EFFECT OF A NONVERBAL IMMEDIACY TREATMENT ON PRE-SERVICE TEACHERS USING MIXED REALITY SIMULATIONS

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EFFECT OF A NONVERBAL IMMEDIACY TREATMENT ON PRE-SERVICE TEACHERS
USING MIXED REALITY SIMULATIONS

Gloria Rosati Peterson

Certificate of Advanced Study, State University of New York at New Paltz, 2011
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A Dissertation
Submitted in Partial Fulfillment of the
Requirements for the Degree of
Doctor of Education in Instructional Leadership
in the
Department of Education and Educational Psychology
at
Western Connecticut State University

2020
EFFECT OF A NONVERBAL IMMEDIACY TREATMENT ON PRE-SERVICE TEACHERS USING MIXED REALITY SIMULATIONS

Gloria Rosati Peterson

Abstract

The purpose of this study was to examine the effect of a treatment package consisting of video and reflection, video feedback, and coaching on pre-service teachers’ use of nonverbal immediacy behaviors as they delivered lessons to student avatars in mixed reality simulations. Pre-service teachers delivered lessons at three points of time over the course of a semester within a teacher preparation course. Following each simulation, participants received three components of a treatment package targeted at improving nonverbal immediacy behaviors of teachers. A mixed methods embedded research design provided for the collection of quantitative data, nonverbal immediacy scores, collected via the Nonverbal Immediacy Scale – Observer Report. Qualitative data were collected via researcher observations of simulations and participant exit interviews. Statistical analysis resulted in a significant difference in pre-service teachers’ nonverbal immediacy when Time 2 and Time 3 were compared. No additional significant differences resulted. An analysis of qualitative data resulted in two findings. Finding one was: Video and reflection, video feedback, and coaching fostered pre-service teachers’ reflections on the simulated environment as they delivered lessons within the simulations. Finding two was: Video and reflection, video feedback and coaching within a mixed reality simulation environment improved pre-service teachers’ use of nonverbal immediacy behaviors in student interactions. Connections to literature and implications are made.
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2020
APPROVAL PAGE

School of Professional Studies
Department of Education and Educational Psychology
Doctor of Education in Instructional Leadership

Doctor of Education Dissertation

EFFECT OF A NONVERBAL IMMEDIACY TREATMENT ON PRE-SERVICE TEACHERS USING MIXED REALITY SIMULATIONS

Presented by

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ACKNOWLEDGEMENTS

First and foremost, I would like to thank Dr. Jody Piro, my dissertation chairperson, for her unwavering support and dedication throughout my entire dissertation journey. I am forever grateful for the countless hours you spent with me, often on weekends and holidays, mentoring me each step of the way, in thinking through the details so I could complete this research. You knew exactly when to push me to write! I can’t thank you enough for your kindness, encouragement, and guidance that fostered my learning and growth throughout this dissertation process.

Additionally, I would like to thank my dissertation committee members. Dr. Carrie Straub, thank you for sharing with me your expertise in mixed reality simulations and for your enthusiasm for my study. Dr. Catherine O’Callaghan, thank you for your feedback and your support for the use of mixed reality simulations within teacher preparation. Dr. Erik Gundel, I am incredibly grateful for your agreeing to be my reader and for your thoroughness with your feedback. Dr. Wes DeSantis, I so appreciated your willingness to take the time to teach me about the technology involved within the simulation lab. Dr. Marcy Delcourt, I knew when you personally called me back when I initially inquired about your Doctor of Education program, I had found the course of study and model that was right for my learning and research goals. Your passion for educational statistics and research is inspiring!

Thank you to the members of Cohort 7 that spurred my thinking and growth along the way. Those of you that have completed your journeys before me inspired me to complete mine. Those of you who are still traveling on your journey, I know you can attain your goals! Donna, thank you for your friendship and emotional support when there were bumps along the way. You’re an inspiration to me – I still don’t know how you manage to “do it all”! Amy C., thank
you for that “pep talk” years ago. Your kindness when I was so full of self-doubt was not forgotten. Krystina, thank you for also supporting me and being a cheerleader as I continued my pursuit of this research and for the many trips for beer and burgers!

Finally, I want to thank my family and friends. Mom, thank you for teaching me from a young age that anything was possible with hard work and perseverance. Your belief in me helped foster a belief in myself to be able to take on challenges and overcome them, even those that seemed overwhelming at times. I am grateful for your love and support. Dad, I wish you were here so I could share this accomplishment with you. You also taught me anything I dreamed was possible. You would probably say, “I knew you could do it! Grass doesn’t grow under your feet”! Roberta, you always believed in me and saw things in me I didn’t see myself. How I wish you were still here so we could share a glass of wine and talk about this adventure and our upcoming visits to great places for ice cream. To my extended family, friends, and “the girls” – thank you for your understanding when I had to spend time on weekends and holidays reading and writing instead of spending time with you. I know sometimes I wasn’t successful at balancing professional and personal aspects of my life, and I’m grateful for your support of me as I diligently worked in pursuit of my goal. I love you all and am fortunate to have such wonderful people who care about me in my life!
DEDICATION

This dissertation is dedicated to my husband, Daniel Peterson. You are my best friend, my rock, and my loudest cheerleader. You believed in me when I doubted myself and I’m forever grateful to you for being such a kind, generous, and caring soul who makes me feel loved and supported every single day. I can’t possibly put into words how much I have appreciated all you’ve done over the past few years as I focused on the completion of this project and you did the grocery shopping, laundry, and many trips to Dunkin’ for iced tea. WE did this!
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>i</td>
</tr>
<tr>
<td>Approval Page</td>
<td>iii</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>iv</td>
</tr>
<tr>
<td>Dedication</td>
<td>vi</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>vii</td>
</tr>
<tr>
<td>List of Figures</td>
<td>x</td>
</tr>
<tr>
<td>List of Tables</td>
<td>xi</td>
</tr>
<tr>
<td>Chapter One: Introduction to the Study</td>
<td>1</td>
</tr>
<tr>
<td>Rationale</td>
<td>3</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>4</td>
</tr>
<tr>
<td>Significance of the Research</td>
<td>4</td>
</tr>
<tr>
<td>Potential Benefits</td>
<td>5</td>
</tr>
<tr>
<td>Key Terms and Definitions</td>
<td>6</td>
</tr>
<tr>
<td>Brief Literature Review</td>
<td>7</td>
</tr>
<tr>
<td>Overview of Methodology</td>
<td>7</td>
</tr>
<tr>
<td>Chapter Two: Review of the Literature</td>
<td>10</td>
</tr>
<tr>
<td>Literature Review Process</td>
<td>10</td>
</tr>
<tr>
<td>Immediacy</td>
<td>11</td>
</tr>
<tr>
<td>Simulations</td>
<td>27</td>
</tr>
<tr>
<td>Video Based Instructional Coaching</td>
<td>47</td>
</tr>
<tr>
<td>Summary of the Chapter</td>
<td>56</td>
</tr>
<tr>
<td>Chapter Three: Methodology</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>Setting and Participants</td>
<td>58</td>
</tr>
<tr>
<td>Research Questions and Hypotheses</td>
<td>62</td>
</tr>
<tr>
<td>Research Design</td>
<td>63</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>66</td>
</tr>
<tr>
<td>Treatment</td>
<td>71</td>
</tr>
<tr>
<td>Data Collection</td>
<td>75</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>78</td>
</tr>
<tr>
<td>Statement of Ethics</td>
<td>81</td>
</tr>
<tr>
<td>Summary of the Chapter</td>
<td>82</td>
</tr>
</tbody>
</table>

| Chapter Four: Analysis of the Data                                                          |   |
| Overview of the Study                                                                       | 83|
| Data Analysis and Findings                                                                  | 84|
| Summary of the Chapter                                                                      | 120|

| Chapter Five: Summary and Conclusions                                                       |   |
| Overview of the Study                                                                       | 124|
| Discussion of Results, Related Literature, Implications, and                               | 127|
| Discussion of Connections Among Quantitative and Qualitative Results                      | 149|
| Limitations of the Study                                                                    | 151|
| Trustworthiness                                                                             | 153|
| Summary and Conclusions                                                                     | 154|

| Appendix A: Mursion Mixed Reality Simulation Environment Information                         | 169|
| Appendix B: Pre-service Teacher Student Participant Consent Form                            | 171|
Appendix C: Course Mixed Reality Simulation Scenario 174
Appendix D: Nonverbal Communication Behavior Observation Tool (NCBOT) 185
Appendix E: Semi-structured Exit Interview Protocol 187
Appendix F: Pre-service Teacher Demographic Survey 190
Appendix G: Semi-structured Coaching Protocol 193
Appendix H: Institutional Review Board (IRB) Approval 196
Appendix I: Site Administrator Approval 198
Appendix J: Course Professor Approval 201
Appendix K: Data Security: Microsoft One Drive Documentation 204
Appendix L: Second Cycle Themes, Categories, and First Cycle Codes 208
Appendix M: Researcher Biography 213
Appendix N: Permissions 215
# LIST OF FIGURES

| Figure 3.1 | Mixed Methods Embedded Research Design | 63 |
| Figure 3.2 | Quasi-experimental One Group Within-Subjects Design | 65 |
| Figure 3.3 | Mixed Reality Simulation Video Capture | 67 |
| Figure 3.4 | Video Analysis Protocol | 72 |
| Figure 3.5 | Data Collection Timeline | 75 |
| Figure 3.6 | Screenshot of Partial List of Codes in NVIVO 12 Plus Software | 81 |
| Figure 4.1 | Boxplots of NIS-O Scores for Time | 88 |
| Figure 4.2 | Qualitative Finding Statement One | 98 |
| Figure 4.3 | Qualitative Finding Statement Two | 107 |
| Figure 5.1 | Possible Model of Connections Between Findings and Among Supporting Themes | 150 |
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2.1</td>
<td>Immediacy Research Studies for Literature Review</td>
<td>15</td>
</tr>
<tr>
<td>Table 2.2</td>
<td>Mixed Reality Simulations in Teacher Education Studies for Literature Review</td>
<td>31</td>
</tr>
<tr>
<td>Table 2.3</td>
<td>Mixed Reality Simulations and Communication Studies for Literature Review</td>
<td>44</td>
</tr>
<tr>
<td>Table 2.4</td>
<td>Video Feedback and Coaching for Communication Skill Development Studies for Literature Review</td>
<td>49</td>
</tr>
<tr>
<td>Table 3.1</td>
<td>Pre-service Teacher Demographic Data</td>
<td>60</td>
</tr>
<tr>
<td>Table 3.2</td>
<td>Nonverbal Communication Behavior Scoring Guide</td>
<td>70</td>
</tr>
<tr>
<td>Table 4.1</td>
<td>Nonverbal Immediacy Scale-Observer Report (NIS-O) Scores for Simulations</td>
<td>87</td>
</tr>
<tr>
<td>Table 4.2</td>
<td>Descriptive Statistics</td>
<td>88</td>
</tr>
<tr>
<td>Table 4.3</td>
<td>Skewness and Kurtosis Tests for NIS-O Scores</td>
<td>89</td>
</tr>
<tr>
<td>Table 4.4</td>
<td>Paired Sign Test for NIS-O Scores – Time 1/Time 2 Comparison</td>
<td>91</td>
</tr>
<tr>
<td>Table 4.5</td>
<td>Paired Sign Test for NIS-O Scores – Time 2/Time 3 Comparison</td>
<td>92</td>
</tr>
<tr>
<td>Table 4.6</td>
<td>Paired Sign Test for NIS-O Scores – Time 1/Time 3 Comparison</td>
<td>93</td>
</tr>
<tr>
<td>Table 4.7</td>
<td>Summary of Paired Sign Test Results</td>
<td>94</td>
</tr>
<tr>
<td>Table 4.8</td>
<td>Pre-service Teacher Age and Simulation Experience Data</td>
<td>96</td>
</tr>
<tr>
<td>Table 4.9</td>
<td>Demographic Information for Pre-service Teacher Participants</td>
<td>97</td>
</tr>
<tr>
<td>Table 4.10</td>
<td>Frequency of Codes for Finding One, Theme One</td>
<td>101</td>
</tr>
<tr>
<td>Table 4.11</td>
<td>Frequency of Codes for Finding One, Theme Two</td>
<td>102</td>
</tr>
<tr>
<td>Table 4.12</td>
<td>Frequency of Codes for Finding One, Theme Three</td>
<td>104</td>
</tr>
<tr>
<td>Table 4.13</td>
<td>Frequency of Codes for Finding Two, Theme One</td>
<td>108</td>
</tr>
<tr>
<td>Table 4.14</td>
<td>Frequency of Codes for Finding Two, Theme Two</td>
<td>111</td>
</tr>
<tr>
<td>Table 4.15</td>
<td>Frequency of Codes for Finding Two, Theme Three</td>
<td>114</td>
</tr>
</tbody>
</table>
Table 4.16  Frequency of Codes for Finding Two, Theme Four  

Table 5.1  Summary of Discussion of Results for Research Question One  

Table 5.2  Finding Statement One Literature Connections, Implications, and Suggested Future Research  

Table 5.3  Finding Statement Two Literature Connections, Implications, and Suggested Future Research
CHAPTER ONE: INTRODUCTION TO THE STUDY

The art of teaching is communication-rich, employing verbal, nonverbal and written modalities. Teachers and students, consciously and subconsciously, send and receive messages that can convey cognitive and affective information as they interact in the classroom (Miller, 2000). Research in communication indicates that the majority of what we communicate is done through nonverbal behaviors (Burgoon, Buller, & Woodall, 1996). Teachers must be able to effectively communicate with students to promote positive learning outcomes (Hunt, Simonds, & Cooper, 2002). State standards address the need for teachers to develop instructional strategies employing both the use of verbal and nonverbal communication behaviors to engage diverse learners, build successful relationships, and promote positive learning environments (Council of Chief State School Officers, 2013).

Nonverbal immediacy skills include nonverbal communication behaviors such as smiling, use of proximity, gesturing, and having a relaxed posture that indicate openness for communication. Teachers’ use of nonverbal immediacy behaviors may have positive effects on students (Andersen, 1979; Burroughs, 2007; Christophel, 1990; Kearney, Plax, Smith, & Sorensen, 1988; Mehrabian, 1971, 1972; Richmond, McCroskey, & Johnson, 2003; Witt, Wheeless, & Allen, 2004). Students of teachers who are perceived as more immediate may exhibit more compliant classroom behaviors (Burroughs, 2007; Kearney et al., 1988), be more motivated to attend class, and experience positive learning outcomes (LeFebvre & Allen, 2014; Witt, Wheeless, & Allen, 2004).

To prepare pre-service teachers for the demands of today’s classrooms, there is a call for teacher preparation programs to move toward a more clinically based approach (CAEP, 2015; Zeichner, 2010) to allow for pre-service teachers to interact and communicate with teachers and
students in the field. These placements, however, require resources and can be costly to implement. Additionally, in areas of the country that are less diverse, there is a concern that field placements will not adequately prepare pre-service teachers for the demands of diverse student populations (Phillion, Miller, & Lehman, 2005).

Mixed reality simulation environments are an emerging technology that allow for pre-service teachers to interact with student avatars to practice skills and rehearse teaching strategies in a safe environment without impacting real students (Dieker, Hughes, Hynes, & Straub, 2017; Dieker, Hynes, Hughes, & Smith, 2008; Dieker, Rodriguez, Lignugaris/Kraft, Hynes, & Hughes, 2013; Dieker, Straub, Hughes, Hynes, & Hardin, 2014). Pre-service teachers’ experiences in the simulations can be aligned with the goals of the teacher educator program (Dieker et al., 2014; O’Callaghan & Piro, 2016). Teachers interact with virtual students that differ with respect to race, gender identity, and personality traits, thus allowing pre-service teachers to apply knowledge gained through college coursework as they deliver lessons to diverse student avatars that often reflect typical students in real classrooms (Dieker et al., 2013; O’Callaghan & Piro, 2016). For additional information on the Mursion® mixed reality simulation environment, refer to Appendix A.

The use of video as a feedback tool in teacher education and instructional coaching has been utilized since the early 1960’s when the concept of microteaching emerged at Stanford University (Knight, 2014). Following trials of an instructional strategy, teachers received video feedback and coaching for the purpose of professional development (Knight, 2014). Today, instructional coaching is a collaborative process where the coach and teacher analyze current reality to set goals for development and improvement (Knight, 2017). Fuller and Manning (1973) described the ability to realistically assess one’s self as one’s capacity to identify discrepancies
between one’s perceived experiences and observations from reviewing video recordings of performances. The use of video analysis to ground the instructional coaching process is powerful as often a truer assessment of reality is revealed (Knight, 2014). This grounding in reality is critical for the processes of goal setting and monitoring one’s progress in meeting goals.

There is a potential that pre-service teachers may develop and improve upon important communication skills, including nonverbal immediacy, as teachers are made aware of their own behaviors, and receive coaching targeted at improvement of effective communication techniques, within mixed reality simulations.

**Rationale**

Nonverbal immediacy behaviors are behaviors such as smiling, gesturing, and having a relaxed posture that indicate warmth, friendliness, and willingness to engage in communication (Mehrabian, 1971, 1972). In the educational context, teachers’ use of nonverbal immediacy behaviors has been shown to affect students’ levels of motivation, compliance, affective learning, and academic achievement (Andersen, 1979; Burroughs, 2007; Christophel, 1990; Kearney et al., 1988; Richmond et al., 2003; Witt, Wheeless, & Allen, 2004).

The use of video as a feedback tool in teacher professional development is well-documented (Fuller & Manning, 1973; Knight, 2014; Tripp & Rich, 2012) and coaching within mixed reality simulations has been shown to impact teachers’ targeted behaviors (DeSantis, 2018). However, mixed reality simulation environments are an emerging technology, and there is a lack of research in this area (Dieker et al., 2008; Dieker et al., 2014).

This study on the effect of video and reflection, video feedback and coaching on pre-service teacher learning within the emerging technology of a mixed reality simulation
environment can help inform best practices for teacher educators that prepare future teachers to meet the demands of today’s diverse classrooms.

**Statement of the Problem**

Teacher nonverbal immediacy behaviors are behaviors including gesturing, posture, and eye gaze that decrease psychological distance and increase feelings of warmth and approachability between teachers and students (Mehrabian, 1971; Richmond et al., 2003). Although research supports the connections among teacher nonverbal immediacy behaviors, positive teacher-student relationships, and student achievement, (Christophel, 1990; McCroskey & Richmond, 1992; Velez & Cano, 2008), little coursework in undergraduate teacher preparation programs is devoted to the development of these skills (CAEP, 2015; CCSSO, 2013). Teacher immediacy skills are important in developing positive student-teacher relationships and have been shown to positively affect student motivation and learning (Christophel, 1990; LeFebvre & Allen, 2014), and align with high-leverage teaching practices. High-leverage practices are foundational teaching practices that are critical to advance student learning and teacher pedagogical skills (Ball & Forzani, 2010; Teaching Works, 2020). Further study is needed to determine the effectiveness of this emerging technology within teacher preparation programs to impact teacher learning and practice to positively affect students (Dieker et al., 2008) and specifically, to understand pre-service teachers’ immediacy behaviors within mixed reality simulations.

**Significance of the Research**

This mixed-methods study was used to examine the effect of video and reflection, video feedback and coaching on pre-service teachers’ use of nonverbal immediacy behaviors as they delivered lessons within mixed reality simulations. The simulation environment allows for pre-
service teachers to practice communication and pedagogical skills with student avatars before honing their competencies with live students (Dieker et al., 2017; Dieker et al., 2013; O’Callaghan & Piro, 2016; Pankowski & Walker, 2016). Currently, there is a paucity of research within the field of education on the use of immersive environments in teacher preparation programs (Dieker et al., 2013; Judge, Bobzien, Maydosz, Gear, & Katsioloudis, 2013). Few studies have examined the impact of using mixed reality simulations to promote communication competencies (Taylor, Tucker, Donehower, Pabian, Dieker, Hynes, & Hughes, 2017; Walker, Vasquez, & Wienke, 2016). This study examines how the use of video and reflection, video feedback, and coaching, within mixed reality simulation environments, can be utilized within a teacher preparation program to develop teacher nonverbal immediacy skills that align with high leverage teaching practices.

**Potential Benefits**

The purpose of this study was to explore the effect of video and reflection, video feedback and coaching within mixed reality simulations on pre-service teachers’ nonverbal immediacy skills within a teacher preparation program. This research may help inform best practices for teacher preparation programs in impacting teacher learning and practice to positively affect student outcomes in classrooms. Additionally, this research may inform how mixed reality simulation environments can assist pre-service teachers in developing important communication skills that align with high-leverage teaching practices that may lead to positive student outcomes.
Definition of Key Terms

1. An **avatar** is a “perceptible digital representation whose behaviors reflect those executed, typically in real time, by a specific human being” (Nagendran, Pillat, Kavanaugh, Welch, & Hughes, 2014, p. 110).

2. **High leverage teaching practices** are foundational teaching practices that are critical to promote social and emotional development and advance student learning while also increasing teacher pedagogical skills (Ball & Forzani, 2010; Teaching Works, 2020).

3. **Simulation Specialists**, formerly known as “interactors,” are live actors and digital puppeteers who manipulate and control student avatars within the mixed reality simulation environment provided by Mursion® (Dieker et al., 2008).

4. **Mixed reality simulation environments** are environments that employ a combination of virtual reality and actual reality within the same environment (Milgram, Takemura, Utsumi, & Kishino, 1994).

5. **Pre-service teachers** are enrolled at a university and pursuing coursework that will prepare them to perform duties of a teacher serving students of varying ages and abilities and within various content areas (NCES, 1999).

6. **Teacher nonverbal immediacy behaviors** are teacher behaviors such as smiling, looking, gesturing, and having a relaxed posture that could create physical or psychological closeness between teachers and students (Mehrabian, 1971). This set of behaviors convey approachability, warmth, and availability for communication.
Brief Literature Review

The impact of a video and reflection, video feedback, and coaching treatment package within mixed reality simulations on pre-service teachers’ nonverbal immediacy behaviors was examined in this study. Fundamental theories and research related to the present study were explored. Research focused on teacher nonverbal immediacy and its impact on student outcomes, mixed reality simulations, and the use of video feedback and coaching for teacher development. There is a lack of research in the area of pre-service teacher learning within mixed reality simulations.

Overview of Methodology

To examine the effect of a video and reflection, video feedback, and coaching treatment package within mixed reality simulations, the present study employed a mixed methods design (Creswell & Plano Clark, 2011). The quantitative component followed a quasi-experimental one-group, repeated measures design (Fraenkel, Wallen, & Hyun, 2012), while the qualitative component was a case study design (Creswell & Poth, 2018; Yin, 2014) bound by participants’ enrollment in a pre-service teacher preparation course which embeds mixed reality simulations within its curriculum. Two research questions provided for the framework of the study. The two research questions were:

1. Using the Nonverbal Immediacy Scale - Observer Report (NIS-O), is there a statistically significant difference over time between pre-service teachers’ nonverbal immediacy behaviors for three rounds of data collected, before, during, and at the conclusion of a semester in which a video and reflection, video feedback, and coaching treatment package is administered following mixed reality simulations?
2. What are the perceptions of pre-service teachers’ reflection and use of nonverbal immediacy behaviors over the course of a semester in which they received video, video feedback, and coaching while utilizing a mixed reality simulation environment?

Over the course of the Fall 2019 semester, 15 \((n = 15)\) pre-service teacher student participants received a video and reflection, video feedback, and coaching treatment within mixed reality simulations which targeted their use of nonverbal immediacy behaviors as part of their teacher preparation program. Demographic data were collected and pre-service teacher participants’ nonverbal immediacy scores, as measured by the NIS-O, were collected following each of three mixed reality simulations embedded within an Educational Psychology course. Additionally, a semi-structured exit interview was conducted following the third and final coaching session.

Quantitative data were analyzed to address research question one. A paired Sign test procedure was employed and a statistically significant difference in pre-service teachers’ nonverbal immediacy, as measured by the NIS-O, was found for the pairwise comparison between the second (Time 2) and third (Time 3) simulation session. No additional statistically significant differences in scores were found.

Qualitative participant exit interview data were analyzed through a systematic process employing both inductive and deductive coding methods (Miles, Huberman, & Saldaña, 2014). A first cycle of coding (Miles et al., 2014; Saldaña, 2016) employing descriptive, process, and \textit{in vivo} coding methods was used to develop initial codes. Deductive codes, informed by the research question and the literature on nonverbal immediacy, mixed reality simulations, video feedback, and coaching were used to analyze chunks of data. Inductive coding methods (Miles et al., 2014) allowed for the emergence of additional codes.
A second cycle of coding employed pattern coding methods (Miles et al., 2014; Saldana, 2016) to further condense the data, and allowed for the emergence of categories, themes, and two finding statements (Adu, 2019; Saldana, 2016). Qualitative data were also collected via researcher notes collected during live simulations and during a researcher video analysis process with respect to the participants’ use of nonverbal immediacy and responses by the avatars for data triangulation purposes.

In Chapter Two, the theoretical underpinnings of nonverbal immediacy and empirical research within the context of education are detailed. Additionally, mixed reality simulations, video feedback, and instructional coaching for teacher development are described and relevant empirical research are highlighted.
CHAPTER TWO: REVIEW OF THE LITERATURE

This mixed methods research study was used to explore the effect of video feedback and coaching on pre-service teachers’ nonverbal immediacy behaviors as they experienced a mixed reality simulation environment. The subsequent review of the literature is divided into the following sections: (a) literature review process, (b) immediacy, (c) simulations, (d) video based instructional coaching, and (e) summary of the chapter.

Literature Review Process

The university library’s multi-resource online search portal allowed the researcher to search books in print, e-books, and peer-reviewed articles housed in online databases. Online databases included Academic Search Premier, Communications and Mass Media Complete, Education Research Complete, and the Education Resource Information Center (ERIC). The researcher selected only peer-reviewed articles that aligned with the area of interest.

A search within the university’s print and electronic database interface using the search term “teacher nonverbal immediacy” yielded 173 articles. The search was narrowed by using the Boolean search term, “teacher nonverbal immediacy” AND teacher education AND “student learning” which yielded 120 results. Titles and abstracts of returned articles were reviewed by the researcher for relevance to the study. Resources identified within articles were also explored, and relevant articles were selected for review. A search using the Boolean search terms “teacher preparation” AND “nonverbal immediacy” yielded eight articles; two of which were relevant to the present study. When searching for the use of simulations in teacher training on nonverbal immediacy skills, the search terms “teacher nonverbal immediacy” AND “teacher preparation” OR “teacher training” AND “simulation” yielded one reference that was deemed relevant to the study. When the term “communication skills” was used in place of “nonverbal immediacy,” and
a search employing the terms “communication skills” AND “teacher preparation” AND “computer simulations” limited to the last 10 years, four articles were returned. A mixed reality simulation environment is used as part of the methodology of this study, known formerly as “TeachLivE™” and currently as “Mursion®”. Therefore, the researcher explored the literature using the search terms “TeachLivE™” OR “Mursion®” AND “teacher preparation” which returned 47 articles. The TeachLivE™ website was also utilized to identify relevant literature to the current study. The present study employs videotape to ground self-reflection by pre-service teachers and the coaching process by the researcher for the purpose of increasing nonverbal communication skills. A search for literature that employed the use of video for self-reflection and a coaching process for the purpose of improving communication skills was conducted. The Boolean search terms “video for reflection” OR “video feedback” AND “communication” AND “teacher education” AND “coaching” limiting articles in English published within the last 10 years produced 10 results that were not deemed relevant to the present study. Therefore, the search term “coaching” was eliminated, and 22 results were returned. Three studies that analyzed the use of video for self-reflection by pre-service teachers and included coaching in promoting increasing communication skills were included.

**Immediacy**

The immediacy construct, often proposed to be grounded in approach-avoidance theory (Mehrabian, 1971; Witt, Schrodt, & Turman, 2010; Witt, Wheeless, & Allen, 2004), evolved from the work of Albert Mehrabian (1971, 1972) who described his “principle of immediacy” and stated that, “people are drawn toward persons and things they like, evaluate highly, and prefer; and they avoid or move away from things they dislike, evaluate negatively, or do not prefer” (Mehrabian, 1971, p. 1). Immediate communication behaviors decrease the perceived
physical or psychological distance between people and include verbal and nonverbal behaviors that convey warmth, positive affect, approachability, and availability for communication (Andersen, 1978, 1979; Mehrabian, 1971; Richmond, McCroskey, & Hickson, 2008; Richmond et al., 2003; Velez & Cano, 2008). Nonimmediate behaviors can signal unfriendliness, disinterest, and even hostility (Richmond et al., 2008). Immediate behaviors relate to an approach tendency while nonimmediate behaviors relate to an avoidance tendency (Mehrabian, 1971; Richmond et al., 2008). Richmond et al. (2008) suggest a communication immediacy principle from the communicator’s point of view in that, “the more communicators employ immediate behaviors, the more others will like, evaluate highly, and prefer such communicators; and the less communicators employ immediate behaviors, the more others will dislike, evaluate negatively, and reject such communicators” (p. 191). Mehrabian (1971) also addressed the reciprocal nature of immediacy stating that, “immediacy and liking are two sides of the same coin. That is, liking encourages greater immediacy and immediacy produces more liking” (p. 77). Thus, in human communication interactions, the sender’s use of immediate behaviors influences perceptions by the receiver in the communication dyad.

Within the educational context, verbal immediate behaviors include addressing students by name, using inclusive pronouns (e.g., “we” versus “I”), including personal examples, praising students, and using humor in class (Gorham, 1988). Nonverbal immediacy behaviors include smiling, eye contact, use of gestures, and having a relaxed body position (Andersen, 1978; 1979; Andersen, Andersen, 2005; McCroskey & Richmond, 1992; Richmond et al., 2008; Richmond et al., 2003; Woolfolk & Brooks, 1985) that can decrease the physical and perceived psychological distance between teachers and students to promote positive student outcomes (Andersen, 1979;
Theoretical Framework of Immediacy

The construct of immediacy has been studied extensively within the field of instructional communication as an important variable in the teacher-student relationship (Myers, 2010; Nussbaum, 1992), contributing to positive educational outcomes. The effect of nonverbal immediacy in the educational context was first explored by Andersen (1979) in her seminal work which examined teachers’ nonverbal behaviors and their effect on students cognitive and affective learning. According to Bloom (1956), cognitive learning is related to one’s intellectual abilities in recall and knowledge development while affective learning relates to students’ attitudes, emotions, or interests. Findings of additional investigations suggest that teacher use of nonverbal immediacy behaviors increase students’ fondness for a course’s subject matter and instructor (Andersen, 1979; LeFebvre & Allen, 2014; McCroskey & Richmond, 1992; Witt, Wheeless, & Allen, 2004) and positively impact student motivation and learning (Allen, Witt, & Wheeless, 2006; Velez & Cano, 2008). Additionally, teacher immediacy has been found to have a positive relationship with students’ willingness to comply to teacher requests (Burroughs, 2007; Kearney, Plax, & Burroughs, 1991; Kearney et al., 1988; Woolfolk & Brooks, 1985), suggesting a key role in establishing positive learning climates that promote student learning.

Despite the number of investigations of the construct of immediacy, no definitive theory has been developed to date that explains exactly how behaviors, deemed as immediate, positively affect student motivation and learning (Witt et al., 2010). Witt, Schrod, & Turman (2010) pointed out that instructional communication scholars have proposed several explanations including approach-avoidance theory (Mehrabian, 1971, 1972) which asserts that students are
drawn to instructors who smile, engage in eye contact, and use gestures while teaching. Kelley and Gorham (1988) concluded that immediacy influences arousal which affects attention, and students’ attention is necessary for cognitive learning. Butland & Beebe (1992) reasoned that teacher immediacy elicits feelings of pleasure and liking for the instructor and course subject matter which positively impacts student learning. Witt (2008) suggested that immediacy is rooted in Communicative Connection Theory, which posits that teacher immediacy assists in establishing positive psychological connections with students which enhances the learning environment and promotes positive learning outcomes.

**Immediacy, Instructional Communication, and Pre-service Teachers**

McCroskey and Richmond (1992) asserted that to adequately prepare novice teachers for the demands of the classroom environment, explicit training in verbal and nonverbal communication skills is critical. Teacher preparation programs that not only teach content-related subject matter, educational theory, and pedagogy, but include instructional communication concepts, could better prepare beginning teachers to promote positive classroom climates to affect student learning. Teachers may become more immediate as they become aware of, and focus on increasing, their own level of nonverbal immediate behaviors (McCroskey & Richmond, 1992; Velez & Cano, 2008).

**Focused Review of Immediacy in the Educational Context**

In order to understand the construct of immediacy in the educational context, and its impact on positive educational outcomes, a focused review of empirical research was conducted. Explorations included the effect on student learning, motivation, and behavior management for successful student academic outcomes. Most of the literature on the impact of teachers’ nonverbal immediacy on student educational outcomes are studies that were conducted within
higher education settings and are included in the review. In Table 2.1, relevant research about the impact of teacher use of immediacy behaviors on positive educational outcomes are described.

