

The Future Is Now: Implementing Mixed-Reality Learning Environments as a Tool for Language Teacher Preparation

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Abstract

This article reports on two case studies designed to investigate the use of Mursion, a mixed-reality simulation platform, in two language teacher preparation programs. The first case study involved eliciting the attitudes of MA in TESOL pre-service teachers (PSTs) toward the mixed-reality simulation environment, and the second explored how themes uncovered in the first study transpired as novice PSTs working towards foreign language teaching credentials taught in the simulation for the first time. The results of the two case studies showed that while PSTs with teaching experience argued that the simulations did not reflect the realities of real classrooms, PSTs with limited teaching experience found the simulations to be extremely valuable since they helped them develop much needed confidence.

Keywords: *teacher preparation, pre-service teachers, simulations, software*

Virtual Reality for Pre-Service Teaching Training?

The field experience is an important aspect of pre-service teacher preparation programs. Regardless of whether pre-service teachers (PSTs) are enrolled in credential or MA in Teaching English to Speakers of Other Languages (TESOL) programs, PSTs are required to spend time working in classrooms where they function under the supervision of experienced teachers. In these classrooms, PSTs complete a variety of activities that include, but are not limited to, developing lessons and activities, working with small groups of students to address a particular need, teaching whole class lessons, administering and grading assignments, engaging in reflective activities, etc. (Posner, 2010; Richards & Farrell, 2011; Wood, Rogers, & Yancey, 2006).

Prior to the field experience, teacher preparation programs provide PSTs with opportunities to observe classrooms and work with individual students or small groups. However, it is not until the field experience classes that PSTs get to engage directly with large numbers of students in classrooms that reflect their future teaching contexts. In order to bridge the gap between pre-service teacher preparation classes and the reality of the field experience, our university has proposed the use of Mursion, a mixed-reality platform that allows PSTs to practice their teaching in which the role of students is played by avatars (computer generated, graphical representations of a child, youth, or adult—(College of Education, n.d.) controlled by artificial intelligence (AI) and human interactors.

While mixed-reality platforms have become widely used in fields like medicine, aviation, and business (Hayes, Straub, Dieker, Hughes, & Hynes, 2013; Mursion, 2019-2020), only recently have they begun to be implemented in pre-service teacher preparation programs (Kaufman & Ireland, 2016). This is the case of our programs, an MA in TESOL and a credential program, offered in a public university in Southern California, where the Mursion technology is being slowly adopted. These two programs are designed to prepare teachers who work within counties in the nation where nearly one in three residents are born outside of the US and the majority speak a language other than English at home (US Census Bureau, 2018).

With the current COVID-19 pandemic outbreak in and outside the US and the replacement of face-to-face classrooms with remote instruction, it has become evident to us that there is an urgent need to assess the viability of virtual tools like Mursion in pre-service teacher preparation programs. These tools would still allow PSTs to practice their teaching if their face-to-face field experience classes, in which PSTs teach students face-to-face, were suspended or disrupted due to unforeseen events. Given this situation, the purpose of this article is to describe two closely related case studies conducted in our programs. The first one was designed to pilot Mursion in order to understand the attitudes of PSTs towards the integration of mixed-reality platforms into the MA in TESOL program specifically, and language teacher preparation programs more broadly. The second case study, conducted with students enrolled in the credential program, was designed to investigate how the themes identified in the first case study transpired in a Mursion session in which actual PSTs, rather than practicum mentors or MA in TESOL faculty, taught a lesson.

In the following section, we describe the background literature informing the use of mixed-reality platforms in pre-service teacher preparation. We then describe the methodology implemented in the two case studies, present results and discuss their implications for pre-service teacher preparation.

Background

What Is Mursion?

Mursion is a mixed reality platform that relies on technology called TLE TeachLivE™, originally developed at the University of Central Florida as a means to strengthen the preparation and retention of PSTs (Hudson, Voytecki, Owens, Zhang, 2019; Hudson, Voytecki, & Zhang, 2018). As we explained in the previous section, Mursion is used for training purposes in a variety of industries. In the education field, for the most part, Mursion is used in pre-service teacher preparation programs where PSTs practice their teaching through the use of scenarios—called simulations—in which the role of students is played by avatars (Hudson, Voytecki, & Zhang, 2018).

Mixed reality environments like Mursion integrate virtual elements in the form of classrooms with student avatars that can be viewed on a projection screen or large computer monitor (Hayes, Straub, Dieker, Hughes, and Hynes, 2013). PSTs teach the student avatars who are controlled by human interactors, who, in turn, manipulate the avatars through exoskeleton suits. These interactors know the intensity level of the simulation and the objectives of the lesson and respond in real time and consistently with one or more of four levels of intensity assigned to them by the course instructor, but unknown to the PSTs teaching their lessons. These levels are low, medium, medium-high, or high. In the low-level intensity, avatars—who have cartoon-like appearances—are pleasant and compliant throughout the lesson. In the medium level, avatars may initially be non-compliant, or eventually become somewhat agitated in the lesson. In the medium-high level, avatars may be non-compliant throughout the session or become very agitated or upset during the session. In the high-level intensity, which is hardly ever used, avatars are extremely non-compliant, agitated or upset throughout the session (College of Education, n.d.).

