

Impacting Student Perceptions of Engagement and Student Voice through Equity-Focused Teacher Professional Development in a Simulated Teaching Environment

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Student engagement, cultural identity and voice in school have been shown to have measurable influence on student learning. While many factors may affect student dispositions, teachers likely have the most direct impact on the dispositions related to classroom engagement and student voice. Measures of student perceptions of their teachers' cultural engagement, cultural teaching practices and the students' own engagement and voice in schooling are included in this paper. Data from 822 grade 3 – 12 students of teachers who participated in a simulated teaching environment intended to improve equitable teaching practices revealed significant pre-post changes for measures of voice and engagement. The data also showed significant differences by gender and ethnicity.

INTRODUCTION

Classroom environments are frequently diverse as they reflect the society in which we live. One factor affecting academic achievement in the US is the racial, gender, and language disparity between the diverse student population (NCES, 2020) and the teacher workforce, which is predominantly white, middle class and female (McFarland et al., 2019). 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 and classroom environments (Chen et al., 2009) in order to create more culturally responsive teaching practices. Creating an environment in which students feel their voice is heard and are engaged in learning is a critical objective in education that is known to promote success in students (Benner et al., 2019).

The *simEquity* project was developed to be a transformative, scalable model for encouraging equitable, culturally responsive teaching practices through an artificial intelligence (AI)-driven algorithm for detecting and mitigating implicit bias in a simulated teaching environment. The overall goal of the project was to help educators recognize and mitigate implicit bias in their teaching practices with the aim of improving student learning dispositions that lead to improved academic achievement. The intervention was a computer-based teaching simulation that provided the opportunity to use system-provided feedback to identify and implement best practices related to equitable, culturally responsive teaching practices that impact both teaching and learning.

This paper focuses on the student survey data of teachers who participated in the simulated teaching intervention and was aimed at exploring the impact on student dispositions related to culturally responsive teaching, student engagement and student voice. Analyses are focused on examining evidence that the guided professional development (PD) of teachers in a simulated classroom environment can have a measurable positive impact, as assessed by the students of grades 3 - 12 teachers who participated in the PD.

LITERATURE REVIEW

Student Engagement, Cultural Identity and Voice – Influences on Learning

Student engagement, cultural identity and voice in school have been shown to have measurable influence on student learning. Early studies defined student engagement primarily by observable behaviors such as participation and time on task (Brophy 1983; Natriello, 1984). Researchers more recently incorporated emotional or affective aspects into their conceptualization of engagement (Pedler et al., 2020). Student engagement measures have been shown to correlate positively with achievement and negatively with the likelihood of dropping out of school (Fraysier et al., 2020; Szabo et al., 2024). Engaged students are more likely to earn better grades and perform well on standardized tests (Fraysier et al., 2020). Many scholars have found a link between student engagement at school and improved outcomes including life skills, self-esteem (Mager & Nowak, 2012), student health and well-being (deRoiste et al., 2012), agency (student voice), belonging and competence (Mitra, 2004) and future success (Fraysier et al., 2020).

For the purposes of this study, student voice is defined to include values, beliefs, perspectives, and cultural backgrounds of students as well as the instructional approaches that focus on student choices and interests (The Glossary of Educational Reform, 2013). Schools in which students feel their voice was heard had better grades and attendance (Kahne et al., 2022). Researchers have found a strong correlation between student voice and student engagement (Anderson, 2018) leading to the strategy that making students feel heard in the classroom can help promote student engagement (Wallace & Chhuon, 2014).

Several studies have shown that strong student cultural identity is positively associated with learning engagement (Altugan, 2015). For example, Eleuterio (1997) and Hoelscher (1999) observed that classrooms filled with teachers and students who share cultural identities build trust and foster stronger relationships, leading to student engagement, higher motivation and excitement about learning together. Cultural identity includes individuals' experiences, skills, beliefs, values and knowledge as well as their status in their family, school, and environment (Altugan, 2015). Cultural backgrounds of learners such as economics, religions, ethnicity, race and linguistic ability, if not understood, can cause disruption to learning (Altugan, 2015). Cultural identity is believed to be an important condition for self-esteem, sense of belonging and personality development (Mezzich et al., 2009).

Gender has been shown to be a predictor of teacher ratings of conduct problems as well as academic achievement, with boys having more reported problem behaviors and academic issues than girls (Patterson et al., 1990). Males often receive more teacher attention – both positive and negative – than females (Sadker et al., 2016). Some researchers emphasize that low-achieving males get most of the negative attention while high-achieving males get more positive and constructive academic contacts. However, no matter whether they are high or low achievers, female students are more likely to receive less instructional time, less help, and less positive and negative attention (Berekashvili, 2012; Sadker & Zittleman, 2016). Gender and race intersect to create inequitable interaction patterns; girls of color are least likely to receive teacher time and attention (Sadker et al., 2016). However, when it comes to engagement in school, females have been shown to report significantly ($p < .01$) more engagement than males (Santos et al., 2021).

