

Impacting Culturally Responsive Teaching Strategies by Decreasing Bias Through Simulation Experiences

Rhonda Christensen, Gerald Knezek*

Abstract

Simulated teaching environments have been used for more than two decades and are likely to continue to expand to meet the demands of teacher development programs. In this study, the self-reported changes in culturally-responsive teaching perceptions of ten classroom teachers serving more than six hundred students are reported. This paper includes first year findings from a program designed to use artificial-intelligence (AI) based algorithms to reduce implicit bias in teaching. Findings from this study include significant pre-post increases for self-efficacy related to culturally responsive teaching as well as instructional self-efficacy. These findings add credibility to the contention that a key innovation of using simulation programs for teacher professional development is that it provides teachers and teacher trainees many learning trials with simulated students, thereby increasing teacher confidence and competence, and which in turn will improve student learning. Findings set the stage for measuring the impact on student perceptions of learning and cultural engagement intended to support teachers in recognizing and ameliorating their own implicit biases.

Keywords: simulated teaching, reduce bias, teachers, culturally responsive, artificial intelligence

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* University of North Texas.

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Introduction

Classrooms are becoming more diverse as they reflect the society in which we live. Gender, ethnicity, socioeconomic status, and English language learning status have been linked to differences in teacher perceptions of students for whom they may hold implicit negative attitudes and stereotypes (McGinnis, 2017). To address the diversity of differences, educators need to actively recognize and counter patterns of bias in their teaching practices as well as classroom environments (Chen et al., 2009).

Danielson (1996) surmised that a typical teacher makes up to 3,000 important decisions during a day of instruction, many of which have varying impacts on different types of learners in the classroom. It is imperative that educators provide a culturally responsive environment for all students to be confident in their learning (Derman-Sparks & Ramsey, 2000). Cultural responsiveness requires looking beyond teachers' own beliefs, cultures, perspectives and practices to being able to understand where implicit biases may exist and how they can be overcome. Operationally, teachers need to be able to plan and deliver culturally responsive instructional challenges and supports that build on the strengths of students to address their learning needs (Sianjina, 2000). Teachers need to be able to assess students after an instructional activity and analyze student results, enabling adjustments to their instructional practices (Girod & Schalock, 2002).

This paper explores the use of a simulated teaching program to enable educators to recognize, reflect and remediate implicit biases that may exist in their teaching practices. Specifically, the paper addresses how the personal attributes of a teacher can be recognized, assessed and related back to teaching practices in an unobtrusive environment where underlying biases can be identified, acknowledged and remediated.

Background and Supporting Literature

Effects of Implicit Bias on Students

Demographics of teachers often do not reflect the growing classroom diversity; the educators serving these diverse students are predominantly white, female and middle class (Taie & Goldring, 2020) and have been found to infuse their teaching with implicit and explicit biases that may benefit one group to the detriment of another (Gay & Howard, 2000). K-12 teachers in the US today continue to be under-represented by minorities (US Dept. of Ed., 2016) which has an overall negative impact on diversity in the pursuit of careers and income

potential (NSTC 2018). Even the most dedicated educators hold beliefs and stereotypes that impact their students' learning. Ethnicity, native language, gender, and economic status have all been linked to teacher biases (McGinnis, 2017) and the negative impact of stereotypes may be additive (Copur-Gencturk et al., 2019). If unexamined, these beliefs can be harmful to students.