**Table 2.1**

*Immediacy Studies Related to Teacher Immediacy and Educational Outcomes*

<table>
<thead>
<tr>
<th>Topic/Investigators</th>
<th>Participants/Studies</th>
<th>Purpose</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher immediacy and teacher effectiveness; Andersen (1979)</td>
<td>College students ((n = 238)) enrolled in an introductory communications course and their professors ((n = 13))</td>
<td>This seminal researcher examined immediacy in the educational context as a potential predictor of teacher ability to impact student learning.</td>
<td>The construct of immediacy, when applied to the educational context, may be an influential variable in the teacher-student relationship and a predictor of student learning.</td>
</tr>
<tr>
<td>Teacher immediacy and student learning; Witt, Wheeless, and Allen (2004)</td>
<td>Meta-analysis of 81 studies ((n = 24,474))</td>
<td>This meta-analysis reviewed findings of research studies dealing with the relationship of teacher immediacy on student learning.</td>
<td>Teacher immediacy appears to influence students’ perceived affective ((r = .49)) and perceived cognitive learning ((r = .51)) at higher levels than students’ cognitive learning as obtained by traditional measures, like tests ((r = .17)).</td>
</tr>
<tr>
<td>Graduate teaching assistants’ immediacy and student learning; LeFebvre and Allen (2014)</td>
<td>Undergraduate students ((n = 256)) taught in lecture/laboratory or self-contained settings by 20 teaching assistants</td>
<td>The researchers examined the impact of immediacy on students’ cognitive and affective learning.</td>
<td>A positive relationship between teacher immediacy and students’ cognitive ((r = .21, p &lt; .001, n = 256)) and affective ((r = .43, p &lt; .01, n = 256)) suggests that beginning teachers should develop immediacy skills to promote positive student educational outcomes.</td>
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<tr>
<th>Topic/Investigators</th>
<th>Participants/Studies</th>
<th>Purpose</th>
<th>Findings</th>
</tr>
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<tbody>
<tr>
<td>Relationship among teacher immediacy, student motivation, and learning; Christophel (1990)</td>
<td>Two separate studies comprised the research – Study One ( (n = 562 ) college students); Study Two ( (n = 624 ) college students)</td>
<td>The research explored the relationship among teacher immediacy, student motivation, and student cognitive and affective learning.</td>
<td>Positive, statistical correlations between immediacy and learning, immediacy and student state motivation, and student motivation and learning were found.</td>
</tr>
<tr>
<td>Testing of a causal model of the relationship among teacher immediacy, student motivation, and cognitive learning; Allen, Witt and Wheless, (2006)</td>
<td>Use of previous meta-analysis of 81 studies; additional meta-analysis across 8 studies that explore the impact of teacher immediacy, affective learning, and cognitive learning.</td>
<td>The researchers tested a causal model of immediacy that posits teacher immediacy impacts students’ affect or motivation which impacts cognitive learning.</td>
<td>Results indicated support for the proposed causal model where teacher immediacy predicts student affective learning/motivation and affective learning predicts cognitive learning.</td>
</tr>
<tr>
<td>Relationship among teacher immediacy, student compliance, and prosocial / antisocial strategies; Kearney, Plax, Smith, and Sorensen (1988)</td>
<td>Undergraduate students ( (n = 629) ) enrolled in communication classes</td>
<td>The researchers investigated the effects of teachers’ level of nonverbal immediacy and prosocial / antisocial strategies on college students’ likelihood of resisting teacher compliance-gaining attempts.</td>
<td>Findings indicated that student compliance is highest when teachers are perceived as nonverbally immediate, employing prosocial verbal compliance-gaining strategies. Additionally, results suggest the important role of an instructors’ consistency between their verbal and nonverbal communication with students.</td>
</tr>
<tr>
<td>Teacher nonverbal immediacy, student compliance/ resistance, and student learning; Burroughs (2007)</td>
<td>Undergraduate students ( (n = 564) ) enrolled in various general educational courses</td>
<td>The study examined the relationship between teacher nonverbal immediacy, student compliance/noncompliance, and student compliance/noncompliance with student perceived cognitive and affective learning in actual classrooms.</td>
<td>A significant, positive result for compliance and nonverbal immediacy was found ( (r (562) = .29, \ p &lt; .001) ). Student compliance had a statistically significant effect on both perceived cognitive and affective learning.</td>
</tr>
</tbody>
</table>
**Immediacy and teacher effectiveness.** The construct of immediacy was first applied to the educational context by Andersen (1978; 1979) in her seminal work which examined the construct of teacher immediacy and its impact on teacher effectiveness (Özmen, 2010) and spurred subsequent investigations of teacher immediacy and its relationship with student learning (Witt, Wheeless, & Allen, 2004). Teacher effectiveness was conceptualized as the ability of teachers to produce cognitive, affective, and behavioral student learning.

Teacher nonverbal immediacy was examined as a possible predictor of cognitive, affective, and behavioral learning (Andersen, 1979). Data were collected from 238 college students enrolled in an introductory communications course ($n = 238$) taught by 13 different professors ($n = 13$) simultaneously. Four aspects of affect were examined in the study. Student affect toward the communication practices suggested in the course, the content of the course, the course instructor, and the course in general, was measured using previously validated scale instruments. Two aspects of students’ behavioral commitment, the likelihood of attempting to engage in practices suggested in the course and the likelihood of enrolling in another course of similar content, were measured using four semantic differential scales (Andersen, 1979). Student performance on a 50-item multiple choice exam served as the measure of cognitive learning for this investigation. The construct of immediacy was measured using two instruments, the Behavioral Indicants of Immediacy Scale (BII) and the Generalized Immediacy Scale (GI). The BII, a 15-item, Likert-type scale instrument, examined specific nonverbal behaviors related to the immediacy construct (e.g., instructor use of gesturing, smiling, eye contact, and vocal expressiveness) while the GI scale, a 9-item scale instrument, measured the students’ general perception of the level of immediacy of their instructor (Andersen, 1979).
Multiple regression statistical analysis was employed to determine the predictive role of teacher nonverbal immediacy in affective, behavioral, and cognitive learning. With respect to student affect, Andersen (1979) found that immediacy contributed 21.93% of the variance in student affect toward communication practices suggested in the course ($F(2/235) = 33.01$), 19.19% of the variance in student affect toward the content of the course ($F(2/235) = 27.90$), 13.37% of the variance in student affect toward the course in general ($F(2/202) = 15.59$) and 46.32% of the variance of student affect toward the instructor ($F(2/235) = 101.41$). Andersen (1979) found that with respect to behavioral commitment and students’ likelihood of engaging in the communication practices as suggested in the course, immediacy predicted 18% of the variance ($F(2/235) = 25.80$). Additionally, Andersen’s (1979) results revealed that teacher immediacy also predicted 18.31% of the variance in students’ likelihood of enrolling in a course of similar content ($F(2/235) = 26.34$).

Teacher immediacy, however, did not significantly predict students’ measure of cognitive learning in the study. Andersen (1979) noted that the single score on the exam may not have accurately measured cognitive learning. Additionally, she suggested the possibility that the timing of the measure, administered early in the semester, may not have allowed for the relationship to develop. Andersen (1979) suggested that “teacher-student relationships may be improved by teaching teachers to be more immediate,” (p. 557) as the results indicated that nonverbal immediacy is a strong predictor of student affect toward the instructor.

**Teacher immediacy and student learning.** The introduction of a measure of cognitive learning, a perceived “learning loss” measure (Richmond, McCroskey, Kearney, & Plax, 1987), spurred several studies that were used to explore the relationship of nonverbal immediacy and perceived cognitive learning (Witt, Wheeless, & Allen, 2004). The “learning loss” score was
obtained by asking participants to rate their level of learning in a class on a zero through nine scale (Richmond, McCroskey, et al., 1987). Secondly, respondents followed the same procedure about their level of perceived learning had they had an ideal instructor. The first rating was subtracted from the second, which resulted in a “learning loss” score. This measure served to adjust the initial rating of cognitive learning to consider students’ preconceived attitudes toward certain classes (Richmond, McCroskey, et al., 1987).

In their meta-analysis of 81 studies \( (n = 24,474) \), Witt, Wheeless, and Allen (2004) examined the relationship between immediacy and student cognitive, affective, and perceived learning. The scholars created a “perceived learning” category before conducting their investigation “…because of the large number of studies using the learning loss measure and the questions surrounding the validity of learning loss as a cognitive measure” (Witt et al., 2004, p. 198). Results of the meta-analysis revealed a strong, positive relationship was found between overall teacher immediacy and overall student learning, average \( r = .500 \), var. = .037, \( k = 81 \), \( n = 24,474 \) (Witt et al., 2004). Overall student learning included studies that examined cognitive learning and used traditional measures (i.e., tests), affective learning which included behavioral aspects, and perceived learning which used the self-reported measure. Similar results were obtained (average \( r = .481 \), var. = .040, \( k = 68 \), \( n = 21,171 \)) when only the effect of nonverbal immediacy on overall student learning was examined (Witt et al., 2004).

When the relationship of nonverbal immediacy and each of the three categories of learning were examined individually, meta-analysis revealed studies that examined nonverbal immediacy and perceived learning (average \( r = .510 \), \( k = 44 \), \( n = 13,313 \)) were similar to results from studies that examined the relationship of nonverbal immediacy and affective learning (average \( r = .490 \), \( k = 55 \), \( n = 17,328 \)). Outcomes of studies that examined nonverbal immediacy
and cognitive learning, (average $r = .166$, $k = 11$, $n = 3,777$), revealed the lowest associations. The authors noted that the studies included in their meta-analysis did not investigate cognitive learning over time, and that if affect provides motivation for cognitive learning over time, “then the statistically significant (albeit small) results provide credibility and have implications for future research” (Witt et al., 2004, p. 200). Longitudinal studies may offer more insight into the relationship of teacher immediacy on student learning.

**Beginning teacher immediacy and student learning.** The relationship between nonverbal immediacy of teaching assistants or beginning teachers, teaching in self-contained or lecture/laboratory settings, and students’ affective and cognitive learning, was recently studied at a mid-western public university (LeFebvre & Allen, 2014). In their investigation, 256 undergraduate students enrolled in one of 20 sections of an introductory public speaking course, taught by a total of 20 teaching assistants, were surveyed. The Nonverbal Immediacy Scale - Self Report (Richmond et al., 2003) was used to evaluate students’ perceptions of their instructors’ level of immediacy. Students’ perceptions of affective learning, which included their feelings about the course content and instructor, were collected utilizing the Affective Learning Measure (McCroskey, 1994). The students’ overall grade for the course served as the measure of cognitive learning.

No statistical difference ($t(254)$, $p = .88$) on the level of immediacy was found between teaching assistants teaching in a self-contained setting ($M = 97.55$, $SD = 10.50$, $n = 139$) and teachers instructing in a setting which consisted of a combination of a lecture/laboratory ($M = 97.74$, $SD = 9.99$, $n = 117$). However, teacher immediacy impacted cognitive and affective learning of students in both settings. A significant, positive relationship between teachers’ nonverbal immediacy behaviors and students’ cognitive learning, as measured by the final grade
for the course, was found \( (r = .21, p < .001, n = 256) \). Students that perceived their teachers to be more immediate received higher course grades. Additionally, immediacy correlated positively with students’ affective learning \( (r = .43, p < .01, n = 256) \). Student learning was impacted by immediacy regardless of the class format. The researchers concluded that the findings in the investigation supports the training and development of beginning teachers’ nonverbal immediacy skills to promote positive educational outcomes for students (LeFebvre & Allen, 2014).

**Relationship among teacher immediacy, student motivation, and student perceived learning.** Christophel (1990) sought to understand the relationship among teacher immediacy, student state motivation, and perceived cognitive learning. Students’ state motivation for learning is temporary in nature, and reflective of students’ attitudes toward a course at a period of time. Conversely, trait motivation is reflective of a students’ general level of motivation or attitudes toward learning that are consistent over time (Christophel, 1990).

Two separate studies comprised the total of this research. In the first study, 562 graduate and undergraduate students completed three survey instruments related to their perceived level of teacher immediacy, trait/state motivation or affective learning, and cognitive learning. In an effort to collect immediacy behavior data from a wide variety of teachers and classes, students were asked to rate the level of teacher immediacy and their perception of their level of trait/state motivation and cognitive learning from the class they were enrolled in that took place immediately prior to the class in which the surveys were administered. Teacher immediacy was measured via the Immediacy Behavior Scale which included items that reflected verbal immediacy (Gorham, 1988) and nonverbal immediacy (Richmond, Gorham, & McCroskey, 1987) behaviors. The Trait/State Motivation Scales (Christophel, 1990) measured perceived student motivation or attitudes for learning in general, and for the course immediately preceding
the one in which they were enrolled. Perceived cognitive learning was measured using two items related to students’ perceived learning in the class and perceived learning had they had an ideal instructor. The resulting “learning loss” score (Richmond, McCroskey, et al., 1987), obtained by subtracting students’ rating in the first question from the second, generated the students’ overall cognitive learning scores. Affective learning, or positive attitudes about the instructor, the course in general and content, and likelihood of enrolling in a similar course or in a course taught by the same instructor, was also measured via an affective learning scale instrument (McCroskey, Richmond, Plax, & Kearney, 1985). Six elements were measured and an overall affective learning score, as well as sub-scores, were computed.

In the second study, approximately half of the students in each class were asked to complete the immediacy and motivation scales and the other half of the students were asked to complete the motivation and learning scales based on the class in which they were currently enrolled. Correlational and regression analyses of data collected in the first study were conducted to determine the relationship among teacher immediacy, motivation, and learning. Results of correlational analyses found significant, positive relationships between overall teacher immediacy and student state motivation (r = .49, n = 562, p < .001), verbal immediacy and student state motivation (r = .47, n = 562, p < .001), and nonverbal immediacy and student state motivation (r = .34, n = 562, p < .001). Therefore, students who reported higher levels of immediate behaviors by their teachers, also reported higher levels of student motivation. With respect to student perceived learning, a positive, significant relationship between teacher immediacy and perceived cognitive learning (r = .45, n = 562, p < .001) was found; regression analysis indicated that nonverbal immediacy was more predictive of student learning than verbal immediacy. Partial correlation analysis revealed that much of the variance in learning scores
predicted by nonverbal immediacy was due to the predictor variable, state motivation. According to Christophel (1990), the data suggested that nonverbal immediacy initially modifies student state motivation before affecting student perceived learning, which aligns with the approach-avoidance aspect of motivation theory.

In the second study, scores obtained from Group A \( (n = 624) \) were comprised of student trait/state motivation and immediacy scales and represented half of the class. The remaining half, Group B, \( (n = 624) \) reported scores for the motivation scales and learning instruments. Group C, or “Classes,” were the average of reported scores of participants in Group A and B. Correlations and regression analysis of data obtained in the second study revealed similar findings as the first study. Teacher immediacy was positively correlated with student motivation \( (r = .60, n = 60, p < .001) \), cognitive learning \( (r = .40, n = 60, p < .001) \), and total affective learning \( (r = .53, n = 60, p < .001) \). Further data analysis exploring the degree that teacher immediacy and student state motivation were collinear predictors of learning, revealed similar findings as in the first study. Therefore, findings suggest that in general, teacher nonverbal immediacy initially modifies student state motivation to affect student perceived learning (Christophel, 1990).

**A causal model: Immediacy, Affective Learning, and Cognitive Learning.** A causal model which explored the relationship of teacher immediacy and students’ affective learning as an intermediary outcome leading to potential higher levels of cognitive learning was investigated through meta-analysis by Allen, Witt, and Wheeless (2006). The researchers posited that teacher immediacy would function as a source of positive reinforcement for students, which would in turn motivate students to perform (Allen et al., 2006). Two-thirds of the required correlational data were obtained from another meta-analysis by the same researchers (Witt, Wheeless, & Allen, 2004) and used to test the model. The relationship between immediacy and cognitive
learning was estimated, $r = .13, k = 16, n = 5,437$. The relationship between immediacy and affective learning was estimated, $r = .50, k = 81, n = 24,474$. Eight studies were identified from the first study (Witt et al., 2004) that met the criteria to allow for estimation of an average correlation between cognitive and affective learning (Allen et al., 2006), and a positive correlation was found ($r = .08, k = 8, n = 1,449$). The model was tested, and results supported the notion that teacher immediacy behaviors predict student affective learning (Allen et al., 2006). Results suggested a direct relationship between teacher immediacy and affective learning and motivation and an indirect relationship with cognitive learning (mediated by student motivation). The scholars contended that teacher immediacy may have more of an impact on student learning than the data show, as the small effect revealed by the data reflected only a snapshot in time in an individual class. In their view, the cumulative effect of teacher immediacy should be considered (Allen et al., 2006).

**Teacher immediacy and student behavior management.** Teachers promote student learning by effectively establishing positive learning climates where students behave appropriately, are engaged in learning, and are motivated to complete coursework that leads to positive educational outcomes (Back, Polk, Keys, & McMahon, 2016; Barr, 2016). Kearney et al. (1988) investigated the interaction between teachers’ nonverbal immediacy behaviors and use of verbal prosocial and antisocial strategies to gain student compliance. Prosocial strategies were conceptualized as reward-based and meant to encourage students and convey concern for a student’s success. Conversely, antisocial strategies are punishment-based and foster competitiveness and erode students’ dignity (Kearney et al., 1988). The researchers hypothesized that teacher nonverbal immediacy and use of compliance-gaining verbal strategy would affect students’ resistance to comply with teacher requests. The researchers posited that, “the use of
verbal strategies that are asynchronous with teachers’ immediacy or nonimmediacy orientation may prompt more student resistance than the use of verbal strategies that are synchronous with teachers’ nonverbal immediacy” (Kearney et al., 1988, p. 58). Therefore, there would be less student resistance to immediate teachers employing prosocial strategies than antisocial strategies. However, nonimmediate teachers employing prosocial verbal strategies would be resisted more than instructors employing antisocial strategies, as the verbal and nonverbal messages are inconsistent, and may seem disingenuous (Kearney et al., 1988).

One of four scenarios or treatments were administered to undergraduate students enrolled in communication classes ($n = 629$). The scenarios described a teacher that exhibited one of four combinations of nonverbal immediacy and verbal strategies: nonverbally immediate, employing prosocial verbal strategies; immediate using antisocial strategies; nonimmediate utilizing prosocial strategies; and nonimmediate applying antisocial verbal compliance-gaining strategies.

Results of a two-way ANOVA was significant, $F(1,15) = 9.21$, $p < .01$, eta squared $= 1\%$. Follow-up tests employing Tukey’s test for unconfounded means (critical value for mean differences $= .712$) revealed that student resistance to a teacher perceived as immediate and employing antisocial verbal strategies ($M = 8.5$) was significantly more than resistance to a teacher that was perceived as immediate employing prosocial verbal messages ($M = 7.7$). Student resistance was significantly more when the teacher was perceived as nonimmediate employing antisocial strategies ($M = 13.36$) than the immediate teacher using prosocial messages ($M = 7.7$). However, student resistance to the nonimmediate teacher employing prosocial verbal messages ($M = 15.2$) was resisted more than the nonimmediate teacher utilizing antisocial messages ($M = 13.36$). Therefore, the results suggest the important role of consistency when one considers the role of nonverbal behavior and verbal communication. Further statistical analysis that examined
the main effects for immediacy ($F(1,515) = 199.67, p < .001, \eta^2 = .27\%$) and strategy type ($F(1,515) = 2.29, p > .05, \eta^2 = .004\%$) revealed a significant immediacy effect ($F(1,515) = 21.678, p < .001$), suggesting the important role of nonverbal immediacy behaviors and their effect on student behavior management (Kearney et al., 1988).

**Teacher immediacy, student behavior management, and learning.** The relationship between teacher nonverbal immediacy and students’ compliance-resistance to teacher requests with students’ perceived affective and cognitive learning was explored in the context of actual classrooms in Burroughs’ (2007) study of 564 undergraduate students. During the 13th week of the semester, undergraduate participants enrolled in a variety of general education courses completed questionnaires about their willingness to comply with teacher requests, compliance-resistance strategies, perceived cognitive and affective learning, and the immediacy level of their instructor of the class they had immediately before the class in which they were surveyed. Simple correlation analysis revealed a significant, positive result for compliance and nonverbal immediacy, $r(562) = .29, p < .001$, accounting for 8\% of the variance. The findings suggest that students are more willing to comply with teachers they perceive as nonverbally immediate (Burroughs, 2007).

Additional analysis, employing a one-way ANOVA procedure, explored the degree to which students’ compliance or resistance behaviors affected their perceived affective and cognitive learning. Students’ perceived cognitive learning was measured by asking students to rate on a scale from zero through nine, with zero meaning they learned nothing and nine indicating they learned more than any other class taken, resulting in a simple learning score. Students were asked to answer a second question about their perceived level of learning, using the same rating scale, but in the context of them having an ideal instructor. A “learning loss”
score was computed by subtracting the simple learning score from the second score (Richmond, McCroskey, et al., 1987). The effect of students’ compliance-resistance was statistically significant for both simple learning \(F(2, 203) = 13.09, p < .05, \eta^2 = .11\) and learning loss \(F(2, 203) = 10.37, p < .05, \eta^2 = .09\). With respect to affective learning, significant outcomes were obtained for attitudes toward the content of the course \(F(2, 203) = 6.47, \eta^2 = .06\), the instructor \(F(2, 203) = 11.85, \eta^2 = .10\), likelihood of enrolling in a related course of similar content \(F(2, 203) = 5.38, \eta^2 = .05\), and the likelihood of enrolling in another course with the same instructor \(F(2, 203) = 9.43, \eta^2 = .09\). The findings with respect to learning suggest that students who are more compliant have higher affect toward the course and instructor, and perceive they learn more from the course. Overall, the research suggested that teacher nonverbal immediacy positively affects students’ willingness to comply with teacher requests for a course, which positively affects students’ perceived learning (Burroughs, 2007).

**Simulations**

Sauvé, Renaud, Kaufman, & Marquis (2007) define a simulation as, “a simplified, dynamic, and accurate model of reality that is a system used in a learning context” (p. 253). Unlike games, simulations are non-competitive, serve as a model of real-life scenarios, are often tied to educational objectives, and allow learners to study real phenomena that is often complex in nature (Kaufman & Ireland, 2016; Suavé et al., 2007). Simulations offer novices in fields such as medicine, business, and teaching the opportunity to practice and apply theoretical skills learned in coursework to realistic situations and environments (Bradley & Kendall, 2014; Dawson & Lignugaris/Kraft, 2017; Dede, 2009; Dieker et al., 2017; Wang & Su, 2018). Simulations have been used for training purposes in complex and often risky fields such as aviation, the military, and medical fields for decades. In the field of education, however, the
application of simulations is relatively new (Bradley & Kendall, 2014; Dieker et al., 2013; Kaufman et al., 2016; Shaffer et al., 2001).

**Simulations in Education**

In the educational context, simulations originated as written case studies, videos, or role-plays within teacher preparation classes for the purpose of learning targeted skills (Dieker et al., 2014). As technology evolved, simulations have evolved, and several types of simulations are available to be used for educational purposes. These simulations can be categorized as single user programs, Multi-User Virtual Environments, and mixed reality virtual puppetry simulations (Bradley & Kendall, 2014). Due to the scope of the present study, the following section is limited to literature about the use of mixed reality simulations in education.

**Mixed Reality Simulations**

A mixed reality simulation environment, like augmented reality, combines elements of reality and virtual reality. According to Milgram and Kishino (1994), augmented reality and mixed reality environments lie in the middle of a continuum between actual reality and virtual reality. Effective simulations are realistic, personalized learning experiences where participants feel a sense of immersion and an impression of participation within the digital environment (Dede, 2009). Mixed reality simulations allow for repeated practice of targeted skills without harm to others (Dieker et al., 2008; Dieker et al., 2013; Dieker et al., 2014; Kaufman et al., 2016).

**Mixed reality simulations in education.** In the field of teacher preparation, mixed reality environments allow for virtual situated learning experiences (Brown, Collins, & Duguid, 1989) that enable teacher candidates to take on the role of a teacher and practice communication and pedagogical skills in an immersive environment (Dieker et al., 2013; Dieker et al., 2014).
**TeachLivE™/Mursion® mixed reality simulation environment.** A multidisciplinary group of educators and scientists at the University of Central Florida created the TeachLivE™ mixed reality simulation environment, now commercialized as Mursion®, to help recruit and prepare pre-service math, science, and special education teachers for the demands of the complex teaching environment (Dieker et al., 2008; Hudson, Voytecki, Owens, & Zhang, 2019; Schlueb, 2015). Mursion® provides simulation environments for development of technical and interpersonal skills of personnel in fields such as business, health care, defense, and education (Mursion®, Inc., 2019a). The educational environment looks much like an elementary, middle school, or high school classroom, and includes props such as whiteboards, books, and desks (Dieker et al., 2014; Mursion®, Inc., 2019b). Sitting at the desks are a diverse group of virtual student avatars, representing a range of personality types and abilities, that can exhibit certain behaviors depending on the objectives of the simulation (Dieker et al., 2014). Trained human simulation specialists then control student avatars to enable learners to “…become empathetic to the emotions, abilities, and circumstances of the avatar” (Mursion®, Inc., 2019b, p. 2). Pre-service teachers, in this environment, begin to apply their understanding of diversity in utilizing their knowledge of teaching strategies with student avatars of differing personalities, abilities, and cultural backgrounds that are reflective of real classrooms (Dawson & Lignugaris/Kraft, 2017; Dieker et al., 2013). In this environment, the pre-service teacher can practice a teaching strategy, behavior management technique, or other targeted practice while having the opportunity to pause the simulation to correct any errors or to get feedback and restart the simulation (Dieker et al., 2013; Dieker et al., 2014). The controlled environment, unlike a real classroom, allows for pre-service teachers to engage in multiple rehearsals of a practice without
affecting live students or taking up valuable classroom instructional time (Dieker et al., 2013; Dieker et al., 2014).

**Mixed Reality Simulations Empirical Research**

The following section details empirical research that examines the use of mixed reality simulations for teacher professional development. Literature related to teachers’ learning of specific teaching strategies to support academic and behavior outcomes are reviewed. Additionally, a study that examines the length of exposure to mixed reality simulations on pre-service teachers’ sense of self-efficacy is discussed. Moreover, the use of mixed reality simulations to promote verbal and nonverbal communication skills are included in the review.

**Mixed Reality Simulations and Teacher Professional Development**

In Table 2.2, studies that aligned with the use of the Mursion® mixed reality system in teacher professional development were reviewed. Participants across the studies included regular and special education pre-service and in-service teachers.
### Table 2.2

*Mixed Reality Simulations in Teacher Education*

<table>
<thead>
<tr>
<th>Topic/Investigators</th>
<th>Participants/Studies</th>
<th>Purpose</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of fully immersive mixed reality simulations, feedback, and coaching for teacher training in specific teaching strategies; Garland, Vasquez, and Pearl (2012)</td>
<td>Special Education teachers enrolled in an Autism Spectrum Disorder advanced certification program ( (n = 4) )</td>
<td>The researchers investigated the use of a fully immersive mixed reality simulation environment and coaching on the development of Discrete Trial Teaching (DTT); a teaching strategy used with students on the Autism spectrum.</td>
<td>All four participants markedly improved their implementation of the DTT strategy; participants felt more confident following the treatment in using the technique and felt more comfortable making mistakes with an avatar rather than a live student.</td>
</tr>
<tr>
<td>The effect of data driven feedback and coaching within mixed reality simulations on pre-service teachers’ perceived sense of self-efficacy and on development of higher-order questioning strategies; DeSantis (2018)</td>
<td>Pre-service teachers enrolled in a teacher preparation course that embeds mixed reality simulations into the curriculum ( (n = 30) )</td>
<td>This study explored the effect of data driven feedback and coaching on the development of pre-service teachers’ perceived sense of self-efficacy and development of higher order questioning strategies</td>
<td>A significant effect of the impact of data driven feedback and coaching on higher order questioning strategies within mixed reality simulations was found. Participants who experienced the treatment expressed they recognized their growth in questioning skills, lesson planning, and lesson delivery.</td>
</tr>
<tr>
<td>Mixed reality simulation and in-service teacher professional development; Dieker, Hughes, Hynes, and Straub (2017)</td>
<td>Middle school mathematics teachers ( (n = 135) )</td>
<td>The researchers examined whether professional development utilizing simulations increased the use of middle school mathematics teachers’ effective strategies and impact on student academic outcomes in math.</td>
<td>Significant effects over time on the use of teacher high leverage practices were found. Skills developed within simulations transferred to actual classroom environments.</td>
</tr>
</tbody>
</table>
Table 2.2 (Continued)

<table>
<thead>
<tr>
<th>Topic/Investigators</th>
<th>Participants/Studies</th>
<th>Purpose</th>
<th>Findings</th>
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<tbody>
<tr>
<td>Use of mixed reality simulations and a formal coaching model as a teacher-focused</td>
<td>Special education teachers ( n = 19 )</td>
<td>This study explored the effects, acceptability, and feasibility of an intervention that employs mixed reality simulations and a coaching framework on special education teachers’ behavior management strategies and student behavior.</td>
<td>Results showed significant improvements in special education teachers’ use of behavior management strategies and in special education students’ behaviors in classrooms. Additionally, positive ratings of coaching and simulations by both coaches and teachers.</td>
</tr>
<tr>
<td>intervention; Pas et al. (2016)</td>
<td></td>
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<tr>
<td>Mixed reality simulations and pre-service teacher professional development; Gundel,</td>
<td>Pre-service teachers enrolled in a teacher preparation</td>
<td>The researchers examined the effect of increased exposures of mixed reality simulations within teacher preparation on pre-service teachers’ perceived sense of self-efficacy.</td>
<td>Increased exposure to mixed reality simulations led to an increase in pre-service teachers’ sense of self-efficacy. An initial drop was observed in self-efficacy scores.</td>
</tr>
<tr>
<td>Piro, Straub, and Smith (2019)</td>
<td>coursework ( n = 53 )</td>
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**Mixed reality simulations and coaching for teacher training.** Garland et al. (2012) examined the effect of coaching within mixed reality simulations on special education teachers’ development of an evidence-based teaching strategy that is recommended for students with Autism Spectrum Disorder (ASD). The use of the simulation environment, TeachLivE™, was used to train four special education teachers in the learning and implementation of a teaching technique known as Discrete Trial Teaching (DTT). The technique, rooted in applied behavior analysis, breaks down objectives into smaller components and utilizes positive reinforcement when objectives are met (Garland et al., 2012).

A student avatar exhibiting behaviors consistent with students with ASD was used throughout the course of the study to train special education teachers in the practice of DTT. A multiple baseline research design across four female participants examined the effect of coaching
within the mixed reality simulation on the participants’ implementation of the DTT teaching strategy, as measured by an evaluation rubric aligned to the DTT technique (Garland et al., 2012).

Data were collected from four baseline sessions, in which teachers were given instruction in the DTT teaching strategy and practiced implementing the technique with Austin, a student avatar in the simulation environment. The treatment consisted of a review of participants’ previous simulation session, feedback, and coaching in the components of the DTT teaching strategy. Following the training session, participants then interacted with the avatar and performed ten discrete trials which were scored using a rubric.

Results showed consistent and positive gains in scores from baseline to treatment phases of the study. Overall, the average gain in scores was 49.9% over three participants that participated in all treatment sessions; while an increase of 41% was obtained for a participant who completed only one treatment session (Garland et al., 2012).

Interview data revealed that teacher participants appreciated the opportunity to practice learning about and implementing the teaching strategy with the student avatar that could be manipulated so a focus on the technique could be achieved, and the student avatar could not be harmed like a real student (Garland et al., 2012). The small number of participants is a limitation to this study; however, the results show that positive results in the learning and implementation of a specialized technique, DTT, was realized when the mixed reality environment and follow-up coaching was used for special education teacher professional development.

Data driven feedback and coaching within mixed reality simulations for teacher training. DeSantis (2018) examined the impact of data driven feedback and coaching on pre-service teachers’ sense of self-efficacy and on the development of higher order questioning
strategies to elicit student thinking. In the mixed method study, a quasi-experimental treatment and control group design was employed where the treatment group \( n = 15 \) experienced data driven feedback and coaching related to the participants’ use of higher order questioning techniques as they delivered lessons to student avatars in a mixed reality simulation environment. Participants in the comparison group \( n = 15 \) did not receive the feedback and coaching but did experience the mixed reality simulation environment.

When the number and type of higher order thinking questions (HOTs) generated between the groups were analyzed via a Chi-Square analysis, a statistically significant difference \( (\chi^2 = (1) = 47.56, p < .01) \) between basic knowledge and comprehension questioning (K/C) and HOT questioning performance between the treatment and comparison groups resulted. Follow-up analysis of the participants’ creation of HOT questions via a Sign test procedure revealed statistically significant results for all pairwise comparisons of scores among the treatment group; \( p \) values ranged from .002 to .005. However, no statistically significant differences in scores were found for any of the pairwise comparisons among scores of the comparison group. An examination of pre-post self-efficacy scores, as measured by the Teacher’s Sense of Self-efficacy Scale (TSES), did not reveal a statistically significant result when the treatment and comparison groups’ scores were analyzed. Therefore, results from the TSES appear to indicate that while the treatment did not affect pre-service teachers’ sense of self-efficacy, an impact on the skill of generating higher order thinking questions was realized. The researcher noted that the participants typically experienced six mixed reality simulations as part of their program prior to the study, and the TSES focuses on perceptions of self-efficacy with respect to teaching overall, not on just the skill of higher order questioning practices. Qualitative analysis of interview and coaching data revealed that pre-service teacher student participants in the treatment group
appreciated the data driven feedback and coaching treatment and recognized their overall growth in their ability in utilizing higher order questioning techniques, lesson planning, and lesson delivery. Comparison group participants expressed they did not experience growth in the skill of higher order questioning, and some members expressed confusion as to the basics of the strategy. Results of the study indicated that data driven feedback and coaching within mixed reality simulations can help foster the development of higher order questioning techniques among pre-service teachers.

**Mixed reality simulations and instructional skills.** An exploration of the effect of virtual professional development on teachers’ application of pedagogical knowledge and improvement in student outcomes in mathematics was conducted in a large-scale national research study (Dieker et al., 2017). Participants were in-service middle school mathematics teachers ($n = 135$), teaching in 10 schools across six states. A quasi-experimental four-group randomized trial research design measured teachers pre-post in their classrooms and, as the case with two of the groups, four times in the mixed reality simulation environment (Dieker et al., 2017).

Each participant in all four groups were provided a lesson plan aligned to Common Core Standards in Mathematics, while different types of professional development were implemented with three of the four groups. Group 1 received the lesson plans only and served as the comparison group (Dieker et al., 2017). Group 2 received professional development in the form of one 40-minute online session that focused on formative assessment strategies and included the teachers’ analysis of student work samples and follow-up discussion of teacher questioning and feedback strategies (Dieker et al., 2017). Teachers in Group 3 received four 10-minute sessions in the TeachLivE™ simulator (now known as Mursion®) over the course of four to six weeks.
Participants in this group reviewed the same student work samples as those used in Group 2 and taught a whole class discussion to the five student avatars under the premise the work samples were from these virtual students (Dieker et al., 2017). Following the simulation session, teachers took part in a review process that included their individual reflections on their performance with respect to the use of higher-order questioning and feedback strategies, and the receipt of feedback in the form of data on their frequencies of those strategies during the session. Upon completion of this review process, participants completed another 10-minute simulation session and, approximately one month later, experienced two additional 10-minute simulations that included the review process after leading a discussion with the student avatars (Dieker et al., 2017). Participants in Group 4 received the 40-minute online professional development experienced by participants in Group 2 as well as four, 10-minute simulation sessions. However, participants in this group did not participate in the review process (Dieker et al., 2017).