An important aspect of the virtual reality experience provided by Mursion is the users' willingness to suspend their disbelief as they become physically and cognitively immersed in the simulation (Hayes, Straub, Dieker, Hughes, & Hynes, 2013). It is when PSTs struggle with the notion of suspended disbelief that the virtual reality experience fails to bring benefits to them (Hayes, Straub, Dieker, Hughes, & Hynes, 2013). Another important aspect of the simulation is the fact that, in contrast to the experience of teaching real students in face-to-face situations, in the mixed reality experience, PSTs can teach the student avatars multiple times without running the risk of negatively affecting the well-being of actual learners (Ledger & Fischetti, 2019).

The Use of Simulations in Pre-service Teacher Preparation

As noted in this article, the use of mixed reality environments is a relatively recent development in the education field. In turn, most of the attention on mixed reality environments has focused on the implementation of TLE TeachLive™ and Mursion with PSTs for the purposes of helping them improve their classroom management skills and assessing or enhancing PSTs' self-efficacy (e.g., Black, Noltemeyer, Davis, & Schwartz, 2016; Gundel, Piro, Straub, & Smith, 2019; Hudson, Voytecki, & Zhang, 2018). In addition, much of the research has focused on PSTs working towards special education credentials or master's degrees (Dawson & Lignugaris/Kraft, 2017; Garland, Hudson, Voytecki, & Zhang, 2019; Larson, Hirsch, McGraw, & Bradshaw, 2020).

Research on mixed-reality platforms has shown that PSTs find Mursion to be beneficial to them since they perceive the experience to be similar to that of a face-to-face classroom. Using Mursion has been found to result in PSTs' improvement and higher confidence in classroom management, lesson planning, and delivery skills (Hudson, Voytecki, & Zhang, 2018). On the other hand, research has also shown that PSTs find the cartoon-looking student avatars "awkward" or "robotic" (Dalinger, Thomas, Stansberry, & Xiu, 2020, p. 10). In addition, PSTs have been found to struggle with the student avatars' lack of mobility since they cannot do physical actions like clap their hands or move from their seats (Hudson, Voytecki, & Zhang, 2018).

Research on mixed-reality platforms has also investigated issues of gender differences in classroom management and has shown that PSTs do not treat male and female student avatars

who misbehave in significantly different ways (Black, Noltemeyer, Davis, & Schwartz, 2016). In fact, PSTs have been found to equally and deliberately ignore male and female student avatars who display non-compliant behavior as a classroom management strategy (Black, Noltemeyer, Davis, & Schwartz, 2016).

Central to the value of the Mursion or TLE TeachLivE™ experience is the idea that PSTs find the reflection and feedback that are part of mixed-reality experience to be beneficial to their preparation (Cohen, Wong, Krishnamachari, & Berlin, 2020; Dalinger, Thomas, Stansberry, & Xiu, 2020). At the same time, the lack of familiarity and experience with mixed-reality platforms like Mursion or TLE TeachLivE™ has been found to raise PST anxiety (Dalinger, Thomas, Stansberry, & Xiu, 2020; Hudson, Voytecki, Owens, & Zhang, 2019); Larson, Hirsch, McGraw, and Bradshaw (2020). A solution to this problem that has been proposed in the literature is continued exposure to and practice with mixed-reality platforms (Garland, Holden, & Garland, 2016); Gundel, Piro, Straub, & Smith, 2019; Hudson, Voytecki, Owens, & Zhang, 2019) and exposure to introductory simulations designed to prepare PSTs for the simulation experience (Larson, Hirsch, McGraw, & Bradshaw, 2020). In fact, continued exposure is key since PSTs have been found to show a drop in self-confidence when they go from no teaching experience to actual teaching experience. This drop has been attributed to the “reality shock” (Pendergast, Garvis, & Keogh, 2011, p. 53) that results from the actual teaching experience.

Continued exposure to mixed-reality platforms has also been found to be critical to help PSTs improve their self-confidence in relation to the degree of complexity of the lessons they teach. For example, in a study by Gunder, Piro, Straub, and Smith (2019), the self-confidence of PSTs dropped when they went from teaching a lesson dealing with issues of classroom routines and student avatar-PST rapport to a lesson that integrated the delivery of complex content through graphic organizers. It was only after the PSTs taught for the third time that they perceived themselves to be better prepared to work with real students.

It is clear that there is a body of literature that points to the value of implementing TLE TeachLivE™ and Mursion with PSTs preparing to work in K-12 settings and with students in special education classes. However, to our knowledge, there is a lack of research focusing on the implementation of mixed-reality platforms with MA in TESOL PSTs and PSTs working towards foreign language (FL) teaching credentials. These two groups of PSTs are the focus of the current article. In the sections that follow, we describe the studies and identify implications for language teacher preparation programs.

