

Article

Preparing General Education Teachers for Inclusive Settings: Integrating High-Leverage Practices and Mixed-Reality Simulation in Pre-Service Coursework

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Abstract: Students with disabilities are increasingly being educated in general education classrooms. This exploratory study investigates the efficacy of using mixed-reality simulation (MRS) to provide deliberate practice on high-leverage practices (HLPs) for pre-service general education teachers. Results indicate significant shifts in pre-service teacher understanding of and perceived readiness to implement HLPs in favor of the mixed-reality treatment group. Examining the influence of this innovative technology on pre-service teacher lesson planning yielded mixed results. Findings hold implications for the preparation of special and general education teachers across all content areas.

Keywords: high-leverage practices; mixed-reality simulation; deliberate practice; pre-service teacher; teacher preparation; students with disabilities



Citation: Driver, M.K.; Zimmer, K.E.; Khan, O.; Sadler, J.V.; Draper, E. Preparing General Education Teachers for Inclusive Settings: Integrating High-Leverage Practices and Mixed-Reality Simulation in Pre-Service Coursework. *Educ. Sci.* **2024**, *14*, 428. <https://doi.org/10.3390/educsci14040428>

Academic Editor: Maria B. Peterson-Ahmad

Received: 5 January 2024

Revised: 15 March 2024

Accepted: 18 March 2024

Published: 19 April 2024



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1. Introduction

Since the passing of the Education of Handicapped Children Act in 1975 and the most recent reauthorization of the Individuals with Disabilities Education Act (2004), students with disabilities (SWD) are increasingly served in the general education classroom. Receiving instruction in the general education classroom is especially prevalent for students with high-incidence disabilities (i.e., learning disabilities, emotional/behavioral disorders, speech/language impairment, other health impairments such as ADHD, and high-functioning autism spectrum disorders [1]). Pre-service general education teachers must learn to teach students with diverse abilities and academic needs while enrolled in preparation programs. Once employed, General education teachers are responsible for the academic and socio-emotional success of all learners, including SWD.

General education teacher preparation has continuously evolved since 1975 to address these growing demands and the inclusion of SWD in schools; however, these efforts are often siloed in one federally mandated course that pre-service general education teachers must take concerning SWD [2]. This one course can range drastically in content and quality across teacher preparation programs, despite calls to move from the traditional disability characteristics format towards a more holistic instructional approach [3]. High-leverage practices (HLPs) provide structured focus for teacher educators to organize course content for both special and general education teacher candidates.

1.1. High-Leverage Practices (HLPs) for SWD

HLPs are defined as “tasks and activities that are essential for skillful beginning teachers to understand, take responsibility for, and be prepared to carry out in order to enact their core instructional responsibilities” [4]. Specifically, HLPs are specific teacher practices that are likely to improve student outcomes through professional knowledge, classroom practices, skills, and behaviors that can be taught to pre-service teachers using highly

structured and well-supervised opportunities where feedback is essential to field experience [5]. Research indicates that focusing on HLPs can improve the instructional practices of teachers that lead to higher student academic achievement and social outcomes [4,6–9].

1.2. General Education and Special Education HLPs

There are nineteen HLPs for general education [10] and twenty-two HLPs for special education that span all subject areas, grade levels, and content [9,11]. Figures 1–3 provide a complete list of HLPs for both general education and special education, in addition to how these sets overlap. The special education set organizes HLPs into four domains: collaboration, assessment, social/emotional behavior, and instruction. Given the increasing representation of SWD taught in general education classrooms, pre-service teachers should be well-versed in both sets.

1. Leading a group discussion.
2. Explaining and modeling content, practices, and strategies.
3. Eliciting and interpreting individual students' thinking.
4. Diagnosing particular common patterns of student thinking and development in a subject-matter domain.
5. Implementing norms and routines for classroom discourse and work.
6. Coordinating and adjusting instruction during a lesson.
7. Specifying and reinforcing productive student behavior.
8. Implementing organizational routines.
9. Setting up and managing small group work.
10. Building respectful relationships with students.
11. Talking about a student with parents or other caregivers.
12. Learning about students' cultural, religious, family, intellectual, and personal experiences and resources for use in instruction.
13. Setting long- and short-term learning goals for students.
14. Designing single lessons and sequences of lessons.
15. Checking student understanding during and at the conclusion of lessons.
16. Selecting and designing formal assessments of student learning.
17. Interpreting the results of student work, including routine assignments, quizzes, tests, projects, and standardized assessments.
18. Providing oral and written feedback to students.
19. Analyzing instruction for the purpose of improving it.

Figure 1. TeachingWorks high-leverage practices. Note: full list with expanded descriptions available at: <https://library.teachingworks.org/curriculum-resources/high-leverage-practices/> (accessed on 26 March 2024).