Implicit bias is described as the attitudes or stereotypes that affect our understanding, actions and decisions in an unconscious manner (McGinnis, 2017; Staats, 2015-16). Most neuroscientists agree that the majority of our cognitive processing occurs unconsciously (Soon et al., 2008). Because implicit associations are unconscious, implicit biases do not necessarily align with our explicit beliefs and stated intentions (Staats, 2015-16). Personal history and experiences may lead teachers to directly or indirectly attribute those experiences to students they teach (Graham, 2017). While we may not be aware these biases exist, they can have a significant impact on decision making. Some situations in which we are likely to rely on our subconscious for decision making involve ambiguous or incomplete information, the presence of time constraints in addition to fatigue or an overloaded mind (Bertrand et al., 2005). Given that teachers are often in these situations, it is not difficult to imagine that implicit biases may be contributing to their decisions (Staats, 2015-16) regarding how they interact with students along lines of gender, socio-economic status, ethnicity, and language proficiency. It is critical to identify evidence of these kinds of biases in instructional decision-making in order to foster supportive conversations with practitioners and build skills for culturally responsive teaching (Gauthier et al., 2022).

Gender and race are known to intersect to create inequitable interaction patterns; girls of color are least likely to receive teacher time and attention (Sadker et al., 2016). Providing teachers with objective information about the gender distribution of their interactions with documented behavioral changes over time during repeated similar teaching situations can improve gender biases that may exist.

Research has shown that teachers generally have lower expectations of their students living in poverty (Hecht & Greenfield, 2002). Of all the children living in poverty, the poverty rate for Black children (31%) and Hispanic children (26%) is higher than the rates for White and Asian children (10%) (de Brey et al., 2019). Research has shown that implicit biases such as teachers' expectations for particular students can harm academic outcomes for minority students, perhaps explaining differing racial achievement gaps (van den Bergh et al., 2010). Minority students are more often referred for Individualized Education Plans (IEPs; U.S. Dept. of Ed., 2021).

English Language Learners are defined as students who have sufficient difficulty speaking, reading, writing, or understanding the English language to

be able to learn successfully in classrooms or to participate fully to society (de Brey et al., 2019). In one large study regarding teacher attitudes toward ELL, 70% of the respondents were not interested in having these students in their classrooms and 51% did not intend to pursue additional training (Walker et al., 2004). There is also a negative perception toward multilingual learners in Europe and a lack of focus on preparing teachers to work with these learners (Erling et al., 2022). Of particular interest, one study found that mainstream teachers' implicit beliefs about ELL were negative while their explicit beliefs were more positive with these contradictions likely influencing the deliberate, conscious and spontaneous choices teachers make each day (Gawronski & Bodenhausen, 2006). Most classroom teachers have little or no training in adapting their teaching practices to meet the needs of linguistically diverse students (Walker et al., 2004).

Teacher Self-efficacy and Student Learning

The concept of perceived self-efficacy is rooted in social cognitive theory and is "concerned with judgments about how well one can organize and execute courses of action required to deal with prospective situations containing many ambiguous, unpredictable, and often stressful elements" (Bandura & Schunk, 1981, p 587). An individual's perception of ability to impact a situation is critical for whether or not they actually do affect change (Bandura, 2012). Teachers' beliefs about their ability to make a difference for students impacts their resilience and persistence in difficult situations (Gibson & Dembo, 1984).

Many research studies have found that a teacher's sense of self-efficacy was one of the variables highly related to student achievement (Tucker et al., 2005). Teachers with high self-efficacy are more likely to believe their teaching can impact student learning while teachers with low self-efficacy are more likely to look for solutions outside the classrooms (Soodak & Podell, 1994). One way that teachers can develop their self-efficacy is by understanding the needs of learners in the classroom with strategies to teach them. "Teachers who believe that student learning can be influenced by effective teaching despite home and peer influence and who have confidence in their ability to teach persist longer in their teaching, efforts, provide greater academic focus in the classroom, give different types of feedback, and ultimately improve student performance" (Tucker et al., 2005, p. 29).

Researchers have identified connections between teachers' sense of efficacy, culturally responsive pedagogy (Callaway, 2016), and student achievement (Oyerinde, 2008; Tucker et al., 2005).