Case Study 1: Understanding the Attitudes of MA in TESOL PSTs Towards Mursion

Methodology

In spring 2018, we set out to pilot the use of Mursion in the MA in TESOL program offered in our college. The research questions guiding this case study were: What are the attitudes and perceptions towards the use of mixed-reality platforms among a group of MA in TESOL PSTs with various degrees of teaching experience? What are the opportunities and constraints provided by the mixed-reality platform to MA in TESOL PSTs?

Setting and Participants

To conduct this case study, we invited second-year MA in TESOL students, whom we will call PSTs, to participate in the pilot administration. Eight MA in TESOL PSTs, four males and four

females, responded to the invitation. Table 1 presents information on the Mursion session participants with their corresponding pseudonyms.

Table 1. Demographic Information on the MA in TESOL PSTs Participating in the Mursion Session.

Participants	Status, Race or Ethnicity and Language Background	Teaching experience
Females		
Ana	US-born, Latinx, biliterate English-Spanish	EFL, Adult ESL, less than 2 years
Cynthia	US-born, Caucasian, English-French biliterate	Secondary, History, less than 2 years
Carmen	US-born, Vietnamese descent, Vietnamese speaker, English as an L1	Elementary school, more than 2 years
Hannah	Immigrant, former refugee, Armenian-English biliterate	Adult ESL, less than 2 years
Males		
Charley	US-born Latinx, English-Spanish bilingual	K-12 charter school tutoring, less than 2 years
Peter	Immigrant, Polish, English-Polish biliterate	EFL, US-based IEP, more than 2 years
Harold	US-born, Armenian descent, English as an L1, English-Armenian biliterate	US-based IEP, more than 2 years
Haruaki	International student, Japanese, English-Japanese biliterate	Teaching assistant in elementary school in Japan, no teaching experience

As can be seen in Table 1, half of the participants in our Mursion session were females and the other half males. While all of the participants had experience in the language classroom, the experience was varied in that it ranged from working as teaching assistants and tutoring in charter schools, to teaching adult ESL, EFL, and working in intensive English programs (IEPs).

To pilot the use of Mursion, two of this article’s co-authors, who have a long history of collaboration, decided to team-teach a lesson. One of us is the MA in TESOL program coordinator and practicum supervisor and the other one is an ESL instructor who has served as a practicum course mentor for more than seven years and taught in the IEP of the same university. The third co-author of this article, who is the Mursion coordinator in our college, participated in the PTs-instructors debriefing session held after the lesson was taught.

The Lesson

To pilot Mursion, we designed a scripted lesson on the topic of politeness. Specifically, the language focus of the lesson was on making requests that integrated registers that ranged from the least to the most formal. In designing the lesson, our objective was for our PSTs to critique

how we—the instructors—managed the classroom and gave error feedback to the student avatars. The error feedback strategies that were of interest to us were adopted from Brinton (2014). These included overt teacher correction (the teacher provides direct correction); recast (the teacher repeats the correct form or word); questioning (the teacher asks whether the response given was correct); denial (the teacher says that the answer given is incorrect); pinpointing (the teacher uses rising intonation to lead the student and/or class to identify the correct response); oral cuing (the teacher gives different choices for the answer and asks students to identify the appropriate one); giving written cues (the teacher points to written reminders placed around the classroom); and appealing to peers (the teacher calls on other students in the class to give the right response).

Additionally, when we designed our lesson, we selected “embedded events,” involving specific actions or occurrences that were written into the scenario in order for the five secondary student avatars to act out. The embedded events, which were not disclosed to the PSTs, were having the student avatars use cell-phones and going off task. By having the student avatars act out the embedded events, we would be able to implement classroom management strategies.

The Mursion Session

The Mursion session we ran lasted 1 hour and 20 minutes from start to finish. During the first 10 minutes of the session, we checked the technology and connected with the interactor while the PSTs waited outside the classroom. Next, the PSTs were invited into the classroom and, working with the two instructors, they reviewed a handout containing the list of the different types of error feedback which we described in the previous section. Then we, the instructors took turns teaching and pausing the lesson in order to lead a group discussion highlighting what the instructor did well or could have done better (49 minutes). In doing this, our focus was on directing the discussion towards analyzing the use of classroom management and error feedback strategies, as these were our initial lesson objectives for the PSTs watching the simulation. We should note that the notion of frequent pausing is central to Mursion’s mixed-reality experience since it is when the lesson pauses that PSTs are engaged in reflection which, in turn, enhances their opportunity for development (Dalinger, Thomas, Stansberry, & Xiu, 2020).

After the lesson was over and the simulation ended, we opened the floor for a discussion regarding the experience and reflected on the Mursion technology, its benefits, and drawbacks.

Data Collection and Analysis

In order to answer the research questions, the data collected included the recording of the lesson delivery and the pauses in which the class discussion highlighting the instructors’ actions was held. Data collected also included written notes on the subsequent discussion in which the three article co-authors and the PSTs analyzed the Mursion platform. The data were analyzed qualitatively drawing on Corbin and Strauss (2015) notion of open coding, which involved identifying concepts in the Mursion lesson delivery and debriefing. Then, all similar concepts were grouped into themes and the themes were named.