Both the general and special education HLPs support the implementation of evidence-based practices (EBPs) for SWD. Certain HLPs have an abundance of empirical backing for SWD (i.e., explicit instruction) while others are less easily studied (i.e., collaborating with professionals). EBPs are teaching strategies that are effective for certain populations of learners and have been validated through numerous, rigorous, and high-quality research studies [12]. Teachers of SWD are legally mandated to use evidence-based practices (i.e., Individuals with Disabilities Education Act, IDEA, 2004), and research supports that when these strategies are used effectively, they increase outcomes for students with and without disabilities [13,14].

Collaboration HLPs
<ol style="list-style-type: none"> 1. Collaborate with professionals to increase student success. 2. Organize and facilitate effective meetings with professionals and families. 3. Collaborate with families to support student learning and secure needed services.
Assessment HLPs
<ol style="list-style-type: none"> 4. Use multiple sources of information to develop a comprehensive understanding of a student's strengths and needs. 5. Interpret and communicate assessment information with stakeholders to collaboratively design and implement educational programs. 6. Use student assessment data, analyze instructional practices, and make necessary adjustments that improve student outcomes.
Social/Emotional/Behavior HLPs
<ol style="list-style-type: none"> 7. Establish a consistent, organized, and respectful learning environment. 8. Teachers provide positive and constructive feedback to guide students' learning and behavior. 9. Teach social behaviors. 10. Conduct functional behavioral assessments to develop individual student behavior.
Instruction HLPs
<ol style="list-style-type: none"> 11. Identify and prioritize long-term and short-term learning goals. 12. Systematically design instruction toward a specific learning goal. 13. Adapt curriculum tasks and materials for specific learning goals. 14. Teach cognitive and metacognitive strategies to support learning and independence. 15. Provide scaffolding supports. 16. Use explicit instruction. 17. Use flexible grouping. 18. Use strategies to promote active student engagement. 19. Use assistive and instructional technologies. 20. Teach students to maintain and generalize new learning across time and settings. 21. Provide intensive instruction. 22. Teachers provide positive and constructive feedback to guide students' learning and behavior (learning focus).

Figure 2. High-leverage practices for special education. Note: for teaching SWD: [11,15].

HLPs for special education are considered more intense and focused versions of the general education HLPs [9,11]. For example, not only should teachers explain and model content, practices, and strategies, but they should use explicit instruction (i.e., HLP 16) and teach cognitive and metacognitive strategies to support learning and independence (i.e., HLP 14). Embedding HLPs in instruction can support SWD in numerous ways. For example, teachers can model how to complete a novice task, plan scaffolded supports as students learn new content, create flexible learning groups for students to practice, and provide positive and constructive feedback to actively engage students in the classroom [5].

Overlapping Domains	HLPs in Special Education	HLPs in General Education
<i>Sets the Learning Goal for Lesson</i>	11	13
<i>Reviews Previously Learned Academic Skills or Behaviors</i>	20	
<i>Creates a Positive and Welcoming Environment (including getting to know students)</i>	7	10, 12
<i>Teaches and Reinforces Classroom Routines and Social/Emotional Behaviors</i>	9	5, 7, 8, 9
<i>Checks for Student Understanding</i>	4	3, 15
<i>Uses Student Responses to Adjust Instruction</i>	6	6
<i>Actively Engages Students</i>	18, 19	
<i>Leads Students through a Systematic Lesson (i.e., Explicit Instruction)</i>	12, 16	2, 14
<i>Provides Feedback to Guide Learning</i>	8	18
<i>Uses Evidence-based Instructional Strategies to Support Student Learning (i.e., graphic organizer, mnemonics, etc.)</i>	13, 14	1, 2

Figure 3. Overlapping domains for both the general and special education HLPs addressed in the present study.

2. Existing Research on HLPs

At present, there are many position papers and articles that discuss the implications of HLPs for teaching SWD [5,8,9,16–18]; however, empirical research in the field is growing but rather limited. There has been a noticeable shift in the field of education to investigate the efficacy of introducing a small subset of HLPs in teacher preparation programs.

For example, Davin and Troyan [19] conducted a multiple-case study design using four pre-service teachers in K-12 foreign language classrooms to implement the same two general education HLPs: (1) increasing interaction for language comprehension, and (2) using questioning to develop and gain knowledge of student understanding. Findings revealed that pre-service teachers benefited from the deliberate practice of each HLP for which they can anticipate, plan, and practice before implementation in the field.