Increasing Culturally Responsive Teaching Strategies by Reducing Bias

All people are born, raised and enveloped in some culture, and the transfer of culture often occurs during the teaching and learning process (Rachmadtullah & Kusmaharti, 2018). Culture informs how we communicate with each other, the way we receive information as well as shapes the thinking process of interaction with others (Hilliard, 2001). Students in classrooms where teachers effectively incorporate culturally responsive practices show evidence of higher grade-point averages, increased attendance (Dee & Penner, 2017), more positive racial identities, and improved learning experiences (Hamdan, 2012). Culturally responsive educators adopt the view that all students are capable of the success shown to be critical to student growth (Boser et al., 2014). Culturally responsive teaching is an approach that 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). One human attribute that can impact culturally responsive teaching is unrecognized bias, also known as implicit bias.

Implicit bias is described as the attitudes or stereotypes that affect our understanding, actions and decisions in an unconscious manner (McGinnis, 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 during the school day, 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, socioeconomic status, ethnicity, special needs and English language proficiency.

There are few studies that compare teachers' biases to the impact on students (Chin et al., 2020). While explicit bias may exist in educators, implicit biases are the most difficult to recognize and reduce. Many biases are reproduced through socialization during formative years of growing up (Yogeeswaran et al., 2017) and are deeply rooted in actions, phrases, mindset, and perceptions of ability. People can hold implicit bias even though they do not consciously recognize the underlying attitude or stereotype that may exist (Devine, 1989) and cannot intentionally control the impact these biases have in their perception and judgement during decision making.

While most people have some type of implicit bias, the impact in education is worthy of exploration as it will likely impact educators in their interactions with students and parents. Bias is most likely to occur from teachers whose students do not share their racial, cultural, linguistic, socioeconomic or gender traits (Pasternak et al., 2023). Because biases are likely to impact equitable teaching practices, the biases need to be recognized and addressed.

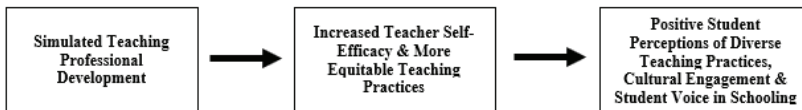
Even the most dedicated educators hold beliefs and stereotypes that impact their students' learning. Ethnicity, native language, gender, and economic status have all been linked to teacher biases (McGinnis, 2017). If unexamined, these beliefs can be harmful to students. Examining implicit bias is critical to improving educational outcomes for all students.

While many studies have established that implicit biases exist, few have focused on the role implicit bias plays in the classroom (DeCuir-Gunby & Bindra, 2022) with students who have various differences related to gender, ethnicity, language development, and special needs. No studies exist in the literature that use an unobtrusive "observation" via a computer-based teaching environment to address and improve biases toward these groups of students. This study examined the efficacy of simulation-based educator professional development for remediating implicit biases in teaching practices. The primary indicator is the pre-post changes in the self-reported perceptions of the students of teachers who participated in the simulation-based intervention. The logic flow diagram for the conjectured process flow and impact is provided in Figure 1. While there are three components in the flow

diagram, this paper is focused only on the intervention by the teachers and the pre-post survey outcomes on their students.

Figure 1

Logic Flow Diagram for Impact of Simulation-based Teacher Professional Development on Student Perceptions



RESEARCH QUESTIONS

Three research questions are addressed in this paper:

1. To what extent does teacher participation in equity-focused simulation modules impact student perceptions of their voice in school and engagement in school?
2. To what extent does student engagement and student voice vary based upon student demographic variables such as gender, and ethnic identity?
3. To what extent do student variables change based on the gender of their teachers?

RESEARCH METHODS

Pre-post data were gathered to measure changes in student dispositions related to student voice, school and cultural engagement and perceptions of their teachers' diverse teaching practices, before and after their teachers completed simulation-based teacher professional development (unknown to their students). Demographic data such as teacher gender and grade level taught were gathered and tagged to the student data. Analysis of variance (ANOVA) with Statistical Package for the Social Sciences (SPSS) version 29 was used to test for significant ($p < .05$) differences on measures pre to post and based on demographic variables such as gender. In many cases ANOVA findings were re-run using the unpaired t-test in SPSS in order to compute an accurate estimate of the magnitude of the change as reported

in terms of Cohen's *d*. This combination of methods was used to examine research questions 1, 2 and 3.

The Study

The study aimed at using a computer-based online simulated teaching environment to improve equitable teaching practices with the goal of improving instruction, as well as dispositions. University ethics approval was obtained to recruit participants and collect data from both teachers and students. Participants were recruited from two school systems via email sent by administrative contacts at the school systems. Participants were provided a stipend upon completion of all required components of the project including a self-report pretest teacher survey, asking their students to complete a pretest survey, completing four modules of the simulated teaching program, collecting post test data from their students, and completing a self-report post test teacher survey. The school system in California participated in Fall 2022 and the school system in Texas participated in Spring 2023. Each site completed the cycle of pre-post surveys and modules in approximately six weeks.