Findings

In our analysis of the data, we identified two themes. These were: “Who Is Behind That Screen?” and “The Mixed-Reality Platform Is Not Authentic, But...” Following is a description of each of the themes and salient examples supporting them.

Who Is Behind That Screen?

A common theme among the 8 PSTs who participated in the Mursion session was a high interest in understanding how the Mursion technology worked. Immediately after we opened the session by explaining that the practicum supervisor and mentor would be teaching student avatars, a PST asked: “So are the avatars AI or are they actual people online?” In fact, for the first half of the lesson, the PSTs had a difficult time partaking in a willing suspension of disbelief. This means that rather than becoming cognitively immersed in the simulation, PSTs felt apprehension about the simulation and they struggled to have a full immersive experience.

The question of what or who was behind the student avatars came up a second time when we paused the simulation after an embedded event, involving a student avatar having a side conversation with another student avatar, to which the instructor responded by redirecting the student avatar. As we began to elicit what the PSTs had observed, focusing on the strategy implemented by the instructor, another PST said, “So I’m thinking it’s all scripted and pre-recorded.” In response to this comment, one of the instructors reminded PSTs that they would be analyzing the platform later in the session and that at that point, they were expected to focus on the instructional strategies. It was at that point that PSTs seemed to have an “aha” moment and limited their observations and comments to the classroom management and error feedback strategies until the simulation ended. In summary, while eventually the PSTs were able to suspend their disbelief and engage in the Mursion simulation, their initial difficulty in suspending their disbelief negatively affected their ability to focus on the objectives at hand.

The Mixed-reality Platform Is Not Authentic, But...

As we noted elsewhere, after teaching the lesson, PSTs and the three article co-authors engaged in a discussion designed to assess the PSTs’ attitudes towards the Mursion technology. The attitudes of the 8 PSTs could be categorized as fitting into one of two groups: PSTs with either limited or more extensive teaching experience. In general, the 3 PSTs with teaching experience found the simulation to be inauthentic and compared it to the experience of teaching real students in a classroom. These PSTs did not find the cartoon-looking avatar characters to be believable ESL students. In addition, they argued that a class size of 5 students did not represent the authentic larger class sizes (15 students and above for IEPs and 30 students and above for K-12 settings) in which they had taught. Following is what two PSTs had to say about this issue: “I don’t think they were believable as ESL students” (Peter); “Is it always such a small group? Because I have to work with like 30 students, which is much bigger than that” (Carmen).

Another concern raised by Peter and Harold, two of the PSTs with teaching experience, was that the Mursion class only allowed for teacher-fronted lessons; therefore, they did not see the Mursion classroom as an authentic one since the lack of interaction among the student avatars was not reflective of real language classrooms which tend to be centered around small group activities that are typical of communicative approaches to language teaching—or this was the case until COVID-19.

In contrast to the concerns expressed by the PSTs with more experience, those with limited teaching experience like Ana, Charley, Hannah, and Haruaki did not question the platform and expressed being more open to practicing teaching in a simulation. In fact, they admitted feeling nervous or anxious when thinking of appearing in front of real students as a teacher figure for the first time; therefore, practicing in a simulation and receiving feedback could provide some relief. This idea was best expressed by Haruaki, the novice PST from Japan, who stated: “But

this technology will help me since I can practice teaching and feel more comfortable before I actually get to teach real students. This is very important for a novice teacher like me.”

While the PSTs had concerns about the authenticity of the Mursion experience, the ability to pause the Mursion session provided a forum for reflection. Specifically, it allowed the PSTs to engage in a discussion and reflection on the strategies implemented by the instructors. In the discussion that occurred when we paused, the PSTs pointed out classroom management and error feedback strategies they noticed, discussed whether they were effective or not, asked questions, and suggested alternatives. For example, when referring to the instructor’s reaction to a student avatar who was having a side conversation with another student, an MA in TESOL PST asked the following question.

“When Ava was off task talking to Ethan, instead of calling on her multiple times because it took you 5, 6, or 7 times before she stopped and turned to look at you, would you have in a real life situation walked closer to her, or not even addressed her but continued teaching and lecturing or touched her shoulder, or be close by, making use of close proximity instead of calling her name multiple times?” In response to this question, the instructor asked for feedback from other PSTs, and one of them responded by stating that it was never a good idea to break the flow of the lesson for one student. Another PST, Cynthia, argued that the disruptive behavior should have been ignored. The group resolution to this was that perhaps the instructor could walk closer to the student instead of calling on the student several times from a distance to get her attention since “That was so much attention to Ava,” Hannah stated.

Overall, we found that the Mursion session did not represent a real classroom; however, the group consensus at the end was that teaching in the simulation could be a beneficial first step for PSTs who had never taught before. Additionally, its capacity for pauses allowed the PSTs to reflect on the classroom management and feedback strategies, which were our lesson objectives for the MA in TESOL PSTs.