In another study, Kearney [20] investigated practice-based education of two high-school-level, novice world-language teachers of Spanish and Latin regarding their use of general education HLPs. Teachers used micro-practices relative to HLPs, including providing tools to guide students' participation in discussion, previewing relevant grammar and terminology, stating goals of the interaction, making explicit expectations for student contributions, and referencing and/or asking open-ended guiding questions, which taken together lead to a more effective approach to leading open-ended group discussions [20]. Students also experience higher outcomes when teachers provide HLPs such as scaffolding, which Kearney advises stems from asking a chain of probing questions and echoing student statements to extend their thinking. A synthesis of empirical studies exploring the impact of HLP on student outcomes reveals the benefits of implementing specific high-leverage practices such as performance feedback, modeling, and classroom discussions [6,7,21,22].

Providing adequate instruction to SWD is an international concern, and the need to focus on HLPs in teacher preparation extends beyond the United States [15]. For instance, Akalin and Sucuoglu [6], from Turkey, recently explored the impact of performance feedback, a commonly used HLP, with pre-service teachers using a single-subject multiple-baseline design study. The purpose of this study was to discover if performance feedback was effective in helping teachers manage behaviors and implement strategies to engage students with and without disabilities. Results indicate that active performance feedback can increase academic engagement and positive behaviors while decreasing negative behaviors when teachers properly integrate classroom management strategies in the classroom using special education HLPs.

2.1. Deliberate Practice with HLPs

According to the National Council for Accreditation of Teacher Education [23], pre-service teacher education course work should include meaningful clinical practice that purposely incorporates academic content and professional learning opportunities. By encouraging the use of HLPs in pre-service education training programs, future teachers can learn to confidently use EBPs while working with SWD to systematically design instruction toward specific learning goals where the curriculum tasks and materials are adapted to meet the needs of all learners.

In terms of the learning process required to prepare pre-service teachers to learn to use HLPs, McLeskey and Brownell [24] provide the following guidelines: (a) introducing and learning about the HLP, (b) preparing for and rehearsing the activity, (c) enacting the activity with students, and (d) analyzing enactment. They also encourage current education researchers to identify types of technologies that can play a role in helping pre-service teachers learn to use HLPs.

Grossman et al. [8] discuss the need for restructuring pre-service curriculum that would provide multiple core practices to be introduced within teacher preparation programs to teach pre-service teachers to elicit student thinking and adjust to real-time responses during interactive teaching. Grossman and colleagues support the notion of coaching where the role of the instructor is there to help “novices” or pre-service teachers develop ways of seeing and understanding their pedagogy through providing rich feedback on practice and routines, thus creating a mediated learning experience for delivering HLPs.

It is critical for pre-service teachers to have opportunities to practice teaching through structured, scaffolded, and supervised experiences [25]. High-quality teacher preparation programs provided numerous opportunities for deliberate practice, performance feedback, and targeted coursework [14]. The Collaboration for Effective Educator Development, Accountability and Reform (CEEDAR) Center and several distinguished researchers in the field of teacher preparation [8,16,26–28] have urged teacher educators to provide deliberate practice (i.e., strategically sequenced and calibrated opportunities) for pre-service teachers to develop mastery of HLPs. McLeskey et al. [9] argue that “HLPs can become the foundation of a cohesive, practice-based teacher education curriculum that incorporates repeated, scaffolded, effective opportunities to special education teacher candidates to practice” (p. 9). Thus, it is important that teacher education programs examine their current practices to ensure that pre-service teachers are allotted such opportunities.

The concept of deliberate practice is based on five principles to improve teacher performance: (1) push beyond one’s comfort zone; (2) work toward well-defined, specific goals; (3) focus intently on practice activities, (4) receive and respond to high-quality feedback, and (5) develop a mental model of expertise [29,30]. Practice opportunities prior to field experiences involving actual students, however, are scarce and often limited to inauthentic roleplays and scenarios that do not reflect the complexities and challenges of a classroom environment. One innovative and promising solution emerging in the field of education to provide such practice is the use of mixed-reality simulation (MRS).

2.2. Mixed Reality Simulation

MRS is an innovative technology that merges human knowledge with artificial technology. Mursion™ is an MRS platform that evolved from technology developed out of the University of Central Florida (e.g., TeachLivE™) [31]. Programs like Mursion™ provide simulated environments to practice skills essential for classroom teaching [32–37]. These simulated environments are realistic settings where a trained human interactor digitally puppeteers a variety of avatars displayed on a screen visible to participants [38].

The technology allows for a natural conversation that is personalized to the participants within the simulations. This creates an authentic learning experience that places pre-service teachers in naturalistic classroom scenarios, regarding the possibility of various events occurring [39,40]. When participants interact within the simulation, both the mind and body are immersed in a simulated experience where the authenticity and relevance are high while the cognitive load is appropriate [41]. MRS offers the opportunity for pre-service teachers to practice with the safety net of being able to make mistakes, reflect on what went wrong, and continue to practice without putting anyone at risk [33,41]. This allows pre-service teachers an opportunity to hone their skills in a safe environment, to learn from their mistakes, and receive real-time instructor feedback before ever entering the classroom setting [33]. The implementation of MRS in teacher education programs also provides the opportunity for pre-service teachers to practice various HLPs such as opportunities to respond (OTR), which supports the learning of students with and without disabilities [32].

