Simulations and Teacher Professional Development: Approaches to Cross-Validation of Culturally Responsive Teaching Strategies

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Abstract: To improve teaching practices that encourage more culturally responsiveness to the diversity of classrooms, a simulated teaching program is being implemented to provide reflective feedback intended to reduce implicit biases that may exist. This birds-of-a-feather session is intended to explore ways to validate the use of artificial intelligence in the simulated teaching environment. Pilot data have been collected from year one of a three-year project and results indicate improvement in strategies to teach in a culturally responsive manner. Pre-post survey data as well as simulation-gathered data are being used to validate the simulator through changes in teachers' perceptions.

Keywords: simulation, teacher preparation, AI, culturally responsive teaching

Introduction

Classrooms are becoming more diverse each year as they reflect the changing society. Teacher perceptions of students for whom they teach may include implicit negative attitudes and stereotypes related to gender, ethnicity, socioeconomic status, and English language learning status (McGinnis, 2017). To address the increasing diversity of the students in the classrooms, educators need to actively recognize and change patterns of bias in their teaching practices as well as classroom environments (Chen, Nimmo, & Fraser, 2009).

The goal of the NSF funded *simEquity* project is to implement a transformative, scalable model for developing equitable, culturally responsive teaching practices through an artificial intelligence (AI)-driven algorithm for detecting and mitigating implicit bias in a simulated teaching environment. This theory-driven project, based on human-centered design methods, will confirm the feasibility of a three-phase approach to teaching bias reduction and which of the three phases alone, in sequence, or in combination, is most effective. The outcomes of this project will identify bias-mitigation best practices that can be implemented broad scale to help teachers recognize and mitigate the influence of implicit bias on their teaching and their students' learning dispositions and academic achievement. Lessons learned from this project could help contribute to a more just and equitable society in the future.

However, what are the best ways to validate the experiences provided via a simulated teaching environment indeed change teaching practices? Research on the use of simulation-based learning has shown improved educator understanding in *teaching skills* (Christensen et al., 2011; Knezek et al., 2015), *classroom management* (Christensen et al., 2007), *motivation* (Tyler-Wood et al., 2017), *multicultural awareness*, *literacy* (Collum, Christensen et al., 2019), self-reported *educator bias* (Collum, Christensen, Delicath, & Knezek, 2020) and *instructional self-efficacy* (Knezek & Christensen, 2009). Badiee (2012) identified four advantages to simulation based learning: (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 provided the immediate application of theory to practice in a realistic, yet controlled setting, with great potential to learn by allowing educators to act within virtual environments.

In the current three-year NSF-funded project, self-report survey data are being collected from the participating teachers as well as their students. Data gathered within the simulator during the intervention are being used to compare to the self-report data. The challenge has been in determining at what level of granularity the data need to be in order to see what changes impact teacher practices.

Methods

Participants

Ten classroom teachers employed in a large school district in a western state in the US participated in one of two sets of modules depending on the grade level taught. Each of these ten teachers participated in the pre-post self-response surveys described below. In addition, data were collected within the simulation program based on their responses within the simulation.

Implementation

simSchool is the simulation program being used for this project. SimSchool is an online classroom simulation program that allows future and current teachers the opportunity to practice teaching in a "flight simulator" environment in which no matter what choices are made no children are hurt in any instructional errors. Feedback is provided that allows users to improve in the subsequent "tries". 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.

The school system that participated selected various modules that were used a professional development learning. Each participant was provided with onboarding and training via Zoom and first completed a practice module in order to become familiar with the simulation system. Following the practice module, each of the participants completed three more modules, each of which contained 3-5 sessions that allowed for multiple iterations of teaching the same content, receiving feedback and focusing on improving their teaching skills.

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 the findings reported in this paper. 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) was used to measure self-efficacy related to three subscales: instructional strategies, classroom management, and student engagement.
2. The *Culturally Responsive Self-Efficacy Survey* (Siwatu, 2007) was included to determine 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) were included. These scales include: *Self-Awareness*, *Pedagogical environment*, and *Relationships with families and community* adapted from Chen et al. (2009).

Pilot Project Results

Table 1 includes the modules from simSchool that participants completed, based on their grade level taught. The results from the year one pilot study showed significant changes in the self-report pre-post measures for the ten teachers who completed everything that included pre and post test self-reported survey data.

Table 1. *Modules Completed by Classroom Teachers*

Elementary teacher modules
Module 1: Introduction to Teaching in simSchool
Module 2: Cultural Intelligence and Inclusion 2.0
Module 3: ELE 3-5 Bullying and Bias the First Coconut Tree
Module 4: ELE 3-5 Gender and Identity Supermom Saves the Day Why Can't Girls Be Superheros
Middle School Modules
Module 1: Introduction to Teaching in simSchool

Module 2: MS 6-8 Gender and Identity: The Misfits
Module 3: MS 6-8 History Empowering Learners to Change the World
Module 4: MS 6-8 (Race, Ethnicity, Class, Immigration) A Tale of Two Schools

As shown in Table 2, two of the measures increased significantly (p <.05) pre to post while all measures showed an educationally meaningful change from pre to post as calculated by the effect sizes (all above .30) (Bialo & Sivin-Kachala, 1996). The two measures that changed significantly *(p* <.05) were related to self-efficacy, the confidence that the participant can create these changes in the classroom.