Intervention

SimSchool, a cloud-based, simulated teaching environment, uses learning analytics (LA) to capture user interactions in the simulated classroom environment and displays quantifiable teacher observation criteria benchmark data as well as visual data so participants can self-reflect on their performance, adapt their practices (Kovanovic et al., 2021) and complete multiple iterations of interactions with simStudents while adapting their teaching strategies. SimSchool's inference engine draws upon several instructional models and frameworks to simulate the authentic human behaviors and reactions that one experiences when teaching in simSchool (simSchool, 2018-19). These extensively researched and validated models include: 1) Cattell-Horn-Carroll Theory of Intelligence (Schneider & McGrew, 2012); 2) OCEAN model of Emotion (McCrae & Costa, 1996); 3) Interpersonal Circumplex Theory (Smith, 2013); 4) Standard models of language learning and language proficiency used to diagnose ELL students (Phakiti et al., 2013); and 5) Structural functional (Case, 1993) and social constructivist theories of learning (Dweck, 1999; Vygotsky, 1962). These models are distilled into "cognitive and behavioral states" within simulated students and

“cognitive and behavioral requirements” within instructional tasks. When a student has a certain quantitative reasoning ability, for example, an assigned math task has a quantitative reasoning requirement already coded. How the student performs and behaves is a direct reflection of how well-matched expectations are to students’ capabilities.

As shown in Figure 2, using student profiles, teachers need to be able to plan and deliver culturally responsive instructional strategies and supports that build on the strengths of students to address their learning needs (Sian-jina, 2000). The main goal of developing better teaching practices through simulation is to improve student learning outcomes in real students.

Figure 2
SimSchool Interface and Student Profiles



The feedback reports include criteria related to equitable teaching practices regarding student learning needs, gender and ethnicity. Figure 3 includes 7 of the 14 criteria related to teacher observations within the simulation.

All teacher participants completed the tutorial teaching module to allow for learning the system before advancing to modules containing meaning-

ful content. As shown in Table 1, the modules were selected for different grade bands to be appropriate for the level of student taught by elementary versus middle school or high school teachers. Within the modules, the student avatars (simStudents) reflect the appropriate age level as well. Each participant completed one tutorial module followed by three modules with five class sessions in each one. The participants were required to review their feedback from each session before they were allowed to move forward. The minimum amount of time in each session was 15 minutes before feedback would be generated. Some teachers spent longer in each session than 15 minutes. By the time participants had completed all three modules, they had interacted in simSchool for a minimum of 225 minutes (3 hours, 45 minutes). Within the simulated teaching environment, teachers were given many options of teaching strategies, classroom management strategies, optional accommodation strategies in which they assigned to individual, groups or a classroom of simulated students.

Table 1

Modules Completed by Classroom Teachers

Elementary School Modules
Tutorial: Teaching in simSchool
Module 1: Cultural Intelligence and Inclusion 2.0
Module 2: Bullying and Bias the First Coconut Tree
Module 3: Gender and Identity: Supermom Saves the Day
Middle School Modules
Tutorial: Teaching in simSchool
Module 1: Gender and Identity: The Misfits
Module 2: History Empowering Learners to Change the world
Module 3: Race, Ethnicity, Class, Immigration: A Tale of Two Schools
High School Modules
Tutorial: Teaching in simSchool
Module 1: Showing Empathy
Module 2: Sounds of Change
Module 3: Why Local Elections Matter

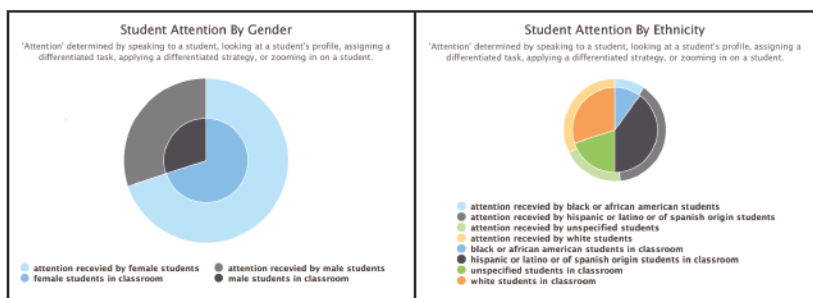
At the end of each simulation session, participants received graphical feedback displaying degree of success at promoting academic (learning) increase in the class overall, as well as feedback regarding the degree of suitability of the instructional activities selected for each individual simulated student in the class. Among the aspects of instructional activities that are documented for review are impacts on individual students regarding teaching strategies selected to address the learning needs. Figures 3 and 4 illustrate examples of graphical feedback as well as an observation feedback report that participants received. Participants were required to view the feedback prior to completing another session in the module. Each session in a module contained the same simulated students and content with the intent that with each teaching session, there would be improvement based on the provided feedback.