In addition to providing purposeful practice, the use of MRS also affords the opportunity for individualized coaching. For example, there have been studies that focus on pre-service teachers receiving coaching from their instructor and/or peers to improve their classroom management skills [32,34,35,39,42].

3. Purpose of the Present Study

The probability of academic success is greatly influenced by the teacher's instructional behavior [43]. Students who feel supported by their teacher tend to build positive relationships more easily with their teacher. Due to this rapport, students are more inclined to meet the teacher's expectations which, in turn, reduces students' off-task and challenging behaviors [44]. Higher levels of student engagement are related to the frequency and quality of teachers' academic interactions [43]. Figure 3 identifies the general and special education HLPs that focus on engaging students across different content, grade levels, and abilities [24].

Throughout the literature, novice teachers often state that they do not feel they adequately prepared to enter the classroom [30]. Novice teachers require more practice with newly acquired pedagogical skills; thus, there is a need to provide pre-service teachers with deliberate and purposeful opportunities to practice HLPs [25]. Given the limitation of teacher preparation programs (e.g., time, effective field placement, and opportunities to practice effective pedagogy), paired with the fact that SWD are increasingly served in the general education classroom, well-designed simulation experiences that integrate purposeful practice of HLPs is one promising solution to prepare pre-service teachers. The purpose of this study is to investigate the efficacy of using MRS to provide deliberate practice for pre-service general education teachers to increase their use of HLPs.

RQ 1: *Does embedding MRS in a teacher preparation course influence pre-service teacher understanding of and readiness to implement target HLPs?*

RQ 2: *Does pre-service teacher instructional planning skill increase after engaging in MRS?*

4. Methods

4.1. Participants and Context

Participants in the study were a cohort of general education elementary pre-service teachers in their second to last year of a traditional teacher preparation program, specifically in the final semester prior to student teaching. All participants were enrolled in a three-

credit course on teaching SWD in inclusive settings as part of a full-semester course load that included elementary education methods coursework. None of the participants had prior teaching experience as a teacher of record. This is the one and only course on SWD that general education pre-service teachers are required to take during their preparation program. The content of this course focuses on the history of special education, evolution of laws and policies protecting SWD, characteristics of high-incidence disabilities, evidence-based practices for instruction, positive behavior supports, differentiation, and collaboration. Participants were recruited across four separate sections of the course in the spring academic semester and signed a consent form following IRB protocols. Sections of the course were randomly assigned to the treatment and the comparison groups.

The final sample in this exploratory design included two distinct groups: HLP + MRS (i.e., treatment; $n = 25$) and HLP only (i.e., comparison; $n = 29$). There were no statistically significant differences between groups at pretest ($p = 0.56$). All participants engaged in the typical course content and sequence. For this study, we also embedded a series of supplemental learning modules introducing HLPs and explicitly connected them to EBPs taught in the course. Participants in both the treatment and comparison groups received this enhanced instruction. The key distinction between groups was the opportunity for deliberate practice of the HLPs using MRS. After viewing each of the online modules and completing the guided notes, participants submitted a lesson plan to apply and demonstrate learning. Both groups received instructor feedback on their planning through graded assignments as part of the course. The treatment group then engaged in the MRS to practice teaching the lesson they planned.

4.2. Data Collection

Explicit teaching of HLPs occurred through five recorded online modules and accompanying guided notes. Participants watched the online modules and completed guided notes to demonstrate completion. Each recorded presentation introduced 1–2 special education and/or general education HLPs in a model known as The Engagement Cycle [45].

The Engagement Cycle is an instructional model designed to help pre-service teachers develop mastery of 5 HLPs that focus on student and classroom engagement and embeds [24] recommendations for teaching HLPs to pre-service teachers: (a) introducing and learning about the HLP, (b) preparing for and rehearsing the activity, (c) enacting the activity with students, and (d) analyzing enactment. The Engagement Cycle introduces HLPs, and the accompanying guided notes promote the application and reflection of the targeted HLPs and EBPs.

In the first module entitled “Getting to Know Your Students”, pre-service teachers learned why activating background knowledge (i.e., HLPs 1, 3, and 5) is important to instruction in the context of culturally sustaining teaching. Throughout this module, participants were provided with specific EBPs on how to present content knowledge, and elicit student funds of knowledge and student identity [46,47] to support positive student outcomes and engagement [48]. In the next module, “Activating Engagement”, participants focused on HLP 18 (use strategies to promote active student engagement) with EBPs that support actively connecting current learning to previously learned material. EBPs of modeling, guided practice, and independent practice were selected and highlighted in this module as it helps teachers design instruction in a way that builds on students’ prior knowledge and experiences [5].

