students were quieter because that's definitely a real possibility for a classroom. And it gave me practice on how to juggle those behaviors and for the students who are talking a little too much,

figure out ways to have them give other people turns. If the other students are quiet, it was really good practice to figure out ways to get them more engaged.

**#3 - Participants gained confidence in successfully planning and implementing a lesson plan.** While participants found the mixed-reality teaching sessions challenging, when they were able to successfully meet the challenge, they gained confidence in themselves and their ability to successfully manage a classroom.

Today, I taught the first day of school and thought that it actually went really well. ... I feel like the students were on task, they came up with rules with me, they engaged with me when asked, they were all respectful, and nobody gave me any kind [of] trouble.

**#4 - Participants gained a deeper understanding of their own teaching and behavior management practices through reflection.** Several participants demonstrated their ability to critically evaluate their own teaching and behavior management practices, and in doing so, identified key aspects of successful teaching (e.g., developing personally relevant lessons, organization, higher-level questioning, clear expectations, and positive reinforcement of desired behaviors).

I did [a lesson about] body systems and I did not expect it to go the way that it did. I was introducing the unit and Kevin kept trying to take it to a reproductive system ... it was very difficult at times because they wanted to be off task the entire time. So, if I could change it, I would probably try and do something [that was] a little bit more engaging than just asking the students to figure out what the unit was [about].

**#5 - Participants benefited from multiple mixed-reality teaching experiences.** Participants indicated that they felt their subsequent mixed-reality teaching experiences were better than their first.

... this time around, I was a little bit more aware of each student's actions and what they were doing. And I redirected behavior appropriately, I feel like. I also think that I started the lesson off really well by reviewing school rules and having everyone participate.

...what went well [this time] was my interaction with the students. I feel like I got everybody to answer and interact. I did get everyone to interact with me in the lesson by doing my KWL chart, so that was good.

**#6 - Participants became aware of important behavior management skills they were missing.** Perhaps one of the most important learning opportunities provided in the mixed-reality experiences was giving participants a chance to discover important behavior management skills still missing from their repertoire. Making the connection between knowing about strategies and being able to effectively and efficiently do them when needed is a challenge faced by all new teachers and teacher preparation programs. It appears that many participants took advantage of these opportunities including these:

How to get them not to interrupt and understand that you have to raise your hand when you want to talk? How to get a student to understand to be respectful to the teacher and their classmates? I think that's my biggest thing. How to go about just knowing what strategies to use? I think if I'm able to figure that out, then it could make the session go smoother and I could probably get more done.

**#7 - Participants found it helpful to speak with an avatar individually.** Within the mixed-reality environment, participants were able to speak individually to an avatar by stepping forward

towards the screen. A few participants spoke one-on-one to an avatar during their lessons and found it helpful.

I stepped aside with Maria specifically when she didn't feel comfortable talking to the whole class, which is something that I feel like I'll have to deal with in real life too, where students are not going to feel comfortable speaking in front of the whole class.

**#8 - Participants found it challenging to manage disruptive behaviors positively.** The avatars were capable of displaying various levels of behavior, including level one - minimal (e.g., talking out of turn), level two – minimal/medium (e.g., using cell phone, making rude comments, sleeping), and level three – medium (e.g., not responding immediately to redirection, escalating frequency and intensity of lower level behaviors). During the first Mursion experience, the interactor was instructed to keep the avatars on level one behaviors; during the second Mursion experience, the behaviors were to be set at level two; and the subsequent third Mursion experiences had avatars on level three behaviors. Even still, as their reflections illustrate, participants found it difficult to manage student behavior during their lessons.

When I asked them to do [a] Think, Pair, Share [activity], at first they were not paying attention and I got really frustrated... So then I moved on to a KWL chart and that was also frustrating because they did not want to [do it]. When I asked them what they already know, they could only tell me solids, liquids, and gases and they didn't want to talk about anything else. Then I asked what they wanted to learn [and] they did not want to stay on task. They wanted to talk about mammals and other things.

**#9 - Participants struggled with time-management.** Another challenge for participants was managing the time they had to complete an activity. In the second and third experiences, participants had five minutes to accomplish a specific task. In the second mixed-reality experience, it was the first day of school and participants were asked to introduce themselves and establish rules for the classroom. In the third, participants were asked to teach a lesson of their choice and include an alerting activity.

I always think there is more time than what there actually is so I didn't get through a lot of my lesson. I need to add in time for students to respond when I'm planning the lesson.