Figure 3
Sample of Observation Feedback Following One Simulation

Why Local Elections Matter - Class 1 Report						
	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.				✓

Figure 4

Graphical Feedback for Gender and Ethnicity Following a Teaching Simulation



Instrumentation

As established in the literature review, culturally responsive teaching practices impact students in multiple ways, including engagement and sense of belonging. The student surveys were selected to focus on dispositions related to learning (student engagement, cultural identity, student voice and their perceived culturally responsive teaching of their environment). The team also aimed to find surveys that would be appropriate for the targeted student population (grades 3 – 12). To make sure the survey completion took no longer than 20 minutes, selected scales related to the project goals were included from three surveys. The complete battery of surveys included 41 items which were 6-point (Strongly Disagree to Strongly Agree) Likert items, administered pre and post during the 2022-2023 school year. The administered survey scales included:

1. The *Student Engagement Inventory* (SEI) (Appleton et al., 2006) measures the cognitive and psychological aspects of engagement. For this study, one of the six subscales of student engagement (9 items), named Teacher-Student Relationships, was administered.
2. Two scales from the *Student Measure of Culturally Responsive Teaching* (Dickson et al., 2016) were administered to the students to measure their perceptions of their teachers' level of culturally responsive teaching. The first scale addresses the construct of *Cultural Engagement* (9 items) while the second scale assesses *Diverse Teaching Practices* (11 items) from the student point of view.

- 3. Two scales representing independent constructs from the *Student Participation Survey (SPS)* (Anderson et al., 2019) were administered to students. *Voice about Schooling* (8 items) and *Voice about Having Influence* (4 items) was gathered to assess how students feel about the level of choices they have in their classrooms.

Reliability information for each scale for this set of data is included in Table 2. As shown in Table 2, reliabilities ranged from .84 to .97, which would be considered “good” to “very good / excellent” according to guidelines by DeVellis (2012). Exploratory factor analysis (not shown) confirmed that the intended construct integrity (construct validity) of the original scales was maintained for the data gathered for this study.

Table 2
Cronbach’s Estimated Reliabilities for Student Measures

Scale	No. Items	Cronbach’s Alpha	n
Student Engagement Scale	9	.927	822
Student Measure of Cultural Engagement	9	.897	822
Student Measure of Diverse Teaching Practices	11	.907	822
Voice About Schooling	8	.887	822
Voice about Having Influence	4	.843	822

Participants

Complete data that included pre-post self-report surveys for the teachers and the students was used for the analysis in this report. The data set included student data from 39 teachers from two different US states. State One data included elementary (11), middle school (10) and high school (2) teachers and students while State Two data only included high school participants. Twenty-eight (71.8%) of the teachers reported being female and eleven (28.2%) of the teachers reported being male. Data were collected from the students of the 39 teachers prior to beginning the treatment (pre-test) and following the intervention (post). No individually identifiable information was collected for the students so the pre-post data were not paired. The data included 822 students at pretest and 574 students at post test with complete data.

The gender data were approximately balanced between male and female, with 49% (n= 389) males and 51% (n=401) females at pretest and 46% (n=256) males and 54% (n=296) females at post test. The grade level of the students ranged from grade 3 to grade 12 and the breakdown by grade level is shown in Table 3. Students were also asked to identify the ethnicity to which they most closely aligned. As shown in Table 4, the largest percentage of students who reported the data were Hispanic, followed by White, Asian and Black/African American (AA).

Table 3

Self-Reported Grade Level of Students

Grade Level	Pre	Post
3	51 (6%)	95 (17%)
4	59 (7%)	51 (9%)
5	139 (17%)	63 (11%)
6	79 (10%)	60 (10%)
7	72 (9%)	74 (13%)
8	138 (17%)	82 (14%)
9	97 (12%)	60 (10%)
10	47 (6%)	11 (2%)
11	68 (8%)	30 (5%)
12	72 (9%)	48 (8%)
Total	822	574

Table 4

Self-Reported Ethnicity of Students

Ethnicity	Pre	Post
American Indian	10 (1%)	9 (2%)
Asian	105 (13%)	83 (14%)
Black/AA	95 (12%)	72 (13%)
Hispanic	250 (30%)	150 (26%)
Latinx	43 (5%)	20 (3%)

Ethnicity	Pre	Post
Native Hawaiian/PI	9 (1%)	4 (1%)
White	205 (25%)	138 (24%)
No response	105 (13%)	98 (17%)
Total	822	574

FINDINGS AND RESULTS

Results for Student Surveys

As reported in the Research Methods section, pretest and post test survey data were collected from students of teachers who participated in the study for 2022-2023. Because the data were anonymous, it was not possible to pair the student data by individual, pre to post. Therefore, the reported results are from pretest versus post test comparisons of student data, overall. For pretest data, 822 students completed the surveys prior to their teachers’ participation in the simEquity simulated intervention while 574 students completed surveys following their teachers’ participation. Every teacher is represented by both pre and post student data. Complete data varied by scale and is reported with the usable, complete data for each measure.

Student Disposition Changes Pre to Post

Findings are based on self-reported student survey data from five indicators: students’ perceptions of their voice in schooling, voice in having influence about schooling, student engagement, how they feel their teachers practice culturally responsive teaching practices (which is measured in two separate subscales of cultural engagement and the perception of diverse teaching practices by their teachers).