In “Providing Opportunities to Respond”, the third module, pre-service teachers were presented with research on why checking for student understanding is important to embed throughout daily instruction. Students were then introduced to the varying levels and uses of Depth-of-Knowledge (DoK) questions (i.e., HLP 4). In the fourth module, “Feedback”, pre-service teachers learned why effective feedback is critical for students. In this module, pre-service teachers were introduced to EBPs that focused on positively reinforcing student learning through academic- and behavior-specific praise (i.e., HLP 2). Providing behavior-specific praise is a well-documented approach for managing classroom behaviors and

creating a welcoming learning environment [44]. Likewise, academic-specific praise is a meaningful tool that provides positive and constructive feedback while also reinforcing the correct understanding of content for all learners (i.e., “That’s right, the answer is a triangle because there are three sides and three vertices”). The fifth, and final, module reviewed The Engagement Cycle and additional EBPs to support the targeted HLPs. The guided notes, which students completed in each module, provided prompting questions and activities that encouraged the participants to review their lessons and embedded the HLPs throughout. Figure 4 shows the HLPs that were taught, when they were taught, and the EBPs that were highlighted throughout The Engagement Cycle.

Engagement Cycle	High-Leverage Practices	Evidence-Based Practices
<i>Module 1: Getting to Know Your Students</i>	Learning about students’ cultural, religious, family, intellectual, and personal experiences and resources for use in instruction Building respectful relationships with students	Setting High Expectations Connections with Families Open Door Policy Outside interactions Talk to your students
<i>Module 2: Activating Engagement</i>	Use strategies to promote active student engagement	Connects new learning to previously learned material Modeling Guided Practice Independent Practice Diagnostic assessments
<i>Module 3: Providing Opportunities to Respond</i>	Checking student understanding during and at the conclusion of lessons	Provide scaffold supports Peer tutoring Diagnostic assessments Guided Notes, Graphic Organizers, Small Group DOK questions
<i>Module 4: Specific Feedback on Student Performance</i>	Specifying and reinforcing productive student behavior Providing oral and written feedback to students	Specific academic praise Specific behavioral praise Setting positively stated expectations
<i>Module 5: Review of Engagement Cycle</i>	Review of all HLPs	Review of above EBPs

Figure 4. The Engagement Cycle overview. Note: [45].

4.3. Lesson Planning

Participants in both groups designed four lesson plans across the span of the study. The course instructor provided the context for which participants would plan a sequence of lessons based on the book *Everglades* by Jean Craighead for a hypothetical fifth-grade classroom. In this classroom, one child had a specific learning disability and another child had attention deficit disorder (Inattentive Type). In addition to this classroom context, pre-service teachers were provided with four objectives that scaffolded in instructional complexity. For the first lesson, pre-service teachers selected three vocabulary words to explicitly teach in context. The second lesson plan objective instructed the students to describe the physical characteristics presented in the *Everglades*. The third objective instructed the students to identify causes and associated effects in the text. The fourth and

final objective focused on prompting students to generate questions and connections to the text. Course instructors provided detailed feedback on each lesson using a standardized rubric to guide improvement on subsequent plans. Feedback included specific references to the target HLPs in The Engagement Cycle.

4.4. MRS Scenario

After completing each lesson, the HLP + MRS treatment group engaged in simulated practice. Due to the large size of the classes, each pre-service teacher in this condition engaged in two MRS practice teaching opportunities and observed four simulated sessions (see Figure 5 for detailed sequence). For the duration of the study, both sections in this treatment group were divided in half. Half of the students received traditional instruction from their instructor while the other half engaged in the MRS session for approximately one hour of the class. After an hour, the two groups switched. Pre-service teachers were assigned a teaching schedule and planned to teach either the first and third session (e.g., Group A) or the second and fourth session (e.g., Group B). During instruction, the pre-service teachers delivered a ten-minute lesson to five elementary avatars. When not teaching, participants watched their peers instruct in the simulator and provided informal peer feedback. During each session, after approximately every five lessons, the group would debrief with one of the researchers in the simulator prior to returning to their instructor and traditional course instruction. In the debrief the researcher prompted participants to consider which HLPs were observed during the session, what each participant did well, what could be strengthened, and to reflect on how the MRS experience made them feel in relation to their development as a classroom teacher. Each debrief lasted between 10–15 min. All MRSs and debriefs occurred in person during the participant's regularly scheduled course time. In total, each participant engaged in at least 20 min directly teaching a lesson in the MRS and observed over 400 min of peer MRS teaching throughout the course of the semester.