**#10 - Participants felt the mixed-reality environment limited their teaching plans.** Two participants were not able to carry out their lessons in the way they wanted because the avatars were not able to do the actions required (e.g., clap hands).

I was [not] able to do my [lesson] plan [where] I had the kids doing an actual activity, so it was harder to just have them do an activity where it's speaking rather than hands-on.

### 3.3. Triangulation of Quantitative and Qualitative Data

In this study, the results from the questionnaire responses (i.e., quantitative data) and themes from videotaped reflections (i.e., qualitative data) are compared. Participant questionnaire responses are in agreement with four themes, disagreement with four themes, and had mixed agreement for two themes.

### 3.4. Agreement

Moderate agreement is found for the first theme “Participants felt the mixed-reality experience was like a real classroom.” Specifically, 58% agree or strongly agree with statement 3: My session seemed like a real classroom experience; 58% agree or strongly agree with statement 10: I felt like I

was in a real classroom within the first two minutes of the session; and 74% agree or strongly agree with statement 4: The avatar students seemed like real middle school students.

Next, agreement is found for the second theme “Participants practiced new behavior management skills.” Specifically, 79% agree or strongly agree with statement 2: Teaching in the Mursion lab is an effective way to practice new classroom skills; 68% agree or strongly agree with statement 6: I was able to effectively manage the classroom during my session; and 63% agree or strongly agree with statement 8: I have more confidence in my ability to manage undesired behaviors after my session.

Additionally, agreement is found for the fourth theme “Participants gained a deeper understanding of their own teaching and behavior management practices through reflection.” Specifically, 74% agree or strongly agree with statement 1: I feel better prepared to teach after my session; 79% agree or strongly agree with statement 2: Teaching in the lab is an effective way to practice new classroom skills; 68% agree or strongly agree with statement 6: I was able to effectively manage the classroom during my session; 74% agree or strongly agree with statement 7: I felt my instruction was delivered effectively; 63% agree or strongly agree with statement 8: I have more confidence in my ability to manage undesired behaviors after my session; 68% agree or strongly agree with statement 9: I am better prepared to teach lessons after my session; and 89% agree or strongly agree with statement 11: I was prepared with a plan to teach the avatar students.

Last, agreement is found for the seventh theme, “Participants found it helpful to speak with an avatar individually.” Specifically, 79% agree or strongly agree with statement 2: Teaching in the Mursion lab is an effective way to practice new classroom skills and 74% agree or strongly agree with statement 4: The avatar students seemed like real middle school students.

### **3.5. Disagreement**

Disagreement is found for the sixth theme “Participants became aware of important behavior management skills they were missing,” where most participants perceived their classroom and behavior management skills to be effective. Specifically, only 16% disagree with statement 6: I was able to effectively manage the classroom during my Mursion session and only 16% disagree or strongly disagree with statement 8: I have more confidence in my ability to manage undesired behaviors after my session.

Disagreement is also found for the eighth theme, “Participants found it challenging to manage disruptive behaviors positively,” where most participants indicated that they managed the classroom effectively. Specifically, only 16% disagree with statement 6: I was able to effectively manage the classroom during my Mursion session.

Additionally, disagreement is found for the ninth theme, “Participants struggled with time-management,” where only 16% disagree with statement 7: I felt my instruction was delivered effectively. Lastly, disagreement is found for the tenth theme, “Participants found the mixed-reality environment limited their teaching plans,” where only 16% disagree with statement 7: I felt my instruction was delivered effectively.

### **3.6. Mixed Agreement**

Agreement for two of the themes is mixed. For the third theme, “Participants gained confidence in successfully planning and implementing a lesson plan,” 74% agree or strongly agree with statement 1: I feel better prepared to teach after my Mursion session; 74% agree or strongly agree with statement 7: I felt my instruction was delivered effectively; 68% agree or strongly agree with statement 9: I am better prepared to teach lessons after my Mursion session, and 89% agree or strongly agree with statement 11: I was prepared with a plan to teach the avatar students. On the

contrary, only 42% agree or strongly agree with statement 5: After my Mursion session, I am more confident that I can engage students in my class. Instead, 42% indicate they neither agree nor disagree with this statement.

Likewise, for the fifth theme, “Participants benefited from multiple mixed-reality teaching experiences,” 63% agree or strongly agree with statement 8: I have more confidence in my ability to manage undesired behaviors after my session; but only 42% agree or strongly agree with statement 5: After my Mursion session, I am more confident that I can engage students in my class.