Case Study 2: The Case of a Novice Teacher Teaching in a Mursion Simulation

While in the first case study the teaching of the lesson was done by two of the co-authors of this article in order to assess the Mursion simulation and elicit MA in TESOL Program PSTs’ perceptions about the platform, the second case study was designed to answer two research questions: How did the findings of the first case study transpire when a novice PST enrolled in a FL, Mandarin, credential program taught for the first time, using the Mursion platform? What were the opportunities and constraints provided by the mixed-reality platform to a novice PST enrolled in a FL credential program

Methodology

Setting and Scope

In fall 2018, one of us, who is our college’s Mursion coordinator, set out to integrate Mursion in a credential course titled “Advanced Secondary Instructional and Management Strategies.” While the 24 PSTs enrolled in the course were divided into 4 groups consisting of 6 PSTs each, for the purposes of this case study, our focus was on a PST who was part of a group consisting of 4 female and 2 male students in their first year of the credential program. Cindy, our focal PST, was part of a group assigned to teach a lesson on similes and metaphors. As we will

explain below, after listening to the Mursion session multiple times, we decided to focus on Cindy because she was working towards a FL credential and her Mursion simulation provided examples of her interaction with the student avatars and the course instructor pointing to her teacher talk and issues of language intelligibility.

Table 2 presents information on the group assigned to teach similes and metaphors.

Table 2. Demographic Information on the PSTs Teaching a Lesson on Similes and Metaphors.

Participants	Credential Content Area	Semester in the Credential Program/ Teaching Experience
Females		
Allison	English	2nd semester/none
Cindy	Mandarin	1st semester/none
Renee	History	2nd semester/none
Wendy	English	2nd semester/English tutor in a high school after-school program
Males		
Julio	English	1st semester/none
Kevin	Spanish	2 nd semester/TA in an elementary school

As can be seen in Table 2, the PSTs assigned to teach similes and metaphors were working towards a credential in the humanities, were in their first or second semester in their credential programs, and had limited, if any, teaching experience. In fact, the Mursion simulation was their first practice of directed teaching.

The Lesson

To teach the lesson on similes and metaphors, the PST's in the group in Table 2 decided to use Rihanna's song, "Shine Bright Like a Diamond" whose lyrics provide examples of the two literary devices.

Two events were embedded into the simulation. These involved 1) one of the student avatars talking endlessly about Rihanna's fashion choices and 2) a second student avatar joking about another student avatar's example of a simile. The course instructor did not share the embedded events with the PSTs so as to provide them the opportunity to think on their feet and react to student avatars' unexpected behaviors as they would occur in a face-to-face classroom. Since the majority of the PSTs were either in their first or second semester of the credential program and had no prior teaching experience, the simulation session was set at a medium level of intensity, meaning that the student avatars were somewhat engaged with the lesson and would not be a challenge.

The Mursion Session

The Mursion simulation session in the credential course lasted 2 hours and 5 minutes in its entirety, with the first 10 minutes devoted to the technology check. The PSTs in Table 2 were allotted 15 minutes to deliver their complete lesson, with each of the PSTs in the group taking

turns to teach. During instruction, the PSTs could pause at any time if they needed to by saying “stop session” and “resume session” when they were ready to begin again. After the group’s lesson, the course instructor asked for feedback and reflection from the rest of the class on what the group had done well on and on what they could improve.

Data Collection and Analysis

Data were collected for the duration of the Mursion session, including the actual teaching and the pauses before, during, and after the delivery of the lessons where the instructor and the PSTs engaged in feedback and reflection on the lessons.

The recorded video was viewed and segments referencing Cindy’s teacher talk were transcribed through message units, involving minimal bursts of speech that carry the smallest inscription of meaning (Green & Wallat, 1981). How to bind message units was informed by contextualization cues such as pauses, gestures, intonation, pitch and stress (Green & Wallat, 1981; Gumperz, 1992). While we used such cues to help bind and determine message units, though we did not include them overtly in the transcription. Each transcription piece consisted of three columns labeled: Speaker, Line #, and Talk. Table 3 below presents an example of a typical raw transcript.

Table 3. Example of a Typical Raw Transcript.

Message Unit Line (MUL)	Speaker 1	Speaker 2
1	hi class	hello
2	today	
3	we are going to learn	

Findings

In this case study, we identified three main themes which are parallel to those in the first case study. These were “Playing Along and Focusing on the Lesson,” “Pausing the Simulation for Reflection and Feedback,” and “The Mixed-reality Platform Is Not Authentic, But...” Following is a description of the themes with supporting examples.

Playing Along and Focusing on the Lesson

While the PSTs in the former case study continuously questioned the Mursion technology, the PSTs in this study remained focused on the lesson they had to present and did not interrupt the simulation at any point to explicitly question how the platform worked. What this means is that the PSTs played along as if the student avatars were real, being able to suspend their disbelief. The PSTs followed their lesson plan, teaching all parts of the lesson and directly interacting with the student avatars the way they would in a face-to-face classroom. This was observed in the way our focal PST, Cindy, reacted to the embedded event that involved one of the student avatars talking endlessly about Rihanna’s fashion choices. In fact, in Cindy’s case, when she announced to the class the title of Rihanna’s song “Shine Bright Like a Diamond,” a student avatar quickly interrupted the PST by sharing how popular Rihanna was on Snapchat, “Yah. That’s a good sound. She’s like amazing. Her Snapchat has like MILLIONS of followers. They called her like that girl on Insta [Instagram]. She’s amaz.” In response to this comment, Cindy,

politely thanked the student avatar and quickly moved on with her lesson. Through this gesture, Cindy acknowledged and treated the student avatar as if she were a real human and did not, at any point, stop the lesson to question how the platform worked.