<i>Simulation Session I</i>	HLPs: Learning about students' cultural, religious, family, intellectual, and personal experiences and resources for use in instruction; building respectful relationships with students. <i>Assignment Due:</i> Planning for initial student questions (all). <i>Simulation Treatment Group Only:</i> Meet the Students (A and B).
<i>Simulation Session II</i>	HLP: Use strategies to promote active student engagement. <i>Assignment Due:</i> LP1 (all). <i>Simulation Treatment Group Only:</i> Teach LP 1 (Group A).
<i>Simulation Session III</i>	HLP: Checking student understanding during and at the conclusion of lessons. <i>Assignment Due:</i> LP2 (all). <i>Simulation Treatment Group Only:</i> Teach LP 2 (Group B).
<i>Simulation Session IV</i>	HLPs: Specifying and reinforcing productive student behavior; providing oral and written feedback to students. <i>Assignment Due:</i> LP3 (all). <i>Simulation Treatment Group Only:</i> Teach LP 3 (Group A).
<i>Simulation Session V</i>	HLPs: Review. <i>Assignment Due:</i> LP4 (all). <i>Simulation Treatment Group Only:</i> Teach LP 4 (Group B).

Figure 5. Purposeful practice MRS study design.

4.5. Measures

To address both research questions, two separate measures were created. For the first research question, a survey was created to assess pre-service teacher understanding of the

HLPs in The Engagement Cycle and their belief in their ability to implement these target instructional skills. For the second research question, a rubric was created to assess HLP implementation in pre-service teacher lesson plans.

4.6. Engagement Survey

The Engagement Survey consists of 44 items to measure participants' understanding of their ability to implement HLPs in instruction. Pre-service teachers took the survey on the first day of the course and at the conclusion of the semester. Cronbach's α for reliability of the sample was 0.88 at pretest and 0.94 at posttest. Each question stem was related to the HLPs and EBPs presented in The Engagement Cycle materials and participants responded on a 4-point Likert Scale indicating whether they Strongly Agree, Agree, Disagree, or Strongly Disagree with each statement. Of the 44 items, 14 measured "Getting to Know your Students", 12 measured "Activating Engagement", seven measured "Providing Opportunities to Respond", and 11 items measured "Specific Feedback on Student Performance". Sample questions included: "I understand how to provide effective feedback so students can acquire new knowledge"; "I know how to use consistent, proactive disciplinary practices"; "I know how to set clear expectations for student behavior"; "I believe students' prior knowledge and experiences should be embedded in every lesson I teach"; and "I understand how to design effective instruction that will meet the needs of all students regardless of ability levels". The Engagement Survey was developed by the first two authors and reviewed by two external experts in HLPs to ensure construct and content validity.

4.7. HLP Lesson Plan Rubric

To investigate if instructional planning skills differed by group, a rubric was created to assess HLP implementation. The Lesson Plan Rubric has a total of 19 components measuring the presence of elements of explicit instruction, culturally sustaining pedagogy, depth of knowledge questioning, use of formative assessment throughout the lesson to adjust instruction and plans to proactively support positive student behavior. Each component was ranked on a scale of zero to three: No Evidence (0); Does Not Meet (1); Proficient (2); and Exceeds (3); Figure 6. The maximum score available was 57 points. Two research assistants were trained on the Lesson Plan Rubric until they reached 80% Inter-observer agreement (IOA) on three consecutive lesson plans [49]. Both research assistants were practicing classroom teachers currently enrolled in a graduate education Master's or Doctoral program. The two faculty researchers held a series of training sessions with the research assistants to review each rubric component and the alignment to HLP content presented to participants in the study. After reviewing the rubric content and addressing clarifying questions, the research team practiced scoring a sample of lesson plans from previous course semesters collaboratively and individually to reach agreement. At least twenty percent of lesson plans across conditions were coded to ensure IOA ($M = 97\%$; 80% to 100% accuracy).

	0 points = No Evidence	1 point = Some evidence	2 points = Proficient Evidence	3 points = Significant Evidence
Connect to Prior Knowledge and interest (personal or academic) (CK)	Does not connect prior knowledge and interests to lesson on a personal or academic level.	Provides statements to connect prior knowledge and interest on a personal OR academic level.	Provides statements to connect prior knowledge and interest on a personal and academic level.	Consistently connects prior knowledge and interest to lesson on a <i>personal</i> and academic level.
Pre-Assessment of Student Learning (PA)	Does not ask questions to provide pre-assessment of learning.	Asks questions to provide pre-assessment of learning. Questions are general and vague.	Asks questions to provide pre-assessment of learning. Questions are specific to lesson objective about to be learned, but the connection to content/objective is <i>not clearly stated</i> .	Concept in and terms are explicitly reviewed in the opening. The candidate integrates previous concepts throughout the I Do, We Do, You Do sections (doesn't have to be in all sections). Consistently asks questions regarding pre-assessment of learning. Questions are specific to lesson objective about to be learned and teacher makes this connection clear.
Modeling (M)	Does not model by demonstrating how students should act/think.	Attempts to model but addressing the why and telling students what "it" (i.e., vocab word) is. ~Does not demonstrate how students should act/think to find meaning on their own.	Clearly demonstrate of how students should act/think to find meaning on their own (i.e., a think aloud).	Clearly demonstrate of how students should act/think to find meaning on their own (i.e., a think aloud). States why the process matters and is beneficial.
Depth of Knowledge (DOK) Levels 1-4	Only DOK level 1 questions were included in lesson.	Only DOK level 1-2s questions were included in lesson.	Primarily DOK 2s asked and at least one DOK Level 3.	Multiple questions asked throughout the lesson. More than one Level 3 or 4 question asked.