Qualitative and quantitative data were collected pre-post treatment utilizing the Teacher Practice Observation Tool (TPOT) to measure teachers’ practices in their actual classrooms (Dieker et al., 2017). Frequency data with respect to teachers’ use of high leverage practices, specifically higher-order questioning techniques, type of feedback, and amount of wait time, were collected during classroom observations (Dieker et al., 2017). Frequency data on the specific high leverage practice targeted in a simulation session were also collected for participants experiencing the sessions as part of the treatment condition. Additionally, teacher data were collected on eight modified sub-constructs from the 2011 Danielson Framework for Teaching Evaluation Instrument and qualitative field notes. Student data, specifically 10 items from the National Assessment of Educational Progress (NAEP) assessment were collected pre-post intervention.
For data analysis purposes, teaching practices were measured pre-post intervention along three dimensions: describe/explain questions (DE), specific feedback (SF), and score on the TPOT instrument (Dieker et al., 2017). A two-factor mixed design ANOVA was employed to analyze whether differential effects on teacher performance occurred over four 10-minute simulations, depending on whether participants received online PD. Time served as the within-subjects factor while condition (online PD or no online PD) served as the between-subjects factor; SF and DE were the dependent variables. Results indicated no differential effects with respect to DE questions ($F(3,171) = .735, p = .532, \eta^2_p = .13$) nor SF given to student avatars ($F(3,168) = 1.989, p = .118, \eta^2_p = .034$) based on whether teachers experienced online PD. However, there was a significant large effect for time when DE questions were analyzed ($F(3,171) = 9.993, p = .000, \eta^2_p = .149$) and a significant effect for time when SF was analyzed ($F(3,168) = 2.306, p = .079, \eta^2_p = .040$). Teacher performance scores, with respect to those high leverage practices, significantly increased over the four sessions of the simulations regardless of whether they received the online PD.

The researchers investigated whether differential effects of development of targeted skills in the simulation environment transferred to teachers’ practices in their actual classrooms (Dieker et al., 2017). Results of a three-way mixed ANOVA examining the effects of the simulations, online PD, and time on the percentage of DE questions asked during a 45-90 minute classroom lesson indicated no statistical differential effect of time for online PD when combined with the simulation sessions ($F(1,130) = .168, p = .682, \eta^2_p = .001$). However, there was a statistically significant interaction between time and the simulations ($F(1,130) = 3.479, p = .064, \eta^2_p = .026$). Teachers who participated in the simulations asked a significantly higher ($t(132) = 3.198, p = .002$) percentage of DE questions post-intervention ($M = 24\%$) than teachers who did
not experience the simulations ($M = 14\%$). The results indicated that the targeted skill developed in the simulations transferred to actual classroom environments and support the efficacy of mixed reality simulations as a professional development tool to support teacher learning that is applied to actual classrooms (Dieker et al., 2017).

A selection of findings related to the use of simulations for improving teacher practices have been discussed in this review. This comprehensive study included additional analyses with regards to whether a reflection process was used post-simulations, effects on students’ scores of teachers who participated in simulations, and whether online PD was combined with the simulations. Please see Dieker et al. (2017) for further analyses, findings, implications, and limitations of the study.

**Mixed reality simulations, teacher education, and behavior management.** Results of a research study (Pas et al., 2016) over the course of a school year in which mixed reality simulations were embedded within a formal coaching framework, indicated positive effects on teachers’ use of behavior management strategies and student classroom behavior. An intervention employing the use of a mixed reality simulation environment within a coaching model targeted toward teachers’ use of behavior management strategies was conducted with 19 special education teachers working in non-public schools (Pas et al., 2016). Participants taught in self-contained classrooms that served students aged 5-13 ($n = 10$) and 14-21 years ($n = 9$). Students were identified as those with moderate to severe needs in terms of academic, emotional, and behavioral supports and included students with Autistic Spectrum Disorder (ASD).

The research employed the use of a formal coaching model, the Classroom Check Up (CCU) designed to support effective classroom behavior management strategies aimed at proactive teacher behaviors that help prevent student behavior issues before they occur (Reinke,
These strategies include active supervision, use of praise, and communicating clear behavioral expectations (Reinke, 2013). Coaches, following the CCU model, observed teachers in their classrooms and worked with teachers at the beginning of the study to identify and select one or two target teacher behaviors to improve positive student behavior in the classroom (Pas et al., 2016). Teachers then practiced the identified skills in the mixed reality simulation environment. Teachers practiced with middle school or high school avatars, depending on the grade level taught, for 10 minutes while being observed by the coach and another teacher (Pas et al., 2016). Following the simulation, each teacher received immediate feedback from the coach and observed the other teacher practice the targeted skills and receive feedback. This procedure was then repeated for a total of two practice sessions within one simulation (Pas et al., 2016).

After the first simulation, the coach then observed the teacher in their classroom to determine the extent to which the teacher was able to apply the skills that were practiced in the simulator to their classroom (Pas et al., 2016). During classroom observations, coaches provided feedback to teachers to support their use of identified classroom management strategies. Teachers experienced a total of three TeachLivE™ simulations over the course of about 10 weeks (Pas et al., 2016).

Frequency counts of individual teacher and student behaviors, as well as overall rating scales of behaviors, were collected by research assistants via the Assessing School Settings: Interactions of Students and Teachers (ASSIST; Rusby et al., 2001 as cited in Pas et al., 2016) instrument at three time points throughout the study (Pas et al., 2016). Data were collected before the coaching/mixed reality intervention which served as baseline data, following the coaching/mixed reality intervention, and then after about 3 months’ time, which served as follow-up data (Pas et al., 2016). Frequencies of individual teacher behaviors collected via this
instrument were proactive behavioral expectations, reactive behavior management, approval, disapproval, and opportunities to respond. Frequencies of individual student behaviors were collected and consisted of noncompliance, disruptions, profanity, verbal aggression, and physical aggression (Pas et al., 2016). The ASSIST instrument consists of overall rating scales of teacher and student behaviors using a 5-point Likert scale (Pas et al., 2016). Overall ratings of teacher and student behavior with respect to teacher positive behavior management, teacher control, teacher monitoring, teacher anticipation, teacher and student meaningful participation, student compliance, and student socially disruptive behavior were collected using this instrument (Pas et al., 2016).

Frequency data of teachers’ classroom management strategies and students’ classroom behaviors were collected and analyzed via repeated measures MANOVA. When teachers’ classroom management behaviors over time were examined, significant results for time \( (F(2, 13) = 4.33, p = .04, \text{partial } \eta^2 = .40) \), frequency counts of teacher behaviors \( (F(3,12) = 43.36, p < .01, \text{partial } \eta^2 = .92) \), and the interaction between time and frequencies, \( (F(6,9) = 5.25, p = .01, \text{partial } \eta^2 = .79) \) were obtained indicating that teacher behaviors varied across individual behaviors and changed over time. Follow-up data analysis employing ANOVAs revealed significant increases in frequencies of teachers’ use of proactive behavioral expectations, \( (F(2, 28) = 6.73, p < .01, \text{partial } \eta^2 = .33) \), and approval \( (F(2,28) = 8.12, p < .01, \text{partial } \eta^2 = .37) \). Moderate to large effects were observed between baseline and follow-up data for teachers’ use of proactive behavioral expectations \( (d = .092) \) and use of strategies related to approval of student behavior \( (d = 1.06) \). When differences in student behaviors over time was examined via a repeated measures MANOVA, a significant result for frequencies of student behaviors \( (F(4, 11) = 10.72, p < .01, \text{partial } \eta^2 = .80) \) was realized. No significant results for time nor an interaction between time and
frequencies of behaviors were obtained. Follow-up data analysis employing the ANOVA statistic revealed significant results over time for student non-compliance \((F(2, 28) = 3.58, p = .04, \text{ partial } \eta^2 = .20)\).

When overall observer ratings of teacher behavior and student behavior were analyzed, significant results of the MANOVA were obtained for teacher behaviors over time \((F(2, 8) = 10.64, p < .01, \text{ partial } \eta^2 = .73)\), scale \((F(7, 3) = 46.17, p < .01, \text{ partial } \eta^2 = .95)\), and an interaction for time by scale \((F(4, 6) = 19.28, p < .01, \text{ partial } \eta^2 = .97)\). With respect to student rating scales, significant results for time \((F(2, 13) = 7.60, p < .01, \text{ partial } \eta^2 = .54)\), by student rating scale \((F(2, 13) = 564.24, p < .01, \text{ partial } \eta^2 = .99)\), and an interaction between time and student rating scale \((F(4, 11) = 9.34, p < .01, \text{ partial } \eta^2 = .77)\) were obtained. Taken together, improvements in teachers’ use of behavior management strategies and students’ classroom behaviors were realized over time.

Significant results of follow-up data analysis via ANOVAs were obtained for observer ratings of teacher proactive behavior management \((F(2,28) = 6.92, p < .01, \text{ partial } \eta^2 = .33)\), teacher control \((F(2,28) = 17.11, p < .01, \text{ partial } \eta^2 = .55)\), teacher monitoring \((F(2,28) = 14.10, p < .01, \text{ partial } \eta^2 = .50)\), teacher and student meaningful participation \((F(2,28) = 9.81, p < .01, \text{ partial } \eta^2 = .41)\), indicating that ratings for these teacher scales increased significantly over time. A significant result for ratings of student social disruption \((F(2,28) = 3.19, p = .057, \text{ partial } \eta^2 = .19)\) indicated improvements in ratings over time.

The acceptability of coaching and the use of the TeachLivE™ simulations was examined, as data were collected from coaches and teachers about their perceptions of the coaching experience using the coach-teacher alliance scales and ratings of the TeachLivE™ simulations (Pas et al., 2016). A zero to four (never to always) 5-point Likert scale was employed, and
overall results for both coaching and the TeachLivETM simulations were positive. Teachers’ scores for coaching which examined the working relationship, process, investment, and perceived benefits from the experience ranged from an average of 3.13 to 3.69; teachers scored the TeachLivETM simulations more moderately (M= 2.77, SD = .60; Pas et al., 2016). Coaches’ ratings for the coaching experience ranged from an average of 2.5 to 3.26; coaches scored the TeachLivETM simulations higher than the teachers (M= 3.05, SD = .39; Pas et al., 2016).

Overall results of this study appear to indicate the viability of the use of mixed reality simulations and coaching to promote positive changes in special education teachers’ use of behavior management strategies that positively impact students’ behaviors in classrooms. Moreover, the results show that some positive changes were sustained, as follow-up data appear to indicate.

Mixed reality simulations and pre-service teachers’ perceived self-efficacy. The possible effect of increased levels of exposure to mixed reality simulations on pre-service teachers’ sense of self-efficacy was conducted within a teacher preparation program (Gundel et al., 2019). In the study, participants (n = 53) experienced 30, 60, or 90 minutes of mixed reality simulations embedded within their teacher education coursework. A repeated measures, one group with three levels, pretest/posttest design was employed to examine the effect of exposure level on pre-service teachers’ sense of self-efficacy, as measured by the Teachers Sense of Self Efficacy Scale (Tschannen-Moran & Hoy, 2001). An analysis of the data, employing a 3 x 2 one-between-one-within subjects ANOVA, and follow-up t-tests, revealed a significant main effect for exposure (F(2, 50) = 5.91, p < .01) and a significant interaction between total exposure and time before and after simulations (F(2, 50) = 5.45, p < .01). The self-efficacy scores of participants in the 90 minute exposure group were significantly different than scores of
participants in the 30 minute or 60 minute groups. The researchers noted that for the 60-minute exposure time, a small, nonsignificant decrease in scores from before exposure to after exposure was revealed, and this drop in scores were observed in other studies (Bautista & Boone, 2015).

**Focused Review of Mixed Reality Simulation and Communication Skills**

The scope of this study examines communication behaviors of pre-service teachers as they interact with student avatars in a mixed reality simulation environment and receive video feedback and coaching on their performance. A brief review of the literature was conducted on the use of mixed reality simulations and measurement of communication skill development. There is a lack of research in the field of teacher education in this area (Taylor et al., 2017). In Table 2.3, two studies aligned with the employment of a coaching intervention aimed at increasing communication skill competencies as participants utilized the Mursion® mixed reality environment.
Table 2.3

*Mixed Reality Simulations and Communication Skills*

<table>
<thead>
<tr>
<th>Topic/Investigators</th>
<th>Participants/Studies</th>
<th>Purpose</th>
<th>Findings</th>
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<tbody>
<tr>
<td>Effect of mixed reality simulations and follow-up coaching on verbal, nonverbal, and interviewing skills; Walker, Vasquez, and Wienke (2016)</td>
<td>Five adolescents, aged 18-22, with low intellectual ability</td>
<td>Examine the effect of rehearsals within a mixed reality simulation environment combined with follow-up coaching on verbal, nonverbal, and communication skills in interview scenarios.</td>
<td>The treatment package, consisting of rehearsal within a mixed reality simulation environment and coaching sessions, was effective in positively increasing interviewing skills both post simulations and in a live setting.</td>
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Impact of virtual simulation on the interprofessional communication skills of physical therapy students: A pilot study; Taylor et al. (2017)

Pilot case study: three students who recently completed all required coursework in a Doctor of Physical Therapy program at a large university in the southeastern United States

Investigate the impact of a mixed reality virtual simulation program on the communication skills of doctoral-level physical therapy students.

Following the simulations, which included feedback and reflection, each participant improved their scores in effectively communicating health information and ability to communicate with stakeholders.

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**Mixed reality simulations, communication skills, and special needs participants.**

Mixed reality simulation environments allow for participants to rehearse targeted skills before enacting them in reality. In a study aimed at improving communication skills within interviewing situations, five students with low intellectual ability utilized a mixed reality simulation environment and received follow-up coaching sessions to promote verbal and nonverbal communication in interviews (Walker et al., 2016). Participants included five young adults, aged...
18-22, whose IQ scores were significantly below average, in the 55-65 range. Three phases comprised the study: a baseline, treatment, and follow-up phase. During the follow-up phase, participants were interviewed by a career professional at the university in which the study took place to help determine if generalization of skills to a live setting had occurred.

Participants experienced interviewing with an adult avatar within the simulation and were assessed using an interview performance rubric as they answered a total of eleven interview questions within the simulation. The rubric measured verbal communication skills (e.g., voice clarity and volume), nonverbal skills (e.g., posture and eye gaze), and content of responses to interview questions (e.g., answered questions asked). Additionally, participants’ ability to smile and greet the interviewer was assessed, and a total of 100 points could be earned on the rubric (Walker et al., 2016).

Baseline data were collected as participants interacted with the avatar, and when the data showed a stable performance, participants were moved to the treatment phase of the study. No coaching sessions were provided during the baseline phase. The treatment phase consisted of virtual rehearsals of communication skills in an interview scenario, and coaching sessions which fostered reflection on the performance as guidance targeted toward improving verbal and nonverbal interviewing skills. Participants received coaching until 80% mastery of identified skills on the or a total of six sessions were given, and sessions lasted from 10-20 minutes in length. The final phase of the study took place 14-21 days after each participant completed the treatment phase, where participants engaged in an interview in a live setting.

Results of the study show that the intervention consisting of virtual rehearsals and coaching sessions was effective in improving verbal and nonverbal communication and interviewing skills both within the mixed reality simulation environment and post-intervention in
a live interview setting. For the mixed reality simulations, the overall mean increase in the five participants’ scores from baseline to treatment was 28.82 points on a 100-point rubric. For the live interviews, the overall average increase in scores for the five participants from the pre-interview phase to post-interviews was 30.4 points. Results suggest that the treatment package, consisting of rehearsal within a mixed reality environment and coaching sessions, positively affected participants’ communication and interviewing skills that generalized to a live interview setting (Walker et al., 2016).

Mixed reality simulation and coaching – communication skills. A pilot study was conducted to explore the effect of a mixed reality simulation environment on the learning of interprofessional communication skills of Doctoral-level Physical Therapy students (Taylor et al., 2017). This simulation environment requires a human simulation specialist who operates, through digital puppetry, avatars that represent students or adults in various roles and interacts with the simulation participant in real time (Dieker et al., 2008). For this study, the specialist was a teacher, trained in school-based education, and was made familiar with physical therapy medical terminology and the scenario for the simulation (Taylor et al., 2017). The simulations were guided by a scenario which centered around making recommendations for mobility, including a wheelchair, for a 13-year-old girl who experienced a traumatic brain injury. Adult avatars represented three adult stakeholders - a parent, teacher, and physician. Three participants experienced the simulation environment and interacted with each adult stakeholder for a period of five minutes. After each session, a 5-minute period for feedback and reflection took place. The participant then experienced communicating with the same adult avatar for another five minutes for a second simulation session. This process was repeated for all three adult avatar stakeholders; each participant experienced the simulation environment for a total of 60 minutes (Taylor et al.,
A quasi-experimental, pre-test and post-test case study design was employed, and each of the three participants were scored using a modified version of the Situation, Background, Assessment, Recommendation (SBAR) tool, which provides a framework for medical professionals when communicating with health team members (Institute for Healthcare Improvement, 2019). Results of the study revealed that all three participants, following the simulations which included a period for feedback and reflection, were able to more effectively communicate situational and background information, as well as discuss treatment and make recommendations with all three adult stakeholders in the scenario (Taylor et al., 2017). Among all three participants, interactions with the parent avatar were the most challenging, whereas interactions with the physician avatar were the most successful (Taylor et al., 2017). However, each participant scored higher for every adult avatar interaction following the first simulation. Therefore, the results of this pilot study provide support for the use of a mixed reality simulation environment in developing interprofessional skills of medical personnel.

**Video as a Feedback Tool**

The use of video as a feedback tool for teacher self-reflection in teacher professional development is well-documented (Fukkink, Trienekens, & Kramer, 2011; Fuller et al., 1973; Tripp & Rich, 2012). In their analysis of 63 studies involving pre-service and in-service teachers where participants used video to examine and reflect on their own teaching performance, Tripp and Rich (2012) provide evidence for the use of video to foster teachers’ abilities to self-reflect and to make instructional changes. The use of video grounds the process of reflection in one’s actual performance of teaching instead of relying on a memory of the performance (Xiao & Tobin, 2018).
Microteaching, conceptualized in the early 1960’s at Stanford University, involved the recording of teachers as they tried out an instructional strategy and the receipt of feedback and coaching by an expert for the purposes of teacher development (Knight, 2014). Today, instructional coaching is a collaborative process where the coach and teacher analyze, “…current reality, set goals, identify and explain teaching strategies to meet goals, and provide support until goals are met” (Knight, 2017, p. 2). The use of video analysis to ground the instructional coaching process is powerful, as often a truer picture of reality is illuminated. Video analysis allows for the focusing on specific behaviors or strategies while helping to alleviate habituation or confirmation bias (Knight, 2014). This grounding in reality is critical for the processes of goal setting and the monitoring of progress toward meeting goals.

In their seminal work on video playback in education, Fuller et al. (1973) described the viewing of one’s performance on video as “self-confrontation,” and the identification of discrepancies between one’s perceived experience and observations from video playback as one’s ability to realistically assess one’s self. In focused observations, they asserted that behavioral changes could occur when an outside observer’s perceptions are compared with one’s own, the level of realism with respect to the experience is increased, and the outside observer possesses facilitating characteristics (Fuller et al., 1973). The researchers cautioned that the process causes one to intently focus on the self and may induce stress in some students (Fuller et al., 1973). However, Xiao, and Tobin (2018) asserted that today’s students, raised in an age where sharing images and video of themselves via social media is common, may not experience the same feelings of discomfort as the students referred to by Fuller and Manning over 40 (Xiao & Tobin, 2018).
Review of Video Feedback and Coaching

In Table 2.4, studies that involved the use of video for self-reflection and included coaching to examine and improve communication skills in were selected. Participants in each of the studies included pre-service and in-service teachers.

Table 2.4

<table>
<thead>
<tr>
<th>Topic/Investigators</th>
<th>Participants/Studies</th>
<th>Purpose</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of video technology for self-reflection and peer feedback to promote communication skills in pre-service teachers; Bower, Cavanagh, Moloney, and Dao (2011)</td>
<td>Pre-service teachers enrolled in methodology teacher preparation courses: Mathematics ($n=10$) and Languages ($n=14$) in Australia</td>
<td>The researchers investigated communication skill outcomes and perceptions of pre-service teachers utilizing a video reflection and peer review process within a teacher preparation course.</td>
<td>The use of the video reflection and peer review process contributed to teacher confidence and growth in communication skills. Pre-service teachers indicated they appreciated reviewing their teaching via video for reflection and growth.</td>
</tr>
<tr>
<td>Effect of video feedback and reflection on embodied aspects of teaching (e.g., posture, eye gaze, etc.); Xiao and Tobin (2018)</td>
<td>Pre-service teachers ($n=23$) enrolled in an early childhood education certification program</td>
<td>This study explored the effect of video feedback and reflection on early childhood pre-service teachers’ non-verbal or embodied aspects of teaching.</td>
<td>Post-intervention, pre-service teachers’ embodied teaching behaviors increased. Teachers expressed their comfort level with videotaping, self-reflection, and coaching increased over the semester.</td>
</tr>
<tr>
<td>Video feedback interventions and interaction skills of professionals; Fukkink, Trienekens and Kramer (2011)</td>
<td>Meta-analysis of 33 experimental studies ($n=1058$)</td>
<td>This meta-analysis reviewed findings of research studies employing video feedback interventions on professionals’ interaction skills.</td>
<td>The use of video for self-reflection was found to positively affect the overall interaction skills of human service professionals.</td>
</tr>
</tbody>
</table>

Video feedback, reflection, and pre-service teacher communication skills. Self-examination through the use of video technology can be an important part of a learning cycle which includes reflection, conceptualization and revision, and practice (Kolb, 1984). The impact
of a video reflection system on the communication skills of undergraduate pre-service teachers was investigated in a mixed methods study in Australia (Bower, Cavanagh, Moloney, & Dao, 2011). Participants included undergraduate pre-service teachers enrolled in a mathematics methods course ($n = 10$) or a language methods course ($n = 14$).

A video reflection system was used to facilitate pre-service teachers’ self-reflection as part of a learning cycle aimed at improving communication skills. Pre-service teachers presented, reviewed their presentations individually via video technology, reflected on their performances and wrote reflections via a blogging tool, received peer feedback and viewed peers’ presentations, and revised practices to improve communication skills in a subsequent presentation (Bower et al., 2011). Over the course of one semester, pre-service teachers completed this process twice. Following the completion of both presentations, pre-service teachers completed an online questionnaire consisting of 10 questions about their performances, the video reflection process and its features, and suggestions for improvements in the process.

Between both courses, a total of 50 video posts which included self-reflections and 106 posts consisting of peer feedback were completed. Results of a two-sample two-tailed t-test revealed that the average rating of the second presentation was significantly higher than the first presentation, $t(21) = 2.55, p = .02$. Pre-service teachers’ average self-ratings of the first presentation was 5.1 out of 10. For the second presentation, the average of self-ratings was 6.3 out of 10 (Bower et al., 2011).

An examination of pre-service teachers’ qualitative data revealed that the teachers believed that nervousness and behaviors that convey anxiety (e.g., rigid or stiff posture) were underlying factors that contributed to the low scores of the first presentations. With respect to contributing factors that improved their scoring of the second presentations, pre-service teachers
indicated that they felt more confident to present and intentionally tried to increase nonverbal behaviors such as eye gaze, gesture, and using an effective tone of voice (Bower et al., 2011). Overall, 86.3% of the teachers indicated that they felt the video reflection system helped them learn and improve in their ability to communicate and appreciated the opportunity to see and hear themselves perform. The process, which included peer-review, allowed the students to anchor their self-reflections while comparing their performances to those of their peers.

An analysis of student comments also illustrated that the opportunity to view one’s self using communication strategies with students, the process of self-critique, and the receipt of feedback and support from peers contributed to their growth in learning about classroom communication and its effect on students. According to the researchers, “student reflections on the physical aspects of communication (such as eye contact, body movements, pace of delivery) shaped their understanding of how to effectively construct meaning for the onlookers (their pupils)” (Bower et al., 2011, p. 323). The researchers point out that following the first video reflection process, pre-service teachers gained confidence in their abilities, and communication anxiety was reduced for the second presentation. Video analysis of their performances allowed for a comprehensive analysis of communication skills and promoted understanding of the effect of these behaviors on the receivers of the communication. This study supports the use of video technology to promote self-reflection combined with feedback to nurture growth in communication skills of pre-service teachers.

**Video Feedback, Reflection, and Embodied Aspects of Teaching.** The impact of video for self-reflection on the use of nonverbal or embodied aspects of teaching behaviors was explored in a study of 23 pre-service teachers enrolled in an early childhood education certification program (Xiao & Tobin, 2018). Students’ videotaped lessons taught during a field
experience and narrative reflections served as the main source of data. Acknowledging the use of video in teacher preparation focusing on verbal aspects of teaching, the researchers argued that video could be used as a tool to promote the embodied or nonverbal aspects of teaching, “…by drawing attention to aspects of teaching that are unplanned, tacit, and embodied such as pedagogical tact, the teacher’s use of materials, gaze, gesture, posture, positioning in the classroom, and withitness” (p. 329). Video can capture important nonverbal communication data.

At the midpoint and end of the semester in which participants were immersed in their first field experiences, pre-service teachers planned, taught, and videotaped themselves teaching a lesson and interacting with pre-kindergarten students (Xiao & Tobin, 2018). The pre-service teachers were instructed to watch their videos with sound and without sound, and to reflect on the lesson while focusing on nonverbal communication behaviors such as gesturing, posture, eye gaze, and touch. Additionally, the pre-service teachers reflected on the experience of videotaping themselves and the process of watching and assessing the videos through written narratives (Xiao & Tobin, 2018).

Following the first round of video data and narrative collection, the instructor presented information about embodied aspects of teaching such as use of gestures, voice, facial expressions, and touch. The class and instructor then reviewed the students’ videos, pointing out effective and ineffective pedagogical practices related to embodied aspects of the pre-service teachers as they taught their lessons (Xiao & Tobin, 2018). These procedures were duplicated at the end of the semester, and students’ video submissions were coded for eight embodied aspects of teaching including use of gestures, posture, and touch as well as non-embodied aspects of teaching, such as use of wait time (Xiao & Tobin, 2018). Students’ narrative reflections were coded and a content analysis procedure was completed that classified reflections into one of three
categories - embodied aspects (e.g., eye gaze), non-embodied aspects of teaching (e.g., wait time) and other aspects of the video (e.g., comments about being videotaped). Video data analysis consisted of identifying and counting the categories of embodied teaching techniques used in lessons at the midterm and end of the semester, yielding frequency counts for each category. Once an identified embodied technique was used, it was counted once, even if used multiple times throughout the lesson. Frequency counts of body techniques that were mentioned in students’ narrative reflections were also obtained in addition to students’ reflections about the experience of being videotaped (Xiao & Tobin, 2018).

When video data from the midterm was compared to the final, the number of categorized embodied teaching techniques increased 11%, with the most marked increases in the techniques of positioning and touch (Xiao & Tobin, 2018). At midterm, 15 students utilized positioning in their lessons, while at the end of the semester, 21 students used positioning. Touch was used by seven students at midterm, while 11 students used touch as an embodied pedagogical practice during the final lesson. An analysis of students’ reflections revealed that students increased their comments on their use of bodily techniques by 13%, with body positioning mentioned by 13 students at midterm, while all 23 students commented on their body positioning on the final reflections. The second largest increases in students’ mentions of behaviors were in the categories of touch and eye gaze; five more students reflected on these behaviors when the midterm and final reflections were compared. The researchers assert that based on the increases in embodied techniques displayed in lessons on the videos and mentioned in pre-service teachers’ reflection papers in their study, there is some evidence that bodily techniques used in teaching can be, “…learned, practiced, and improved” (Xiao & Tobin, 2018, p. 337).
Qualitative data analysis of students’ narrative reflections indicated that many students felt they were better able to focus on the embodied aspects of their teaching when they viewed the video with the sound off, allowing for a more focused review of the nonverbal facets of their teaching. Some students indicated they had a better understanding of the power of some embodied teaching techniques for presenting information, such as the use of gesturing, following reviewing their video and receiving peer feedback (Xiao & Tobin, 2018).

An analysis of the final reflections on the experience revealed that although some students found the experience initially awkward, they grew more comfortable with the process as the semester progressed. Data indicated that students began to assess themselves more positively, as the ratio of positive to negative comments about their embodied teaching behaviors grew from a ratio of 2:1 at midterm to a ratio of 3:1 at the end of the semester (Xiao & Tobin, 2018). Taken as a whole, the study supports the use of video feedback and reflection as powerful tools in assisting pre-service teachers in developing their nonverbal teaching skills to communicate more effectively, manage classroom behaviors, and promote their students’ understanding of concepts (Xiao & Tobin, 2018).

**Video feedback interventions and interaction skills of professionals.** The effect of various video feedback interventions on communication and interactional skills of professionals in human service occupations, as well as instructional and methodological characteristics that correlate to results of the research, was investigated in a meta-analysis of 33 empirical studies (Fukkink et al., 2011). The meta-analysis included studies that utilized video feedback for instructional purposes and examined the effect of the intervention on communication and interaction skills of professionals such as teachers, social workers, counselors, doctors, and nurses (Fukkink et al., 2011).
Across the studies, the video feedback intervention aimed at professionals’ communication skills took place over an average of 4.4 sessions spanning an average of 10 weeks (Fukkink et al., 2011). Participants were recorded an average of 20 minutes per session (SD = 22.5; k = 25; Fukkink et al., 2011). Videotapes were viewed by the participant and the trainer in 55% of the studies, a trainer and other participants in 30% of the studies, viewed alone in 10% of the studies, and in one study, with a consultant (Fukkink et al., 2011). In 58% of the studies, a structured observation form was utilized that focused on the skills that were targeted in the training (Fukkink et al., 2011).

Outcome measures across the studies included verbal communication skills (82%), nonverbal communication skills (33%), and paralingual skills (17%). Verbal aspects include the content of what is spoken, where nonverbal aspects include eye contact, posture, and the use of gestures. Paralingual aspects of communication include intonation and volume of voice. For professionals in human service occupations, these skills are important in facilitating effective interactions with those they serve. Studies were coded for outcome measures relating to information skills (31%) or the professionals’ ability to explicitly communicate information. Outcome measures related to the receptive domain (47%) related to the professionals’ verbal and nonverbal expressions of openness for communication. The majority of the studies related to the interpersonal-affective domain (54%), which evaluated professionals’ communication skills related to interpersonal relationships (e.g., expression of warmth, empathy).

A statistically significant, medium effect size (ES = .40, SE = .07) was found when the total effect of video feedback on the interaction skills of professionals was examined through meta-analysis of 217 experimental results across the 33 (Fukkink et al., 2011). Verbal, nonverbal, and paralingual aspects were examined and a statistically significant result was found.
for verbal communication skills, with an effect size of .42, suggesting that verbal aspects of communication can more easily be influenced by video feedback (Fukkink et al., 2011).

Nonsignificant results were found for nonverbal communication skills with an effect size of .35 and paralingual aspects, with an effect size of .39; the authors point out the small differences among the three aspects of communication that were examined (Fukkink et al., 2011).

An examination of methodological variables across the studies revealed significant results if the outcome measure was positive (ES = .41) rather than negative (ES = .28). Additionally, experimental effects were larger if outcome measures related to broader skills (e.g., empathy) obtained through rating scales (ES = .52) rather than micro-level studies that often employ the use of frequency counts (ES = .32). Moreover, a significant result was obtained when studies were examined for the absence (ES = .21) or presence (ES = .55) of use of an observation form of targeted skills.

This meta-analysis provides support for the use of video feedback as a viable tool to increase professionals’ interactional skills. The study suggested that self-reflection by professionals, grounded by the viewing of a videotape of oneself, can promote verbal and nonverbal communication and interpersonal skills.

Summary of the Chapter

This chapter provided the theoretical underpinnings of the construct of immediacy and focused on teacher immediacy and its effect on educational outcomes. A focused review on the effect of teacher nonverbal immediacy behaviors on student cognitive, behavioral, and affective learning was detailed. Additionally, a discussion of the use of fully immersive mixed reality simulation technologies in teacher education was discussed, and focused reviews on the use of the technology to promote teacher pedagogical practices and verbal and nonverbal
communication skills was included. Finally, the use of video feedback within instructional coaching to improve communication skills was discussed, and a focused review of the literature related to video feedback and coaching to improve verbal and nonverbal communication was included.

Mixed reality simulations are an emerging technology tool, and the effect of this technology on teachers’ pedagogical and communication skills is limited. One study (Taylor et al., 2017) investigated the impact of the use of a fully immersive simulation environment on communication skills. No studies were found that also employed the use of a video feedback and coaching treatment package within mixed reality simulations to improve communication.

Chapter Three details the methods and procedures employed in this mixed methods study addressing the two research questions that related to the examination of the impact of a video feedback and coaching treatment package on pre-service teachers’ nonverbal immediacy skills as they delivered lessons within simulations.
CHAPTER THREE: METHODOLOGY

The purpose of this chapter is to describe the procedures and methods employed in this mixed-methods study exploring the effect of a video feedback and coaching treatment package on pre-service teachers’ nonverbal immediacy behaviors as they utilized a mixed reality simulation environment. This chapter is divided among the following sections: (a) setting and participants, (b) research questions and hypotheses, (c) research design, (d) treatment, (e) instrumentation, (f) data collection, (g) data analysis, (h) statement of ethics, and (i) summary of the chapter.

Setting and Participants

The current study took place at a university located in the northeastern United States. Located in an urban center, and consisting of two campuses, the university was attended by 4,982 undergraduate students and 649 graduate students as of the Fall 2019. Approximately 83% of students were in-state residents with the remaining students residing in a neighboring state. The faculty to student ratio was 12 to 1, with 223 full-time faculty members of which 91% held a doctorate or other terminal degree. The number of part-time faculty was 427. Full-time incoming freshmen consisted of 52% of students who identified as female and 41.8% identified as members of historically underrepresented racial and ethnic groups.