Research on teacher efficacy and its relationship with culturally responsive teaching illustrates a need to address teacher self-efficacy with respect to

working with children from diverse backgrounds (APA, 2012; Oyerinde, 2008; Tucker et al., 2005). Efforts to increase teacher efficacy are vital in increasing the low academic achievement among culturally diverse students (Callaway, 2016; Tucker et al., 2005). Highly efficacious teachers have more persistence when helping struggling students, and they create lessons designed to engage their students (Kitsantas, 2012).

Using Simulation Experiences to Improve Teaching Strategies

Simulations mimic a simplified version of the real world allowing intentional design features to focus on specific features of interest for instruction. These “approximations of practice” (Grossman et al., 2009) allow users to try out strategies and receive targeted feedback in a scaffolded way in a low-stakes environment. Badiie (2012) identified four advantages to simulation based teaching: (a) classroom decision-making, (b) practice through repeating, receiving feedback and advice, (c) self-efficacy in classroom teaching, and (d) collaborations and social interactions. Fischler (2006) added that simulation based learning had great potential in education by allowing educators to act within virtual environments, immediately applying theory to realistic yet controlled settings. The use of simulations in many areas including equity-based teaching has recently increased (Chen et al., 2021; Littenberg-Tobias et al., 2021).

Studies that have focused on improving teaching practices through simulations include changes in equity mindsets and in self-reported equity-promoting practices (Littenberg-Tobias et al., 2021), more confidence in classroom skills, (Smith & Klumper, 2018), and teacher self-efficacy (Knezek & Christensen, 2009; Samuelsson et al., 2021). In addition, studies using simulations have found improvement in instructional teaching skills (Christensen et al., 2011; Lee & Ahn, 2021), classroom management (Christensen et al, 2007), motivation (Tyler-Wood et al., 2010), multicultural awareness literacy (Collum et al., 2019), and reduction of educator bias (Collum et al., 2020).

While not replacing classroom experiences, simulations are intended to extend and enhance opportunities to experience different types of students in a near real world environment. The key innovation of using simulation programs for preparing teachers is that it provides teachers and teacher trainees many learning trials with simulated students, thereby increasing confidence and competence, which in turn improves student learning. Repetition of many trials is important in changing habit complexes such as implicit bias (Malone, 2016).

Culturally responsive educators adopt the view that all students are capable of successes shown to be critical for student growth (Boser et al., 2014).

Culturally responsive teaching challenges educators to recognize that, rather than deficits, students bring strengths into the classroom that should be leveraged to make learning experiences more relevant and effective for students (Muniz, 2019). A simulated teaching environment allows for comparing self-reported bias indicators to objective measures produced by teaching within the simulator.

Three research questions focused on the teachers' use of a simulation tool, *simSchool*, guided this study.

1. To what extent can teaching in a simulated environment produce measurable changes regarding educator implicit bias with respect to visual characteristics (such as skin color and gender)?
2. To what extent can algorithm-based identification of – and prompted reflection on – educator biases in simulated teaching practices be decreased?
3. To what extent do simulation experiences impact participant measures related to teacher instructional self-efficacy, culturally awareness self-efficacy and educator bias related to teaching practices?

Methods

Participants

For the pilot year of a three-year project, twenty teachers were selected from the 47 who applied. Criteria that guided the selection process was representation from each of the three geographical areas of the state that were part of the school system, as well as at least two teachers from the same school, if possible. Each of the participants attended an introductory Zoom session to get started in *simSchool* with additional support from the team if needed. Of the 20 who participated, ten completed all components necessary for the study. Findings reported in this study are from the ten teachers who completed both pre and posttest survey data as well as all the required simulation modules.

Intervention

SimSchool is a dynamic, online classroom simulation program that allows preservice and inservice teachers the opportunity to practice teaching. *SimSchool* was designed to provide future and current teachers with a safe environment for experimenting and practicing techniques, especially methods of addressing different learning needs, and wide variations in academic and behavioral performance of students.