Figure 6. Excerpt of Lesson Plan Rubric.

5. Results

To investigate our first research question, we conducted a 2×2 analysis of variance (ANOVA) to investigate the effects of group condition (i.e., HLP + MRS; HLP only) on participants' pre- and posttest scores. Results of this analysis revealed a statistically significant main effect between the group condition and time point (i.e., pre- and posttest); $F(1,52) = 81.95, p < 0.001, \eta^2 = 0.96$. There was also a statistically significant interaction between the time and group; $F(1,52) = 8.54, p < 0.01, \eta^2 = 0.72$. A follow-up one-way ANOVA indicated a significant effect between group conditions in favor of the treatment (i.e., HLP + MRS; $M = 158.92$) compared to the HLP-only group ($M = 146.62$); $F(1,52) = 10.14, p < 0.01$.

To investigate our second research question, we conducted a 2×4 ANOVA to investigate the effects of group condition (i.e., HLP + MRS; HLP only) across the four consecutive lesson plans. Only participant data that included all four timepoints were included for analysis ($n = 24$ for the HLP + MRS condition; $n = 27$ for HLP only). Results of this analysis revealed a statistically significant main effect between the group condition and lesson time point $F(3,147) = 24.11, p < 0.001, \eta^2 = 0.93$. There was not a statistically significant interaction between the time and group; $F(3,147) = 1.33, p = 0.27$. These results indicate that both groups increased HLP implementation while lesson planning throughout the course of the study. There was not a statistically significant difference between group conditions at any timepoint. It is important to note that normality was not supported for the lesson plan data at the third timepoint. See Figure 7 for a visual analysis of HLP implementation across the four timepoints.

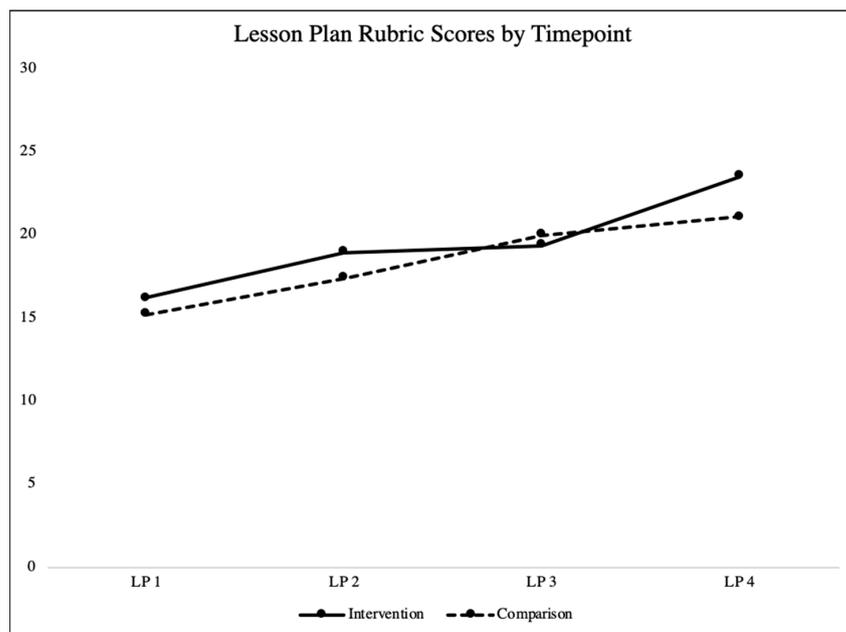


Figure 7. Lesson Plan Rubric Scores by Time.

6. Discussion

In this study, general education elementary pre-service teachers learned about HLPs in an introductory course on teaching SWD. The treatment group engaged in the MRS for additional practice delivering instruction. The additional practice with MRS did not appear to influence participants' planning abilities; however, it did influence their understanding of and readiness to implement the target HLPs. Both the treatment and comparison groups increased HLP implementation as evidenced by the lesson plan rubric scores over the four time points. Using MRS as a tool to provide practice opportunities for pre-service teachers is an innovative approach with promising results. Further investigation is warranted to determine the efficacy of this approach.