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

	Pretest			Post test			Signif.	ES
Subscale	**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.

However, equity gains on the modules were only significantly (p <.05) increased for one of the four modules (Table 3). The researchers are currently exploring whether the equity index is measuring what is intended. The index is being revised before year two begins with a large number of participants.

Table 3. *Simulation Data Gains for Academic, Emotional and Equity Gains by Module*

Pre-Post Matched Pair Measures		Mean	N	Std. Dev	Sig.
Pair 3	M1FEquity Index (First Attempt)	.9780	10	.04	
	M1LEquity Index (Last Attempt)	.9940	10	.01	.203
Pair 6	M2FEquity Index (First Attempt)	.9160	10	.05	
	M2LEquity Index (Last Attempt)	.9240	10	.06	.475
Pair 9	M3FEquity Index (First Attempt)	.9920	10	.01	
	M3LEquity Index (Last Attempt)	.9980	10	.01	.024
Pair 12	M4FEquity Index (First Attempt)	.9250	10	.06	
	M4LEquity Index (Last Attempt)	.9260	10	.06	.343

Discussion

This birds-of-a-feather session is intended to promote a discussion on the use of simulated data to improve culturally responsive teaching practices and how to validate the data to give confidence in the findings. Specifically, the questions of concern are:

How do we validate the use of simulation and the impact on classroom practice?

How do we ensure that researchers and simulation developers do not unintentionally introduce bias into the simulation intervention?

To what extent can we use valid self-report survey instruments to validate improvements in a simulated teaching environment related to educator bias?

Does the use of students' perceptions of school engagement and teacher culturally responsive teaching validate teacher perceptions of culturally responsive teaching?

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References

Badiee, F. (2012). *From the digital to the authentic classroom: A study using an online simulation for teacher education* (Unpublished master's thesis). Simon Frasier University, Burnaby, BC, Canada.

Bialo, E.R., & Sivin-Kachala, J. (1996). The effectiveness of technology in schools: A summary of recent research. *School Library Media Quarterly, 25*(1), 51-57.

Chen, D.W., Nimmo, J., & Fraser, H. (2009). Becoming a culturally responsive early childhood educator: A tool to support reflection by teachers embarking on the anti-bias journey. *Multicultural Perspectives, 11*(2), 101-106. doi: 10.1080/15210960903028784

Christensen, R., Knezek, G., Patterson, L., Wickstrom, C., Overall, T. & Hettler, L. (2007). Early Experiences with SimMentoring: From Virtual to Real Teaching. In R. Carlsen (Ed.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2007* (pp. 1186-1188). Chesapeake, VA: AACE. http://www.editlib.org/p/24719Collum, Christensen et al., 2019

Collum, D., Christensen, R., Delicath, T. & Johnston, V. (2019). SimSchool: SPARCing New Grounds in Research on Simulated Classrooms. In K. Graziano (Ed.), *Proceedings of Society for Information Technology & Teacher Education International Conference* (pp. 733-739). Las Vegas, NV, United States: Association for the Advancement of Computing in Education (AACE).

Collum, D., Christensen, R., Delicath, T., & Knezek, G. (2020). Measuring changes in educator bias in a simulated learning environment. In G.H. Marks & D. Schmidt-Crawford (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference* (pp. 410-416). Online: Association for the Advancement of Computing in Education (AACE).

Fischler, R. (2006). *SimTeacher: Simulation-based learning in teacher education* (Doctoral dissertation). Available from ProQuest Dissertation and Theses database. (UMI No.3210046)

Knezek, G., & Christensen, R. (2009). Preservice educator learning in a simulated teaching environment. In *Research Highlights in Technology and Teacher Education* (Vol. 1, pp. 161–170).

Knezek, G., Hopper, S., Christensen, R., Tyler-Wood, T., & Gibson, D. (2015). Assessing pedagogical balance in a simulated classroom environment. *Journal Digital Learning in Teacher Education*, 31(4), 148-159.

McGinnis, C.M. (2017). Effects of implicit bias on teachers' expectations of student relationships. *Public Access Theses and Dissertations from the College of Education and Human Sciences*. University of Nebraska-Lincoln. http://digitalcommons.unl.edu/cehsdiss/294.

Tyler-Wood, T., Estes, M., Christensen, R., Knezek, G., & Gibson, D. (2017). SimSchool: An Opportunity for Using Serious Gaming for Training Teachers in Rural Areas. *Rural Special Education Quarterly*, *34*(3), 17–20. https://doi.org/10.1177/875687051503400304