SimSchool promotes pedagogical expertise by re-creating the complexities

of classroom decisions through mathematical representations of how people learn and what teachers do when teaching. SimSchool’s underlying artificial intelligence model includes research-based psychological, sensory and cognitive domains. The Five-Factor Model of psychology (McCrae & Costa, 1996) serves as the foundation of the student personality spectrum. This model includes the characteristics of extroversion, agreeableness, persistence, emotional stability, and intellectual openness. A simplified sensory model component with auditory, visual and kinesthetic perceptual preferences comprises the physical domain. Together the physical, emotional and academic factors were demonstrated to represent salient elements of classroom teaching and learning (Christensen et al., 2011; Gibson, 2007).

As shown in Figure 1, simSchool users have options to review detailed student profiles before or during any session. Through the “Teach” button, users select which students to assign activities, either as individuals, groups, or as a whole class. The simSchool user can also make different types of comments through the “Talk” button in which they can encourage, redirect or discipline students. The “Progress” button allows the user to see how each student is performing in multiple dimensions including academics and emotions. The “Logs” button allows the user to see how the class and each individual student performed for each action the user selected. These features provide a robust system that allows each user to see the overall performance in the simulator after it is complete. Users are able to reflect and make corrections prior to beginning another session within the module with the intention of improving their teaching performances.

Figure 1 - SimSchool Classroom Highlighting Student Profiles.



While refining their own best practices in this “flight simulator for teachers,” simSchool participants are encouraged to interact with this cognitive model over several sessions spanning several weeks, with micro-teaching interactions lasting from 15 to 30 minutes. Each module focuses on a different aspect of teaching and ranges from classroom management to Pre-calculus. Prior to beginning the sessions, users review the student profiles that contain information on student strengths, preferences and academic performance so they can attempt to match instruction with learner needs. During the sessions, participants adapt their teaching to the diversity of students they encounter. At the end of each simulation session, participants receive graphical feedback displaying degree of success at promoting academic (learning) increase in the class overall, as well as feedback regarding the degree of suitability of the instructional activities selected for each individual simulated student in the class. This feedback can reveal aspects of a teacher’s implicit biases. Figure 2 illustrates the complex capabilities of simSchool.

Experiences in the simulated teaching environment allow teachers to recognize and reflect on implicit biases they may have that impact teaching strategies related to diverse learners, revealing possible cognitive dissonance related to inconsistencies in teaching behaviors versus beliefs. Following the simulated teaching session, users are provided with detailed post-hoc analysis of teaching patterns disaggregated by race and gender. Following the reflective feedback, teachers begin a new simulated teaching session with the intention of adjusting their teaching strategies to address specific learner needs. Multiple iterations are provided with the intention that improvements in teaching strategies occur due to the ability to “teach” in a system in which student variables are held constant in that they respond the same way (within systems dynamics boundaries) each time a teaching action is introduced. Thus, simSchool provides a non-invasive platform for researching impacts of alternative teaching behaviors.