As shown in Table 5, analysis of variance was used to determine the pre-post differences on each of the subscales. Three of the five subscales showed a significant ($p < .05$) increase: voice having influence, diverse teaching practices of their teachers and the engagement respondents felt as students. Effect sizes varied from Cohen’s $d = .12$ to $d = .20$ across these three scales, indicating a positive change that was unlikely due to chance and small in magnitude according to guidelines by Cohen (1988). All five of the survey indicators showed a positive gain from pre to post, which can

be assessed as indicative of positive gains overall, on the borderline of $p < .05$ evidence that the overall effect is real and did not occur by chance (two-tailed p value is 0.0625; Graphpad, 2023).

A Pearson Product correlation was conducted for the five student scales finding that student engagement was significantly ($p < .01$) correlated with all four of the other measures including voice, cultural engagement, and perceptions of teachers’ diverse teaching practices.

Table 5
Overall Means and Standard Deviations for Each of the Student Scales

Measure		N	Mean	SD	Sig.	ES
Voice in Schooling	Pre	822	3.75	1.04	.100	
	Post	574	3.84	1.02		
	Total	1396	3.79	1.03		
Voice Having Influence	Pre	803	3.94	1.08	.000	.20
	Post	556	4.15	1.07		
	Total	1359	4.03	1.08		
Cultural Engagement (CRTP subscale)	Pre	745	3.60	1.05	.194	
	Post	530	3.68	1.09		
	Total	1275	3.64	1.07		
Diverse Teaching Prac- tices (CRTP subscale)	Pre	745	4.55	.83	.021	.14
	Post	530	4.67	.85		
	Total	1275	4.60	.84		
Student Engagement	Pre	709	4.31	1.05	.041	.12
	Post	524	4.43	.99		
	Total	1233	4.36	1.03		

Gender Differences Pre vs. Post

Analysis of variance by gender at pretest and posttest times showed that there were initially significant differences between male and female students on two of the measures. Specifically, at pretest time males were significantly ($p = .048$) higher than females on their voice having influence and sig-

nificantly ($p = .007$) higher on student engagement. By posttest time, there were no significant ($p < .05$) differences between male and female students on any of the measures. When comparing pre-post for males and females separately, there were no significant pre-post changes for males, but for females, three of the measures increased significantly ($p < .05$) pre-post (Table 6). Females gained in voice having influence, perception of their teachers’ diverse teaching practices and student engagement. The magnitude of the gains for these three areas were Cohen’s $d = .29, .25$ and $.21$ respectively (Lenhard & Lenhard, 2016) which would be categorized as positive “teacher effects” according to classifications of effect size by Hattie (2009).

Table 6
Pre-Post Comparisons for Females on Each of the Student Scales

Measure		N	Mean	SD	Sig.	ES
Voice in Schooling	Pre	401	3.68	1.03	.180	.098
	Post	296	3.78	1.00		
	Total	697	3.72	1.02		
Voice Having Influence	Pre	395	3.87	1.05	.000	.285
	Post	287	4.16	.98		
	Total	682	3.99	1.03		
Cultural Engagement (CRTP subscale)	Pre	363	3.56	1.01	.219	.098
	Post	270	3.66	1.03		
	Total	633	3.60	1.02		
Diverse Teaching Practices (CRTP subscale)	Pre	363	4.52	.83	.002	.248
	Post	270	4.72	.77		
	Total	633	4.60	.81		
Student Engagement	Pre	347	4.21	1.02	.010	.212
	Post	268	4.42	.95		
	Total	615	4.30	.99		

Results Related to Reported Student Ethnicity

Analyses were completed to examine pre to post changes for the ethnic groups to which each of the students reported their affiliation. Asian and

White students each had significant ($p < .05$) pre-post gains for three measures while American Indian and Hispanic students had significant ($p < .05$) gains for one of the measures. Details of the analyses are shown in Table 7. There were no significant changes from pre to post on any of the measures for Black/African American or Latinx students. Effect sizes varied from Cohen’s $d = .28$ to $d = 1.38$ across the changes by ethnicity on the provided scales, indicating a positive change that was unlikely due to chance and small in magnitude according to guidelines by Cohen (1988).

Table 7
Student Measures Significant by Ethnicity

Student Ethnicity	Measure	Pre/ Post	N	Mean	SD	Sig.	ES
American Indian/ Alaska Native	Voice About Schooling	Pre	10	3.58	.51	.007	1.38
		Post	9	4.29	.52		
Asian	Voice Having Influence	Pre	103	4.00	1.02	.008	.40
		Post	80	4.39	.92		
	Diverse Teacher Practices	Pre	100	4.60	.79	.053	.29
		Post	76	4.83	.77		
Hispanic	Student Engagement	Pre	97	4.26	.85	.009	.41
		Post	75	4.60	.80		
	Voice Having Influence	Pre	243	3.92	.95	.009	.28
		Post	144	4.18	.92		
White	Voice Having Influence	Pre	204	3.77	1.23	.003	.34
		Post	137	4.18	1.20		
	Diverse Teacher Practices	Pre	191	4.46	.87	.009	.30
		Post	133	4.72	.88		
	Student Engagement	Pre	182	4.15	1.22	.001	.38
		Post	131	4.58	1.02		

These findings allow us to draw conclusions for the first two research questions in this study: 1) To what extent does teacher participation in an equity-focused simulation module impact students’ perceptions of their voice in school and engagement in school? and 2) To what extent does stu-

dent engagement and student voice vary based upon student demographic variables such gender, and ethnic identity? Significant ($p < .05$) differences were found on pre-post changes related to voice and engagement. Additional significant findings for student ratings were based on disaggregated analyses by male versus females, and ethnic identity. Implications of findings in each area will be addressed in greater detail in the discussion section of this paper.