This researcher studied undergraduate students enrolled in the college’s pre-service teacher preparation program. This program is accredited by the Council for the Accreditation of Educator Preparation (CAEP) and prepares teachers for state certification at the elementary and secondary levels. A total of four teacher preparation courses utilized mixed reality simulations within their curriculum. Three of these courses also simultaneously embedded field experiences in an urban school setting within the course.
At the beginning of the Fall 2019 semester, the researcher met with pre-service teacher education students enrolled in an educational psychology course to inform them of the study and ask for their consent to participate. All 17 pre-service teachers agreed and granted their consent (see Appendix B). Two pre-service teachers dropped the course during the semester and were removed from the study as they had incomplete datasets. A total of 15 \((n = 15)\) undergraduate pre-service teachers participated in the study; 10 participants identified as female, while 5 participants identified as male. Pre-service teachers were in their second, third, or fourth year of study and were enrolled in a second course in a series of two-part coursework in educational psychology. With respect to ethnicity, 12 participants indicated they were Caucasian while the remaining 3 participants stated their ethnicity as Hispanic/Latino. Most pre-service teacher participants had experienced the mixed reality simulations a total of three times as part of previous coursework within their teacher preparation program. The majority of participants indicated they had never received training in nonverbal communication. See Table 3.1 for demographic information.
Table 3.1

*Pre-service Teacher Participant Demographic Data*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Age</th>
<th>Ethnicity</th>
<th>Year in Program</th>
<th>Concentration in Education</th>
<th>Prior Simulations</th>
<th>Training in NVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annie</td>
<td>F</td>
<td>22</td>
<td>White</td>
<td>Junior / Senior</td>
<td>K-12 Music</td>
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<tr>
<td>Arnold</td>
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<td>Hispanic / Latino</td>
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<td>Secondary Math</td>
<td>3</td>
<td>Some</td>
</tr>
<tr>
<td>Bob</td>
<td>M</td>
<td>20</td>
<td>White</td>
<td>Junior</td>
<td>Secondary Social Studies</td>
<td>3</td>
<td>None</td>
</tr>
<tr>
<td>Callie</td>
<td>F</td>
<td>20</td>
<td>White</td>
<td>Junior</td>
<td>Secondary Social Studies</td>
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<td>None</td>
</tr>
<tr>
<td>Kate</td>
<td>F</td>
<td>19</td>
<td>White</td>
<td>Sophomore</td>
<td>Secondary Math</td>
<td>0</td>
<td>Some</td>
</tr>
<tr>
<td>Linda</td>
<td>F</td>
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<td>White</td>
<td>Junior</td>
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<td>4</td>
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<tr>
<td>Maria</td>
<td>F</td>
<td>21</td>
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<td>Senior</td>
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<td>Some</td>
</tr>
<tr>
<td>Patrick</td>
<td>M</td>
<td>24</td>
<td>Hispanic / Latino</td>
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<td>Secondary Math</td>
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<td>None</td>
</tr>
<tr>
<td>Renee</td>
<td>F</td>
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<td>White</td>
<td>Sophomore</td>
<td>Secondary Math</td>
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</tr>
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<td>Rose</td>
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</tr>
<tr>
<td>Samuel</td>
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</tr>
<tr>
<td>Sheila</td>
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</tr>
<tr>
<td>Steven</td>
<td>M</td>
<td>20</td>
<td>White</td>
<td>Junior</td>
<td>Secondary English</td>
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<td>Some</td>
</tr>
<tr>
<td>Sylvia</td>
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<td>White</td>
<td>Junior</td>
<td>Secondary Social Studies</td>
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</tr>
<tr>
<td>Winnie</td>
<td>F</td>
<td>21</td>
<td>White</td>
<td>Junior</td>
<td>Elementary</td>
<td>0</td>
<td>Some</td>
</tr>
</tbody>
</table>
Course Description

Participants in the study were pre-service teacher undergraduate students enrolled in an educational psychology course within a teacher preparation program. The curriculum for this course focused on major theories and research in the area of adolescent educational psychology and includes topics such as learning styles, intelligence measurement and assessment, exceptionalities, and socio-environmental influences such as family, peers, and media on growth in a culturally diverse society.

The curriculum for the course embedded three simulations and a field experience. The simulations employed the use of scenarios (Piro & Callaghan, 2016) that were aligned with the high leverage teaching practice of using questioning techniques to elicit student thinking (Ball & Forzani, 2011; Teaching Works, 2018) and allow for interpretation and evaluation of students’ understanding (see Appendix C). There were two sections of this course, each taught by the same professor. One section of the course was a hybrid course and participants occasionally met on campus. The second section followed a traditional structure, and students met weekly on campus.

Each student enrolled in the course, regardless of section, met on campus to engage in the mixed reality simulations in the university’s simulation lab. The university’s simulation lab is a rectangular classroom with desks arranged in a horseshoe for viewing of a television mounted on one wall. The television is connected to a computer and peripherals that allow for a connection to the Mursion® simulation environment. Participants stand in front of the television and deliver a lesson to five student avatars while their peers and course professor view their interactions. Following each simulation experience, there was time for peer and professor feedback to the student participant. Usually, this course provided for the second exposure to teaching in the mixed reality simulations within the university’s teacher education program.
Convenience sampling was used to select the course in the investigation as the researcher had access to the participants and the simulation lab. The course embedded mixed reality simulations within its curriculum and focused on verbal teaching strategies, namely higher order questioning skills. There was no focus on nonverbal communication skills within the course curricula.

**Research Questions and Hypotheses**

The researcher examined the effect of a video feedback and coaching treatment package on the dependent variable, level of nonverbal immediacy behaviors of preservice teachers experiencing mixed reality simulations. Additionally, the perceptions of pre-service teachers about their reflections following their receipt of a video feedback and coaching treatment package targeted at improving nonverbal immediacy behaviors within a mixed reality simulation environment were explored. The following research questions were addressed:

1. Using the NIS-O, is there a statistically significant difference over time between pre-service teachers’ nonverbal immediacy behaviors for three rounds of data collected, before, during, and at the conclusion of a semester in which a video and reflection, video feedback, and coaching treatment package is administered following mixed reality simulations?

   Non-directional hypothesis: Using the NIS-O, there will be a statistically significant difference over time between pre-service teachers’ nonverbal immediacy behaviors for three rounds of data collected, before, during, and at the conclusion of a semester in which a video and reflection, video feedback, and coaching treatment package is administered following mixed reality simulations.
2. What are the perceptions of pre-service teachers’ reflection and use of nonverbal immediacy behaviors over the course of a semester in which they received video, video feedback, and coaching while utilizing a mixed reality simulation environment?

**Research Design**

The study followed a mixed methods research design (Creswell & Plano Clark, 2011) as quantitative and qualitative data were collected to substantiate the study (see Figure 3.1). Quasi-experimental quantitative data provided for primary evidence in the study. Qualitative data were secondary, and supported triangulation of data sources. A repeated measures design (Fraenkel et al., 2012) was utilized to address the initial research question as participants were measured at three points of time over the course of a semester. Time served as the independent variable and scores obtained via the NIS-O (Richmond et al., 2003) was the dependent variable.

![Figure 3.1. Mixed methods embedded research design employed for this study (Creswell & Plano Clark, 2011).](image-url)
Quantitative Design

A quasi-experimental, one-group within-subjects design, with three levels (Time 1, Time 2, and Time 3), was employed within the embedded design to address research question one (Gall, Gall, & Borg, 2003; Hinkle, Wiersma, & Jurs, 1998). Participants enrolled in the course, the professor, and a facilitator who set up the simulation technology, assembled in the university’s mixed reality simulation lab at the start of the Fall, 2019 semester. During each live simulation session, observations were conducted by the researcher, and observational notes about participants’ use of nonverbal immediacy behaviors and avatars’ responses were collected via the researcher-created observational form, the Nonverbal Communication Behavior Observation Tool or NCBOT (see Appendix D). Within 24 hours of a simulation session, each participant was provided with a video of their performance within the simulation and asked to review it with a focus on their use of nonverbal immediacy behaviors as they delivered a lesson to the student avatars. The researcher reviewed video recordings of participants’ performances and completed a video analysis of the simulation, employing a video analysis protocol. Frequencies and durations of participants’ use of nonverbal immediacy behaviors were collected via the NCBOT. Researcher notes were also collected via this tool during the video analysis process. As soon as a participant completed a review of their performance video, they were contacted by the researcher and received a treatment package consisting of video and reflection, video feedback, and coaching focused on the pre-service teacher’s use of nonverbal immediacy behaviors in the simulation. Typically, the components of the treatment package were administered within 10 days of the simulation. The NCBOT and a scoring guide were used to score the NIS-O instrument after the live mixed reality simulations had taken place. Observations of pre-service teachers’ mixed reality simulations took place three times over the course of the semester, and
the treatment was administered within 10 days of a simulation. The independent variable was time, with three levels (Time 1, Time 2, and Time 3) and the dependent variable was the scores obtained from the NIS-O instrument. Simulations occurred four weeks apart, on the 3rd, 7th, and 11th week of the semester. Observations, researcher analysis, and the administering of the three components of the treatment package were conducted as shown in a visual representation of the quantitative design in Figure 3.2.

<table>
<thead>
<tr>
<th></th>
<th>Time 1</th>
<th>Video and Reflection, Video Feedback, and Coaching 1</th>
<th>Time 2</th>
<th>Video and Reflection, Video Feedback, and Coaching 2</th>
<th>Time 3</th>
<th>Video and Reflection, Video Feedback, and Coaching 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-service teachers</td>
<td>O</td>
<td>X</td>
<td>O</td>
<td>X</td>
<td>O</td>
<td>X</td>
</tr>
</tbody>
</table>

*Figure 3.2. Quasi-experimental design for one group, within-subjects design, for quantitative data collection (Gall et al., 2003; Hinkle et al., 1998).*

**Qualitative Design**

A case study design (Creswell & Poth, 2018; Yin, 2014) was employed to address research question two. The case was bounded by enrollment and participation in an educational psychology course over one semester where mixed reality simulations were embedded into the curriculum (Creswell & Poth, 2018; Yin, 2014). At the conclusion of the semester, a semi-structured exit interview protocol (see Appendix E) was administered and gathered qualitative data that explored pre-service teachers’ perceptions of the receipt of a video and reflection, video feedback, and coaching treatment package within mixed reality simulations related to reflections about their use of nonverbal immediacy behaviors. Qualitative data were also collected via researcher notes collected via the NCBOT (see Appendix D) during live simulations and during a researcher video analysis process with respect to the participants’ use of nonverbal immediacy and responses by the avatars for data triangulation purposes.
Instrumentation

Multiple instruments were utilized to gather data that addressed the two research questions and to provide for the treatment within the present study. Four instruments were utilized to administer the treatment and three instruments were used for data collection purposes. A total of six instruments were employed with one instrument used for both data collection and treatment purposes. The six instruments were: (a) mixed reality simulation video capture, (b) Nonverbal Immediacy Scale – Observer Report (NIS-O), (c) semi-structured exit interview protocol, (d) demographic survey, (e) Nonverbal Communication Behavior Observation Tool (NCBOT), (f) semi-structured coaching protocol.

Instrumentation – Data Collection and Treatment

Mixed Reality Simulation Video Capture. The mixed reality simulations were recorded using a customized recording system (DeSantis, 2018; Gundel, 2018) that captured both participants and student avatars as the pre-service teachers delivered lessons and interacted with the simulated students (see Figure 3.3). The video recording captured each entire mixed reality simulation session for all participants in one video file.
**Instrumentation – Data Collection**

*The Nonverbal Immediacy Scale (NIS).* Nonverbal immediacy behaviors include behaviors such as smiling, nodding of the head, looking, gesturing, and having a relaxed posture that create physical or psychological closeness and convey approachability, warmth, and availability for communication (Mehrabian, 1971). The Observer-Report version of the instrument, the NIS-O, was used to measure student participants’ overall level of nonverbal immediacy behaviors while interacting with student avatars in a mixed reality simulation environment. The NIS-O was developed as “a reliable nonverbal immediacy measure which could be used as a self-report instrument or (with modified wording) as an observer-report instrument” (Richmond et al., 2003, p. 505). The only difference between the Self-Report (NIS-S) version of the instrument and the Observer-Report version (NIS-O) version is the beginning pronoun of each item making up the instrument (e.g., “I” versus “He/She”). The instrument contains 26 items that are rated on a 5-point Likert scale (1 = Never, 2 = Rarely, 3 =
Occasionally, 4 = Often, 5 = Very Often). Half of the items are positively related to nonverbal immediacy behaviors and the remaining half are negatively related to nonverbal immediacy behaviors. Examples of positive nonverbal immediacy behaviors include the use of smiling, having a relaxed posture, and using a varied tone of voice. Conversely, negative nonverbal immediacy behaviors include frowning, having a stiff or rigid posture, and using a monotone voice. Examples of items that are positively related to the use of nonverbal immediacy behaviors include questions about whether the person being observed uses gesturing and having a relaxed posture when talking to others. Examples of items that are negatively related to the use of nonverbal immediacy behaviors include questions about whether the person being observed speaks in a monotone or dull voice, or if they avoid using eye contact when verbally communicating with others. A nonverbal immediacy score was obtained by a three-step process. The scorer first adds scores of the instrument’s items that are related positively to nonverbal immediacy. Second, the scorer adds the scores of items that are negatively related to immediacy. Finally, the scorer adds 78 to the score obtained in the first step, then subtracts the score obtained in the second step to get an overall nonverbal immediacy behavior score (Richmond et al., 2003). Reliability was determined to be .90 or above for both versions of the instrument (Richmond et al., 2003). The researchers concluded that content validity was strong, and predictive validity of the instrument ranged from “…moderate to very high” (Richmond et al., 2003, p. 516). The authors of the instrument granted permission for the use of the NIS for research purposes (McCroskey, 1995).

**Participant Semi-structured Exit Interview Protocol.** A researcher-created semi-structured interview protocol (see Appendix E) was employed immediately after the third and final coaching session to address research question number two. This instrument gathered data
about the participants’ perceptions of nonverbal immediacy behaviors and the treatment package within the mixed reality simulations. Pre-service teachers were asked about their beliefs about the effectiveness of the treatment following their mixed reality simulations in improving nonverbal immediacy behaviors.

**Pre-service Teacher Demographic Survey.** A pre-service teacher demographic questionnaire was administered just prior to the start of the first mixed reality simulation session (see Appendix F). The survey asked respondents to indicate their current student status, major of study, anticipated level of teaching, and prior experiences with the mixed reality simulations. Additionally, students were asked questions about their gender identity, ethnicity, and employment status.

**Instrumentation – Treatment**

**Nonverbal Communication Behavior Observation Tool (NCBOT).** The researcher-created NCBOT (see Appendix D) collected frequencies and durations of participants’ use of nonverbal immediacy behaviors with student avatars within simulations via video reviews of performances. The nonverbal immediacy behaviors of gesturing, smiling, proximity, eye contact, relaxed posture, varied tone of voice, and touch were identified, however, the behavior of “touch” was not included in data collection or analysis due to the nature of simulations. Video time stamp information, total length of the video of the simulation, and researcher notes were also collected via this observational tool.

The NCBOT (see Appendix D) was utilized to administer the video feedback and coaching components of the treatment package and to inform scoring and ensure consistency in rating the Likert items on the validated NIS-O instrument. A scoring guide was established (see Table 3.2) following the analysis of participants’ baseline performances (pre-treatment) during
the first mixed reality simulation session. This criterion-referenced scoring guide for observed frequencies and durations of nonverbal behaviors and the related Likert category (“never,” “rarely,” “occasionally,” “often,” and “very often”) employed on the NIS-O, were utilized to evaluate all three mixed reality simulation sessions.

Table 3.2

<table>
<thead>
<tr>
<th>Nonverbal Communication Behavior Observation Tool Scoring Guide</th>
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</thead>
<tbody>
<tr>
<td>Nonverbal Behavior</td>
</tr>
<tr>
<td>Gesture (rate per minute)</td>
</tr>
<tr>
<td>Touch (rate per minute)</td>
</tr>
<tr>
<td>Proximity (rate per minute)</td>
</tr>
<tr>
<td>Smiling (rate per minute)</td>
</tr>
<tr>
<td>Posture (%)</td>
</tr>
<tr>
<td>Eye Contact (%)</td>
</tr>
<tr>
<td>Tone of Voice (%)</td>
</tr>
</tbody>
</table>

Based on the first session, nonverbal behaviors related to gesturing and smiling were established from this baseline information; most participants’ observations fell within the middle “occasionally” and “often” categories. For the nonverbal communication behaviors of relaxed posture, eye contact, and use of varied tone of voice, the rating on the rubric corresponded to the percentage of length of observations in quarters. For proximity, most participants did not move toward or away from the avatars and thus their observations related to the “never” category. Due to the nature of simulations, the nonverbal communication behavior of touch was not observed, and each participant was rated “never” for that behavior.
**Semi-Structured Coaching Protocol.** The researcher employed a semi-structured coaching protocol (see Appendix G) informed by the “objective, reflective, interpretive, decisional” (ORID) focused questioning technique (Stanfield, 2000). This protocol was used to gather information about participants’ reflections on their use of nonverbal immediacy behaviors during each of the three simulations embedded within the course and allowed for the researcher to provide a coaching intervention aimed at improving pre-service teachers’ use of such behaviors in subsequent simulations. Participants were asked questions about their nonverbal immediacy behaviors as they interacted with the avatars and their overall assessment of their performance in the simulation. The third and final coaching session utilized the protocol to provide not only feedback on the third simulation session, but also provided summative information to the student participant about their use of nonverbal immediacy behaviors over the course of the semester.

**Treatment**

The researcher employed the use of a video analysis process following each of three mixed reality simulations experienced by pre-service teacher participants as part of their teacher preparation program. Participants received a treatment package following each simulation consisting of three components: video and reflection, video feedback, and coaching, that was targeted at improving the pre-service teachers’ nonverbal immediacy skills as they delivered lessons to student avatars.

**Researcher Video Analysis Process**

The researcher analyzed video recordings of pre-service teachers’ mixed reality simulations and collected data with respect to pre-service teachers’ use of nonverbal immediacy behaviors in their interactions with the avatars. A video analysis protocol (see Figure 3.4) was
utilized and six views of each video recording allowed for the collection of frequencies and durations of nonverbal immediacy behaviors via an observational tool, the NCBOT (see Appendix E). Half of the views were with the sound off to enable a better focus on certain nonverbal behaviors (Xiao & Tobin, 2018). Researcher notes were captured via the NCBOT throughout the video analysis process. The frequencies and durations of nonverbal immediacy data and researcher notes collected via this tool helped to inform the administering of the three components of the treatment package.

![Figure 3.4. Video analysis protocol used to analyze pre-service teachers’ nonverbal immediacy behaviors.](image)

**Treatment Package Components**

**Video and Reflection.** The researcher used the video editing software Cyberlink Powerdirector® to reduce the overall simulation video capture for each individual student participant’s performance and uploaded it to the university’s Microsoft® Office 365 - OneDrive for Business application for dissemination to participants. A link to the video was then sent to
each individual student for their review within 24 hours of the simulation to anchor the treatment package provided by the researcher. Pre-service teachers were instructed to review their video as soon as possible and focus on their use of nonverbal immediacy behaviors as they delivered lessons to the student avatars. After the participant reviewed their video, they were contacted by the researcher and a semi-structured coaching protocol (see Appendix G) was administered. The protocol collected participant’s reflections about their use of nonverbal immediacy with the avatars based upon the video review. Reflective questions asked for participants’ reflections on how they felt as they interacted with the avatars, if they appeared warm and friendly to the student avatars when teaching, and if they thought they had the avatars’ attention.

**Video Feedback.** After gathering participants’ reflections on the video of their simulation performance, the researcher, using the data collected via the NCBOT as a guide, provided feedback about the pre-service teachers’ use of nonverbal immediacy behaviors with the student avatars. These behaviors were gesturing, smiling, proximity, eye contact, varied tone of voice, and relaxed posture.

**Coaching.** Behavioral suggestions, or coaching, for improving nonverbal immediacy skills with the avatars in subsequent simulations were provided by the researcher after the administering of video feedback. The third coaching session provided summative information about the participants’ use of nonverbal immediacy behaviors over the course of the semester and coaching for transfer of skills to practice. Immediately following the third coaching session, a semi-structured exit interview was conducted to address research question two.

**Treatment Fidelity**

According to the Treatment Fidelity Workgroup of the National Institute of Health (NIH) Behavior Change Consortium (BCC), treatment fidelity “…refers to the methodological
practices used to ensure that a research study reliably and validly tests a clinical intervention” (Bellg et al., 2004, p. 443). The BCC identified five components of a study that address treatment fidelity: study design, training procedures, treatment delivery, treatment receipt, and treatment enactment which refers to a participant utilizing targeted behaviors outside of the clinical environment (Bellg et al., 2004).

Standardization of procedures employed in this research helped to promote reliability and validity of the study. The treatment package, consisting of video and reflection, video feedback, and coaching, was implemented solely by the researcher, and employed the use of a semi-structured coaching protocol (see Appendix G) to ensure consistency across participants. All participants, for every simulation, received a video of their performance within 24 hours of the session. The three components of the treatment package were typically provided within 10 days of the simulations, after participants had indicated they had reviewed their video. Before administering the three components of the treatment package to a participant, the researcher reviewed the video recording of the simulation and utilized the NCBOT (see Appendix D) to inform the treatment session. A treatment session typically lasted about 15 minutes; each component was about 5 minutes in duration. Simulations typically lasted about three minutes and students delivered lessons that focused on pre-service teachers’ employment of strategies to elicit student thinking while utilizing higher order thinking questioning techniques. No coursework or professor feedback related to the use of nonverbal communication in teaching. All participants received the treatment package prior to any subsequent mixed reality simulations. All treatments were administered by phone except for one, which was conducted on the university campus. The coaching component in the third and final simulation focused on participants’ use of nonverbal immediacy behaviors for transfer to practice.
Data Collection

Prior to commencing the data collection phase of the study, the researcher was granted Institutional Review Board (IRB) approval (see Appendix H) and permission from the site administrator (see Appendix I) and professor of the course (Appendix J) to conduct the research. Data collection began immediately following obtaining consent from pre-service teachers just prior to their first mixed reality simulation experience. A total of 17 pre-service teachers (100%) enrolled in the course consented to participate in the research and completed a demographic survey. Two students dropped the course during the semester and were removed from the study.

Data Collection Timeline

Data collection occurred during the Fall 2019 semester. Prior to the collection of any data, site consent (see Appendix I) was granted. In August, IRB approval (see Appendix H) and approval from the professor of the course (see Appendix J) was obtained. At the start of the first mixed reality simulation, participant consent (see Appendix B) was granted by all students enrolled in the course, and data collection commenced. Refer to Figure 3.5 for a visual representation of the timeline for permissions and data collection procedures.
Figure 3.5. Timeline of data collection procedures.

**Quantitative Data Collection**

Simulations were recorded via a customized screen within a screen (DeSantis, 2018; Gundel, 2018) recording system utilizing a Dell® Alienware laptop computer, Open Broadcaster Software (OBS), and appropriate hardware and peripherals, including a webcam with built-in microphone. Video recordings are utilized by the education and educational psychology departments at the university for research purposes. Additionally, a Canon VIXIA HF R800 video camera was utilized to capture pre-service teachers’ simulation experiences as a backup to the university’s system.
A session-long recording of pre-service teachers’ simulation experiences was created through the university’s customized system. The researcher utilized the video editing software, Cyberlink PowerDirector® and segmented the recording into individual student performance videos. The researcher then uploaded each participants’ video to Microsoft® Office 365 - OneDrive for Business application which allowed for private sharing of digital individual simulation performances with each participant. On average, simulations for each participant lasted 3 minutes and 23 seconds.

Observations were conducted during the participants’ performances within the simulation lab and via the video recordings. Following a video analysis protocol, the NCBOT (see Appendix D) was used to gather frequency data about participants’ nonverbal immediacy for each simulation. The NCBOT helped to inform the scoring of the NIS-O, which served as the measure of nonverbal immediacy. The NIS-O instrument was scored after each of the three simulations over the course of the semester.

**Qualitative Data Collection**

A researcher-created semi-structured interview protocol (Galletta, 2013) was utilized to gather qualitative data. All participant interviews were conducted immediately following the third and final coaching session, via phone, and were recorded using a Sony ICD-PX470 digital voice recorder with a built-in USB. Recordings were uploaded to the web-based transcription service site, Otter.ai. When transcriptions were complete, they were checked against the audio recordings simultaneously for accuracy; appropriate edits were made when necessary. Participants’ pseudonyms were assigned to each participant and a database was created using Microsoft® Excel® for Office 365, where data were organized.
Exit interview questions explored participants’ perceptions of the impact of video feedback and coaching on reflection about their nonverbal immediacy behaviors with student avatars within the mixed reality simulations and with real students in their classroom placements. The average exit interview length was approximately 19 minutes.

In addition to interview data, observational data were collected for triangulation purposes. The NCBOT collected researcher notes during live and recorded simulations about participants’ use of nonverbal immediacy behaviors and student avatars’ interactions. Qualitative data collection fidelity was supported as data were collected solely by the researcher.

**Data Analysis**

The following sections will describe the methods employed to analyze quantitative and qualitative data collected for the present study.

**Quantitative Data Analysis**

Quantitative data consisted of nonverbal immediacy scores obtained via the validated NIS-O instrument. The use of a behavior observation tool, the NCBOT (see Appendix D), was used to inform scoring of the NIS-O instrument during a video analysis process of pre-service teachers’ use of nonverbal immediacy behaviors in each of three mixed reality simulations over the course of one semester.

**Interrater agreement.** The researcher and the dissertation chairperson who was familiar with the mixed reality simulations and NIS-O met in data meetings for the purpose of assessing the degree of agreement between them with respect to scoring the NIS-O instrument. The researcher and faculty member simultaneously re-watched and re-scored the observation tool (NCBOT) until they reached 100% agreement with respect to nonverbal immediacy behaviors, and their rating on the NIS-O survey instrument.
Quantitative data, scores obtained via the NIS-O instrument at three times over the course of one semester, were analyzed to address research question one: Using the NIS-O, is there a statistically significant difference over time between pre-service teachers’ nonverbal immediacy behaviors for three rounds of data collected, before, during, and at the conclusion of a semester in which a video and reflection, video feedback, and coaching treatment package is administered following mixed reality simulations?

Data collected via the NIS-O instrument were analyzed using the nonparametric paired Sign test (Gibbons & Chakraborti, 1992; Laerd Statistics, 2015; Sign Test Calculator, 2020). This procedure was used to test for a median difference in pre-service teachers’ nonverbal immediacy, as measured by the NIS-O, between two points of time. Pairwise comparisons were conducted between Time 1 and Time 2, Time 2 and Time 3, and Time 1 and Time 3. The Sign test allows for comparisons at the individual participant level, and for pairwise comparisons for all three sessions. The dependent variable was scores obtained via the NIS-O and the independent variable was time (Time 1, Time 2, and Time 3). The Sign test was employed using an online calculator (Sign test calculator, 2020) to determine whether there were significant differences in participants’ levels of nonverbal immediacy between the sessions being compared.

Qualitative Data Analysis

Qualitative data were analyzed consistent with case study design (Creswell & Poth, 2018; Yin, 2014). Researcher notes collected during observations of simulations about participants’ use of nonverbal immediacy behaviors and reactions of the avatars were analyzed for data triangulation purposes. Additionally, at the conclusion of the study, participant interview data in the single case design were examined to address research question two: What are the perceptions of pre-service teachers’ reflection and use of nonverbal immediacy behaviors over the course of
a semester in which they received video, video feedback, and coaching while utilizing a mixed reality simulation environment?

Participant interview data were analyzed through a systematic process employing both inductive and deductive analyses (Miles et al., 2014). A first cycle of coding (Miles et al., 2014; Saldaña, 2016) employing descriptive, process, and in vivo coding methods was used to develop initial codes. Deductive codes, informed by the research question and the literature on nonverbal immediacy, mixed reality simulations, video feedback and coaching, were used to analyze chunks of data. Inductive coding methods (Miles et al., 2014) allowed for the emergence of additional codes.

A second cycle of coding employed pattern coding methods (Miles et al., 2014; Saldaña, 2016) to further condense the data, and allowed for the emergence of categories and themes (Adu, 2019; Saldaña, 2016). Analytic memos (Saldaña, 2016) generated throughout the analysis process assisted with critically thinking about the data, making meaningful connections, and reporting findings.

**Coding.** Transcriptions of interview data and researcher observation data collected during three simulation sessions were uploaded to NVivo 12 Plus version 12.6.0.959 (NVivo, 2019), a popular computer assisted qualitative data analysis software (CAQDAS) package. A first cycle of coding (Miles et al., 2014) employing descriptive, process, and in vivo coding methods was used to develop initial codes. Deductive codes, informed by the research question and the literature on nonverbal immediacy, mixed reality simulations, video feedback, and coaching, were used to initially summarize chunks of data. Inductive coding methods (Miles et al., 2014) allowed for the emergence of additional codes from patterns of data. Initially, this first cycle of coding yielded 56 codes. See Figure 3.6 for an example of how transcriptions of
interview data were coded in the initial cycle of coding using the NVivo 12 Plus version 12.6.0.959 (NVivo, 2019) software.

Figure 3.6. Screenshot of partial list of first cycle codes created within NVivo 12 Plus software. In the graphic above, a transcript of Sylvia's transcription data was coded. The software shows that the transcript was coded with 31 first cycle codes and with 56 references of said codes.

A second cycle of coding employed pattern coding methods to further condense the data (Miles et al., 2014; Saldaña, 2016). The initial codes that resulted from the first level of coding were grouped into categories which were organized into themes and finding statements (Miles et al., 2014; Saldaña, 2016). Two overarching finding statements emerged through analysis of the data.

Statement of Ethics

The researcher obtained approval from the Institutional Review Board (IRB) prior to conducting the study. Following IRB approval, the researcher provided all participants with a detailed overview of the proposed study, the methods of data collection employed throughout, and the expected amount of time required for the intervention and participant interviews. All
video data were kept in a secure location on servers that utilize multiple forms of data encryption (see Appendix K) and participants were informed about the inherent threats to digital data. All transcriptions of interview data and data collected on quantitative instruments were kept confidential. Names of participants as well as the name of the school where the study was conducted were changed to maintain confidentiality. An internal audit (Appendix L) of all data was conducted. The overall results of the study will be made available to participants, if requested.

Summary of the Chapter

This chapter detailed the methods and procedures employed in this mixed-methods research study examining the effect of a video feedback and coaching intervention on pre-service teachers’ nonverbal immediacy behaviors as they interacted with student avatars in a mixed reality simulation environment. Chapter Four will detail the results and findings for the qualitative and quantitative data analysis employed in the present study.
CHAPTER FOUR: ANALYSIS OF DATA

The purpose of this study was to examine the effect of a video feedback and coaching treatment package on the nonverbal immediacy behaviors of pre-service teachers utilizing a mixed reality simulation environment. This mixed methods study addressed two research questions and data were collected across various data sources. The following chapter is divided into seven sections: (a) overview of the study, (b) data analysis and findings, (c) quantitative data analysis results, (d) summary of research question one results, (e) qualitative data analysis results, (f) summary of qualitative findings, and (g) chapter summary.

Overview of the Study

This mixed methods research study was used to explore the effect of a video feedback and coaching intervention and perceptions of pre-service teachers utilizing a mixed reality simulation environment with regards to their nonverbal immediacy behaviors. All pre-service teacher education students enrolled in an educational psychology course that embeds mixed reality simulations into the curriculum received a video feedback and coaching treatment package to promote use of nonverbal immediacy behaviors in the educational context. The study followed a mixed methods embedded design (Creswell & Plano Clark, 2011). Quasi-experimental quantitative data were collected at three points of time over the course of one semester and addressed the first research question, while qualitative data (case study) were collected to support triangulation of data sources and address the second research question. The two research questions for this study were:

1. Using the NIS-O, is there a statistically significant difference over time between pre-service teachers’ nonverbal immediacy behaviors for three rounds of data collected, before, during, and at the conclusion of a semester in which a video and reflection,
video feedback, and coaching treatment package is administered following mixed reality simulations?

a. *Non-directional hypothesis*: Using the NIS-O, there will be a statistically significant difference over time between pre-service teachers’ nonverbal immediacy behaviors for three rounds of data collected, before, during, and at the conclusion of a semester in which a video and reflection, video feedback, and coaching treatment package is administered following mixed reality simulations.

2. What are the perceptions of pre-service teachers’ reflection and use of nonverbal immediacy behaviors over the course of a semester in which they received video, video feedback, and coaching while utilizing a mixed reality simulation environment?

**Data Analysis and Findings**

The quantitative component of the study utilized a quasi-experimental design (Gall et al., 2003). Convenience sampling was utilized from two intact groups of students enrolled in two sections of an educational psychology course which is part of the teacher preparation program at the research site. Both groups received the treatment implemented during the study. The qualitative component of the research employed a case study design bound by pre-service teachers’ enrollment in an educational psychology course which embeds mixed reality simulations (Creswell & Poth, 2018; Yin, 2014).

A video feedback and coaching treatment package targeted at increasing nonverbal immediacy behaviors was provided to pre-service teacher participants (n = 15). The treatment was administered following each of three mixed reality simulation experiences that were embedded within the course. Quantitative data were collected following each simulation via the
NIS-O survey instrument. Video data of each participants’ performances were analyzed and a researcher-created observational tool, the NCBOT, was utilized to help inform scoring of the NIS-O instrument. Qualitative data were collected via mixed reality simulation observations, and a semi-structured exit interview. Additionally, data were collected via a demographic survey.

Pre-service teacher participants were observed during three mixed reality simulations, as they delivered a lesson to student avatars, over the course of a semester. Participants were provided with a video recording of their individual simulation experiences for their viewing. After participants watched their video, they received coaching by the researcher targeted at increasing their use of nonverbal immediacy behaviors in their interactions with the student avatars. Coaching sessions were informed through observational data collected both during live simulations in the simulation lab at the university, and through reviews of video recordings of the performances. These data, consisting of frequencies and durations of the pre-service teachers’ use of nonverbal immediacy behaviors and avatars’ behaviors and responses, were used to inform coaching sessions and for triangulation of data purposes.

To address research question one, quantitative data were collected via the NIS-O instrument at three time points over the course of a semester. Quantitative data were prepared, and assumptions were addressed. A Sign test statistic calculation was performed, and data analysis revealed a statistical difference in individual participant scores between Time 2 and Time 3, using an alpha level of .05.

After the third and final coaching session, which provided participants with summative feedback about their use of nonverbal immediacy behaviors over the semester and suggestions for applying learning to future practice, exit interviews were conducted. Transcripts of interviews comprised the main source of qualitative data and were analyzed to address research question
number two. An inductive and deductive coding process was employed (Miles et al., 2014) which resulted in the creation of categories and seven themes. These themes were analyzed, and two overarching finding statements resulted.