### **3.7. Possible Reasons for Disagreements between the Quantitative and Qualitative Data**

The possible causes for the disagreements between these data are interesting to contemplate. The first discrepancy is at the heart of this study – the participants’ perceptions of readiness to manage a classroom. In their videotaped reflections immediately following their teaching sessions, many participants stated that they became aware of important behavior management skills they were missing (i.e., theme 6). In fact, this theme was found in 14 entries - the most entries for any of the themes - as illustrated by these entries:

... this time the students had a lot more behavioral issues. I did my best to try and address each one of them, but I don't know if I did as well as I could.

I should have transitioned into my lesson [better], and had the students ready to learn about liquids and the states of matter...

Yet, when completing the questionnaire form, participants indicated agreement with statements that were contrary (i.e., I was able to effectively manage the classroom during my Mursion session. I have more confidence in my ability to manage undesired behaviors after my session.) Why were the participants reluctant to indicate on the questionnaire their need for additional skills in this area? One reason for the difference might be the maturity level of the participants, who are mostly 18-20 years old. Although the questionnaires were completed anonymously, another motive might be that participants wrongly thought the questionnaire was tied to their grade in the course and were reluctant to admit they still felt unprepared in classroom management. While there is no evidence to definitively determine an answer, the authors wondered if the reason might lie in the fact that participants had not yet learned to critically reflect on their own practices in a constructive way. For teachers, reflection involves the ability to evaluate one’s teaching performance and make appropriate changes based on that to improve their teaching practice. Similar to classroom management skills, preservice teachers require intensive instruction to develop reflective practices in teaching (Robinson & Kelley, 2007).

Another discrepancy was noted between qualitative and quantitative data for a related theme. In their video reflections, participants described their struggle to manage the avatars’ behavior in positive ways (i.e., theme 8), as illustrated in these entries:

When I asked them to do [a] Think, Pair, Share [activity], at first they were not paying attention and I got really frustrated...

The only problem was with the one student, CJ, who asked me why we are in school and what the point of math is. She didn't want to do anything.

And CJ did not want to be there. She just thought that the whole thing was stupid. It was a lot harder this time. She [CJ] was a lot meaner today.

Their videotaped responses clearly articulated the participants' frustration during the Mursion session; however, when completing the questionnaire, the majority indicated that they had effectively managed the classroom during the Mursion session. In contemplating this discrepancy, it bears remembering the complexity of what participants were being asked to do. The avatars exhibited varying levels of behavior that changed in frequency and intensity across the scenarios. These changing variables contributed to the complexity and challenge for participants. As preservice teachers, their experiences managing student behavior in positive ways is mostly limited to reading about strategies and observing competent individuals model the practice under contrived circumstances. We think these discrepant data highlight the need for intensive, systematic training in positive behavior management skills to ensure fluency in preservice teachers.

Additionally, participants described struggling with time-management (i.e., theme 9) as illustrated in several videotaped entries:

I didn't get to my transition activity because the rules did take a bit longer than I expected.

I had more to say than what time I had, so I didn't get to my second activity.

On the other hand, most participants indicated they felt their instruction was delivered effectively on the questionnaire. The reason for these discrepant data could possibly be the lack of experience in delivering lessons (e.g., all students were preservice teachers in their junior year). Additionally, learning to deliver a lesson within a certain amount of time is another skill that takes time and experience to perfect. This highlights the fact that the specific skill of time management is not something preservice teachers just know intuitively, and is a skill that needs to be explicitly taught and paired with lots of opportunities to practice.

### **3.8. Implications for Practice**

There are several implications for practice evident from this study. The first implication is that the Mursion lab provided opportunities for participants to safely apply classroom management skills in a way that is often hard to do. For example, the student avatars look and act like human students, but because they are avatars, they are unaffected by the experience. This enables the experience to be stopped and started again, or repeated without the avatar students being affected by or even remembering the initial encounter. Instructors are also able to tailor the intensity of the behavior exhibited by the avatar students to obtain the desired outcomes for participants. For example, when participants are just beginning to apply classroom management strategies, avatar student behavior can be set to a low level of intensity where the student avatars respond quickly to the direction and do not continue to demonstrate the behavior. This allows the participant to concentrate on delivering the strategy appropriately and with precision. Likewise, the behaviors demonstrated by the avatar students can be increased in frequency and intensity to provide participants with opportunities to develop fluency in their behavior management skills. At a medium level of intensity, the avatar students will initially demonstrate non-compliance to redirection, frequently speak out of turn, talk to each other, use their cell phone, and be off-topic. To provide opportunities to practice managing less frequent but hard to manage behaviors that can occur in a classroom, the avatar students' behavior can be set at even higher levels. For example, at a medium-high level, the avatar students will demonstrate inappropriate and disruptive behaviors such as bullying, resist redirection two or three times before complying, ask questions such as "Why we gotta learn this stuff anyway?", and use profanity (e.g., damn). In this study, we were able to increase the level of behavior being demonstrated by the avatars across scenarios to give participants an opportunity to practice the management skills they were learning in class. This type of controlled teaching experience is a valuable way of helping preservice teachers hone their management skills safely, without harming any people.