Impact of Teacher Gender on Student Results

Teacher demographics were self-reported on the teacher surveys and included in the student data. These data were then analyzed using the SPSS ANOVA routine to determine whether there were any differences in reported student values based on the reported ethnicity or gender of the teacher. Analysis by teacher ethnicity showed there to be one significant difference by ethnicity for the cultural engagement factor as reported by students. At pretest time, students of White teachers were significantly lower ($p < .005$) on the cultural engagement factor than students of Black teachers. However, by posttest time, there were no significant differences on any of the measures.

Comparing students by their teachers' gender, there were no significant differences on any of the five measures at pretest time. However, by posttest time, four of the five measures showed students of female teachers were significantly ($p < .05$) higher on four of the five measures (Table 8). Separating the analysis by gender of the teacher and analyzing the data from pre to post, the students of female teachers went up significantly from pre to post on each of the five measures (Table 9). However, while not significant, the students of male teachers tended to decrease on all five measures from pretest to posttest. These findings allow us to draw conclusions for the third research questions in this study: To what extent do student variables change based on the gender of the teachers? There were changes between pre and posttest according to the gender of the students' teacher with students of females increasing significantly for voice at school, cultural engagement and perception of their teachers' diverse teaching practices. In a separate analysis of the teacher data (Christensen, 2023), male teachers increased significantly pre to post on two of the seven teacher measures, while female teachers increased significantly pre to post on six of the seven teacher measures. Female teachers appeared to change more on the PD intervention from pre to post and so did their students.

Table 8

Pre-post Student Measures by Gender of Their Teacher

Student Measures	Teacher Gender	Student Pretest				Student Posttest			
		N	Mean	SD	Sig	N	Mean	SD	Sig
Voice About Schooling	M	214	3.77	1.04		141	3.70	1.03	
	F	608	3.75	1.04		433	3.89	1.01	
	Total	822	3.75	1.04	.793	574	3.84	1.02	.049
Voice Having Influence	M	207	3.97	1.07		136	3.93	1.07	
	F	596	3.93	1.08		420	4.23	1.05	
	Total	803	3.94	1.08	.644	556	4.15	1.06	.005
Cultural Engagement	M	198	3.55	1.06		128	3.39	1.09	
	F	547	3.62	1.05		402	3.77	1.08	
	Total	745	3.60	1.05	.440	530	3.68	1.09	.001
Diverse Teaching Practices	M	198	4.59	.78		128	4.51	.80	
	F	547	4.54	.85		402	4.72	.86	
	Total	745	4.55	.83	.526	530	4.67	.85	.015
Student Engagement	M	188	4.30	1.03		128	4.32	.93	
	F	521	4.31	1.06		396	4.46	1.02	
	Total	709	4.31	1.05	.894	524	4.43	1.00	.155

Table 9

Pre-post Measures for Students of Female Teachers

Student Measures	PrePost	N	Mean	SD	Sig
Voice About Schooling	Pre	608	3.75	1.04	
	Post	433	3.89	1.01	
	Total	1041	3.81	1.03	.024
Voice Having Influence	Pre	596	3.93	1.08	
	Post	420	4.23	1.05	
	Total	1016	4.05	1.08	.000

Student Measures	PrePost	N	Mean	SD	Sig
Cultural Engagement	Pre	547	3.62	1.05	.029
	Post	402	3.77	1.08	
	Total	949	3.69	1.06	
Diverse Teaching Practices	Pre	547	4.54	.85	.002
	Post	402	4.72	.86	
	Total	949	4.62	.86	
Student Engagement	Pre	521	4.31	1.06	.028
	Post	396	4.46	1.02	
	Total	917	4.38	1.04	

DISCUSSION

Some overarching trends have emerged. Overall, students whose teachers completed the simEquity simulated teaching intervention reported significant ($p < .05$) increases in a) their voice having influence, b) in diverse teaching practices by their teachers, and c) in the level of engagement respondents felt as students, pre to post. Pre-post changes were especially noteworthy in areas related to the students feeling they had a voice in their own schooling.

The significant ($p < .05$) differences found in this study for student perceptions based on gender and ethnicity add to the complexity of attempting to attribute causes for desirable outcomes in students directly to teacher professional development. There were significant gender differences at pretest time with male students being higher on voice and student engagement. That is the opposite of what Santos et al. (2021) found with females reporting more engagement than males. However, in this study, by posttest time, there were no significant differences for males and females due to the increase for females pre to post on voice, engagement, and perception of their teachers' diverse teaching practices. The Santos et al., (2021) study was a one-time assessment to compare males to females whereas this study included a professional development intervention with pre-post data comparison. Previous researchers also found a strong correlation between student voice and engagement (Anderson, 2018), which is similar to the findings in this study, showing strong correlations between engagement and all four other student scales.