**Quantitative Data Analysis Results**

Quantitative data for this study consisted of pre-service teachers’ scores on the NIS-O. At the start of the research study, Microsoft® Excel® for Office 365 was used to create a record of all data collected. Each of 17 pre-service teachers enrolled in an introductory educational psychology course, which embedded mixed reality simulations, were assigned a unique pseudonym to maintain confidentiality. Additionally, participant data collected via a demographic survey was input, and numeric codes were assigned to nominal data (Pallant, 2013). Data were cleansed using a visual inspection process and were checked for missing values and errors (Myers, Gamst, & Guarino, 2006; Pallant, 2013). Two students were eliminated from the data set as they dropped the course and did not receive all three video feedback and coaching sessions. A total of 15 student participants (100% of students enrolled in the course) were included in the study as they experienced all three simulations and the video feedback and coaching sessions; no missing values were present in the data set. All data were then imported into Statistical Package for the Social Sciences v. 26 (SPSS) from the Microsoft® Excel® spreadsheets and descriptive statistics were performed to help ensure the accuracy of the data (Meyers et al., 2006). See Table 4.1 for NIS-O scores by participant for each simulation session.
Table 4.1

*NIS-O Scores for Each Simulation Session*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Time 1 NIS Score</th>
<th>Time 2 NIS Score</th>
<th>Time 3 NIS Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kate</td>
<td>76</td>
<td>83</td>
<td>89</td>
</tr>
<tr>
<td>Winnie</td>
<td>76</td>
<td>83</td>
<td>99</td>
</tr>
<tr>
<td>Callie</td>
<td>80</td>
<td>96</td>
<td>99</td>
</tr>
<tr>
<td>Samuel</td>
<td>83</td>
<td>85</td>
<td>105</td>
</tr>
<tr>
<td>Sheila</td>
<td>90</td>
<td>89</td>
<td>90</td>
</tr>
<tr>
<td>Renee</td>
<td>95</td>
<td>93</td>
<td>100</td>
</tr>
<tr>
<td>Bob</td>
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<td>94</td>
<td>98</td>
</tr>
<tr>
<td>Linda</td>
<td>98</td>
<td>104</td>
<td>103</td>
</tr>
<tr>
<td>Steven</td>
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<tr>
<td>Arnold</td>
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<td>Annie</td>
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<td>Maria</td>
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<td>Rose</td>
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</tr>
<tr>
<td>Sylvia</td>
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</tr>
<tr>
<td>Patrick</td>
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<td>113</td>
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</table>

Assessing for Univariate Outliers. The data were checked for outliers, or extreme scores (Hinkle et al., 1998). An examination of boxplots for Time 1, Time 2, and Time 3 (see Figure 4.1) did not indicate the presence of any outliers.
Figure 4.1 Boxplots of NIS-O scores for Time. This figure represents the factor of Time (Time 1, Time 2, and Time 3) for the one-group repeated measures quantitative aspect of the study.

**Descriptive statistics.** The means, standard deviations, minimum and maximum values for each group, Time 1, Time 2, and Time 3 are shown in Table 4.2.

Table 4.2

*Descriptive Statistics: Pre-service Teachers’ Nonverbal Immediacy Scores*

<table>
<thead>
<tr>
<th>Session</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td>76</td>
<td>113</td>
<td>96.933</td>
<td>13.247</td>
</tr>
<tr>
<td>Time 2</td>
<td>83</td>
<td>113</td>
<td>97.933</td>
<td>10.700</td>
</tr>
<tr>
<td>Time 3</td>
<td>89</td>
<td>115</td>
<td>102.933</td>
<td>7.459</td>
</tr>
</tbody>
</table>

**Normality.** To assess the normality of the data, the skewness and kurtosis of the NIS-O scores collected for Time were examined. All values for skewness fell between ±1, the acceptable range (Meyers et al., 2006). Values for kurtosis of the distribution of the scores indicated kurtotic distributions for Time 1 and Time 2, as the values fell outside the acceptable ±1 range, therefore the nonparametric Sign test statistic was used to analyze the data. Data
collected for Time 3 fell within the acceptable range. See Table 4.3 for skewness and kurtosis values for the factor of Time.

Table 4.3

*Skewness and Kurtosis for NIS-O Scores*

<table>
<thead>
<tr>
<th>Time</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td>-.409</td>
<td>-1.203</td>
</tr>
<tr>
<td>Time 2</td>
<td>.078</td>
<td>-1.329</td>
</tr>
<tr>
<td>Time 3</td>
<td>.345</td>
<td>-.144</td>
</tr>
</tbody>
</table>

**Research Question One**

Research question one was: Using the NIS-O, is there a statistically significant difference over time between pre-service teachers’ nonverbal immediacy behaviors for three rounds of data collected, before, during, and at the conclusion of a semester in which a video and reflection, video feedback, and coaching treatment package is administered following mixed reality simulations? The non-directional hypothesis for research question one proposed that using the NIS-O, there would be a statistically significant difference over time between pre-service teachers’ nonverbal immediacy behaviors for three rounds of data collected, before, during, and at the conclusion of a semester in which a video and reflection, video feedback, and coaching treatment package was administered following mixed reality simulations.

To address the hypothesis, an exact paired Sign test (Gibbons & Chakraborti, 1992; Laerd Statistics, 2015; Sign Test Calculator, 2020) was employed to analyze the effect of a treatment package on pre-service teachers’ level of nonverbal immediacy, as measured by the NIS-O, as they delivered lessons to student avatars in a mixed reality simulation environment. A
total of 15 pre-service teachers experienced three simulations embedded within their pre-service teacher preparation program.

**Paired sample sign test.** The Sign test is used to determine if median differences between paired observations exist (Laerd Statistics, 2015). The statistic calculates whether the differences between paired observations are statistically significant to 0. To explore differences among three points of time over the course of a semester, participants’ nonverbal immediacy scores were compared for Time 1 and Time 2, Time 2 and Time 3, and Time 1 and Time 3.

**Paired Sample Sign Test Assumptions.** The paired sample Sign test was the statistical test employed to analyze the NIS-O data. This test requires certain assumptions to be met. The NIS-O data met the following criteria:

*One dependent variable.* One dependent variable, continuous or ordinal in nature, is analyzed. The continuous variable considered is pre-service teachers’ levels of nonverbal immediacy, as measured by the NIS-O survey instrument.

*One independent variable consisting of two related groups.* Pairwise comparisons were analyzed for Time (Time 1 and Time 2, Time 2 and Time 3, and Time 1 and Time 3). The same pre-service teachers were measured on the same dependent variable, levels of nonverbal immediacy, during three different times over the course of one semester.

**Research question one data analysis.** The paired sample Sign test statistic procedure was conducted to determine if significant differences in participants’ levels of nonverbal immediacy existed between two points of time. Each pairwise comparison was analyzed by subtracting the Nonverbal Immediacy score obtained from an earlier time point, from the more recent mixed reality simulation for each participant. In Table 4.4, for example, Bob scored 94 on the NIS-O for Time 2 and a 98 for Time 1. The Time 1 score is then subtracted from the Time 2
score, resulting in -4; the sign of the result is included in the calculation of the statistic. Positive signs indicate growth in nonverbal immediacy while negative signs indicate a decline for the pairwise comparison. For instances where there is no difference in scores between the two time points, an “NA” value is attributed, and the result is not counted in the overall calculation (see Table 4.4).

An exact Sign test (Gibbons & Chakraborti, 1992; Laerd Statistics, 2015; Sign Test Calculator, 2020) was used to compare the differences between sessions. Refer to Tables 4.4 through 4.6 for pairwise comparisons for Time 1 and Time 2, Time 2 and Time 3, and Time 1 and Time 3. A significance level of $p < .05$ was used.

Table 4.4

<table>
<thead>
<tr>
<th>Participant</th>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 2-Time 1</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kate</td>
<td>76</td>
<td>83</td>
<td>7</td>
<td>+</td>
</tr>
<tr>
<td>Winnie</td>
<td>76</td>
<td>83</td>
<td>7</td>
<td>+</td>
</tr>
<tr>
<td>Callie</td>
<td>80</td>
<td>96</td>
<td>16</td>
<td>+</td>
</tr>
<tr>
<td>Samuel</td>
<td>83</td>
<td>85</td>
<td>2</td>
<td>+</td>
</tr>
<tr>
<td>Sheila</td>
<td>90</td>
<td>89</td>
<td>-1</td>
<td>-</td>
</tr>
<tr>
<td>Renee</td>
<td>95</td>
<td>93</td>
<td>-2</td>
<td>-</td>
</tr>
<tr>
<td>Bob</td>
<td>98</td>
<td>94</td>
<td>-4</td>
<td>-</td>
</tr>
<tr>
<td>Linda</td>
<td>98</td>
<td>104</td>
<td>6</td>
<td>+</td>
</tr>
<tr>
<td>Steven</td>
<td>101</td>
<td>112</td>
<td>11</td>
<td>+</td>
</tr>
<tr>
<td>Arnold</td>
<td>102</td>
<td>92</td>
<td>-10</td>
<td>-</td>
</tr>
<tr>
<td>Annie</td>
<td>109</td>
<td>100</td>
<td>-9</td>
<td>-</td>
</tr>
<tr>
<td>Maria</td>
<td>109</td>
<td>104</td>
<td>-5</td>
<td>-</td>
</tr>
<tr>
<td>Rose</td>
<td>112</td>
<td>113</td>
<td>1</td>
<td>+</td>
</tr>
<tr>
<td>Sylvia</td>
<td>112</td>
<td>108</td>
<td>-4</td>
<td>-</td>
</tr>
<tr>
<td>Patrick</td>
<td>113</td>
<td>113</td>
<td>0</td>
<td>NA</td>
</tr>
</tbody>
</table>
When a pairwise comparison of nonverbal immediacy scores for Time 1 and Time 2 was conducted using the exact Sign statistic, 7 participants improved, and 7 participants declined in their level of nonverbal immediacy while one participant scored the same for both time points. There was no statistically significant result in nonverbal immediacy, as measured by the NIS-O, when participants’ scores between Time 1 and Time 2 were compared ($z = 0.000$, $p = 1.00$).

Table 4.5

*Paired Sample Sign Test for Nonverbal Immediacy Scores by Participant for Time 2 and Time 3*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Time 2</th>
<th>Time 3</th>
<th>Time 3 - Time 2</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kate</td>
<td>83</td>
<td>89</td>
<td>6</td>
<td>+</td>
</tr>
<tr>
<td>Winnie</td>
<td>83</td>
<td>99</td>
<td>16</td>
<td>+</td>
</tr>
<tr>
<td>Samuel</td>
<td>85</td>
<td>105</td>
<td>20</td>
<td>+</td>
</tr>
<tr>
<td>Sheila</td>
<td>89</td>
<td>90</td>
<td>1</td>
<td>+</td>
</tr>
<tr>
<td>Arnold</td>
<td>92</td>
<td>104</td>
<td>12</td>
<td>+</td>
</tr>
<tr>
<td>Renee</td>
<td>93</td>
<td>100</td>
<td>7</td>
<td>+</td>
</tr>
<tr>
<td>Bob</td>
<td>94</td>
<td>98</td>
<td>4</td>
<td>+</td>
</tr>
<tr>
<td>Callie</td>
<td>96</td>
<td>99</td>
<td>3</td>
<td>+</td>
</tr>
<tr>
<td>Annie</td>
<td>100</td>
<td>103</td>
<td>3</td>
<td>+</td>
</tr>
<tr>
<td>Linda</td>
<td>104</td>
<td>103</td>
<td>-1</td>
<td>-</td>
</tr>
<tr>
<td>Maria</td>
<td>104</td>
<td>108</td>
<td>4</td>
<td>+</td>
</tr>
<tr>
<td>Sylvia</td>
<td>108</td>
<td>108</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Steven</td>
<td>112</td>
<td>110</td>
<td>-2</td>
<td>-</td>
</tr>
<tr>
<td>Rose</td>
<td>113</td>
<td>115</td>
<td>2</td>
<td>+</td>
</tr>
<tr>
<td>Patrick</td>
<td>113</td>
<td>113</td>
<td>0</td>
<td>NA</td>
</tr>
</tbody>
</table>

When Time 2 and Time 3 pairwise comparisons were conducted, 11 participants increased their level of nonverbal behaviors, 2 participants’ scores decreased, and 2 participants’ scores remained constant. An exact Sign test was conducted and a statistically significant increase in nonverbal immediacy, as measured by the NIS-O, resulted ($z = 2.496$, $p = .013$).
Table 4.6

*Paired Sample Sign Test for Nonverbal Immediacy Scores by Participant for Time 1 and Time 3*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Time 1</th>
<th>Time 3</th>
<th>Time 3-Time 1</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kate</td>
<td>76</td>
<td>89</td>
<td>13</td>
<td>+</td>
</tr>
<tr>
<td>Winnie</td>
<td>76</td>
<td>99</td>
<td>23</td>
<td>+</td>
</tr>
<tr>
<td>Callie</td>
<td>80</td>
<td>99</td>
<td>19</td>
<td>+</td>
</tr>
<tr>
<td>Samuel</td>
<td>83</td>
<td>105</td>
<td>12</td>
<td>+</td>
</tr>
<tr>
<td>Sheila</td>
<td>90</td>
<td>90</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Renee</td>
<td>95</td>
<td>100</td>
<td>5</td>
<td>+</td>
</tr>
<tr>
<td>Bob</td>
<td>98</td>
<td>98</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Linda</td>
<td>98</td>
<td>103</td>
<td>5</td>
<td>+</td>
</tr>
<tr>
<td>Steven</td>
<td>101</td>
<td>110</td>
<td>9</td>
<td>+</td>
</tr>
<tr>
<td>Arnold</td>
<td>102</td>
<td>104</td>
<td>2</td>
<td>+</td>
</tr>
<tr>
<td>Annie</td>
<td>109</td>
<td>103</td>
<td>-6</td>
<td>-</td>
</tr>
<tr>
<td>Maria</td>
<td>109</td>
<td>108</td>
<td>-1</td>
<td>-</td>
</tr>
<tr>
<td>Rose</td>
<td>112</td>
<td>115</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Sylvia</td>
<td>112</td>
<td>108</td>
<td>-4</td>
<td>+</td>
</tr>
<tr>
<td>Patrick</td>
<td>113</td>
<td>113</td>
<td>0</td>
<td>NA</td>
</tr>
</tbody>
</table>

The exact Sign statistic was performed and a pairwise comparison of pre-service teachers’ level of nonverbal immediacy for Time 1 and Time 3 was conducted. There was no statistically significant increase in nonverbal immediacy, as measured by the NIS-O, when participants’ scores between Time 1 and Time 3 were compared ($z = 1.732, p = .083$).

**Summary of research question one results.** A paired Sign test statistic procedure was performed to address research question one: Using the NIS-O, is there a statistically significant difference over time between pre-service teachers’ nonverbal immediacy behaviors for three rounds of data collected, before, during, and at the conclusion of a semester in which a video and reflection, video feedback, and coaching treatment package is administered following mixed reality simulations? Pairwise comparisons of pre-service teachers’ level of nonverbal immediacy
were examined for Time 1 and Time 2, Time 2 and Time 3, and Time 1 and Time 3. Pre-service teacher participants received a video feedback and coaching treatment package, aimed at increasing their level of nonverbal immediacy behaviors, following each of three mixed reality simulations over the course of one semester.

An exact Sign test statistic was conducted and resulted in a statistically significant median increase in the level of nonverbal immediacy, as measured by the NIS-O, when Time 2 and Time 3 were compared. No additional statistically significant differences in scores were found. See Table 4.7 for a summary of results for all three pairwise comparisons of NIS-O scores for each simulation session.

Table 4.7

<table>
<thead>
<tr>
<th>Session Comparisons</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1 and Session 2</td>
<td>$p = 1.000$</td>
</tr>
<tr>
<td>Session 2 and Session 3</td>
<td>$p = .013^*$</td>
</tr>
<tr>
<td>Session 1 and Session 3</td>
<td>$p = .083$</td>
</tr>
</tbody>
</table>

*Note. * indicates significance at the .05 level.

**Qualitative Data Analysis**

The qualitative component of this mixed-methods study utilized data that related to pre-service teachers’ perceptions of their reflections and use of nonverbal immediacy behaviors, following receiving a video feedback and coaching treatment package focused on improving use of nonverbal immediacy, over a semester in which they experienced three mixed reality simulations as part of their teacher preparation program. Qualitative data consisted of observations and semi-structured interviews following researcher protocols (see Appendices E and F) which were analyzed through a case study approach (Creswell & Poth, 2018; Yin, 2014).
to address research question number two: What are the perceptions of pre-service teachers’
reflection and use of nonverbal immediacy behaviors over the course of a semester in which they
received video, video feedback, and coaching while utilizing a mixed reality simulation
environment?

Each participant was assigned a unique pseudonym to assist with keeping confidentiality
within the study. Qualitative data were entered into an Excel® spreadsheet and NVivo 12 Plus
version 12.6.0.959 (NVivo, 2019) software for qualitative data analysis purposes.

Observations of mixed reality simulations data. Qualitative data were collected during
live mixed reality simulations in the simulation lab at the university and when videotaped
recordings of simulations were reviewed. Live observations of each of the three simulations over
the course of the semester lasted a total of 7 hours and 15 minutes. The length of individual
recordings ranged from 1 minute and 40 seconds to 5 minutes and 44 seconds with an average
length of 3 minutes and 21 seconds. The total of all participants’ individual video recordings of
their three mixed reality simulation sessions was 2 hours and 31 minutes.

Interview data. Semi-structured interview data were transcribed through an online
transcription service, Otter.ai, and rechecked line by line for accuracy. For clarity, participant
utterances of the words “like” or “um” were not included. Transcriptions were uploaded to
NVivo 12 Plus version 12.6.0.959 (NVivo, 2019). Interviews ranged from a length of about 10
minutes to 28 minutes, with an average length of 19 minutes for the 15 participants.

Participants

A total of 15 (n = 15) pre-service teachers took part in the study. Participants were in
their sophomore, junior, or senior year. Participants ranged in age from 19 – 24 years, with an
average age of 21. Students were enrolled in an educational psychology course that embeds three
mixed reality simulation sessions within its curriculum. Typically, the course provides a second set of three simulations within the overall preparation program. However, two participants did not receive any prior experiences in the mixed reality simulation environment. Refer to Table 4.8 for age and simulation experience statistical data.

Table 4.8

*Age and Simulation Experience Statistical Data for Pre-service Teacher Participants*

<table>
<thead>
<tr>
<th>Variable (n = 15)</th>
<th>Age</th>
<th>Prior Simulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>21</td>
<td>2</td>
</tr>
<tr>
<td>Median</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Mode</td>
<td>20</td>
<td>3</td>
</tr>
</tbody>
</table>

Ten participants identified their gender as female while 12 participants planned on teaching solely at the secondary level. With respect to ethnicity, 12 participants were Caucasian. Moreover, 10 participants indicated that they had received no prior training in using nonverbal communication when working with students. Three pre-service teachers indicated they had received brief training in nonverbal communication, including use of eye contact and posture, within the context of coursework related to delivering a presentation or speech. Two participants stated they had experienced some discussions, during prior semesters within their teacher preparation program, utilizing nonverbal communication with students. See Table 4.9 for additional demographic information.
Table 4.9

**Demographic Information for Preservice Teacher Participants**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Attribute</th>
<th>Number of Student Participants</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender Identity</td>
<td>Female</td>
<td>10</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>5</td>
<td>33</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Caucasian</td>
<td>12</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Hispanic/Latino</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Year of Study</td>
<td>Sophomore</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Junior</td>
<td>11</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Senior</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Program</td>
<td>Elementary</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>12</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>K-12</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Concentration</td>
<td>Elementary Education</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>English</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Math</td>
<td>4</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Music</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Social Studies</td>
<td>4</td>
<td>27</td>
</tr>
<tr>
<td>Prior training-</td>
<td>Nonverbal</td>
<td>Yes</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Communication</td>
<td>No</td>
<td>10</td>
</tr>
</tbody>
</table>

**Qualitative Data Analysis Results**

Analysis of the qualitative data revealed two overarching finding statements. The first finding statement, which was supported by three themes was: Video feedback and coaching fostered pre-service teacher reflection on the simulated environment as pre-service teachers delivered lessons within the simulation (see Figure 4.2). The second finding statement, which was supported by four themes was: Video feedback and coaching within a mixed reality simulation environment improved pre-service teachers’ use of nonverbal immediacy behaviors in student interactions (see Figure 4.3). Both finding statements and their supporting themes are described in the following sections.
Finding Statement One

The first finding statement was: Video feedback and coaching fostered pre-service teacher reflection on the simulated environment as pre-service teachers delivered lessons within the simulation. This finding statement was supported by three themes: objectivity of reflection, layering of reflection with addition of coaching, and comfort and confidence in teaching. See Figure 4.2.

**Figure 4.2.** Qualitative Finding Statement One. The figure depicts the three themes that emerged from the data related to the first of two overarching finding statements.

Pre-service teacher participants’ use of video feedback and coaching promoted reflection on their nonverbal immediacy behaviors while teaching in the mixed reality simulation environment. Tripp and Rich (2012) define teacher reflection as, “a self-critical, investigative process wherein teachers consider the effect of their pedagogical decisions on their situated practice with the aim of improving those practices” (p. 678) and tout the use of video as one way to support teacher reflection. The use of video recordings for reflective practices provides
teachers “…the opportunity to re-live a teaching episode” (McCullough, 2012, p. 139) and serves as a detailed record of teaching events that can be viewed multiple times at the convenience of the teacher (Knight, 2014; McCullough, 2012).

Theme one related to a degree of objectivity of pre-service teachers’ reflections with the use of video to ground the teaching episode. In lieu of a memory of the teaching session, pre-service teachers utilized a video recording of their teaching performance to review their nonverbal immediacy behaviors and interactions with student avatars as they delivered a lesson. Theme two referred to the degree of objectivity of the pre-service teachers’ reflections with the addition of coaching. Coaching offered pre-service teachers opportunities to consider a more experienced outsider’s point of view of the teaching performance. Theme three referred to pre-service teachers’ perceptions of changes in their levels of comfort and confidence in delivering lessons over the course of a semester in which they received video feedback and coaching while experiencing mixed reality simulations.

Citations of transcript and observation data. Citations of quotes from interview transcripts are noted with the letter “I” and the line number(s) of the transcript where the quote is found. Citations of observations are noted with the letter “O” followed by the number of the simulation session where the observed behavior occurred.

Theme 1: Objectivity of reflection. Participants indicated that the use of video provided objectivity when they reflected on their teaching performances. Video recordings of pre-service teachers’ performances allowed for a review of teaching after feelings of stress experienced while delivering the lesson had subsided. Annie, a junior majoring in music education, described her appreciation of having the opportunity to view her teaching when she was emotionally ready when she stated in the interview:
Well, when [the simulation] happens in the moment, it feels like it’s all a blur and it just happens so quick because of the nerves and the time constraint and everything. So being able to review what I did once I calmed down and I can actually soak in everything…it’s just a great reflective practice to improve on myself for the next time. So, I found it very beneficial. (I: 90-93)

Linda, a junior studying secondary social studies also described how the video recordings helped illuminate a more accurate depiction of her teaching when she stated, “I think the videos are helpful to have. In the moment, everything is just kind of ‘go, go, go,’ but when you get to watch [the simulation] back, you can see a lot of different things and see how you actually did” (I: 278-280). She further explained, “[The video] was really helpful because in the moment, you always think you didn’t do very well, but then you watch it back and see what you were successful at and what was a little rough” (I: 286-287). She added, “watching the videos, you can kind of see okay, okay, it wasn’t that bad” (I: 295-296).

Sylvia, another pre-service secondary social studies teacher affirmed, “You’re not going to remember it because you're so nervous going up there, or it just happens in a frenzy so you don’t really remember so the videos are definitely very helpful” (I: 300-302). Renee, a secondary mathematics pre-service teacher, similarly described her reflection and use of video stating, “You know, you’re standing up there and you think you’re saying all the wrong things, but then you go back and watch yourself and it’s like, oh, that wasn’t so bad, you know?” (I: 146-148).

Some pre-service teachers expressed that the video recording allowed them to view themselves from an objective, external view of their teaching. Bob, a junior studying secondary social studies, indicated the video was useful in helping him see how others saw him and conveyed:
It let me see, just look for any, ticks that I may have, you know how some public speakers might fidget or put their hands in their pockets or something, stuff like that. It was lucky to see from a third person’s perspective if I had something that didn’t add up.

(I: 93-96)

Sheila, a sophomore majoring in secondary chemistry education affirmed, “[The video] kind of makes you aware. Watching yourself makes you aware of how you appear to others” (I: 235-236). See Table 4.10 for frequencies of codes related to Theme 1, objectivity of reflection.

Table 4.10

*Frequency of codes for Theme 1: Objectivity of Pre-service Teachers’ Reflections*

<table>
<thead>
<tr>
<th>Categories Related to Objectivity of Reflections</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of video to ground reflection</td>
<td></td>
</tr>
<tr>
<td>Engaged in reflection on interactions with avatars</td>
<td>28</td>
</tr>
<tr>
<td>Appreciation of external view video provided</td>
<td>8</td>
</tr>
<tr>
<td>Reviewed video when calm</td>
<td>9</td>
</tr>
</tbody>
</table>

**Theme 2: Coaching layered pre-service teachers’ reflections.** According to Joyce and Showers (1981), coaching is a collaborative activity “…characterized by observation and feedback cycle in an ongoing instructional or clinical situation” (p. 170). Coaching involves “…analysis of teaching for the purpose of integrating mastered skills and strategies into a curriculum, a set of instructional goals, a time span, and a personal teaching style” (p. 170). In their definition, contextual applications of skills are considered as “…the teacher and ‘coach’ examine appropriate places in the curriculum for use of specific strategies, evaluate the effectiveness of observed lessons, and plan for future trials” (p. 170).
Participants spoke about how coaching by the researcher added to their personal reflections on their use of nonverbal immediacy behaviors with the student avatars. See Table 4.11 for frequency of codes related to Theme 2, coaching layered pre-service teachers’ reflections.

Table 4.11

*Frequency of codes for Theme 2: Coaching Layered Pre-service Teachers’ Reflections*

<table>
<thead>
<tr>
<th>Categories Related to Coaching and Perceptions of Teaching</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coaching provided for an outside perspective</td>
<td></td>
</tr>
<tr>
<td>Appreciation of coaching feedback</td>
<td>18</td>
</tr>
<tr>
<td>Expressed used coaching to change NVC behavior</td>
<td>8</td>
</tr>
<tr>
<td>Use of video to ground coaching sessions</td>
<td>6</td>
</tr>
</tbody>
</table>

*Note.* (Explain the meaning of NVC)

Arnold, a secondary mathematics education student in his junior year, stated:

*I see myself and I can, you know, do my own self-evaluation which is pretty good and I also like your calls so you can give me feedback and, you know, advise and tell me what to do next and what should I not do also.* (I: 150-154)

Callie, a junior studying secondary social studies education, appreciated the feedback and discussion involved in the coaching and relayed, “I just think the biggest part that helped me the most is being able to watch my simulation after the fact and then being able to talk about it so the coaching helps you I’d say” (I: 230-231). Samuel, a 24-year-old junior majoring in elementary education articulated how coaching helped focus his reflection and said, “The videos are actually very helpful and in reflecting I was able to pick up on some things like, for example, when you told me about my leg being bent that I like, really paid attention to that” (I: 122-123).
Renee discussed how coaching addressed the contextual nature of learning to apply nonverbal immediacy behaviors in her teaching when she stated, “Having the coaching sessions made me more aware of what gestures I was doing and then when I should do them or shouldn’t do them” (I: 230-232). Moreover, coaching provided Sheila with a layer of objectivity with regards to her personal reflections when she conveyed:

Watching the video back is definitely beneficial but…I always tend to be harder on myself. So, then I think that when you follow up and do the coaching over the phone, that’s definitely very helpful to realize the things that were done well, not just like nitpick everything. (I: 314-318)

Steven, a junior and secondary English education major, stated that the coaching sessions encouraged reflection activities and conveyed his appreciation for the coaching feedback when he stated, “Your coaching definitely challenged me to reflect a lot and I think that was quite helpful. So that’s pretty much it, I’d say you were very good at helping me to reflect and I’d say I very much appreciate it” (I: 336-338).

**Theme 3: Comfort and confidence in teaching.** Pre-service teachers who received a video feedback and coaching treatment package focused on their nonverbal immediacy behaviors as they utilized a mixed reality simulation environment believed their comfort level and confidence in teaching increased over the course of the semester. Twelve participants described their growth in the level of comfort or confidence in being able to deliver lessons, engage students, and manage student behaviors. See Table 4.12 for frequencies of codes related to Theme 3, comfort and confidence in teaching.
Table 4.12

*Frequency of codes for Theme 3: Confidence in Teaching*

<table>
<thead>
<tr>
<th>Categories Related to Confidence and Comfort Teaching</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Becoming a teacher</td>
<td></td>
</tr>
<tr>
<td>Expressed growth in teaching ability</td>
<td>36</td>
</tr>
<tr>
<td>Perceptions of professionalism</td>
<td>7</td>
</tr>
<tr>
<td>Ability to “think on feet”</td>
<td>3</td>
</tr>
<tr>
<td>Practice</td>
<td></td>
</tr>
<tr>
<td>Opportunities for rehearsal</td>
<td>10</td>
</tr>
<tr>
<td>Real-world experience</td>
<td>8</td>
</tr>
<tr>
<td>Appreciation of coaching feedback</td>
<td>18</td>
</tr>
</tbody>
</table>

Steven shared his perceived increase in confidence in using nonverbal immediacy behaviors and communication to engage students and manage behavior as a result of receiving the treatment when he stated:

I think just having that in mind like having it in the back of my head helped me to think about it while I was teaching. It kind of helped me become more self-confident but in a positive a way making sure that I'm that I have a body language that's engaging or one that's going to keep them on task. (I: 175-178)

Linda also described a similar view and relayed, “I think definitely with confidence in learning how to talk to a group of people and learning how to settle down a class” (I: 205-206). Linda also added, “I’ve kind of been able to change things on the fly a lot better” (I: 219-220).
Annie described how her perceived confidence in utilizing nonverbal immediacy behaviors in her teaching will allow her to apply that learning in a real classroom environment and stated:

Through the coaches with you, I learned some new things to try out. And now I would feel more comfortable using them in the classroom because I got to test them out on the avatars and see like, oh, worked here. So now I'm going to try it [with real students]. (I: 160-162)

Most participants indicated that they grew in confidence or comfort in teaching over the course of the semester. Kate, a sophomore studying secondary mathematics education, and one of the youngest participants in the study described how her confidence in teaching real students changed and conveyed:

I need more work because I’m not as experienced as everyone else. But I do feel more confident in [teaching real students] and I just think that overall, I’ve gotten much better at it and I feel more confident teaching the classroom now as opposed to in the past. (I: 340-342)

Rose, a junior studying secondary English education, echoed a similar sentiment and stated, “I definitely gained a lot more knowledge. I definitely feel a lot more confident a lot more comfortable. I mean, there’s always room for improvement, but yeah” (I: 282-283). Patrick, a non-native English speaker majoring in secondary mathematics education also commented, “I say [it’s] helping us to get more comfortable and when you are teaching, when you have a situation that we are in like a real scenario you will know how to handle those already” (I: 196-197). Winnie, a 21-year-old junior studying elementary education and transfer student, described her increased confidence, especially in the area of behavior management and expressed:
I think I’m more confident…knowing what to do when behaviors are you know, over the top because the [simulation] was like something I’ve never really had to deal with before. I mean, the third one, that behavior I’ve never really seen before so that I think was helpful…being able to deal with kids who actually act like that. (I: 360-363)

Maria, a senior majoring in secondary English education, spoke about how the video feedback and coaching treatment within the mixed reality simulations impacted her growth in confidence and how she sees herself as a teaching professional and declared, “I feel like it’s done a lot just for that confidence and ‘you’ve got this’ kind of idea. I’ve seen a lot of growth because of that, becoming more confident in my place, and idea. I’ve grown not maturity wise, but just in myself and… how I view myself” (I: 72-74).

**Finding Statement Two**

Finding statement two was: video feedback and coaching within a mixed reality simulation environment improved pre-service teachers’ use of nonverbal immediacy behaviors in student interactions. This finding was supported by four themes: building relationships, student engagement, behavior management, and transference of nonverbal immediacy skills to practice (see Figure 4.3).
Finding Statement Two:
Video and reflection, video feedback, and coaching within a mixed reality simulation environment improved pre-service teachers’ use of nonverbal immediacy behaviors in student interactions.

Figure 4.3. Qualitative Finding Statement Two. The figure depicts the four themes that emerged from the data that supported the second of two overarching finding statements.

Theme 1: Building relationships. The teacher-student relationship is an interpersonal one; establishing interpersonal rapport can promote positive student learning outcomes (Worley, Titsworth, Worley, & Cornett-DeVito, 2007). Six participants indicated that the use of video feedback and coaching, focused on their use of nonverbal immediacy behaviors with the student avatars, helped them understand the importance of nonverbal communication in establishing positive student-teacher relationships. See Table 4.13 for frequencies of codes related to Theme 1, building relationships.
Table 4.13

*Frequency of codes for Theme 1: Building Relationships*

<table>
<thead>
<tr>
<th>Categories Related to Establishing Rapport</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception of Students</td>
<td></td>
</tr>
<tr>
<td>Rapport</td>
<td>7</td>
</tr>
<tr>
<td>Approachability</td>
<td>6</td>
</tr>
<tr>
<td>Friendliness</td>
<td>4</td>
</tr>
</tbody>
</table>

Pre-service teachers expressed a desire to appear friendly and open to communication with students and the video feedback and coaching helped to foster their own use of nonverbal immediacy behaviors for that purpose. For example, Maria discussed the importance of student perception and how the feedback and coaching within the simulations assisted her and commented:

> Working with students, you realize…you need to make fast decisions, you need to be confident in what you’re saying. If you’re confident what you’re saying, they’ll be more apt to follow you and it’s all about perception, being friendly and open. So, doing the simulations has allowed me to open up like that. (I: 134-138)

Observational data from all three sessions supported Maria’s comments. Maria moved toward the student avatars when addressing them and used smiling, open hand gesturing, and eye contact at the beginning of the lesson (O: 1, 2, 3).

Sheila expressed how the use of the video feedback and coaching treatment helped her to be more aware of her nonverbal immediacy behaviors to appear open for communication and stated:
I’d say [video feedback and coaching] made me more aware of what I was doing in the moment because I feel sometimes looking back at what you did, you’re like, “Oh! I didn’t even realize I did that”. So, it made me more aware to not talk with my arms crossed or stuff like that, so I didn’t appear closed off. (I: 150-153)

Observational data revealed that Sheila, after the first observation, used many nonverbal immediacy behaviors to help establish rapport with the student avatars. In the first observation, Sheila used eye contact with the avatars, but clasped her hands and did not appear relaxed throughout the session (O:1). However, during the second observation, Sheila used open hand gestures, smiling, and varied her tone of voice when beginning the class discussion (O: 2). Throughout the third simulation, Sheila began to use proximity with the student avatars, smiled, used open hand gestures, and had an overall more relaxed posture when delivering her lesson (O: 3).