Instrumentation

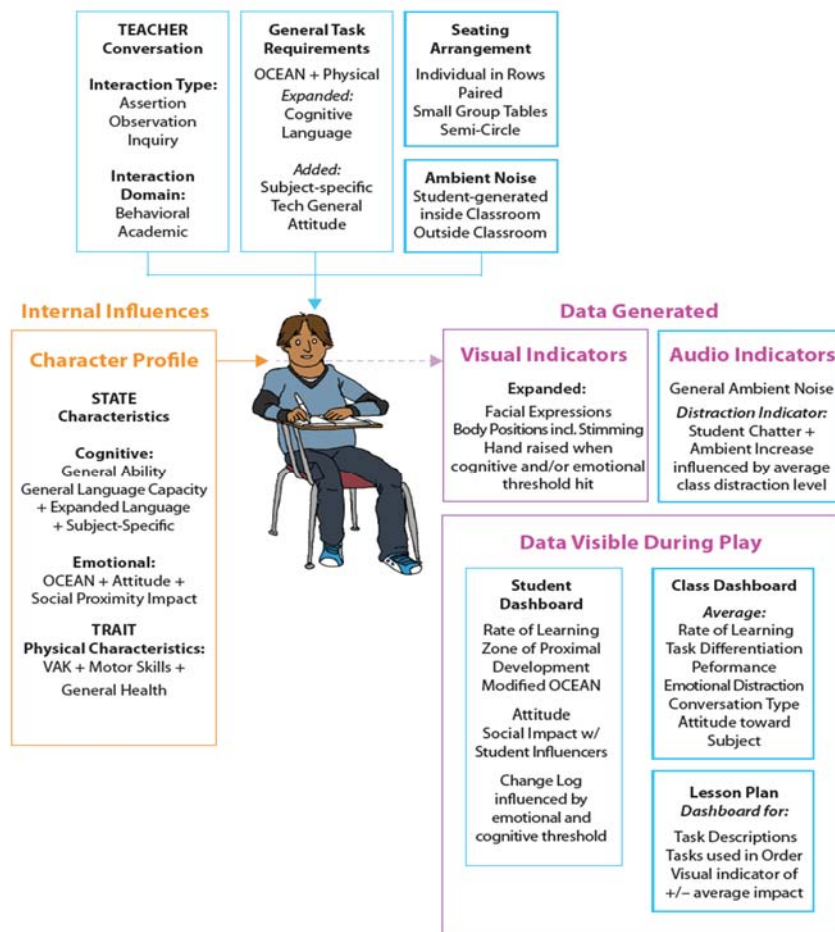
Data related to implicit bias were collected from three sources. First, the simSchool program gathers and retains the data that is used to give debriefing and feedback to the participating educators. A second source of data included demographic and self-report self-efficacy and culturally relevant teaching measures gathered from the participating teachers.

Three teacher measures were included in this study. User data from the simSchool program contained information for each session from each of the modules. In addition, teacher survey measures focused on self-efficacy, culturally responsive teaching, and self-awareness of bias were collected pre-

post within the simSchool program. These surveys included:

1. The *Teachers' Sense of Efficacy Scale* (TSES) (Tschannen-Moran & Hoy, 2001) measured self-efficacy related to three subscales: instructional strategies, classroom management, and student engagement.
2. The *Culturally Responsive Self-Efficacy Survey* (Siwatu, 2007) determined the level of competency in the skills and knowledge needed to engage in culturally responsive teaching that includes curriculum, assessment, classroom management and cultural enrichment.
3. Three scales from the *Educator Bias Inventory* (Collum et al., 2020) included: *Self-Awareness*, *Pedagogical environment*, and *Relationships with families and community* adapted from Chen et al. (2009).

Figure 2 - Model of Individual Learning Characteristics in SimSchool



Classroom teachers participated in one of two sets of modules depending on the grade level taught. The listing of the modules by grade level band is shown in Table 1.

Table 1 - Modules Completed by Classroom Teachers

Elementary teacher modules
Cultural Intelligence and Inclusion 2.0
ELE 3-5 Bullying and Bias the First Coconut Tree
ELE 3-5 Gender and Identity Supermom Saves the Day Why Can't Girls Be Superheros
Middle School Modules
MS 6-8 Gender and Identity: The Misfits
MS 6-8 History Empowering Learners to Change the World
MS 6-8 (Race, Ethnicity, Class, Immigration) A Tale of Two Schools

Figures 3 and 4 illustrate examples of graphical feedback and an observation report that participants received. Participants were required to view feedback prior to completing another session in the module.