Another example that shows how PSTs played along with Mursion and focused on the lesson was observed when Cindy was expected to frame the simile lesson by introducing key ideas that would provide clues to the topic of the lesson (Table 4). As can be seen in Table 4 below, when Cindy introduced the ideas, the student avatars did not initially interrupt her to express their lack of understanding. The fact that they could not understand Cindy became evident when student avatar Ava spoke up and asked for clarification on what to do (MULs 10-13).

Table 4. Transcript of Cindy’s Framing of the Lesson on Similes with Student Avatar Ava’s Responses.

Message Unit Line (MUL)	Cindy	Student Avatar Ava
1	hi class	
2	Today	
3	we are going to learn	
4	[incomprehensible words] devices [<i>two literary</i>]	
5	that have made	
6	famous [incomprehensible word] [<i>singers</i>]	
7	a lot of money	
8	please [incomprehensible word] up [<i>open</i>] your journal	
9	to the next [incomprehensible words [<i>blank page</i>]	
10		wait
11		sorry
12		what are we
13		gonna do
14	open your journal	
15	and	
16	find the blank page	
17		ok
18		open the journal
19		got it

Ava’s prompting question served as a redirection for Cindy to take up. Sensing that her speech was incomprehensible, Cindy slowed down her speech and enunciated her words clearly (as heard in the video) in MULs 14-16. Once Ava understood the directions, she acknowledged them (MULs 17-19). As in a real classroom, only when Cindy addressed a student’s question and cleared up any confusion would she have been able to proceed with the lesson at hand. Even though Cindy was teaching student avatars, she reacted as if the student avatars were real humans needing clarification, a situation she would have most likely encountered in a face-to-face classroom. Cindy played the role of “teacher” by making adjustments to her speech to make it more intelligible. This shows that Cindy was able to teach her lesson in spite of working with student avatars.

Pausing the Simulation for Reflection and Feedback

As was the case in the simulation with the MA in TESOL PSTs, pausing the simulation with the credential PSTs provided opportunities for immediate reflection and feedback. In Cindy’s example, the implementation of Mursion provided her with the opportunity to become aware of her lack of intelligibility, in our case, teacher intelligibility, involving the listener’s ability to 1) recognize words and utterances (intelligibility); 2) recognize the meaning of words or utterances (comprehensibility); and 3) understand the speaker’s intentions (interpretability) (Smith, 1992).

When Cindy mispronounced simile as “sima lay” (Table 5, MULs 51-53), in the delivery of her lesson, the student avatars could not make out what she was saying. This prompted student avatar Dev to ask “of what” (MUL 52). Although Cindy responded to Dev’s question (MULs 53-55), she continued pronouncing “sima lay” two more times towards the end of her lesson (the entire transcript of Cindy’s lesson is not presented due to space constraints).

Table 5. Transcript of Cindy’s Lesson on Similes with Student Avatar Dev’s Responses

Message Unit Line (MUL)	Cindy	Student Avatar Dev
49	shine bright like a diamond	
50	is an example	
51	of a simile [pronounced sima lay]	
52		of a what
53	a simile [pronounced sima lay]	
54	a comparison	
55	using the word like or as	Oh

Not wanting to call attention to Cindy’s mispronunciation and potentially embarrassing her in front of the class, as well as disrupting her lesson, the course instructor remained silent and had Cindy complete her lesson. However, once Cindy concluded her lesson, the course instructor paused the simulation to recap what Cindy had taught. This sequence is captured in Table 6 below.

Table 6. Course Instructor’s and Cindy’s Debriefing When the Lesson Stopped

Message Unit Line	Instructor	Cindy
75	pause	pause
76	within the lesson	
77	we have	
78	um	
79	the example of	
80	shine bright as a diamond	
81	[Cindy] has the students	
82	read out the sentence	
83	then	
84	pointed out that	
85	it was a simile	
86		oh
87	and	simile
88	have them	
89	write down	
90	this is a simile	
91	and	
92	this is the definition	

As can be seen in Table 6, pausing the simulation enabled the course instructor to accomplish two things. First, it allowed her to model the pronunciation of the word simile under the guise of summarizing Cindy’s lesson. By modeling the pronunciation through her summary (see MULs 75-92), the course instructor avoided explicitly correcting Cindy in front of her peers since she believed this could potentially embarrass her. The strategy worked since upon hearing how simile was pronounced and realizing that she had mispronounced it during her lesson delivery, Cindy showed her surprise with an “oh” that was said quietly to herself (MUL 86) and proceeded to, again, quietly repeat the word correctly “simile” in MUL 87.