Sylvia utilized the video feedback and coaching to focus on her nonverbal immediacy behaviors to not only ensure she was building rapport with students, but also considered the role of her nonverbal communication in helping to build rapport with her professional colleagues and administrative personnel as well, and stated:

Well, [the video feedback and coaching] help me to seem more open and not as closed off to people and that’s sort of what I want to be able to emulate so that way people can feel like I’m someone they can trust and rely on…so I want to make sure I can build a good rapport not just with my future students, but with my future co-workers and employers. (I: 185-190)
In all three observations, Sylvia used nonverbal immediacy behaviors to introduce herself and promote subsequent interactions. Sylvia was expressive and used eye contact, smiling, and open hand gestures, and had an overall relaxed posture when she addressed the class (O: 1, 2, 3).

Samuel described how he used the treatment and now intentionally focuses on his nonverbal immediacy behaviors to help ensure he is perceived in a positive way by his students and said:

One of my areas of focus was, you know, being approachable and...just enabling the students to want to communicate with me. It’s cool, I’ve never been able to actually see myself performing the simulations, so it was different, and I liked it. (I: 123-126)

Samuel reiterated his intentional use of nonverbal immediacy behaviors to build relationships with students when he stated:

I’m more conscious about them now, I mean, I would always be smiling with students and I’ll always be very friendly with them. But now I’m doing it in a conscious way where I want to make sure I do it. (I: 306-307)

In the first two observations, Samuel used very few nonverbal immediacy behaviors to help establish rapport with the avatars. When he first addressed the class, he stood awkwardly, crossing his legs, and kept his hands close to his body and his tone of voice was somewhat monotone (O: 1, 2). In the third observation, however, Samuel used proximity, eye contact, smiling, and had a relaxed posture when beginning the session with the avatars (O: 3).

**Theme 2: Student engagement.** Participants described their focus on increasing nonverbal immediacy behaviors to engage students. See Table 4.14 for frequencies of codes related to Theme 2, student engagement.
Table 4.1

*Frequency of codes for Theme 2: Engaging Students*

<table>
<thead>
<tr>
<th>Categories Related to Use of NVC for Interaction</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher / Student Communication</td>
<td></td>
</tr>
<tr>
<td>Openness for communication</td>
<td>10</td>
</tr>
<tr>
<td>Use of NVC for gaining attention</td>
<td>7</td>
</tr>
</tbody>
</table>

Linda described her reflection on her teaching fostered via the video feedback and coaching treatment, and her intentional use of nonverbal immediacy behaviors to engage students when she vocalized:

I think after watching the first one, I kind of saw what I did and didn't do. And then the second and third one, I kind of learned from what I did and realized I had to be a little bit more animated, and a little bit more on top of it, I guess, with that kind of stuff. I couldn't really just, even though they're avatars, you can’t really just like stand there and just talk to them in a monotone voice for two and a half minutes. (I: 95-99)

Observational data revealed that Linda used eye contact and smiling nonverbal immediacy behaviors throughout all three simulations (O: 1, 2, 3). In her second and third simulations, however, Linda began to employ open gestures and her overall posture was more relaxed as she engaged the avatars in a lesson about the thirteen colonies (O: 2, 3). Linda also began to use proximity in her final simulation session (O: 3) after receiving two video feedback and coaching treatments.

Steven also discussed how the treatment increased his confidence in using nonverbal immediacy behaviors to engage students when he said:
I think just having that in mind, having it in the back of my head helped me to think about it while I was teaching. It kind of helped me become more self-confident in a positive way making sure I have a body language that’s engaging or one that’s going to keep them on task. (I: 175-178)

Steven was observed utilizing immediate behaviors of eye contact, smiling, and much open gesturing while engaging the student avatars as he delivered his lessons (O: 1, 2, 3). However, in the first simulation, Steven was observed utilizing nonverbal communication behaviors such as tugging at his shirt and shifting his feet throughout much of the simulation. These adaptive behaviors often nonverbally communicate a nervous or anxious internal state (Allen, 2019). In subsequent observations, Steven appeared to have a relaxed posture, began to move toward avatars while engaging them, and being animated as he delivered lessons (O: 2, 3).

Annie spoke about the importance of not only increasing the use of nonverbal immediacy behaviors to engage students, but also the importance of knowing when to use nonverbal communication based upon changing classroom conditions and voiced:

Kind of in the moment, you have to change things based on [the students’] behavior and maybe based off of the energy in the room of that day, things like that. So yeah, I definitely changed some things whether it was, you know, not exactly what I was saying, but maybe how I gesture, you know, give them a smile or something, just little things like that. (I: 100-105)

Annie was observed utilizing smiling, eye contact, relaxed posture, and a varying tone of voice within each simulation as she engaged with the avatars (O: 1, 2, 3). Annie also employed open gesturing with the avatars in the first and third observations and used a variety of vocal
expressions when talking with the avatars (O: 1, 3). By the third simulation, Annie began to use proximity with the avatars as she engaged them in the lesson (O: 3).

Similarly, Rose articulated that receiving the video feedback and coaching treatment while practicing delivering lessons with student avatars with different personalities helped her to differentiate her teaching and engage students:

I've gotten the tip to constantly move around the room and use hand gestures and…make sure you have eye contact and all that. I definitely find that and, you know, I really wouldn't have noticed the fact by leaving the left side of the classroom open not going there or ignoring that area…without [video feedback and coaching] I wouldn't have known. (I: 251-254)

Rose varied her tone of voice, used open gesturing, smiling, eye contact, and was animated as she taught the student avatars in all three mixed reality simulations (O: 1, 2, 3). In the first simulation, Rose was not observed moving toward the avatars as she engaged them in communication (O: 1); however, in subsequent simulations, Rose employed proximity and displayed an overall relaxed posture with the avatars as she delivered her lessons (O: 2, 3).

**Theme 3: Behavior management.** Pre-service teacher participants indicated that they intentionally used nonverbal immediacy behaviors, such as using facial expressions, eye contact, and proximity, with student avatars to manage behaviors. According to Chesley and Jordan (2012), pre-service teachers in university preparation programs require training and multiple exposures to professional development that fosters learning ways to manage student behavior and to build relationships in the classroom. Pre-service teachers in this study practiced applying nonverbal immediacy communication in the simulated classroom with student avatars that
displayed misbehaviors. See Table 4.15 for frequencies of codes related to Theme 3, behavior management.

Table 4.15

*Frequency of codes for Theme 3: Behavior Management*

<table>
<thead>
<tr>
<th>Categories Related to Student Behaviors</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication and Classroom Expectations</td>
<td></td>
</tr>
<tr>
<td>Teacher presence</td>
<td>7</td>
</tr>
<tr>
<td>Practice managing student behavior</td>
<td>21</td>
</tr>
<tr>
<td>Nonverbal Communication – Reinforcing or discouraging student behavior</td>
<td>3</td>
</tr>
</tbody>
</table>

Annie described her new-found understanding and application of nonverbal communication in managing classroom behavior because of the video feedback and coaching treatment within the simulations and declared:

I always thought that when it came to management that all of it had to be verbal, that you had to say something or reprimand them or something like that. So, you know, through the simulations and the coaching with you, I've just learned that nonverbal communication is key. Like I said, I never had any training on this before, so it just kind of opened my eyes and I’m definitely going to be using some of these practices moving forward, so it will definitely affect my teaching in the future. (I: 138-143)

In the second simulation, one of the avatars stretched and yawned as Annie began to communicate her lesson. Annie looked directly at the avatar, maintained eye contact, and smiled as she addressed the student and said, “You’ve got that, Savannah?” Annie also varied her tone of voice and did not appear to be confrontational, but more conveying concern for the avatar’s well-being but also as a signal to attend to the lesson (O: 3).
Annie used proximity in gaining compliance from one of the student avatars in the third simulation session. During her delivery of a music lesson in which the avatars were asked to write down instruments they heard in a song she played, one of the avatars began to “air drum” with both hands. Annie proceeded to move toward the avatar on the screen, and the avatar responded by picking up his writing utensil and began to comply with her request (O: 3).

Kate expressed her belief in how rehearsing managing avatars’ behaviors in the simulations help her in her development of classroom management skills and stated, “These simulations have helped me to deal with many of the behavior problems, have more of a plan when I go into it” (I: 304-305).

At the beginning of the third observation, the avatars continued to talk despite Kate’s verbally telling them it was time for a math lesson to begin. Using eye contact, varied tone of voice, and proximity, Kate was able to settle the avatars and began to deliver her lesson. Soon after she began to teach, an avatar interrupted Kate, asking about the time on the clock on the wall of the university’s simulation lab. Kate once again looked directly at the avatar and varied her voice in redirecting him. Additionally, she used gesturing to signal that the discussion about the time on the clock was over, and she continued with the lesson and the avatar complied (O: 3).

Arnold mentioned his perceived ability to better manage student behaviors and stated, “I think, you know, being able to manage the different behaviors of the students is pretty important and I think it helped me with that…I think that it gave me an idea of what to expect” (I: 295-298). He also added, “I think with more practice I will get better, but I think I will be able to do it now like to be ready for those different types of behaviors” (I: 305-306). Arnold maintained eye contact, a relaxed posture, open gestures, and used gesturing to illustrate his verbal message with
the avatars when he asked them to comply with his request to put their cell phones on “silent” and put the phones away (O: 1).

At the beginning of the third simulation, the student avatars continued to talk amongst themselves when Arnold tried to gain their attention to begin delivering his math lesson. Arnold was observed using a relaxed posture, maintained eye contact with the students, and frequently displayed open gestures when attempting to engage the avatars in the lesson. Arnold also began to employ proximity when redirecting avatars to remain on task (O: 3).

Patrick, whose first language is Spanish, also echoed Arnold’s sentiment with regards to the use of simulations and receiving video feedback and coaching in preparation to manage inappropriate student behaviors:

It’s helping the student to do that because I mean you're helping me to do that since it [teaches] you bad behavior that a student can have and also gives you a little experience so when you go to the field you are more comfortable (I: 174-176).

Patrick consistently employed smiling and gesturing, varied his tone of voice, maintained eye contact, and had an overall relaxed body position when delivering his lessons (O: 1, 2, 3). In the second simulation, he utilized eye contact and gesturing when redirecting a student avatar who made an inappropriate personal comment about another student avatar and continued to engage the students in his lesson (O: 3).

**Theme 4: Perceived transference of nonverbal immediacy skills to practice.** All but one of the 15 participants described intentionally using nonverbal immediacy behaviors within the context of a field placement embedded in the course to establish rapport, engage students, or manage behavior when they were teaching real students. See Table 4.16 for frequencies of codes related to Theme 4, transference of nonverbal immediacy skills to practice.
Table 4.1  

Frequency of codes for Theme 4: Transference of Nonverbal Immediacy Skills to Practice

<table>
<thead>
<tr>
<th>Categories Related to NVC in Real Classroom Environment</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application of Learning</td>
<td></td>
</tr>
<tr>
<td>NVC – rapport building in classroom placement</td>
<td>9</td>
</tr>
<tr>
<td>NVC – student engagement in classroom placement</td>
<td>10</td>
</tr>
<tr>
<td>NVC – behavior management in classroom placement</td>
<td>5</td>
</tr>
</tbody>
</table>

Note. NVC = Nonverbal communication

Sylvia described how she used gesturing and having a relaxed posture to appear open for communication with her students and stated:

I would try to talk with my hands while I was like explaining things…it helped and it did seem to relax students a bit since they weren't as used to me and it helped them to sort of relax and be like, “okay, she’s not all stiff into herself she’s able to be more open with everybody.” (I: 128-130)

Later in the interview, Sylvia shared her desire to appear open when she was delivering a lesson in the classroom. She discussed her intentional non-use of nonverbal communication that is nonimmediate and revealed:

I will cross my arms if I’m nervous or uncomfortable. So, I made sure to not do that when I was teaching a lesson even if I was nervous, because it was my first time ever teaching a lesson in front of students like that. (I: 147-149)

Similarly, Linda described using nonverbal immediacy behaviors to appear relaxed despite her internal feelings of stress when teaching in her field experience and acknowledged, “I had to try
and be very relaxed, even though was very stressful, but I’d always try to smile and make it kind of a calm environment for them” (I: 177-178).

In his elementary classroom placement, Samuel conveyed how he used nonverbal immediacy behaviors to ensure he appeared approachable and willing to engage in conversation:

I’d just get close to the students and like, you know, hang out behind them or near them or always smile at any questions, make sure that they felt free to, you know, converse with me or approached me if they needed anything. (I: 166-169)

Callie also wanted to ensure she appeared open for communication and described her use of gesturing to convey openness for communication with the students in her 10th grade Modern World History class and relayed, “I kept in mind like I was able to walk around the classroom while they were doing their work. I didn’t have anything in my hands, so I was able to give gestures and stay open” (I: 130-132).

Bob discussed applying the use of nonverbal immediacy behaviors he was coached in using with students in his classroom field placement to establish positive rapport. Recalling his experience with the students in his high school Social Studies classroom, he declared, “The class I was in, I liked the kids and they liked me…and it just worked. Yeah, I was walking around all the time and keeping a level tone and so...everything we talked about, I practiced” (I: 171-173).

Like Bob, Patrick also described using nonverbal immediacy behaviors, specifically proximity and smiling, to promote positive feelings between him and his students and said:

I used proximity [with] the students. I also smiled a lot when we were talking about Algebra tiles, that was the topic that they were teaching in the high school. It was a great experience. The students want me to go back again. (I: 191-192)
In a similar fashion, Kate recalled how she used nonverbal immediacy behaviors to establish rapport with the students and try to motivate them in their learning:

I would get down and talk to [the students] at their level and I would smile if they got things right. Even if they weren't quite right, I would still try to be encouraging by still smiling in that sense, but being like, “Not quite. Let's try doing it this way.” (I: 249-252)

Students reported that the field experience offered some pre-service teachers the opportunity to practice managing student behavior. Winnie illustrated how she used nonverbal immediacy behavior for classroom management and recounted:

When a kid was doing something they shouldn't have done, I just kind of looked at them and gave them the eyebrows, you know? And then they knew to not do that anymore…and then just when a kid does something good then just kind of on, you know, on the DL, I'll give like a little thumbs up. (I: 275-279)

Likewise, Rose used proximity in managing student behavior in her field experience and related:

If I was close to them…it was also a way of showing that if they're on their phone or not participating, I will walk over there, you know, and I felt like each side of the room was equally acknowledged from me. (I: 203-205)

Students reported that nonverbal immediacy learning within the simulations transferred to classroom field experiences as pre-service teacher student participants displayed nonverbal immediacy behaviors as they interacted with actual students.

Summary of Qualitative Findings

Qualitative data were analyzed through an inductive and deductive coding process to address research question two: What are the perceptions of pre-service teachers’ reflection and use of nonverbal immediacy behaviors over the course of a semester in which they received
video, video feedback, and coaching while utilizing a mixed reality simulation environment? Analysis of data revealed two overarching finding statements. The first finding statement, which was supported by three themes was: Video feedback and coaching fostered pre-service teacher reflection on the simulated environment as pre-service teachers delivered lessons within the simulation. The second finding statement supported by four themes was: Video feedback and coaching within a mixed reality simulation environment improved pre-service teachers’ use of nonverbal immediacy behaviors in student interactions. A further discussion of the findings is in Chapter Five.

**Connections Between Quantitative and Qualitative Findings**

Qualitative data analysis revealed that pre-service teachers improved in their use of nonverbal immediacy behaviors and utilized said behaviors to build rapport, engage students in learning, and manage students’ behavior. Qualitative findings were supported by quantitative data analysis as a significant result of an exact Sign test was calculated ($p < .013$) when Time 2 and Time 3 nonverbal immediacy scores via the NIS-O were compared.

**Summary of the Chapter**

The purpose of this study was to explore the effect of a video feedback and coaching treatment package on pre-service teachers’ nonverbal immediacy behaviors as they delivered lessons to student avatars within a mixed reality simulation environment. Two research questions guided the study, and a mixed method embedded design provided for the overall research design. The quantitative design employed a quasi-experimental, one-group repeated measures design and addressed the first research question. This question examined the impact of the video feedback and coaching treatment within simulations on pre-service teachers’ nonverbal immediacy scores on the NIS-O instrument at three points of time over the course of a semester. The nonparametric
paired Sign test was used to determine if a statistically difference in scores occurred when pairwise comparisons were analyzed. Results of statistical analysis revealed that a significant difference in pre-service teachers’ nonverbal immediacy scores occurred when the second (Time 2) and third (Time 3) sessions were compared. Pairwise comparisons between the first (Time 1) and second (Time 2) sessions and the first (Time 1) and third (Time 3) sessions did not result in statistically significant outcomes.

The second question, which was qualitative in nature, examined pre-service teachers’ use of nonverbal immediacy behaviors through video analysis of each simulation, and explored their reflective responses during a post-treatment interview. Exit interviews were the main source of qualitative data and were coded using an inductive and deductive coding method that utilized codes from the literature and emergent codes as the data were analyzed. Additional qualitative data, consisting of researcher notes collected both during live simulations and through repeated viewings of video recordings of the live simulations, served to triangulate qualitative findings. First and second cycle coding methods resulted in the creation of themes which supported two finding statements. The first finding statement was: Video feedback and coaching fostered pre-service teacher reflection on the simulated environment as pre-service teachers delivered lessons within the simulation. Three themes, objectivity of reflection, layering of reflection with addition of coaching, and comfort and confidence in teaching, supporting finding statement one. The second finding statement was: Video feedback and coaching within a mixed reality simulation environment improved pre-service teachers’ use of nonverbal immediacy behaviors in student interactions. Four themes, building relationships, student engagement, behavior management, and transference of nonverbal immediacy skills to real environment, supported finding statement Two.
Quantitative and qualitative findings were compared for data triangulation purposes (Creswell & Poth, 2018). Observations of participants’ use of nonverbal immediacy behaviors and avatar responses, collected via the NCBOT, served to support qualitative findings from analysis of exit interview data. Quantitative analysis of pairwise comparisons of scores on the NIS-O revealed a statistical difference in scores occurred between the second and final mixed reality simulation session over the semester after receiving a video feedback and coaching treatment package targeted at improving such nonverbal communication behaviors. Qualitative findings supported this result as pre-service teachers indicated that the video feedback and coaching treatment fostered reflections on participants’ use of such behaviors. Participants used the video of their teaching to observe themselves from a student’s perspective, at a time when they were not experiencing stress, which added objectivity to their reflections. Coaching added another layer of feedback and promoted the use of targeted nonverbal immediacy behaviors to promote positive student-teacher relationships, engage students, and manage classroom behaviors. Pre-service teachers expressed that they appreciated the opportunity to discuss their reflections with the coach for the purpose of improving and utilized the mixed reality simulations to practice applying what they learned with student avatars. At the conclusion of the semester, pre-service teachers articulated that they applied their learning about their use of nonverbal immediacy behaviors into the real classroom context, as each participant took part in a field experience embedded within the course. Additionally, pre-service teachers reported they felt they had grown more comfortable and confident in their overall ability to teach.

Quantitative results were not statistically significant when pairwise comparisons of scores on the NIS-O from the first session were compared with the second and the third session. Overall scores dropped from the first session to the second; then increased for the third session. This
result at midpoint may be due to unanticipated factors, such as stress associated with midterm examinations or with managing inappropriate student behaviors with avatars. Chapter Five will address these factors and their possible impact on pre-service teachers’ use of nonverbal immediacy skills.

Chapter Five provides a discussion of the results and findings of the present study and related literature, implications, recommendations, and suggestions for future areas of research.
CHAPTER FIVE: SUMMARY AND CONCLUSIONS

This chapter includes a summary of this mixed methods study, which was used to explore the effect of a treatment package, targeted at use of nonverbal immediacy behaviors, administered over the course of a semester to pre-service teachers experiencing mixed reality simulations as part of their teacher preparation program. Implications and recommendations are also discussed, and the chapter is organized into the following sections: (a) overview of the study, (b) discussion of results for each research question, (c) limitations of the study, and (d) summary and conclusions.

Overview of the Study

The purpose of this mixed methods study was to explore the effect of a video and reflection, video feedback, and coaching treatment package targeted at increasing pre-service teachers’ nonverbal immediacy behaviors as they interacted with student avatars during mixed reality simulations. Nonverbal immediacy behaviors include smiling, use of proximity, gesturing, and having a relaxed posture that can have positive effects on students (Christophel, 1990; Mehrabian, 1971,1972; Richmond et al., 2003). Students of teachers who are perceived as more immediate may exhibit more compliant classroom behaviors (Burroughs, 2007), be more motivated to attend class, and experience positive learning outcomes (LeFebvre & Allen, 2014). Participants ($n = 15$) were pre-service teachers enrolled in an educational psychology course that embeds mixed reality simulations and a field experience into its curriculum.

Participants received a treatment package consisting of video and reflection, video feedback, and coaching following each simulation targeted at improving nonverbal immediacy behaviors as they interacted with student avatars. Quantitative and qualitative data were collected employing an embedded research design (Creswell & Plano Clark, 2011). Quantitative data were
collected, and the NIS-O was scored at three points of time over the course of the semester after participants’ delivered lessons in a mixed reality simulation environment. A quasi-experimental, one-group within-subjects design, with three levels (Time 1, Time 2, and Time 3), was employed within the embedded design to address research question one: Using the NIS-O, is there a statistically significant difference over time between pre-service teachers’ nonverbal immediacy behaviors for three rounds of data collected, before, during, or at the conclusion of a semester in which a video and reflection, video feedback, and coaching treatment package is administered following mixed reality simulations? Pairwise comparisons of quantitative data were analyzed via the paired Sign test statistic, and a statistical difference between Time 2 and Time 3 resulted ($z = 2.496, p = .013$). No additional statistical differences between sessions were revealed.

The qualitative component of the study was a case study design, bound by participants being enrolled in an educational psychology course that embedded mixed reality simulations within its curriculum (Creswell & Poth, 2018; Yin, 2014). Qualitative data collected via observations of live and recorded mixed reality sessions were used to inform subsequent coaching sessions and served as a resource for triangulation of data. The main form of qualitative data were transcriptions of exit interviews that were conducted at the conclusion of the semester. After the third and final coaching session, exit interviews were administered to explore participants’ perceptions of reflections and use of their nonverbal immediacy behaviors over the course of the semester, and addressed research question two: What are the perceptions of pre-service teachers’ reflection and use of nonverbal immediacy behaviors over the course of a semester in which they received video, video feedback, and coaching while utilizing a mixed reality environment?
Participant interview data and mixed reality simulation observation qualitative data were analyzed through a systematic process employing both inductive and deductive analyses (Miles et al., 2014). A first and second cycle process of coding was conducted (Miles et al., 2014; Saldaña, 2016) to further condense the data. Two overarching finding statements, and seven themes resulted:

1. Video feedback and coaching fostered pre-service teacher reflection on the simulated environment as pre-service teachers delivered lessons within the simulation.
   a. Theme 1: Objectivity of reflection
   b. Theme 2: Layering of reflection with addition of coaching
   c. Theme 3: Comfort and confidence in teaching

2. Video feedback and coaching within a mixed reality simulation environment improved pre-service teachers’ use of nonverbal immediacy behaviors in student interactions.
   a. Theme 1: Building relationships
   b. Theme 2: Student engagement
   c. Theme 3: Behavior management
   d. Theme 4: Transference of nonverbal immediacy skills to practice

A discussion of the overarching findings, supporting themes, related literature, implications, recommendations, and suggestions for future research is detailed below. Lastly, a discussion of a model for possible connections among findings, limitations of the study, and conclusions are included in subsequent sections.
Discussion of Results, Related Literature, Implications, and Recommendations

The current study was driven by two research questions. The following section is organized by the research question and subsequent results and findings. For each result, connections to the literature, implications, and suggestions for future studies are suggested.

Research Question One Discussion of Results

Research question one was: Using the NIS-O, is there a statistically significant difference over time between pre-service teachers’ nonverbal immediacy behaviors for three rounds of data collected, before, during, and at the conclusion of a semester in which a video and reflection, video feedback, and coaching treatment package is administered following mixed reality simulations? Table 5.1 summarizes the results, connections to literature, implications, and suggestions for further research for research question one.
Table 5.1

**Summary of Discussion of Results for Research Question One**

<table>
<thead>
<tr>
<th>Findings</th>
<th>Connections to the Literature</th>
<th>Implications and Recommendations</th>
<th>Future Research</th>
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<tbody>
<tr>
<td>Results of an exact Sign test for a pairwise comparison of Time 2 and Time 3 was statistically significant ($z = 2.496, p = .013$). No additional significant results were revealed when Time 1 and Time 2 and Time 1 and Time 3 scores were analyzed.</td>
<td>Xiao and Tobin (2018) studied the effect of video feedback and coaching on early childhood pre-service teachers’ embodied aspects of teaching (e.g., posture, eye gaze, etc.). Post-intervention, pre-service teachers’ nonverbal communication teaching behaviors increased; participants expressed their comfort level with videotaping, coaching, and self-reflection also increased over the course of a semester.</td>
<td>Results of the study indicate that developers of teacher education programs may utilize video and reflection, video feedback, and coaching within mixed reality simulations to provide pre-service teachers opportunities to practice strategies, such as nonverbal immediacy behaviors, that will prepare them for their professional practice.</td>
<td>A limited number of participants ($n = 15$) were studied in the current research. A replication of the study with a larger number of participants and the use of a control group is suggested. Future studies may incorporate the use of an enhanced version of the instrument or a newly developed measure of nonverbal immediacy. Given increased popularity in distance learning, an examination into the efficacy of the treatment within remote learning environments could be considered for a future area of research. An examination of the impact of one or a combination of components of the treatment could be conducted.</td>
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<tr>
<td>DeSantis (2018) investigated the impact of data driven feedback and coaching within mixed reality simulations on pre-service teachers’ sense of self-efficacy and the development of the high-leverage teaching practice of generating higher order thinking questions. Significant results for the treatment group were found for the number and type of questioning strategies employed.</td>
<td>Dieker, Hughes, Hynes, and Straub (2017) examined the effect of utilizing mixed reality simulations to promote middle school math teachers’ use of high leverage teaching practices. Significant effects over time on the use of research-based effective teaching strategies were found.</td>
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The nonparametric paired Sign test was used to determine if a statistically significant difference in scores occurred when pairwise comparisons were analyzed. When nonverbal immediacy scores from the NIS-O were compared for Time 1 and Time 2, results indicated that seven participants improved, and seven participants decreased in their level of nonverbal immediacy. One participant scored the same for both time points. A statistically significant result was not calculated \((z = 0.000, p = 1.000)\). A pairwise comparison of nonverbal immediacy scores for Time 1 and Time 3 revealed that nine participants improved in nonverbal immediacy, while three participants’ scores decreased; three participants’ scores did not change from Time 1 to Time 3. Results of the exact Sign test statistic revealed there was no statistically significant increase in nonverbal immediacy as measured by the NIS-O \((z = 1.732, p = .083)\). When a pairwise comparison of nonverbal immediacy scores for Time 2 and Time 3 were compared, scores increased for 11 participants, scores for 2 participants decreased, and there was no change in scores for 2 participants. Results of the exact Sign test statistic resulted in a statistically significant increase in the level of nonverbal immediacy, as measured by the NIS-O, \((z = 2.496, p = .013)\). In summary, results of pairwise comparisons of nonverbal immediacy scores employing the exact Sign test statistic revealed a statistically significant difference in scores for Time 2 and Time 3. No additional pairwise comparisons were statistically significant.

**Related literature.** Other studies have examined the effect of video and reflection, video feedback, coaching, or use of mixed reality simulations to improve targeted outcomes of teacher participants (DeSantis, 2018; Dieker et al., 2017; Garland et al., 2012; Gundel et al., 2019; Xiao & Tobin, 2018). In their investigation of the effect of video as a feedback tool and early childhood pre-service teachers’ nonverbal or embodied aspects of teaching (e.g., posture, eye gaze, etc.), Xiao and Tobin (2018) found an increase in pre-service teachers’ use of embodied
teaching behaviors post-intervention. Additionally, participants expressed they were more comfortable with videotaping their teaching and engaging in self-reflection.

DeSantis (2018) explored the effect of data driven feedback and coaching within mixed reality simulations on pre-service teachers’ sense of self-efficacy and their ability to generate and employ higher order thinking questions. Results of the study revealed that participants who received the feedback and coaching intervention within mixed reality simulations markedly improved in their ability to generate and utilize higher order questioning techniques with student avatars as they delivered lessons. Additionally, an examination of qualitative data revealed that members of the treatment group felt they improved in the skill of higher order questioning and applied the skill across the three simulations. Participants expressed their recognition of growth in the areas of generating higher order questions, lesson planning, and in their overall delivery of lessons within the simulations. However, members of the comparison group felt they did not improve, and some participants were confused as to exactly what the high-leverage teaching practice of higher order questioning entailed. Insignificant results were found when pre-post scores of the TSES were compared for the treatment and comparison groups. The researcher noted that most participants had experienced numerous mixed reality simulations as part of their teacher education program prior to the study, and that the TSES instrument measured participants’ perceived sense of self-efficacy with respect to teaching overall, and not specifically on the skill of higher order questioning. Results of the study suggested that data driven feedback and coaching of pre-service teachers within mixed reality simulations can foster the development of fundamental high-leverage teaching practices to promote positive student outcomes.
Similarly, in a large national study, Dieker et al. (2017) explored the effect of mixed reality simulations on middle school math teachers’ use of effective strategies, including questioning techniques to promote higher order thinking. Participants \((n = 135)\) taught in 10 schools across 6 states. A quasi-experimental four-group randomized trial research design measured teachers pre-post in their classrooms and, as the case with two of the groups, four times in the mixed reality simulation environment (Dieker et al., 2017). Two groups received online professional development (PD), while one of the groups received both online PD and mixed reality simulations. Results of a two-factor mixed design ANOVA revealed that teacher performance scores, with respect to high leverage practices (e.g., higher order questioning and use of specific feedback), significantly increased over the four sessions of the simulations regardless of whether they received the online PD, thus supporting the efficacy of the use of mixed reality simulations for professional development purposes.

In the current study, no statistically significant results were found for pairwise comparisons of Time 1 and Time 2, and Time 1 and Time 3 for pre-service teachers’ use of nonverbal immediacy behaviors. However, when individual scores were examined, it was found that between Time 1 and Time 2, seven participants decreased in their level of nonverbal immediacy, as measured by the NIS-O. Similarly, in a study that examined the effect of mixed reality simulations on pre-service teachers’ perceived sense of self-efficacy (Gundel et al., 2019), an insignificant drop in participants’ perceived sense of self-efficacy for participants who experienced 60 minutes of simulations resulted. According to the researchers, this finding may relate to a dip in self-efficacy scores that was also found by Bautista and Boone (2015) and Pendergast, Garvis, & Keogh (2011), and may be due to a “reality shock” (Gundel et al., 2019;
Pendergast et al., 2011) related to confronting the realities of classroom teaching after initial exposure to teaching.

Implications and recommendations. A statistically significant difference in nonverbal immediacy scores of pre-service teachers was found when a comparison between Time 2 and Time 3 was conducted. No additional significant differences resulted. The results of this study, and findings from related literature, suggest that video and reflection, video feedback, coaching, and mixed reality simulations could be used by developers of teacher education programs to help prepare pre-service teachers for the realities of the classroom. Designers of pre-service teacher preparation programs could consider that there may be a “reality shock” (Gundel et al., 2019; Pendergast et al., 2011) with respect to teachers’ sense of self-efficacy that occurs as teachers confront the realities of classrooms in practical experiences; a drop in self efficacy occurs following an initial higher level. This phenomenon may be true for treatments that target other skills or behaviors within mixed reality simulations. It is also important to consider that some nonverbal immediacy behaviors, like eye contact and the use of gesturing, are cultural and the results of this study should be considered within the context of the research being conducted in the northeastern United States.

Suggestions for future research. A replication of the current study with a larger number of participants is recommended as the small number of participants \((n = 15)\) was a limitation. A larger number of participants could support the use of a control group in the research design, which would help control for limitations that are inherent in one-group designs. In addition, the development of a new instrument to measure nonverbal immediacy behaviors could be considered. The current study utilized the NIS-O instrument and employed the use of a
researcher-created observational tool to help ensure consistency in scoring the validated instrument.

Future studies could explore the impact of the treatment on nonverbal immediacy behaviors or other targeted skills within remote learning or distance learning situations. An examination into the impact of each of the components of the treatment utilized within the current study could be considered. Additionally, it’s important to note that the results may be due to the participant’s ability to review their teaching via the video and make changes accordingly. This study did not attempt to separate the concepts of isolated review of video performance or application of selected components of the treatment package. Future studies could explore the impact of one or more components of the treatment package in an effort to determine which components, if any, provide more of a value added approach to changing targeted behaviors.

**Research Question Two Discussion of Results**

Research question two was: What are the perceptions of pre-service teachers’ reflection and use of nonverbal immediacy behaviors over the course of a semester in which they received video, video feedback, and coaching while utilizing a mixed reality environment? An analysis of qualitative data resulted in two finding statements and supporting themes. Connections to the literature, implications, and suggestions for future research for finding one is summarized in Table 5.2.