Figure 3 - SimSchool Graphical Feedback Based on Interactions with Students

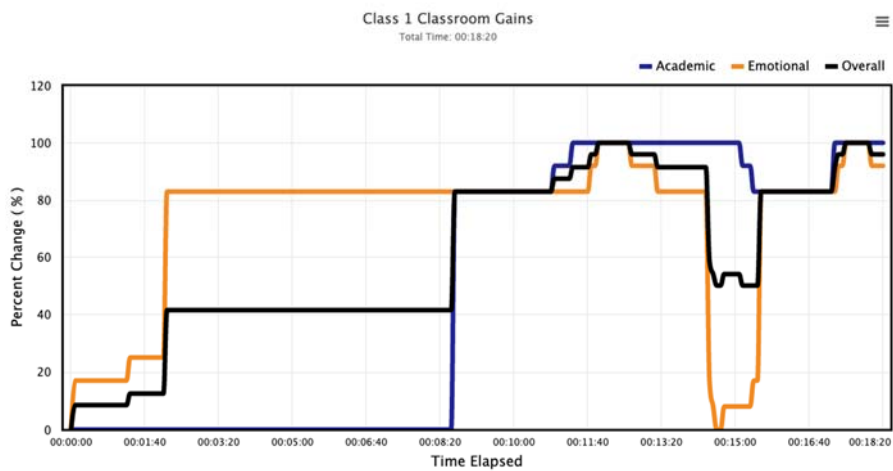


Figure 4 - SimSchool Observation Report Based on Participant Actions in the Simulated Classroom

	Description	Recommended Practice	N/A	Needs Attention	Satisfactory	Good
1	Regularly assesses individual and group performance.	Checks the class progress tab at a regular interval.			✓	
2	Uses information of differing student strengths and needs to further each learner's development.	Clicks on each student's profile and views their traits or progress at least once throughout the simulation.				✓
3	Designs, adapts, and delivers instructions to address each student's diverse learning strengths and needs and creates opportunities for students to demonstrate their learning in different ways.	User uses a variety of tasks during the simulation.				✓
4	Makes appropriate and timely provisions for individual students with particular learning differences and needs.	Assigns tasks in a way that maximizes students' performance (academic and behavioral).		✓		
5	Understands students with exceptional needs, including those associated with disabilities and giftedness, and knows how to use strategies and resources to address these needs.	User chooses appropriate strategies when students with accommodations are present.	✓			
6	Gives students adequate time to transition between instructional activities.	Selects the appropriate strategy 'give break' before assigning a new task.		✓		
7	Pacing maintains student involvement and engagement.	Changes task or makes a comment when students become distressed.				✓
8	Uses proximity control.	Walks by students who have been disruptive.				✓
9	Uses praise and encourages positive behavior	Makes friendly conversation or the 'give praise' strategy for students who have moved up a behavior band.				✓

Results

Results from self-report data

Data were collected both during the simulations and through pre-post surveys related to teacher efficacy and educator bias. As shown in Table 2, there were significant ($p < .05$) positive changes from pre to post for Efficacy for Instructional Strategies as well as Culturally Responsive Teaching Self-efficacy. Near to significance was the Educator Bias Inventory subscale of Pedagogical environment. Since the data set only included 10 teachers who completed pre-post assessments as well as all the modules, effect size becomes a meaningful indicator of gain because it is largely independent of whether or not the change observed (given small n) could be concluded to be rare by chance ($p < .05$). As shown in Table 2, the effect sizes were all educationally meaningful at .30 and above (Bialo & Sivin-Kachala, 1996). Eight individual items that were significant ($p < .05$) each produced a large effect size indicating

that there were significant improvements in adjusting lessons and the environment to support diverse learners.

Table 2 - Comparison of Pre and Post Teacher Means for Equity-Related Subscales

Subscale	Pretest			Post test			Signif. (p)	ES
	N	Mean	SD	N	Mean	SD		
Efficacy for Instructional Strategies	10	4.90	.49	10	5.26	.38	.016*	.93
Efficacy for Classroom Management	10	4.75	.66	10	5.14	.48	.078	.63
Efficacy for Student Engagement	10	4.63	.61	10	5.18	.51	.071	.65
Culturally Responsive Teaching Self-Efficacy Survey	10	4.80	.50	10	5.25	.39	.040*	.76
Educator Bias Inventory: Self Awareness	10	5.33	.40	10	5.40	.38	.279	.36
Educator Bias Inventory: Pedagogical Environment	10	5.14	.51	10	5.36	.39	.055	.70
Educator Bias Inventory: Relationship with families and community	10	4.45	1.03	10	4.87	.43	.203	.43

Note: * Significant at the $p = .05$ level. Cohen's (1988) effect size guidelines .2 = small, .5 = moderate, .8 = large.