For preservice teachers who have little experience teaching in a classroom, there is a big difference between knowing what to do and being able to do it in the moment. For this reason, another implication for practitioners is that the Mursion teaching experiences helped participants realize what classroom management skills they still needed to acquire and/or practice to effectively manage the learning environment.

A final implication for practice is that the group debrief meetings that followed the teaching experience were important learning opportunities for participants. At these group debrief sessions, the researcher was able to lead discussions with the participants about what went well during the teaching scenario and what needed more work – modeling reflective behaviors that are highly valued in educators. Additionally, participants were able to ask questions and share their observations during the group debrief sessions. The authors noted, however, that participants were unlikely to share anything but positive feedback with their peers. This observation indicates that participants may need to be taught explicitly how to give and receive constructive feedback to each other.

### 3.9. Limitations and Future Research

A limitation of this study is that participants only spent a total of 13 min in the Mursion lab over the course of three mixed-reality experiences. The purpose of the first 3-min session was for the participants to get to know the avatar students. The purpose of the second and third 5-min sessions was to provide opportunities for participants to practice classroom management skills within a scenario as well as to practice managing increasingly more intense avatar behaviors (i.e., avatar students' behaviors were medium in the second session and medium-high in the third session). The amount of time spent in the Mursion lab is less than some research studies (e.g., Judge et al., 2013), but was determined after considering the amount of time available for the activity within the course. While the amount of time spent with Mursion was enough to change the participants' perceptions of their ability to manage a classroom, it is likely that more time in the Mursion lab is needed for participants to gain fluency in managing a classroom in a meaningful way. Future research could evaluate the benefit gained by participants following different amounts of time in Mursion.

Another limitation of this study is that there was no evaluation of the accuracy of the transcribed video reflection data. All of the videotaped recordings were transcribed by a trained research assistant, however, no interrater agreement data were collected. To rule out the introduction of error in transcribing these data, a specified amount of the videos (e.g., 20%) could have been independently transcribed and compared to the initial transcriptions to determine the level of interrater agreement.

The results of this study should also be considered in light of the fact that the themes from the videotaped reflections were generated by one person (first author). Having multiple individuals independently generate themes from data and then comparing their findings would have strengthened the qualitative analysis.

A fourth limitation of this study is that all participants were enrolled in face-to-face sections of a university course. The reality for many students preparing to be special education teachers is that they take online classes through distance education programs. Whether students enrolled in distance education courses can benefit from mixed-reality teaching experiences is an area for future research. Future research should explore the use of online platforms for providing the mixed-reality teaching experiences for students taking online courses. Virtual meeting platforms could be used to allow students to join a meeting and take turns leading a mixed-reality scenario with the avatars.

#### 4. Summary and Conclusion

This study evaluated the effects of mixed-reality teaching experiences with Mursion on preservice special education students' perceptions of their readiness to manage a learning environment. Results indicated that following the Mursion experiences, most participants perceived: that they were better prepared to teach, that Mursion was an effective way to practice new skills, that the avatars seemed like real students, that they had more confidence to manage undesired behaviors, and that they felt like they were in a real classroom.

Skills in positive classroom management are necessary for maximizing students' academic and social achievement (Scott, 2017). Learning to effectively and positively manage a classroom requires a complex set of behaviors on the part of the teacher. Teacher preparation programs must find ways to first teach, and then develop fluency in delivering classroom management skills, for the preservice teachers they prepare for licensure. Given the complexity of this task, traditional ways of teaching classroom management strategies (e.g., practicum experiences, internships) often fall short in developing these skills in preservice teachers.

Virtual environments such as Mursion offer an innovative solution for teacher preparation. With Mursion, preservice teachers can have multiple opportunities to practice complex classroom management strategies, thus enabling them to acquire and build fluency with these skills, all without harming real students. Scenarios and avatar behaviors can be customized to meet individual needs of the participants, and scenarios can be interrupted to have a teachable moment, and then restarted as needed. As a result, teacher preparation programs using Mursion are able to deliver the intensity of instruction needed for preservice teachers to become competent in classroom management.

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