**Finding statement one discussion of results.** The first finding statement was: Video feedback and coaching fostered pre-service teacher reflection on the simulated environment as pre-service teachers delivered lessons within the simulation. Three supporting themes emerged from the data. Theme 1: objectivity of reflection; Theme 2: coaching layered reflection; and Theme 3: increased confidence and comfort in teaching (see Table 5.2).
Table 5.2

**Finding Statement One Literature Connections, Implications, and Suggested Future Research**

<table>
<thead>
<tr>
<th>Findings</th>
<th>Connections to the Literature</th>
<th>Implications and Recommendations</th>
<th>Future Research</th>
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<td>A video and reflection, video feedback, and coaching treatment package within mixed reality simulations targeted at increasing pre-service teachers’ nonverbal immediacy skills fostered teacher reflections that were objective.</td>
<td>Video analysis allows for the focusing on specific behaviors or strategies while helping to alleviate habituation or confirmation bias (Knight, 2014). Use of video helps to ground reflection in reality that is critical for goal setting and monitoring progress of meeting goals. Cavanagh, Moloney, and Dao (2011) found that the use of video for teacher reflection and a peer review process contributed to teachers perceived confidence and growth in communication skills. Pre-service teachers indicated they appreciated reviewing their teaching via video for reflection and growth.</td>
<td>The use of video for teachers’ self-observations allowed for more objectivity within reflections. Developers of teacher preparation programs could incorporate the use of video to foster teacher reflections that are more grounded in reality and provide for opportunities to focus on specific teaching strategies or teacher behaviors while teachers deliver lessons within the curriculum of teacher preparation courses.</td>
<td>Future studies could incorporate the use of a framework to guide pre-service teachers’ reflections. In the current study, coaching was provided by a veteran teacher who was experienced in coaching and mentoring. Future studies may study the effect of peer coaching guided by a standard protocol.</td>
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<tr>
<td>Pre-service teachers received individual coaching following the receipt of video feedback targeted at improving nonverbal immediacy behaviors. Coaching provided an additional layer for teachers’ reflections.</td>
<td>Walker, Vasquez, and Wienke (2016) utilized coaching within mixed reality simulations aimed at increasing verbal and nonverbal communication and interviewing skills of young adults with low cognitive ability. Results indicated that the treatment package positively affected participants’ communication and interviewing skills that generalized to a live interview setting. Taylor, Tucker, Donehower, Pabian, Dieker, Hynes, and Hughes (2017) conducted a pilot study that utilized mixed reality simulations followed immediately by feedback and reflection that focused on increasing effective communication skills of physical therapy students. Results of the study revealed that all three participants were able to communicate situational and background information more effectively, as well as discuss treatment and make recommendations, with all three adult stakeholders in the scenario.</td>
<td>Teacher preparation programs that embed simulations within their curriculum to promote the development of high leverage teaching practices could consider incorporating video, video feedback, and coaching to foster reflection to promote pre-service teacher learning outcomes.</td>
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Table 5.2 (Continued)

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<th>Findings</th>
<th>Connections to the Literature</th>
<th>Implications and Recommendations</th>
<th>Future Research</th>
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<tr>
<td>Pre-service teachers perceived their level of comfort and confidence in</td>
<td>Hudson, Voytecki, and Zhang (2018) examined the effect of mixed reality simulations on</td>
<td>Pre-service teachers’ sense of confidence and comfort increased following the receipt of the</td>
<td>Future studies could explore the effect of the treatment within mixed reality</td>
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<td>teaching increased over the course of a semester in which they received</td>
<td>undergraduate special education teachers’ perceptions of their ability to manage a classroom.</td>
<td>treatment within simulations. Teacher educators may want to include the use of the treatment and</td>
<td>simulations not only on nonverbal immediacy, but on teachers’ perceived self-</td>
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<tr>
<td>a treatment package focused on increasing nonverbal immediacy within</td>
<td>Results indicated that following the Mursion simulations, pre-service teachers perceived they</td>
<td>rehearsals of delivering lessons within simulations to promote teachers’ perceptions of readiness</td>
<td>efficacy or confidence in teaching.</td>
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<tr>
<td>mixed reality simulations.</td>
<td>were better prepared to manage classroom behaviors.</td>
<td>for professional practice.</td>
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**Related literature.** The use of video for teacher self-reflection in professional development is well-documented (Fukkink, Trienekens, & Kramer, 2011; Fuller et al., 1973; Tripp & Rich, 2012). Tripp and Rich (2012) define reflection as “…a self-critical, investigative process wherein teachers consider the effect of their pedagogical decisions on their situated practice with the aim of improving those practices” (p. 678). The use of video grounds the process of reflection in one’s actual performance of teaching instead of relying on a memory of the performance (Xiao & Tobin, 2018). The use of video analysis to ground the instructional coaching process is powerful, as often a truer picture of reality is illuminated. This grounding in reality is critical for the processes of goal setting and the monitoring of progress toward meeting goals (Knight, 2014). Additionally, video analysis in the instructional coaching process allows for the focusing on specific behaviors or strategies while helping to alleviate habituation or confirmation bias (Knight, 2014).

The present study utilized video, video feedback, and coaching which fostered pre-service teachers’ reflection. Pre-service teachers expressed that video analysis allowed them to
view their teaching performances more objectively, at a time when they were emotionally ready to do so, and appreciated the opportunity to observe themselves teaching for the purpose of improving performance from their students’ point of view. The impact of a video reflection system on communication skills of undergraduate teachers was investigated in a mixed methods Australian study (Bower et al., 2011). A video reflection system that included a peer review process was used to facilitate pre-service teachers’ self-reflection as part of a learning cycle aimed at improving communication skills during presentations. Results of the study showed that following the first video reflection process, pre-service teachers intentionally tried to increase nonverbal behaviors such as eye gaze, gesture, and using an effective tone of voice (Bower et al., 2011). According to the researchers, “Student reflections on the physical aspects of communication (such as eye contact, body movements, pace of delivery) shaped their understanding of how to effectively construct meaning for the onlookers (their pupils)” (Bower et al., 2011, p. 323). Video analysis of their performances allowed for a comprehensive analysis of communication skills and promoted understanding of the effect of these behaviors on the receivers of the communication. Teachers reported a perceived gain in confidence in their abilities to present, and a perceived reduction in communication anxiety. According to Bower et al. (2011), 86.3% of the teachers indicated that they felt the video reflection system helped them learn and improve in their ability to communicate and appreciated the opportunity to see and hear themselves perform. The process, which included peer-review, allowed the students to anchor their self-reflections while comparing their performances to those of their peers (Bower et al., 2011).

In the current investigation, pre-service teachers received coaching from a veteran teacher and instructional coach following mixed reality simulations aimed at increasing nonverbal
communication abilities. Theme two related to coaching, and its effect on layering of pre-service teachers’ self-reflections. Other studies have utilized coaching within mixed reality simulations for reflection and to promote verbal and nonverbal communication skills. In a study by Walker et al. (2016), five young adults with low cognitive ability were coached within mixed reality simulations to promote verbal and nonverbal communication competencies in interviewing situations. The treatment phase consisted of virtual rehearsals of communication skills in an interview scenario, and coaching sessions which fostered reflection on the performance, as guidance targeted toward improving verbal and nonverbal interviewing skills. An interview performance rubric was used to assess participants’ communication skills, and participants received coaching during simulations until they received 80% mastery of identified competencies, or until six sessions were completed. In a final phase of the study, participants engaged in an interview in a live setting. Results of the study showed that the intervention, consisting of virtual rehearsals and coaching sessions, was effective in improving verbal and nonverbal communication skills both within the mixed reality simulations and a live interview setting. For the mixed reality simulations, the overall mean increase in the five participants’ scores from baseline to treatment was 28.82 points. For the live interviews, the overall average increase in scores for the five participants from the pre-interview phase to post-interviews was 30.4. Findings suggested that the treatment package positively affected participants’ communication and interviewing skills that generalized to a live interview setting. In another study that utilized an intervention focused on improving communication skills, Taylor, Donehower, Pabian, Dieker, Hynes, and Hughes (2017) investigated the impact of mixed reality simulations and feedback on physical therapy students’ interprofessional communication skills. In their pilot study, the treatment consisted of mixed reality simulations followed by a period of
feedback and reflection. Simulations were aligned to a scenario in which physical therapy students had to communicate with three adult stakeholders about a patient’s health-related information. Results of the study revealed that all three participants, following the intervention, were able to communicate patient situational and background information more effectively, as well as discuss treatment and make recommendations with all three adult stakeholders in the scenario (Taylor et al., 2017).

At the conclusion of the current study, pre-service teachers indicated that they felt more comfortable in teaching and more confident in their ability to teach after they received the treatment within three mixed reality simulations; this was reflected in theme three. A similar result was found in a mixed-methods study by Hudson et al. (2018) that evaluated the effects of mixed reality simulations, feedback, and reflection on undergraduate special education students’ perceptions of their ability to manage classroom behaviors over the course of a semester. Participants practiced delivering lessons to student avatars that exhibited more frequent and intense behaviors across the simulations. Pre-service teachers received instructor led and peer feedback following the simulations, and videotaped self-reflections of their performances after the second and third simulations. At the conclusion of the semester, participants indicated they felt more confident in their ability to manage classroom behaviors and better prepared to teach.

**Implications and recommendations.** Pre-service teachers in the current investigation utilized video recordings of their performances in the simulations to reflect on their performance and consider improvements in their nonverbal communication behaviors with the avatars. For many of these participants, it was the first time they had the opportunity to observe themselves teaching, and they appreciated the opportunity to view their teaching from their students’ perspectives. Participants also indicated that they viewed their video at their convenience, when
they were emotionally ready to do so, and discussed the difficulty of reflecting on their teaching during their sessions as they interacted with the avatars. Pre-service teachers indicated that the video helped them to understand their performance more objectively and said that they thought they had performed much worse during the simulation than their review of the video indicated. Some participants reviewed their videos more than once, focusing on certain aspects they deemed needed attention.

Teacher educators should acknowledge the timing of providing feedback as an important variable in the learning process and consider providing pre-service teachers many opportunities to view their teaching. The technology necessary to create video is ubiquitous and inexpensive. Video affords the opportunity to foster pre-service teacher reflections that are more grounded in reality as feedback is received when the pre-service teacher is emotionally ready to receive it. Additionally, the review of video provides teachers opportunities to focus on specific teaching strategies or behaviors while teaching to promote positive student outcomes. Moreover, in teacher educator preparation programs that participate in the edTPA assessment program (Pearson Education, Inc., 2020), the incorporation of video also provides opportunities for pre-service teachers to practice videotaping and viewing themselves teach before the submission of a final portfolio that requires video components.

Participants received coaching related to their nonverbal immediacy behaviors after they reviewed their video of their performance. Although coaching was provided to increase participants’ use of nonverbal immediacy behaviors, it is important to note that no participant increased in nonverbal immediacy to a level that was deemed distracting to the student avatars. Coaching added another layer to the pre-service teachers’ self-reflections. Coaching not only helped to focus the reflection for the intended outcomes, but also helped participants to consider
another perspective of their teaching, from a veteran teacher with almost 25 years of experience. Pre-service teachers indicated they appreciated the opportunity to discuss their teaching performances and help guide their own conclusions that were made because of their self-reflections. Teacher educators should consider incorporating video feedback and coaching to promote pre-service teacher outcomes that will prepare them for the classroom and help foster positive student learning outcomes.

For the current study, post-intervention, almost all participants indicated they believed they were more comfortable and confident in teaching real students. Pre-service teachers also commented that post-intervention, they began to see themselves as future teachers and appreciated the opportunity to practice strategies learned through coursework in their teacher preparation program.

**Suggestions for future research.** Future studies could incorporate the use of a framework to guide pre-service teachers’ reflections as they viewed their video. A framework may help focus the self-reflections. An additional consideration is to include a written reflection component into a study, and these written reflections to be qualitatively analyzed for emerging themes and findings. Coaching was provided by a veteran teacher who was experienced in teaching, coaching, and mentoring educators. Future investigations could explore the effect of coaching by peers, guided by a standard coaching protocol, on pre-service teacher learning. A future investigation could explore the effect of more time within the simulation, and its effect on teacher learning outcomes. In the current investigation, pre-service teachers experienced three simulations which averaged a little over three minutes in length. An exploration into longer or more frequent simulations could provide evidence for the efficacious use of mixed reality simulations and satisfy cost-benefit considerations for teacher educators.
Finding the second discussion of results. The second finding statement was: Video feedback and coaching within a mixed reality simulation environment improved pre-service teachers’ use of nonverbal immediacy behaviors in student interactions. Four supporting themes emerged from the data: Theme 1, building relationships; Theme 2, student engagement; Theme 3, behavior management, and Theme 4, transference of nonverbal immediacy skills to practice. Connections to the literature, implications, and suggestions for future research for finding one is summarized in Table 5.3.

Table 5.3

<table>
<thead>
<tr>
<th>Findings</th>
<th>Connections to the Literature</th>
<th>Implications and Recommendations</th>
<th>Future Research</th>
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<tbody>
<tr>
<td>Pre-service teachers who received video and reflection, video feedback, and coaching within mixed reality simulations targeted at improving nonverbal immediacy skills utilized nonverbal immediacy behaviors to build relationships.</td>
<td>LeFebvre and Allen (2014) investigated the impact of immediacy on college students’ cognitive and affective learning. Affective learning included attitudes about the professor of a course, and the likelihood of taking another course taught by the same instructor. The researchers found a positive relationship between teacher immediacy and students’ cognitive and affective learning and suggested that beginning teachers should develop immediacy skills to promote positive student outcomes.</td>
<td>Teacher educators could consider supporting the learning and development of nonverbal communication teaching strategies within their curriculum to promote positive student-teacher relationships that may lead to positive learning outcomes for students.</td>
<td>The inclusion of an additional variable, such as pre-service teachers’ perceived level of stress while interacting with the avatars, could be considered.</td>
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<tr>
<td></td>
<td>Fukkink, Trienekens, and Kramer (2011) - The use of video for self-reflection was found to positively affect the overall interaction skills of human service professionals.</td>
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<td>Allen, M., Witt, P.L., and Wheless, L.R. (2006) posited that teacher immediacy impacts students’ affect or motivation which impacts cognitive learning. In their meta-analysis of 81 studies, results supported the proposed causal model where teacher immediacy predicted student affective learning/motivation and affective learning predicted cognitive learning.</td>
<td>Teacher educators may include coursework on nonverbal communication in teaching and embed experiences for pre-service teachers to practice these skills to promote student engagement and learning.</td>
<td>A replication of the current study within an online pre-service teacher preparation course could be conducted.</td>
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(Continued)
Table 5.3 (Continued)

<table>
<thead>
<tr>
<th>Findings</th>
<th>Connections to the Literature</th>
<th>Implications and Recommendations</th>
<th>Future Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-service teachers who received video and reflection, video feedback, and coaching within mixed reality simulations targeted at improving nonverbal immediacy skills utilized nonverbal immediacy behaviors to engage students in learning.</td>
<td>Burroughs (2007) examined the effect of nonverbal immediacy on student compliance and found a statistically significant positive result from correlation analysis which suggested students are more willing to comply with teachers they perceive as more immediate. Additionally, student compliance was found to have a statistically significant effect on both cognitive and affective learning.</td>
<td>Teacher preparation programs may include coursework in nonverbal immediacy and positive behavior management strategies and utilize video feedback and coaching within simulations to provide opportunities for practice and rehearsal.</td>
<td>A future study could employ the use of an instrument that examined the treatment’s effect on pre-service teachers’ nonverbal immediacy behaviors as well.</td>
</tr>
<tr>
<td>Pre-service teachers who received video and reflection, video feedback, and coaching within mixed reality simulations targeted at improving nonverbal immediacy skills utilized nonverbal immediacy behaviors to manage students’ behavior.</td>
<td>Pas, Johnson, Larson, Brandenburg, Church, and Bradshaw (2016) conducted a study over the course of a school year that explored the effects, acceptability, and feasibility of mixed reality simulations and a coaching framework on special education teachers’ behavior management strategies, and student behavior. A significant improvement in teachers’ use of behavior management strategies and in special education students’ behaviors in classrooms was found. Coaching and simulations were rated positively by teachers and coaches.</td>
<td>Teacher educators could consider employing video feedback, coaching, and mixed reality simulations within their teacher preparation programs to promote the application of targeted skills within preparation programs into professional practice.</td>
<td>School districts could consider the use of video feedback and coaching within mixed reality simulations to target the use of high leverage teaching practices by staff to promote positive student outcomes.</td>
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Table 5.3 (Continued)

<table>
<thead>
<tr>
<th>Findings</th>
<th>Connections to the Literature</th>
<th>Implications and Recommendations</th>
<th>Future Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-service teachers who received video and reflection, video feedback, and coaching within mixed reality simulations targeted at improving nonverbal immediacy skills reported applying nonverbal immediacy skills to practice.</td>
<td>Walker, Vasquez, and Wienke (2016) utilized coaching within mixed reality simulations aimed at increasing verbal and nonverbal communication and interviewing skills of young adults with low cognitive ability. Results indicated that the treatment package positively affected participants’ communication and interviewing skills that generalized to a live interview setting.</td>
<td>Businesses that are in the service industry could consider the use of video feedback, coaching, and mixed reality simulations to promote nonverbal immediacy behaviors of staff that, when applied to real contexts, may promote positive client interactions.</td>
<td>Since pre-service teachers reported they applied their learning to practice in a field experience, future studies could include observations of participants within placements to gauge to what extent learning was applied.</td>
</tr>
</tbody>
</table>

**Related literature.** LeFebvre and Allen (2014) investigated the relationship between nonverbal immediacy of teachers teaching in self-contained or lecture/laboratory settings and college students’ affective and cognitive learning. The Nonverbal Immediacy Scale-Self Report (NIS-S) was used to evaluate students’ perceptions of their instructors’ level of immediacy (Richmond et al., 2003). The Affective Learning Measure (McCroskey, 1994) was utilized to collect data related to students’ feelings about the content of the course and the instructor. Significant, positive relationships between teachers’ nonverbal immediacy and both affective and cognitive learning were found. The researchers concluded that the findings supported the training and development of beginning teachers’ nonverbal immediacy skills to promote positive educational outcomes for students. In another investigation, Fukkink et al. (2011) conducted a meta-analysis of 33 empirical studies that utilized video for self-reflection of verbal, nonverbal, and paralinguial skills of service professionals, such as teachers, social workers, counselors,
doctors, and nurses. A statistically significant, medium effect size was found when the total effect of video feedback on the interaction skills of professionals was examined through meta-analysis of 217 experimental results across the 33 studies (Fukkink et al., 2011). The study suggested that self-reflection by professionals, grounded by the viewing of a videotape of oneself, can promote positive verbal and nonverbal communication and interpersonal skills of human service professionals.

The current investigation employed a treatment package, that included video for self-analysis, within mixed reality simulations to support the development of pre-service teachers’ nonverbal immediacy behaviors. Pre-service teachers, post-intervention, increased their use of nonverbal immediacy behaviors when interacting with student avatars as they taught in simulations over the course of one semester. Additionally, theme one related to participants’ intentional use of nonverbal communication behaviors to establish rapport with the student avatars. Participants intentionally used smiling and open gestures to convey warmth and friendliness.

Allen, Witt, and Wheeless (2006) hypothesized that teacher immediacy impacts undergraduate students’ affect or motivation, which impacts cognitive learning. The results of a meta-analysis of 81 studies supported a proposed causal model where teacher immediacy predicted student affective learning and motivation and affective learning predicted cognitive learning. Pre-service teachers in the current study described intentionally using nonverbal immediacy behaviors as they delivered lessons to promote student engagement. For example, participants used eye gaze, gesturing, and varied their tone of voice to engage students in discussion and learning.
Participants in the current investigation indicated that they intentionally used nonverbal immediacy behaviors to manage classroom behaviors. The use of facial expressions and proximity to promote student avatars’ on-task behaviors was employed by the participants as they delivered lessons within the simulations. In a study by Burroughs (2007), the relationship between teacher nonverbal immediacy and students’ compliance-resistance to teacher requests with students’ affective and cognitive learning was explored in the context of actual classrooms of 564 undergraduate students. Correlation analysis found a statistically significant result which suggested that students are more willing to comply with teachers they perceive as more immediate. Student compliance was also found to have a statistically significant effect on cognitive and affective learning. Pas et al. (2016) examined the effect of a coaching framework within mixed reality simulations to promote teachers’ use of positive behavior management strategies. In their study of 19 special education teachers, rehearsals of skills within mixed reality simulations and a formal coaching model was utilized to promote special education teachers’ positive behavior management strategies. Overall findings detailed significant improvements in special education teachers’ use of behavior management strategies and in special education students’ behaviors in classrooms.

Pre-service teachers in the current study indicated they applied their learning gained from receiving a treatment package, and rehearsal of nonverbal immediacy skills within mixed reality simulations, to their practice as they participated in a field experience embedded within the course. Similar outcomes relating to application of learning within mixed reality simulations to live settings were found in additional studies (Dieker et al., 2017; Walker et al., 2016). Dieker et al. (2017) investigated whether the differential effects of middle school math teachers’ use of high-leverage teaching practices developed within the simulation environment transferred to
teachers’ practices in their actual classrooms (Dieker et al., 2017). Qualitative and quantitative data were collected post-treatment to measure teachers’ practices in their actual classrooms. Teachers who participated in the simulations asked a significantly higher percentage of higher order questions post-intervention than teachers who did not experience the simulations. The results suggest that the targeted skill developed within the simulations transferred to middle school math teachers’ professional practice. Similarly, in their study of the efficacy of utilizing coaching within mixed reality simulations to promote communication and interviewing skills of low cognitive ability young adults, Walker et al. (2016) found that the treatment positively affected participants’ verbal, nonverbal, and interviewing skills that generalized to a live setting.

**Implications and Recommendations.** Pre-service teachers increased their use of nonverbal immediacy behaviors in their interactions with student avatars during mixed reality simulations to establish rapport, engage the avatars in learning, and manage classroom behaviors. Participants also reported that they intentionally utilized nonverbal immediacy behaviors with real students in a field placement for the same purposes, thus supporting the transfer of their learning to actual practice, and the effectiveness of the treatment within simulations.

Positive teacher-student rapport may promote feelings of classroom connectedness, affective learning, student participation, and academic achievement (Dobransky & Frymier, 2004; Frisby & Martin, 2010; Worley, Titsworth, Worley, & Cornett-DeVito, 2007). Most often, participants utilized open gestures, smiling, and having a relaxed posture to convey friendliness and warmth as they interacted with the avatars. Kinesics and proxemics were employed by the participants to engage students in learning and help motivate them to participate in discussions, learning tasks, and activities. When students are engaged in learning, better educational outcomes can be expected for students (Lei, Cui, & Zhou, 2018). Moreover, teachers’ ability to
manage classrooms is important for student learning and to help prevent teacher burnout and attrition (Aloe, Amo, & Shanahan, 2014; Marzano, Marzano, & Pickering, 2003). In the current study, participants utilized nonverbal communication to manage classroom behaviors of student avatars within the simulations. Most often, pre-service teachers used proximity for this purpose.

Teacher preparation programs should consider the use of video and reflection, video feedback, coaching, and mixed reality simulations to support the development of nonverbal immediacy behaviors that promote positive student-teacher relationships, engage and motivate students to learn, and help manage classroom behaviors to foster classroom climates that are conducive to learning. Since participants indicated that they intentionally utilized nonverbal immediacy behaviors with real students in their field experiences, the treatment within the simulations appeared to be effective and participants may be better prepared for the realities of teaching.

School districts, in an attempt to provide continued professional development and promote teachers’ employment of strategies that will engage and motivate students in learning and foster positive classroom climates, should consider utilizing the treatment within mixed reality simulations for such purposes. Businesses that are in the service industry, and other sectors that require interpersonal competencies, like health-care, could consider the use of video and reflection, video feedback, coaching, and mixed reality simulations to support the development and use of nonverbal immediacy behaviors of staff that, when applied to real contexts, may help foster positive client interactions.

**Suggestions for future research.** The current mixed methods study used an instrument to measure pre-service teachers’ level of nonverbal immediacy, and included one dependent variable, scores obtained from the NIS-O instrument. Future studies could examine an additional
variable, for example pre-service teachers’ levels of perceived stress as they interacted with the avatars. Such a study may suggest the level of realism experienced by participants in the mixed reality simulations, as well as participants’ abilities to manage stress when teaching.

A future area of study could include a replication of the current study, but within a remote learning teacher preparation course. Participants in the current study practiced teaching in a simulation lab at the research site. However, due to the prevalence of online course offerings, a study could be conducted with pre-service teachers who are enrolled in an online teacher preparation course, as the treatment and mixed reality simulations can be administered remotely.

In the current investigation, the effect of the treatment on pre-service teachers’ nonverbal immediacy was explored. A future study could employ the use of an instrument that examined the treatment’s effect on pre-service teachers’ verbal immediacy behaviors as well. Verbal immediacy behaviors include teachers’ use of student names, personal examples, humor, and inclusive pronouns to convey warmth and willingness to engage in communication (Gorham, 1988).

Further studies could include a replication of the study, but within other sectors besides education. For example, the treatment within mixed reality simulations could be used with nurses, physicians, or customer service personnel to not only study the effect of the treatment on participants’ nonverbal immediacy behaviors, but also the perceptions of clients, patients, or customers with regard to their level of satisfaction with their interactions with the provider of service.

Pre-service teachers indicated that they applied their learning to real classrooms in their field placement embedded within the course. Observations of participants within actual
classroom placements could be conducted to gauge to what extent learning within the simulation was applied to actual practice.

**Discussion of Connections Among Quantitative and Qualitative Results**

This present study found that pre-service teachers increased their level of nonverbal immediacy behaviors with student avatars in simulations following receipt of a treatment package consisting of video and reflection, video feedback, and coaching targeted at increasing nonverbal immediacy skills. Additionally, participants reported they applied their learning to real classroom contexts. Analysis of quantitative data via the Sign test statistic revealed a statistically significant difference in scores, as measured by the NIS-O, when a pairwise comparison of Time 2 and Time 3 was conducted. When individual scores across the two sessions were compared, 11 participants’ scores increased, 2 participants’ scores decreased, and 2 participants had no change in their level of nonverbal immediacy. At the conclusion of the study, pre-service participants improved in their use of nonverbal immediacy behaviors as they taught student avatars within the mixed reality simulations, following receiving the treatment package.

When qualitative data were analyzed, two findings resulted. Finding one revealed that use of video as a feedback tool, video feedback, and coaching by an instructional coach, fostered pre-service teachers’ reflections on their use of nonverbal immediacy skills in their interactions with the avatars. Themes that supported this finding included objectivity, as participants viewed their videos when they were emotionally ready to do so. Additionally, a layering of reflections with the addition of receiving coaching resulted. A third theme, comfort and confidence in teaching, was found as the participants described beliefs about their increased ability to teach post-intervention. Finding two related to participants’ increased use of nonverbal communication techniques in their interactions with students. Supporting themes including building
relationships, student engagement, behavior management, and transference of skills to practice. Figure 5.1 presents a possible model of connections among the results, findings, and supporting themes for the current study.

![Figure 5.1 Possible Model of Connections Between Findings and Among Supporting Themes](image)

For the current investigation, Figure 5.1 shows an iterative process where pre-service teachers, after rehearsing targeted skills with student avatars, engaged in self-reflections about their nonverbal immediacy behaviors. The rehearsals within the simulations and reflections, supported by video feedback and coaching, positively affected pre-service teachers’ perceived level of comfort and confidence in applying said skills within their teaching. Increased confidence not only positively affected practice of skills within the simulations, but pre-service teacher learning within the simulations was applied to actual classrooms. Pre-service teachers indicated they were more comfortable and confident in their teaching as they experienced successes with rehearsal of skills within the simulations, and within their field placements. The
statistically significant quantitative finding was supported by the qualitative findings. The participants improved in their level of nonverbal immediacy as measured by the NIS-O and qualitative data analysis supported the quantitative result.

**Quantitative Limitations of the Study**

Due to the nature of the one group, repeated measures design, several threats to the study were identified and controlled for by the researcher.

**Internal validity.** Internal validity refers to the extent to which extraneous variables have been controlled for in the study, thus relating to the quality of findings (Gall et al., 2003). Internal threats to validity were controlled for by the researcher in several ways to help ensure quality of results.

Maturation is a threat that relates to the passing of time and the natural course of human development (Fraenkel et al., 2012; Gall et al., 2003). This threat was medium level threat, however, participants were adults similar in age, and the study took place over the course of only one semester.

Testing refers to contributions to the dependent variable due to participants having experience taking the test and becoming “test-wise” (Gall et al., 2003). This threat was a moderate-level threat as participants were observed, on three occasions, and measured on their level of nonverbal immediacy. This threat was mitigated as observations occurred at least four weeks apart.

Instrumentation effects involves impacting the dependent variable based upon expectations of a change following a treatment (Gall et al., 2003). This threat was controlled through the use of an observational instrument that included reflexive notes to promote consistency in scoring. Additionally, the researcher met with her dissertation chairperson who
was familiar with the NIS-O instrument employed within the study, and mixed reality simulations, for the purpose of agreement in scoring the instrument based upon videotaped observations prior to any participant scoring.

External validity. Population validity refers to the extent one can generalize findings from a sample to a defined population (Gall et al., 2003). The research site and participants were selected via purposeful sampling; sample size may also limit the generalizability of results of the study. However, the teacher preparation program is accredited by the Council for the Accreditation of Educator Preparation (CAEP), with similar certification outcomes as other teacher preparation programs. Additionally, the researcher provided a detailed, rich description of the setting, participants, and procedures used in the investigation. An explicit description of the experimental treatment was also used to address generalizability of the study.

The Hawthorne effect occurs when participants, when aware of being studied, unconsciously behave differently due to their being given special attention, and not as a result of the treatment (Gall et al., 2003). The Hawthorne effect was deemed low as pre-service teachers within the research site are often participants in research studies that include the mixed reality simulations which are embedded into coursework within the teacher preparation program. To mitigate this threat, the researcher asked the professor to minimize the fact that the students were participants in a research study.

The experimenter effect may occur if the treatment is not administered with consistency (Gall et al., 2003). To address this threat, the researcher detailed standardized procedures when administering the treatment. The treatment, consisting of video feedback and follow-up coaching, was completed solely by the researcher. Additionally, there was consistency across participants with respect to the timing of the administering of the treatment. Typically, video
feedback was available to participants within 24 hours, and coaching was administered within 10 days of participants’ performances in the simulations. However, the researcher had no control over simulation specialist consistency.

Qualitative Trustworthiness

The researcher addressed trustworthiness related to the qualitative component of the mixed-methods study. The steps the researcher took to address credibility, transferability, dependability, and confirmability of the study are discussed in this section.

Credibility. Credibility refers to the degree to which findings are plausible, truthful, and accurate (Lincoln & Guba, 1985; Toma, 2006). To address credibility within the study, the researcher was trained in data collection and analysis methodology and provided a researcher biography (Appendix N) detailing her experience as an educator and instructional coach. The researcher spent time with participants, attending all mixed reality simulation sessions, and developed rapport. Video of simulations and audio recordings of interviews were stored securely. The researcher used multiple data sources and consistently met with a faculty member to discuss data collection and analysis procedures in data meetings.

Transferability. Transferability refers to the degree to which the results of the research can be transferred to other contexts or settings (Lincoln & Guba, 1985; Toma, 2006). A detailed description of the methodologies employed, and the results, was provided for readers to determine transferability to other contexts and settings.

Dependability. Dependability refers to the degree to which findings of a study are consistent if repeated within a similar context (Lincoln & Guba, 1985; Toma, 2006). The researcher described all methods of data collection and analysis within the study, and all materials are available for review.
Confirmability. Confirmability refers to the degree to which the findings are derived from the data, and reflect participants’ thoughts and responses, and not that of the researcher (Lincoln & Guba, 1985; Toma, 2006). The researcher provided an audit trail which included raw data consisting of video recordings and audio tapes, observation and interview notes, and process notes.

Summary and Conclusions

The current study was used to investigate the effect of a video feedback and coaching treatment package on pre-service teachers’ \(n = 15\) nonverbal immediacy behaviors as they experienced mixed reality simulations. The study followed a mixed method embedded design (Creswell & Plano Clark, 2011). The quantitative component of the study followed a quasi-experimental repeated measures design using a treatment group only (Fraenkel et al., 2012) while the qualitative component followed a case study design (Creswell & Poth, 2018; Yin, 2014). Participants were pre-service teachers enrolled in a teacher preparation program at a university located in the northeastern United States. The program is accredited by the Council for the Accreditation of Educator Preparation (CAEP) and prepares students for state certification at the elementary and secondary levels.

Quantitative data collected per the NIS-O were analyzed via the exact Sign test statistic (Gibbons & Chakraborti, 1992; Laerd Statistics, 2015; Sign Test Calculator, 2020). Results of the analysis revealed a statistically significant increase in pre-service teachers’ level of nonverbal immediacy, as measured by the NIS-O, between Time 2 and Time 3 \((z = 2.496, p = .013)\). No additional pairwise comparisons were statistically significant. Qualitative data, in the form of semi-structured interviews and observations, were analyzed through thematic analysis that was both inductive and deductive in nature. Two findings emerged through the qualitative data
analysis process. The first finding was: video and reflection, video feedback, and coaching fostered pre-service teacher reflection on simulated environment as pre-service teachers delivered lessons within the simulations. Finding two was: video and reflection, video feedback, and coaching within a mixed reality simulation environment improved pre-service teachers’ use of nonverbal immediacy behaviors in student interactions. For each finding, connections to the literature, implications, recommendations, and suggestions for future research was relayed. A model for a possible connection among the results of the study was presented. The model suggests that for the current study, pre-service teachers engaged in reflections that were supported by video review, video feedback, and coaching and practiced utilizing nonverbal immediacy behaviors with student avatars in mixed reality simulations. Pre-service teachers reported that over the course of the semester, their comfort level and confidence in teaching students increased. Additionally, participants conveyed they applied their learning with respect to nonverbal immediacy skills to practice during a field experience.

In conclusion, the results of the current investigation support the use of video and reflection, video feedback, and coaching within mixed reality simulations to promote the use of pre-service teachers’ nonverbal immediacy behaviors in interactions with students. Nonverbal immediacy behaviors include the use of smiling, gesturing, and proximity that convey warmth, friendliness, and openness for communication. These behaviors may impact students’ levels of engagement, motivation, affective learning, and academic achievement. Post-intervention, participants conveyed they applied their learning to the context of classroom field placements. This investigation may contribute to the research on video and reflection, video feedback, coaching, and mixed reality simulations on pre-service teachers’ development of teaching strategies for application into professional practice.
References


doi:10.1080/03634529009378813


163


Appendix A

Mursion® Simulation Environment
Mursion® Simulation Environment

The Mursion® mixed reality environment for teacher preparation is similar to its previous form, TeachLivETM. The environment looks much like an elementary, middle school or high school classroom and includes props such as whiteboards, books, and desks (Dieker et al., 2014; Mursion, Inc.). Sitting at a desk are a diverse group of student avatars, representing a range of personality types and abilities, that can exhibit certain behaviors depending on the objectives of the simulation (Dieker et al., 2014). Simulation specialists are trained to control the student avatars to enable learners to “…become empathetic to the emotions, abilities, and circumstances of the avatar” (Mursion, Inc., p.2). In this environment, the pre-service teacher can practice a teaching strategy, behavior management technique, or other targeted practice while having the opportunity to pause the simulation to correct any errors or to get feedback and restart the simulation (Dieker et al., 2014; Dieker, Rodriguez, Lignugaris/Kraft, Hynes & Hughes, 2013). The controlled environment, unlike a real classroom, allows for pre-service teachers to engage in multiple rehearsals of a practice without affecting live students or taking up valuable classroom instructional time (Dieker, Rodriguez, Lignugaris/Kraft, Hynes, & Hughes, 2013; Dieker et al., 2014). The simulations provide pre-service teachers the opportunity to deliver lessons to student avatars of different personalities, abilities, and cultural backgrounds that are reflective of real classrooms today (Dawson & Lignugaris/Kraft, 2017; Dieker, Rodriguez, Lignugaris/Kraft, Hynes, & Hughes, 2013).
Appendix B

Consent Letter: Pre-service Teacher Student Participant
Dear Pre-service Teacher Candidate,

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. A requirement of doctoral candidates in this program is the design and implementation of a research study. The purpose of my research is to explore the use of nonverbal communication behaviors of pre-service teachers as they experience the simulator.