Findings related to teacher gender indicated that measurable increases in self-reported student measures took place predominately among the students of female teachers. As one example, the students of female teachers went up significantly from pre to post on each of the five indicators included in this study. By contrast, the students of male teachers tended to decrease on the same measures (NS) from pretest to posttest. There were no significant differences based on teacher gender on any of the five student measures at pretest time. However, by posttest time, students of female teachers were significantly higher on all five measures.

These findings imply that the simEquity professional development activities in the simulated classroom environment were especially effective for female teachers, as reported in pre to post changes in survey responses by their students. The lack of significant student-reported pre to post survey changes among students of male teachers is deemed worthy of further study.

A limitation of this study is the impact of many variables that were not measured, and it is difficult to attribute all the changes to the simulated teaching activities. In addition, it is difficult to attribute any responses from students to one teacher when students have multiple teachers each day. A third limitation is that the lower completion rate of surveys at posttest time might have biased the mean value assigned to the class in a positive or negative direction, compared to what it would have been if 100% of the class had responded. Since student responses were not matched individually pre to post, it was not possible to select only those who completed both pre and posttest surveys for analysis. However, there were students from each of the participating teachers both pre and post.

Significant ($p < .05$) findings in this paper are also related to teacher demographics. For example, at pretest time, students of White teachers were significantly lower ($p < .005$) on the cultural engagement factor than students of Black teachers. However, by posttest time, there were no significant differences on any of the measures. A deeper dive into the teacher simulation created data may allow the researchers to target more nuanced findings related to their actions within the simulation modules.

Possible implications for student learning include the use of unobtrusive, simulated teaching professional development to aid teachers in the identification and remediation of possible biases against students with varying characteristics that might not be like their own. Student engagement increased in this study which has been shown in other studies to impact other outcomes such as voice (Mitra, 2004), achievement and future success (Fraysier et al., 2020).

CONCLUSIONS

In conclusion, pre-post significant ($p < .05$) differences were found for students for Voice Having Influence, Student Engagement, and Diverse Teaching Practices (of their teachers). There were significant ($p < .05$) differences between males and female students on two measures at pretest time (Voice Having Influence and Student Engagement) with males being significantly higher. However, by posttest, the differences between males and females were no longer significant ($p < .05$). In addition, students of female teachers went up significantly from pre to post on each of the five measures while students of males, while not significant, tended to decrease pre to post. Further analysis and follow up with teachers may provide more details on the findings from this paper.

Overall, the findings from the student pre-post data in this study provide indications of the types of teacher professional development that might provide improvement in how students view their relationship with school and their teachers. Previous studies have shown that students who feel they have agency in their school life are more likely to experience improved life skills, self-esteem and general well-being (deRoiste et al., 2012; Mager & Nowak, 2012; Mitra, 2004). This study adds to previous research showing that targeted professional development with teachers can impact their students' learning dispositions (Christensen, 2002) but increases the breadth of access and number of variables that can be targeted using an on-line simulated teaching environment.

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REFERENCES

- Altugan, A.S. (2015). The Relationship between Cultural Identity and Learning. Proceedings of the 5th World Conference on Learning, Teaching and Educational Leadership, WCLTA 2014. *Elsevier Procedia - Social and Behavioral Sciences*, 186, 1159 – 1162. doi: 10.1016/j.sbspro.2015.04.161
- Anderson, D. (2018). *Improving wellbeing through student participation at school: Phase 4, Survey report: Evaluating the link between student participation and wellbeing in NSW schools*. Centre for Children and Young People, Southern Cross University. <https://doi.org/10.25918/report.10>