A discussion of someone’s speech intelligibility can be an uncomfortable topic, an elephant in the room. Given the significance of teacher talk as a medium for imparting knowledge and skills to students, PSTs need to be aware of the importance of intelligibility before they stand in front of a classroom and instruct lessons to real students. The pausing enacted by the course instructor in Cindy’s lesson became a teachable moment. In fact, she used that moment to model the pronunciation for Cindy to hear, but without calling attention to her mispronunciation. In order to make the term simile salient, the course instructor used it more than once, as shown in MUL 90. Thus, the instructor’s correction during the pausing became an opportunity to provide a safe and nurturing space for Cindy to get exposure to the correct pronunciation of the word simile without calling attention to her mispronunciation.

The Mixed-reality Platform Is Not Authentic, But...

In this case study, Mursion had the same limitations as in the first study in relation to its lack of authenticity (i.e. cartoon-looking student avatars, lack of interaction between student avatars, small class size). In spite of this lack of authenticity, we found that implementing Mursion provided multiple opportunities for the instructor and PSTs to be flexible.

First, the instructor was able to adjust the intensity of the student avatars' behavior to make them more or less compliant. Since the PSTs in our case study were either in their first or second semester of the credential program and had no prior teaching experience, the simulation session was set at a medium level of intensity, meaning that the student avatars were somewhat engaged with the lesson and would not be a challenge. The rationale for this was that we intended to have the PSTs focus on their instructional practices, rather than on classroom management issues. The PSTs seemed to appreciate this aspect of their simulation session when one of them shared a quality of the simulator that they thought was beneficial was "[b]eing able to have a back and forth interaction with the students in a safe and low stress environment where we can practice how to handle distractions that are common in the [face-to-face] classroom. Another student echoed this sentiment of the simulator as a safe environment to practice said, "I think this simulation is great experience of getting responses from students in a controlled environment especially if you haven't been in front of students before." If the PSTs had worked in a face-to-face classroom, such adjustments would not have been possible to make; therefore, the PSTs would have had to deal with unpredictable student behaviors in their first directed teaching experience and this could have resulted in negative PST self-confidence.

Second, as mentioned above, during instruction the PSTs and the course instructor could pause the simulation at any time if they needed to by saying "stop session" and "resume session" when they were ready to begin again, a choice unavailable in face-to-face classrooms. This feature, central to Mursion, provided PSTs the opportunity to both reflect on their instructional practices and, either continue teaching with the awareness that had resulted from the reflection or reteach the point that had given them difficulty. Following is what two PSTs had to say about the power of pausing and reflecting: "I liked the fact that if I made a mistake I could try again. I didn't have to worry about making a real student feel bad because I didn't know what I was doing. It allowed me to practice skills." "The session helped me reflect on the different needs of students. I realized that I cannot try to push my agenda of instruction, but rather modify based on student experience."

Third, because PSTs worked in groups and their lessons focused on a specific topic, they were able to participate in a collaborative and controlled environment, an option uncommon in face-to-face classroom settings. In contrast to what happened in the figurative language group, in which the 6 PSTs were grouped based on the relatedness of their content subjects (humanities), in a classroom setting, 6 pre-service teachers would not be collaborating before and during the teaching of a lesson. This would have prevented them from having peer support in making lesson-planning decisions.

In summary, Mursion provides a degree of flexibility that is not afforded in face-to-face classrooms; therefore, in spite of its limitations (e.g., the lack of mobility of the student avatars; the small class size; and the cartoonish features of the student avatars) it still contributes to creating an environment conducive to experimentation and learning.

Discussion and Conclusion

The purpose of this article was to describe two closely related case studies designed to understand the attitudes of MA in TESOL program PSTs toward Mursion and the extent to which the attitudes identified in one case study were reflected in a Mursion session in which a credential PST, Cindy, working toward a Mandarin FL credential taught a lesson. In this section we will present and discuss the similarities and differences between the two studies and, by doing so, hope to contribute to the emerging literature on the use of mixed-reality tools. We will also share our view of the affordance of the tools and make recommendation of its utilization. To our knowledge, this is the first study focusing on MA in TESOL PSTs and PSTs enrolled in FL credential programs. Therefore, it can be argued that this article provides much needed baseline information on issues related to the integration of mixed-reality tools in language teacher preparation.

A similarity we found between the two case studies shows that PSTs without much or any teaching experience found Mursion to be beneficial to their preparation. In fact, the PSTs without teaching experience in our MA in TESOL program argued that the implementation of Mursion in their classes would help them increase their self-confidence as they get ready to teach real students. The PSTs in the second case study argued that the fact that they could reteach the same lesson to the same student avatars gave them the opportunity to practice their teaching in a low-pressure and controlled environment, something that can't be done in face-to-face classrooms. This is not to say that mixed-reality environments should replace face-to-face practice teaching. Instead, what this means is that mixed-reality tools like Mursion should be implemented before PSTs actually get to teach real students. This would involve incorporating mixed-reality environments in pre-service teacher preparation programs as the first step prior to PSTs, especially novice PSTs with little or no teaching experience, teach real students in their practicum course.