6.1. Limitations

There are several limitations to note when interpreting the results of this study. First, the HLP-only group did not have a structured practice opportunity as did the HLP + MRS group. While the instructors were encouraged to provide practice, the HLP + MRS group engaged in highly structured practice opportunities in the simulator with instructor and peer feedback. Although there were not significant differences in the lesson plan data, this practice and immediate debrief sessions appeared to impact participant understanding of and readiness to implement HLPs. Further research is needed to understand whether practice itself or practice in the simulator leads to this increased readiness. The role of instructor and peer feedback, and how reflection and debrief sessions are structured with MRS, should also be explored.

The second limitation to note is the lack of a true control group. Participants in both groups received the professional learning modules, so it is unclear if the modules influenced participants' planning or just maturation through the class. In addition, participants in the treatment group only taught in the MRS on two occasions, due to the size of each class section. Preliminary research indicates that approximately four 10-min sessions in MRS environments can influence teacher behavior [50]. However, educator preparation programs may be limited in scheduling this many sessions within the time parameters of an academic semester. Due to practical limitations of course size, required content in the syllabi, and meeting schedule, four sessions for every candidate may not be feasible during a semester.

6.2. Recommendations for Research and Practice

Future studies should continue to investigate the threshold of simulated teaching sessions for pre-service teachers to be able to apply and generalize new skills. Investigating the efficacy of MRS at varying session frequencies and length can help guide implementation decisions in teacher preparation (i.e., [51]). Instructors may choose to structure MRS practice in several ways including in person, remote, individually, or in group settings [52]. Exploring the impact of delivery structure and modality is critical to further inform practice. Future research should also explore how MRS can support the implementation of HLPs across each of the domains for SWD including collaboration, assessment, social/emotional/behavior, and instruction.

Additional research is needed to understand whether practice itself or practice in the simulator leads to increased readiness. The role of feedback, and how reflection and debrief sessions are structured with MRS should also continue to be explored. For example, how the participants learn from the MRS practice may differ when their feedback and reflection is delivered in person in a group setting from an instructor, or at a later point when watching a recording of the MRS session and scoring themselves on a rubric and completing a reflective guide [52,53]. This present study supports the prior research on the perceived transfer of learning when observing peer sessions as well as personal confidence from MRS practice [54]. Continued research is also needed to expand existing research on the relationship between effective teaching skills observed in MRS sessions, P-12 classroom instruction, and impact on P-12 student learning.

7. Conclusions

In conclusion, integrating MRS in pre-service teacher preparation with HLPs is a promising practice that warrants further investigation. MRS can be used to train pre-service teachers to implement HLPs, which can facilitate the development of future educators prepared to handle instructional and behavioral challenges [2,55], as well as interactions outside the classroom (i.e., collaborating with student stakeholders) [53]. The potential of MRS expands beyond the scope of this study to the various fields in in teacher and leader education. Pursuing innovative technologies in teacher education is critical to address the need for authentic practice with limited time and resources.

This is especially true in preparing general education teachers to work with SWD in inclusive settings. SWD have historically been marginalized in school settings despite advances in federal law and policy to promote more inclusive practices. To truly move toward more equitable classroom experiences, both general and special education teachers must be well equipped to effectively teach all students. While not the only solution, integrating the general and special education HLPs in teacher preparation is a step forward. Using MRS to provide opportunities for deliberate practice can allow for pre-service teachers to deepen their understanding of HLPs as they develop instructional expertise. Innovative technological tools such as MRS have the potential to further bridge theory with practice and solidify learning in meaningful and authentic experiences. Continued investigation on the utility of such practices in teacher education is essential to prepare educators to meet the academic and social emotional needs of all learners.

Author Contributions: Conceptualization, M.K.D. and K.E.Z.; methodology, M.K.D. and K.E.Z.; software, M.K.D. and K.E.Z.; validation, M.K.D. and K.E.Z.; formal analysis, M.K.D., K.E.Z., O.K., J.V.S. and E.D.; investigation, M.K.D. and K.E.Z.; resources, M.K.D., K.E.Z., O.K., J.V.S. and E.D.; data curation, M.K.D. and K.E.Z.; writing—original draft preparation, M.K.D., K.E.Z., O.K., J.V.S. and E.D.; writing—review and editing, M.K.D. and K.E.Z.; visualization, M.K.D. and K.E.Z.; supervision, M.K.D. and K.E.Z.; project administration, M.K.D. and K.E.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding. This research was supported by Kennesaw State University.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of Kennesaw State University (approval code: IRB #18-061, approval date: 5 January 2018).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

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