Results from the Simulation Data

Data included objective performance statistics generated from the simSchool program. Teaching behaviors captured unobtrusively allowed computation of academic gains, emotional gains, and equity gains during teaching. The analyzed data included the gains for the first and last attempts in each of the modules. Paired t -tests showed a significant difference for the equity index for one of the modules ($p < .024$). Aggregated across teachers, equity gains by module ranged in magnitude from effect size = .22 to effect size = .87, the latter of which was individually significant at the $p < .05$ level and would be considered large according to guidelines by Cohen (1988). Most of the modules showed positive gains. Future research with larger sample sizes is anticipated to reconfirm magnitudes of reported effects while enhancing the prospects that additional modules will individually reach $p < .05$ levels of significance.

Summary and Discussion

Findings from this study included significant pre-post increases for self-efficacy related to culturally responsive teaching as well as instructional self-efficacy. In addition, all the pre-post scale measures were educationally meaningful with an effect size range from .36 to .93. Participating in modules that included feedback on teaching strategies indicated significant changes in the equity index that is based on multiple indicators of equity such as gender and skin color. These findings add credibility to the contention that a key innovation of using simulation programs for teacher professional development is that it provides current and future teachers with the opportunity to practice multiple times within a safe environment with simulated students, thereby increasing teacher confidence and competence, and which in turn will improve student learning. These findings set the stage for measuring the impact on student perceptions of learning and cultural engagement intended to support teachers in recognizing and ameliorating their own implicit biases. Limitations of this study include the small sample of teachers that completed each of the parts required to be full participants. While the small numbers still exhibited significant changes, additional studies are planned to include a larger number of participants.

Approximately 200,000 new teachers enter the field in the US each year, many underprepared for the complex and demanding role of classroom teacher (Atteberry et al., 2015). New teachers have reported that classroom management issues of student behaviors are the biggest source of stress in early teaching and likely contributes to high attrition (Aloe et al., 2014). Teacher preparation programs have struggled to ensure that all preservice teachers receive consistent experiences in field-based teaching (Ronfeldt, 2015). The main goal of practice-based teaching is to allow teacher candidates to apply educational coursework theories and techniques to a real classroom. However, assuring they have the highest quality experiences is a challenge. Simulation teaching experiences can provide opportunities to try and retry techniques and strategies prior to going into the classroom, to supplement and enhance the in-person field-based experiences.

4. Implications for Teacher Education

Given the impact of COVID-19 on preservice and inservice programs, simulated teaching environments are likely to continue to expand to meet the demands of teacher development programs. The experiences provided in the simulated teaching program help bridge the gap between theories and

classroom practice while providing scaffolded enhancement of teaching pedagogical knowledge and skills in academic, emotional and equitable domains.

In addition, simulated teaching experiences can provide preservice teachers with opportunities to encounter diverse students that they otherwise may never encounter in their field-based experiences. The recognized importance of socio-emotional stability for the long-term well-being of current teachers and future productive citizens of our society has spotlighted the urgency of research on programs that allow users and researchers to focus on mitigation of implicit bias. Innovative solutions offer the prospect of finding a timely contribution to a significant problem in schools.

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Description of Duties: Rhonda Christensen led the conceptualization, literature review and data analysis portions of the paper. Gerald Knezek assisted in the research design, delimiting focus for the paper, and in interpretation of findings. Both authors contributed to all drafts and manuscript revisions.

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