A difference we found between the two case studies, which corroborates prior research, touches on the issues of PSTs' willingness to suspend their disbelief, an essential prerequisite, if the Mursion session is to bring benefits to PSTs (Hayes, Straub, Dieker, Hughes, & Hynes, 2013). In contrast to the PSTs in our second case study, who did not question the student avatars and instead became cognitively involved in the lesson, the MA in TESOL PSTs initially struggled to have a full immersive Mursion experience. In fact, MA in TESOL PSTs with teaching experience questioned the size of the Mursion classroom, the robotic appearance of the student avatars (Dalinger, Thomas, Stansberry, & Xiu, 2020), as well as the student avatars' lack of mobility (Hudson, Voytecki, & Zhang, 2018). This difficulty to suspend their disbelief negatively affected the PSTs' ability to see the Mursion simulation experience as a valid one and, in turn, their ability to immerse themselves in the simulation. In contrast, Cindy, our focus student in the second case study, and the PSTs without much teaching experience in the first case study did not show any concern about the Mursion experience lack of authenticity and instead benefited from it and viewed it as a tool that would help them further prepare prior to teaching real students.

In spite of the MA in TESOL PSTs' limited immersive Mursion experience, the Mursion session afforded them the opportunity to reflect on the course instructor's classroom management and error feedback strategies. This gave them the opportunity to notice the strategies, discuss whether they were effective, ask questions, and brainstorm alternatives for handling certain situations arising in classrooms.

In the case of the credential PSTs, the inauthenticity of Mursion actually resulted in several advantages over face-to-face classroom settings. For one, the simulation provided PSTs with opportunities for reflection and learning due to the ability to pause the simulation at any time, as was the case in Cindy becoming aware of her teacher talk and intelligibility. Second, Mursion's lack of authenticity offered flexibility since it made it possible to 1) tailor the teaching experience to PSTs' needs and teaching proficiency level as the student avatars' behavior could be adjusted; 2) pause the simulation for timely intervention, reflection, or feedback; and 3) give PSTs the option to teach a lesson collaboratively or practice teaching the same part of a lesson several times. Third, Mursion's inauthenticity provided opportunities for a controlled low-stakes/low risk environment where PSTs could practice teaching without having any impact on real students as this was a simulation. We would argue that these benefits arising from the system can help better prepare PSTs for their future encounters teaching real students.

Incorporating the Mursion simulations in pre-service teacher preparation has afforded us, teacher educators, the opportunity to address the needs and wants of PSTs. In our case, one of the authors of this article was able to address the issue of a PST's intelligibility in a nurturing way without calling attention to the PST and embarrass her in front of her peers. This experience of practice teaching with real-time interaction with student avatars brought to the fore for PST the significance of teacher talk. Real students in the classroom will call on the teacher if their speech is unintelligible. During her simulation session, PST Cindy might have felt frustrated and uncomfortable, causing a frame clash (Tannen, 1993), as the student avatars interrupted her and kept asking her for clarity. However, this frame clash turned into a rich point (Agar, 1994, 1996), an opportunity for learning and growing. It could be the case that the virtual simulation made Cindy cognizant of the situation which PSTs can practice and work on before venturing into the face-to-face classroom for their student teaching.

Drawing on the findings of our case studies, we would recommend engaging PSTs in more than one Mursion session during a term prior to the teaching practicum. For instance, PSTs' curious questions such as the one asked by one PST, "So are the avatars AI or are they actual people online?" and others could all be addressed in the first session. In this way, once the novelty of Mursion goes away, PSTs would then be able to move past it and onto the business of teaching that concentrates on making subject content comprehensible, practicing lesson delivery, and executing classroom management strategies.

While this article contributes to an understanding of how mixed-reality environments can become a useful tool in enhancing pre-service teacher preparation, particularly in relation to MA in TESOL and credential students enrolled in FL courses, there is a need for more extensive research on the topic. The number of participants in this study was small since our goal was to understand the potential of Mursion's integration in our programs.

Finally, with the current COVID-19 pandemic and the struggle to offer face-to-face instruction, countries around the world have moved their courses regardless of whether they are K-12, community college, college and university, to online environments. At the same time, pre-service teacher preparation programs have also been forced to move online and, consequently, offer the teaching practicum course fully online too—though some colleges are opting for, at least for the time being, not offering the practicum course. The need to support PSTs to complete their field experiences remotely due to the coronavirus outbreak prompted the American Association of Colleges for Teacher Education (2020), consisting of 800 higher-

education institutions with teacher preparation programs, to partner with Mursion to assist PSTs. This pathway to completion of the field experiences involves virtual simulations where the PSTs “can practice instructional techniques and access a platform of over 100 videos of classroom instruction” (American Association of Colleges for Teacher Education, 2020, para 2) that they can “review, tag, and share with faculty or mentor teachers for feedback” (American Association of Colleges for Teacher Education, 2019, p. 6). This type of collaboration addresses the current situation, in which the pandemic requires the face-to-face model of pre-service teacher preparation be adapted to provide teaching opportunities to PSTs through mixed-reality environments so that they can complete their field experience.

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