I am seeking your consent to access video data of each of your performances in the mixed reality simulation environment over the course of this semester. The archived video data will be analyzed and reported in a manner that will not specifically identify any individuals. In addition, the researcher will obtain your grade point average from [redacted] via a faculty member’s access ID online. Finally, you will be asked to complete a brief demographic survey. This data will be used to inform the qualitative aspect of the mixed methods study.

If you agree to participate in the study, you will receive a video of your individual performance in each of the three mixed reality simulations in this course, Educational Psychology [redacted]. Following each of the simulations, you will be contacted by phone or Skype for a 15-20-minute interview about your experience. At the end of the semester, you will be asked to participate in a 30-45-minute interview about your overall experience using the mixed reality simulation environment during the semester.

Participation in this study is entirely voluntary, you may withdraw at any time, and there are no known adverse effects for student participants in any way. There is no deception in this study and little risk, beyond everyday risk, in participating in this study. Possible risks include loss of confidentiality in Internet transactions, coercion, and loss of time. Video data of your individual sessions in the simulation will be uploaded to Microsoft One Drive for Business, which provides for the most advanced methods for encryption of data at rest and in transit. As inherent in any process involving the sharing of data that is encrypted, there is a low risk of data breach. Though minimal, the greatest potential risk is confidentiality. However, strict measures will be undertaken by the researcher to assure that confidentiality is maintained for all participants. Participant identities will be maintained in a secure location to protect confidentiality, with all participant names receiving a pseudonym. Identities of participants will
be protected as pseudonyms will be used in the written study. If you choose not to participate, it will not affect your course grade nor any future relationship with the University. The researcher has no supervisory relationship with any of the adult participants.

This research project has been reviewed and approved by the WCSU Institutional Review Board. I appreciate any consideration you may give me in granting your permission to participate in the research. If you have any questions, please do not hesitate to contact me at [redacted] or [redacted]. If you have questions concerning the rights of the subjects involved in research studies, please contact the WCSU IRB Chair at irb@wcsu.edu and mention Protocol # 1920-01. This study is valid until August 27, 2020.

Sincerely,

Gloria Rosati Peterson, Ed.D. Candidate
Instructional Leadership
Western Connecticut State University

Jody S. Piro, Ed.D. Professor
Ed.D. in Instructional Leadership
Western Connecticut State University

If you agree to participate in this phase of the research study, please sign the attached statement and return it to me in class. Please keep a copy for your records.

I, ________________________________, am a pre-service teacher candidate at __________________________ I acknowledge that Gloria Rosati Peterson has made clear to me the purpose of this research study, identified all potential risks involved, and offered to answer any questions. I voluntarily grant my permission to participate in this research study.

Preferred e-mail address (Please print clearly): ________________________________

University e-mail, if different (Please print clearly): ________________________________

Best telephone number to contact you: ________________________________

Printed Name (Please print clearly):

____________________________________

Signature: ________________________________ Date: _____________
Appendix C

Course Mixed Reality Simulation Scenario
**ED 212 Scenario**

Simulation Classroom: Middle School Classroom  
Level: Initial, Preservice  
Certification Level: All  
Content Area: All  
High Leverage Practice #8 (HLP): *Higher Order Thinking Skills*

<table>
<thead>
<tr>
<th>Session</th>
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<th>Day</th>
<th>Time</th>
<th>Facilitator</th>
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<td>2-4PM</td>
<td></td>
</tr>
<tr>
<td>Session 2</td>
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<td>Tuesday</td>
<td>2-4PM</td>
<td></td>
</tr>
<tr>
<td>Session 3</td>
<td>Nov. 20</td>
<td>Tuesday</td>
<td>2-4PM</td>
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**EPY 212 02 Online**

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<th>Time</th>
<th>Facilitator</th>
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<td>Session 1</td>
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<tr>
<td>Session 2</td>
<td>Oct 9</td>
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<tr>
<td>Session 3</td>
<td>Nov 20</td>
<td>Tuesday</td>
<td>2-4</td>
<td></td>
</tr>
</tbody>
</table>

**Simulation Classroom: Middle School Classroom**  
Level: Initial, Preservice  
Certification Level: All  
Content Area: All  
High Leverage Practice #8 (HLP): *Higher Order Thinking Skills*  
Number of Simulations: 3 per semester  
Lesson Planning: Follow professor guidelines
Please provide explicit written permission to reproduce this graphic in your dissertation.

Background: You are a recent college graduate teaching a group of middle school students. Your school district is focusing on HOTS (higher order thinking skills) as a focus for district goals. Use Bloom’s Taxonomy (citation) to ask your students questions using the three highest levels (analyzing, evaluating, creating) to teach a lesson in your content area. Please prepare a lesson plan prior to each of the three simulation lessons following your professor’s guidelines. See below for the specifics of all three simulations this semester.

Simulation #1: Task: Introduce the content with varying levels of questioning.
Pedagogy: Teacher directed and/or individual, small group or whole class discussion

Performance Objectives for Simulation 1:

<table>
<thead>
<tr>
<th>Challenge 1</th>
<th>When learners...</th>
<th>Avatars will...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hit</td>
<td>The learners will introduce a lesson on a content of their choice. Students will begin to focus asking questions on the highest levels of Bloom’s Taxonomy (analyzing, evaluating, creating) in their introductory lesson.</td>
<td>Provide mild or compliant behaviors to the instruction.</td>
</tr>
</tbody>
</table>
Miss: The learners are unable to introduce varying higher levels of Bloom’s Taxonomy in questioning.

Mild/moderate noncompliance behaviors for lesson 1.

Simulation #2: Task: Lead a discussion using varying levels of questions (highest Bloom’s taxonomy levels).
Pedagogy: Think/Pair/Share, One-on-one coaching to elicit student thinking; whole group discussion.

Performance Objectives for Simulation 2:

<table>
<thead>
<tr>
<th>Challenge #1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>When teacher...</strong></td>
</tr>
<tr>
<td>Hit</td>
</tr>
<tr>
<td>Miss</td>
</tr>
</tbody>
</table>

Simulation #3

Task: Develop a formative assessment to check for understanding and conclude lesson. Use higher order thinking questions.
Pedagogy: Whole class discussion using student feedback, checking for understanding and monitoring learning.

Performance Objectives for Simulation 3:

<table>
<thead>
<tr>
<th>Challenge #1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>When teacher...</strong></td>
</tr>
<tr>
<td>Hit</td>
</tr>
</tbody>
</table>
students by using higher order thinking questions.

| Miss | Students do not successfully ask higher order thinking skills questions. | Mild/ moderate non-compliant behaviors. |

Piro & O’Callaghan (2016). ED 212 HOTS scenario for Mixed Reality Simulations. Written for the Education Department Curriculum Map. Used with permission of the authors.

**MATERIALS**

*Teacher will use content within their certification areas. However, no pre-knowledge will be required of the avatars. Students will use content common to the middle school level.*

*The main focus is instruction with classroom management being secondary.*

*Please review the types of questions below. We want students to use higher order (highest levels 4-6).*

**List of Question Starters Based on Bloom’s Taxonomy (from Curriculet)**

This list moves through the 6 taxonomy levels with questions for each one. The first three levels are considered lower order questions; the final three levels are considered higher order. Higher order questions are for critical thinking and creative problem solving. Each taxonomy level has a short description, a list of keywords that can be used to begin a question, and question starters.

**Level 1: Remember – Recalling Information**

Key words: Recognize, List, Describe, Retrieve, Name, Find, Match, Recall, Select, Label, Define, Tell

Question Starters:

- What is…?
- Who was it that…?
- Can you name…?
- Describe what happened after…
- What happened after…?

**Level 2: Understand – Demonstrate an understanding of facts, concepts, and ideas**

Key words: Compare, Contrast, Demonstrate, Describe, Interpret, Explain, Extend, Illustrate, Infer, Outline, Relate, Rephrase, Translate, Summarize, Show, Classify
Question Starters:

- Can you explain why…?
- Can you write in your own words?
- Write a brief outline of…
- Can you clarify…?
- Who do you think…?
- What was the main idea?

**Level 3: Apply – Solve problems by applying knowledge, facts, techniques, and rules in a unique way**

Key words: Apply, Build, Choose, Construct, Demonstrate, Develop, Draw, Experiment with, Illustrate, Interview, Make use of, Model, Organize, Plan, Select, Solve, Utilize

Question Starters:

- Do you know of another instance where…?
- Demonstrate how certain characters are similar or different?
- Illustrate how the belief systems and values of the characters are presented in the story.
- What questions would you ask of…?
- Can you illustrate…?
- What choice does … (character) face?

**Level 4: Analyze – Breaking information into parts to explore connections and relationships**

Key words: Analyze, Categorize, Classify, Compare, Contrast, Discover, Divide, Examine, Group, Inspect, Sequence, Simplify, Make Distinctions, Relationships, Function, Assume, Conclusions

Question Starters:

- Which events could not have happened?
- If … happened, what might the ending have been?
- How is… similar to…?
- Can you distinguish between…?
- What was the turning point?
- What was the problem with…?
- Why did… changes occur?

**Level 5: Evaluate – Justifying or defending a position or course of action**

Key words: Award, Choose, Defend, Determine, Evaluate, Judge, Justify, Measure, Compare, Mark, Rate, Recommend, Select, Agree, Appraise, Prioritize, Support, Prove, Disprove. Assess, Influence, Value
Question Starters:

- Judge the value of…
- Can you defend the character’s position about…?
- Do you think… is a good or bad thing?
- Do you believe…?
- What are the consequences…?
- Why did the character choose…?
- How can you determine the character’s motivation when…?

Level 6: Create – Generating new ideas, products, or ways of viewing things

Key words: Design, Construct, Produce, Invent, Combine, Compile, Develop, Formulate, Imagine, Modify, Change, Improve, Elaborate, Plan, Propose, Solve

Question Starters:

- What would happen if…?
- Can you see a possible solution to…?
- Do you agree with the actions?…with the outcomes?
- What is your opinion of…?
- What do you imagine would have been the outcome if… had made a different choice?
- Invent a new ending.
- What would you cite to defend the actions of…?
Graphic of Bloom’s Taxonomy

Use the behaviors and dispositions below with each criterion for your parent conference in the simulation. Your reflection will also address these criteria.

Classroom Context Rubric
Use the behaviors and dispositions below with each criterion for your parent conference in the simulation. Your reflection will also address these criteria.

<table>
<thead>
<tr>
<th>Performance Category</th>
<th>Criteria</th>
<th>Definition</th>
<th>Look For/Examples</th>
<th>Mentor Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson Behaviors</td>
<td>Opening</td>
<td>Candidate sets purpose with students.</td>
<td>“The purpose of this lesson is…”</td>
<td></td>
</tr>
<tr>
<td>Creates a Positive Learning Environment</td>
<td>Creates a Positive Learning Environment</td>
<td>Candidate provides a positive low risk learning environment that reveals mutual respect.</td>
<td>Positive interactions. Respect is demonstrated. Students ask and answer questions.</td>
<td></td>
</tr>
<tr>
<td>Implements a Learning Task</td>
<td>Implements a Learning Task</td>
<td>Candidates implements a planned learning tasks that address avatar students understanding of concepts/skill</td>
<td>Focus on specific High Leverage Practice. Tasks follow scenario instructional focus. Connects to previous prior learning.</td>
<td></td>
</tr>
<tr>
<td>Elicits Student Responses</td>
<td>Elicits Student Responses</td>
<td>Candidate elicits student responses to support use of concepts/skill.</td>
<td>Uses questioning techniques. Questions prompt higher order thinking related to skills/content.</td>
<td></td>
</tr>
<tr>
<td>Varying methods of calling on students.</td>
<td><strong>Models Strategy</strong></td>
<td>Candidate models the strategy with limited opportunities for practice. Scaffolds instruction.</td>
<td>Explicitly models strategy and provides an opportunity to practice.</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>---------------------</td>
<td>------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Uses Data</strong></td>
<td>Candidate proposes changes that address avatar students collective learning needs related to the lesson focus.</td>
<td>Address gaps in learning and understanding.</td>
<td>Re-engages students in modified tasks. Uses peer and professor coaching to modify instruction.</td>
<td></td>
</tr>
<tr>
<td><strong>Closure</strong></td>
<td>Candidate elicits student responses to close the lesson.</td>
<td>Asks students to summarize, analyze and/or synthesize skills/content.</td>
<td>Links to next lesson.</td>
<td></td>
</tr>
<tr>
<td><strong>Lesson Dispositions</strong></td>
<td>Creates a Positive Learning Environment</td>
<td>Creating a positive learning environment that is responsive to and respectful of the learning needs of all avatar students.</td>
<td>Show appreciation for their efforts. Using positive language. Creating rapport. Identifies and demonstrates knowledge of avatar students’ strengths and needs.</td>
<td></td>
</tr>
</tbody>
</table>
Collaborates to Develop and Sustain Professional Learning Environment

Collaborating to develop and sustain professional learning environment to synthesize and analyze data from the simulation to adjust instruction.

Supports and assists other candidates.

Handles Emotions

Candidate expresses empathy for avatar students’ emotional state.

Candidates their own emotional states.

Listen carefully and empathetically. Accept emotions.

Responds appropriately to avatar students.

Manages Flow

Candidate propels the momentum of the lesson; owns authority.

Keeps movement of each criterion.

Keeps to allotted time frame.


Written Reflection:
Following the simulation, use the guidelines to reflect on your performance. Based on peer and mentor feedback and your own metacognition, reflect on each of the expected lessons behaviors from the rubric, above. Provide examples of your successes in each area and also a goal for improvement for the next lesson.

Behaviors/Dispositions from Rubric:

1. Opening
   Example of Success:

   Area for goals and Improvement:

2. Creates a Positive Learning Environment
   Example of Success:
Area for Goals and Improvement:

3. Implements a Learning Task
Example of Success:

Area for Goals and Improvement:

4. Elicits Student Responses
Example of Success:

Area for Goals and Improvement:

5. Models Strategy
Example of Success:

Area for Goals and Improvement:

6. Uses Data
Example of Success:

Area for Goals and Improvement:

7. Closure
Example of Success:

Area for Goals and Improvement:
Appendix D

Nonverbal Communication Behavior Observation Tool (NCBOT)
Nonverbal Communication Behavior Observation Tool (NCBOT)

<table>
<thead>
<tr>
<th>Gestures</th>
<th>Touch</th>
<th>Varied Tone of Voice</th>
<th>Eye Contact</th>
<th>Proximity</th>
<th>Posture</th>
<th>Smiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of hands and arms to gesture when talking to student avatars</td>
<td>Touching on the should or arm when talking to student avatars</td>
<td>Varied tone of voice in interactions with the student avatars</td>
<td>Eye contact with student avatars</td>
<td>Use of proximity when interacting with student avatars</td>
<td>Appearance of a relaxed posture when interacting with the student avatars</td>
<td>Observation of smiling when interacting with the student avatars</td>
</tr>
</tbody>
</table>

Observations

Other Comments:

Total length of video (in seconds) ___________________________
Appendix E

Semi-Structured Exit Interview Protocol
Participant Semi-Structured Exit Interview Protocol

Congratulations on completing the course, Educational Psychology: Childhood and Adolescence.

Thank you for agreeing to participate in my research study and for agreeing to be interviewed. I have a few questions I’d like to ask you to follow up on our discussion earlier. Is that OK?

1. Prior to this course, had you thought about the role of a teacher’s nonverbal communication behaviors in teaching? Please describe any thoughts you had.

2. Nonverbal immediacy behaviors are behaviors such as smiling, gesturing, and use of proximity that decrease the psychological distance between a teacher and student. Do you think it’s important for teachers and students to decrease that feeling of psychological distance? Why or why not?

3. With respect to your use of nonverbal communication behaviors, do you think that has changed over the course of this semester? If so, how?

4. Do you think your experiences in the mixed reality simulations are helping you to prepare for your student teaching? Why or why not?

5. What are your thoughts about the video feedback and coaching sessions? Did you find them helpful?

6. How do you think your teaching has changed over the course of this semester? Please explain.

7. Do you think you’re better prepared to teach a classroom of real students? What makes you say that?
8. Is there anything you’d like to add about your experiences with using the mixed reality simulation or the video feedback and coaching sessions that I haven’t asked?

Thank you so very much for your time this semester! I truly appreciated your willingness to be a part of this study.
Appendix F

Pre-service Teacher Student Participant Demographic Survey
Pre-service Teacher Demographic Survey

Department of Education and Educational Psychology
181 White Street
Danbury, CT 06810

February 20, 2019

Name: ________________________________ Course Section: _________

School email address: ________________________

Gender: Male _________ Female __________ Other (please specify) __________

Ethnicity:

African American _______ Asian/Pacific Islander _______ Caucasian _______

Hispanic/Latino _______ Native American _______

Other ______ (please specify) __________ Prefer not to answer ______

College year of study: Freshman ______ Sophomore ______ Junior ______ Senior ______

What school level do you plan to teach? Elementary (K-6) _____ Secondary (7-12) _____
What is your content area major? ______________________

Are you currently employed? Yes _____ No ______ If you answered “yes,” what kind of work do you do? ________________________________

Have you participated in the mixed reality simulator in a previous course? Yes _____ No______ If you answered “yes,” about how many times have you participated? _______
Appendix G

Semi-Structured Coaching Protocol
Semi-Structured Coaching Protocol

Opening:

Now that you’ve had a chance to experience the mixed reality environment for the _____ time, and viewed your performance in the simulation, I’d like to take a few minutes to discuss your experience working with the student avatars.

Objective Questions:

- Thinking about the video of your experience with the student avatars, what images, conversations, or interactions with the student avatars stood out for you?

Reflective Questions:

- How did you feel as you experienced interacting with the student avatars?
- Thinking about the student avatars’ perspectives, do you think that you had their attention?
- Do you think that you appeared warm and friendly to the student avatars? What makes you say that?
- Do you think the student avatars were engaged in learning?

Interpretive Questions:

- How do you think you could express to your students, nonverbally, that you want to help them learn?
- How do you think you could appear warm and friendly to your students without telling them that you are a warm and friendly person?
- How do you think you could use nonverbal communication to manage classroom behaviors?

The researcher will now discuss the video of the preservice teachers’ performance in the mixed reality simulation focusing on specific nonverbal immediacy behaviors displayed by the pre-service teacher as they interacted with the student avatars. Coaching will be focused on increasing the following nonverbal immediacy behaviors, and the researcher will make recommendations based upon analysis of the participant’s performance in the simulation, data collected on the Nonverbal Communication Behavior Observation Tool, and the responses by participants to questions asked by the researcher.
- Vocal intonation - varied
- Posture
- Proximity*
- Touch*
- Facial expression - smiling
- Gesturing
- Eye contact
- * NOTE - due to the nature of simulations, pre-service teachers will be coached to be explicit when they intend to decrease the distance between themselves and a student avatar (“I am now moving toward Kevin) and/or touching a student avatar (“I am now touching Kevin on the shoulder to reassure him of his progress”)

**Decisional**

- What do you think you will focus on the next time you experience the simulation?
  - For Simulation 3 - What do you think you will focus on in the future as you work with students?

**Closing**

- Thank you for your time. I appreciate your willingness to view the video data from your experience with the student avatars and work with me as you continue to learn and develop as an educator.

- End call or Skype session.

**Researcher Reflexive Notes:**
Appendix H

Institutional Review Board (IRB) Approval
I am pleased to inform you that your I.R.B. protocol number 1920-01 has been re-approved by full review. This email is documentation of your official approval to start your research. If you need a copy of this official approval for funding purposes, please let me know [REDACTED]. The WCSU I.R.B. wishes you the best with your research.

You have 1 year from the date of this email to complete your research; if you are still conducting that date, you will need to fill out a renewal application. When are you finished with your study please fill out and return via email a Termination/Completion Report (available here: [http://wcsu.edu/irb/forms.asp](http://wcsu.edu/irb/forms.asp)) so we know your study is complete.

Finally – and most importantly! – we have recently learned that current BOR technology policies do not guarantee privacy of any info stored on work computers physically, remotely, or otherwise (i.e., laptop, Dropbox, etc.). As such, to maintain the truth of any anonymity or confidentiality promises you make to participants (consent form, for example), you will need to store all electronic data obtained from those human subjects on a system/computer/file not connected to any CSU system. It is your responsibility as the primary researcher to make sure personal data of participants remains securely private – something not guaranteed in the currently existing CSU system. Rest assured, (because it’s ridiculous to expect faculty to store work-related research on non-work-related systems and/or to conduct research where participants are not guaranteed anonymity/confidentiality), we are working to gain an exception for research purposes to this policy. But until then, it’s technically and legally possible for anyone in the system office to access your participants’ data at any time – without your consent or knowledge before doing so... which makes any guarantees made on research documents (e.g., consent forms) deceptive unless info is stored elsewhere.

Thanks,

[REDACTED] Ph.D.
Chair, Institutional Review Board
Western Connecticut State University
[www.wcsu.edu/irb](http://www.wcsu.edu/irb)
Appendix I

Site Administrator Approval
Dear Dr. O'Callaghan,

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. A requirement of doctoral candidates in this program is the design and implementation of a research study. Please accept this letter as a formal request to conduct research at the Westside campus during the Fall 2019 semester. This study has been approved by Western Connecticut State University’s Institutional Review Board.

The purpose of the research is to explore the impact of a video feedback and coaching treatment package on nonverbal communication behaviors, specifically nonverbal immediacy behaviors, of pre-service teachers who are utilizing a mixed reality simulation environment. All student participants enrolled in the Educational Psychology II: Childhood and Adolescence (ED 212) during the Fall 2019 semester will receive the treatment. Following each of three sessions in the simulation, student participants will receive their individual performance video and participate in a 15-20-minute coaching session focused on nonverbal immediacy behaviors. An exit interview, approximately 30-45 minutes in length, will be administered immediately following the third and final coaching session. Interviews will explore the student participants’ perceptions of the treatment with respect to nonverbal immediacy behaviors as they experienced the mixed reality simulations. Potential benefits of this research are informing best practices for teacher preparation programs in impacting teacher learning to positively affect student outcomes in classrooms as well as a potential to contribute to the knowledge of immediacy behaviors and classroom management for the field.

Participation in this study is entirely voluntary and would not have an adverse effect on a student participant in any way. Participants’ names will be coded numerically and kept in a secure location to protect confidentiality. Results of the study will be reported in a manner that does not identify individuals. The researcher has no instructional relationship with any of the adult participants.
This research study has been approved by the Western Connecticut State University Institutional Review Board, protocol number 1920-01. I appreciate any consideration you may give me in granting your permission to conduct this research. If you have any questions, please don’t hesitate to contact me at [blank] or [blank].

Sincerely,

Gloria Rosati Peterson, Ed.D. Candidate
Instructional Leadership

Jody S. Piro, Ed.D. Professor
Ed.D. in Instructional Leadership

If you agree to allow participation in the study, please sign the attached statement below, and return it to me by March 15th and keep the attached copy for your records.

I, _________________________________, am the Chair of the Education Psychology Department and Professor of Education at Western Connecticut State University. I acknowledge that the researcher has made clear to me the purpose of this research, identified any risks involved, and offered to answer any questions. I voluntarily grant permission for this study. I have read and understand the above consent form and agree to this study.

Printed Name of Chair: _________________________________

Signature of Chair: _________________________________Date: __________
Appendix J

Consent Letter: Course Professor
Consent Letter: Course Professor – ED 212

Department of Education and Educational Psychology
181 White Street
Danbury, CT 06810

08/27/19

Dear Dr. [Name]

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. A requirement of doctoral candidates in this program is the design and implementation of a research study. Please accept this letter as a formal request for you, and your students enrolled in your course, Educational Psychology [Name], to participate in this study.

The purpose of the research is to explore the effects of a video feedback and coaching treatment package on nonverbal communication behaviors, known as nonverbal immediacy behaviors, of pre-service teachers who are utilizing a mixed reality simulation environment. Initially, all students in both sections of your course will be invited to participate in the study and complete a demographic survey. Video data of each pre-service teachers’ performances in the mixed reality simulations that are embedded in the course, as well as official [Data] data via a faculty member’s ID online will be collected. All students who consent to participate will receive a video of each of their three performances in the mixed reality simulation. Additionally, following each experience in the simulation, participants will receive a coaching intervention employing the “objective, reflective, interpretive, decisional” (ORID) focused questioning technique. This coaching treatment will last approximately 15-20 minutes and will take place outside of class time. Finally, at the conclusion of the third simulation experience, participants will be interviewed about their perceptions of the video feedback and coaching targeting their nonverbal immediacy behaviors as they experienced the mixed reality simulation environment. This interview will last approximately 30-45 minutes.
Participation in this study is entirely voluntary and may be withdrawn at any time without threat of penalty. Participants’ names will be coded numerically and kept in a secure location to protect confidentiality. Results of the study will be reported in a manner that does not identify individuals. The researcher has no instructional relationship with any of the adult participants.

Potential benefits of this research are informing best practices for teacher preparation programs in impacting teacher learning to positively effect student outcomes in classrooms as well as a potential to contribute to the knowledge of immediacy behaviors and classroom management for the field.

This research study has been approved by the Western Connecticut State University Institutional Review Board, protocol number 1920-01. I appreciate any consideration you may give me in granting your permission to conduct this study with your students. If you have any questions, please don’t hesitate to contact me at [redacted] or [redacted].

Sincerely,

Gloria Rosati Peterson, Ed.D. Candidate
Instructional Leadership

Jody S. Piro, Ed.D. Professor
Ed.D. in Instructional Leadership

If you agree to allow participation in the study, please sign the attached statement below, and return it to me by [insert date] and keep the attached copy for your records.

I, _________________________________, am an educator at [redacted].

I acknowledge that the researcher has made clear to me the purpose of this research, identified any risks involved, and offered to answer any questions. I voluntarily grant permission for this study. I have read and understand the above consent form and agree to this study.

Printed Name of Educator: ______________________________________________________

Signature of Educator _______________________________ Date: __________
Appendix K

Data Security: Microsoft One Drive Documentation
Data Encryption in OneDrive for Business and SharePoint Online

- 07/01/2018

Understand the basic elements of encryption for data security in OneDrive for Business and SharePoint Online.

**Overview**

Office 365 is a highly secure environment that offers extensive protection in multiple layers: physical data center security, network security, access security, application security, and data security. This article specifically focuses on the in-transit and at-rest encryption side of data security for OneDrive for Business and SharePoint Online.

For a description of Office 365 security as a whole, see Security in Office 365 White Paper.

Watch how data encryption works in the following video.

**Encryption of data in transit**

In OneDrive for Business and SharePoint Online, there are two scenarios in which data enters and exits the datacenters:

- **Client communication with the server** Communication to OneDrive for Business across the Internet uses SSL/TLS connections. All SSL connections are established using 2048-bit keys.

  - **Data movement between datacenters** The primary reason to move data between datacenters is for geo-replication to enable disaster recovery. For instance, SQL Server transaction logs and blob storage deltas travel along this pipe. While this data is already transmitted by using a private network, it is further protected with best-in-class encryption.

**Encryption of data at rest**

Encryption at rest includes two components: BitLocker disk-level encryption and per-file encryption of customer content.

BitLocker is deployed for OneDrive for Business and SharePoint Online across the service. Per-file encryption is also in OneDrive for Business and SharePoint Online in
Office 365 multi-tenant and new dedicated environments that are built on multi-tenant technology.

While BitLocker encrypts all data on a disk, per-file encryption goes even further by including a unique encryption key for each file. Further, every update to every file is encrypted using its own encryption key. Before they're stored, the keys to the encrypted content are stored in a physically separate location from the content. Every step of this encryption uses Advanced Encryption Standard (AES) with 256-bit keys and is Federal Information Processing Standard (FIPS) 140-2 compliant. The encrypted content is distributed across a number of containers throughout the datacenter, and each container has unique credentials. These credentials are stored in a separate physical location from either the content or the content keys.

For additional information about FIPS 140-2 compliance, see FIPS 140-2 Compliance.

File-level encryption at rest takes advantage of blob storage to provide for virtually unlimited storage growth and to enable unprecedented protection. All customer content in OneDrive for Business and SharePoint Online will be migrated to blob storage. Here's how that data is secured:

1. All content is encrypted, potentially with multiple keys, and distributed across the datacenter. Each file to be stored is broken into one or more chunks, depending its size. Then, each chunk is encrypted using its own unique key. Updates are handled similarly: the set of changes, or deltas, submitted by a user is broken into chunks, and each is encrypted with its own key.
2. All of these chunks—files, pieces of files, and update deltas—are stored as blobs in our blob store. They also are randomly distributed across multiple blob containers.
3. The "map" used to re-assemble the file from its components is stored in the Content Database.
4. Each blob container has its own unique credentials per access type (read, write, enumerate, and delete). Each set of credentials is held in the secure Key Store and is regularly refreshed.

In other words, there are three different types of stores involved in per-file encryption at rest, each with a distinct function:

- Content is stored as encrypted blobs in the blob store. The key to each chunk of content is encrypted and stored separately in the content database. The content itself holds no clue as to how it can be decrypted.
The Content Database is a SQL Server database. It holds the map required to locate and reassemble all of the content blobs held in the blob store as well as the keys needed to decrypt those blobs.

Each of these three storage components—the blob store, the Content Database, and the Key Store—is physically separate. The information held in any one of the components is unusable on its own. This provides an unprecedented level of security. Without access to all three it is impossible to retrieve the keys to the chunks, decrypt the keys to make them usable, associate the keys with their corresponding chunks, decrypt any chunk, or reconstruct a document from its constituent chunks.

Retrieved October 02, 2018, from:
Appendix L

Second Cycle Themes and Categories with Respect to First Cycle Codes
Table 6.1

Objectivity of Reflections: Categories with Respect to First Cycle Codes

<table>
<thead>
<tr>
<th>Theme</th>
<th>Category</th>
<th>First Cycle Code</th>
<th>$f$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectivity of Reflections</td>
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<td>Objectivity</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Student perspective</td>
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<td>Reviewed when relaxed</td>
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<td>Video for self-evaluation</td>
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<td>Self-conscious</td>
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<td></td>
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<td>Want to improve</td>
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<td></td>
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<td>Video for reflection</td>
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Table 6.2

Coaching Layered Teachers’ Reflections: Categories with Respect to First Cycle Codes

<table>
<thead>
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<td></td>
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<td>New awareness of NVC role in teaching</td>
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<tr>
<td>Objectivity-coaching</td>
<td>Outside view</td>
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<td>2</td>
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</tbody>
</table>
Table 6.3

*Comfort and Confidence in Teaching: Categories with Respect to First Cycle Codes*

<table>
<thead>
<tr>
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<th>Category</th>
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<tr>
<td>Comfort and Confidence in Teaching</td>
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<td>Awareness</td>
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<td>Practice</td>
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<td>Objective view</td>
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<tr>
<td>Managing Students</td>
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</tr>
<tr>
<td></td>
<td>Think on feet</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Seeing self as teacher</td>
<td>Seeing self as teacher</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Growth</td>
<td></td>
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Table 6.4

*Building Relationships: Categories with Respect to First Cycle Codes*

<table>
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<tbody>
<tr>
<td>Building Relationships</td>
<td>Friendliness</td>
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<td></td>
<td></td>
<td>NVC – smiling</td>
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<td>Teacher-Student relationships</td>
<td>Rapport</td>
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Table 6.5

**Student Engagement: Categories with Respect to First Cycle Codes**

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<tr>
<td>Student Engagement</td>
<td>Openness for Communication</td>
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<tr>
<td></td>
<td></td>
<td>NVC – gesturing</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Differentiation of instruction</td>
<td>NVC – tone of voice</td>
<td>3</td>
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<tr>
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<td>Responsive teaching</td>
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Table 6.6

**Student Behavior Management: Categories with Respect to First Cycle Codes**

<table>
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<td>Behavior Management</td>
<td>NVC to manage student behavior</td>
<td>NVC – proximity</td>
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<td></td>
<td></td>
<td>NVC – posture</td>
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<tr>
<td></td>
<td></td>
<td>NVC – behavior management</td>
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<td>MRS – behavior management</td>
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Table 6.7

*Transference of Nonverbal Immediacy Skills to Practice: Categories with Respect to First Cycle Codes*

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<thead>
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<td>Placement – tone of voice</td>
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</tr>
<tr>
<td></td>
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<td>Placement – smiling</td>
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<tr>
<td></td>
<td></td>
<td>Placement – posture</td>
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<td>Placement – proxemics</td>
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<td>Professional beliefs</td>
<td>Student perceptions</td>
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</table>
Appendix M

Researcher Biography
Researcher Biography

Gloria Rosati Peterson works as an elementary library media teacher in the Beacon (NY) City School District. She has served the district in this capacity for over 23 years, which allows her to leverage two of her passions: children’s literature and educational technology. In her role, she works with faculty, staff, and students in supporting curriculum and instruction in those areas. She is the Library Media Department Coordinator and works with administration in aligning library media resources and activities that support curricular initiatives and district-wide goals.

Gloria has served as a mentor to new teachers for over a decade, providing coaching and support as new educators develop skills in communication, lesson planning, classroom management, assessment, and differentiation of instruction to meet the needs of today’s students. She particularly enjoys supporting new teachers as they master competencies that promote student learning.

She is a certified educator and School District Administrator in New York State. Her decision to focus her doctoral research involving the preparation of pre-service teachers utilizing an emerging technology is the result of her life experiences, passions, and interests.
Appendix N

Permissions
Permissions

Permission for Reproduction of Mixed Reality Simulation Scenario

Subject: Written permission for using rubric

Mrs. Rosati Peterson,

You have our permission to reference our rubric for mixed reality simulations for use in your dissertation.

Warmly,

Jody Piro

Jody S. Piro, EdD
Professor
Coordinator-Certificate in Intermediate Administration and Supervision (Endorsement #092)
Doctor of Education in Instructional Leadership Program
Department of Education and Educational Psychology
Western Connecticut State University
Westside Campus 251
Danbury, CT 06810
Hi Gloria,

You have my permission to use the figure in your proposal and dissertation.

Good luck, let me know when your proposal defense is and I'll see if I can make it!

-Erik
EdD in Instructional Leadership
Department of Education and Educational Psychology
Dissertation Registration Form

Student: Gloria Rosati Peterson  Date: 07/23/20

Dissertation Title: Effect of a Nonverbal Immediacy Treatment on Pre-service Teachers Using Mixed Reality Simulations

Dissertation Committee Members: See attached Dissertation Approval Page

For Office Use Only.

Jody S. Piro, Ed.D. 07/23/20
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Interim Dean, School of Professional Studies

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Associate Director, Division of Graduate Studies

219