- Anderson, D.L., Graham, A.P., & Thomas, N.P. (2019). Assessing student participation at school: Developing a multidimensional scale. *International Journal of Student Voice*, 5(1), 1-24.
- Appleton, J.J., Christenson, S.L., Kim, D., & Reschly, A.L. (2006). Measuring cognitive and psychological engagement: Validation of the student engagement instrument. *Journal of Psychology*, 44, 427- 445. doi.org/10.1016/j.jsp.2006.04.002
- Benner, M., Brown, C., & Jeffrey, A. (2019). *Elevating student voice in education*. Center for American Progress. <https://www.americanprogress.org/article/elevating-student-voice-education/>
- Berekashvili, N. (2012). The role of gender-biased perceptions in teacher-student interactions. *Psychology of Language and Communication*, 16(1), 39-51. doi.org/10.2478/v10057-012-0004-x
- Bertrand, M., Chugh, D., & Mulainathan, S. (2005). Implicit discrimination. *American Economic Review*, 95(2), 94-98.
- Boser, U., Wilhelm, M., & Hanna, R. (2014). *The power of the pygmalion effect: Teachers' expectations strongly predict college completion*. Washington DC: Center for American Progress. <https://files.eric.ed.gov/fulltext/ED564606>.
- Brophy, J. (1983). Conceptualizing student motivation. *Educational Psychologist*, 18, 200-215. doi-org.libproxy.library.unt.edu/10.1080/00461528309529274
- Case, R. (1993) Theories of learning and theories of development, *Educational Psychologist*, 28(3), 219-233. doi: 10.1207/s15326985ep2803_3
- 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
- Chin, M.J., Quinn, D.M., Dhaliwal, T.K., & Lovison, V.S. (2020). Bias in the air: A nationwide exploration of teachers' implicit racial attitudes, aggregate bias, and student outcomes. *Educational Researcher*, 49(8), 566-578. doi.org/10.3102/0013189X20937240
- Christensen, R. (2002). Impact of technology integration education on the attitudes of teachers and students. *Journal of Research on Technology in Education*, 34 (4), 411-434.
- Christensen, R. (2023). *Year Two Report for the SimEquity Project: Changes in Student and Teacher Dispositions Regarding Culturally Responsive Teaching Strategies*. Institute for the Integration of Technology in Teaching and Learning. <https://iittl.unt.edu/content/publications-2>.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.
- Dee, T.S., & Penner, E.K. (2017). The causal effects of cultural relevance: Evidence from an ethnic studies curriculum. *American Educational Research Journal*, 54(1), 127-166.
- de Roiste, A., Kelly, C., Molcho, M., Gavin, A., Nik Gabhainn, S. (2012). Is school participation good for children? Associations with health and well-being. *Health Education*, 112(2), 88-104. doi: 10.1108/09654281211203394

- DeVellis, R. F. (2012). *Scale Development. Theory and Applications* (3rd ed.). Sage.
- Devine, P.G. (1989). Stereotypes and prejudice: Their automatic controlled components. *Journal of Personality and Social Psychology*, 82, 62-68. doi: 10.1037//0022-3514.56.1.5
- Dickson, G.L., Chun, H., & Fernandez, I.T. (2016). The development and initial validation of the student measure of culturally responsive teaching. *Assessment for Effective Intervention*, 41(3), 141-154. doi. org/10.1177/1534508415604879
- DuCuir-Gunby, J.T., & Bindra, V.G. (2022). How does teacher bias influence students? An introduction to the special issue on teachers' implicit attitudes, instructional practices, and student outcomes. *Learning and Instruction*, 78 (2022) 101523.
- Dweck, C. (1999). *Self-theories: their role in motivation, personality and development*, Philadelphia: Psychology Press.
- Eleuterio, S. (1997). Folk culture inspires writing across the curriculum. *C.A.R.T.S. Newsletter*, 4.
- Fraysier, K., Reschly, A., & Appleton, J. (2020). Predicting postsecondary enrollment with secondary student engagement data. *Journal of Psychoeducational Assessment*, 38(7), 882-899. Doi.org/10.1177/0734282920903168
- Graphpad (2024). Sign and binomial test. <https://www.graphpad.com/quickcalcs/binomial1/>
- Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses related to achievement*. London: Routledge.
- Hamdan, A. (2012). Autoethnography as a genre of qualitative research: A journey inside out. *International Journal of Qualitative Methods*, 11(5), 585-606. doi-org.libproxy.library.unt.edu/10.1177/16094069120110050
- Hilliard, A.G., III. (2001). Race, identity, hegemony and education: What do we need to know now? In W. Watkins, J.H. Lewis, & V. Chou (Eds.), *Race and education: The roles of history and society in the education of African American students* (pp. 7-33). Boston: Allyn and Bacon.
- Hoelscher, K.J. (1999). Cultural watersheds: Diagramming one's own experience of culture. *Social Studies & the Young Learner*, 12(2), 12-14.
- Kahne, J., Bowyer, B., Marshall, J., & Hodgins, E. (2022). Is responsiveness to student voice related to student outcomes? *American Journal of Education*, 128(3), 389-415.
- Kovanovic, V., Mazziotti, C., & Lodge, J. (2021). Learning analytics for primary and secondary schools. *Journal of Learning Analytics* 8, 1-5. Doi: 10.18608/jla.2021.7543
- Lenhard, W., & Lenhard, A. (2016). *Computation of effect sizes*. Psychometrica https://www.psychometrica.de/effect_size.html. doi: 10.13140/RG.2.2.17823.92329.
- Mager, U., & Nowak, P. (2012). Effects of student participation in decision making at school: A systematic review and synthesis of empirical research. *Educational Research Review*, 7(1), 48-61.

- McCrae, R., & Costa, P. (1996). *Toward a new generation of personality theories: Theoretical contexts for the five-factor model*. In J. S. Wiggins (Ed.), *The five-factor model of personality: Theoretical perspectives* (pp. 51-87). New York: Guilford.
- McFarland, J., Hussar, B.I., Zhang, J., Wang, X., Wang, K., Hein, S., Diliberit, M., Cataldi, E.M., Mann, F.B., & Barmer, A. (2019). *The condition of education 2019* (NCES 2019-144). United States Department of Education National Center for Education Statistics.
- 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>.
- Mezzich, J.E., Ruiperez, M.A., Yoon, G., Liu, J., & Zapata-Vega, M.I. (2009). Measuring cultural identity: Validation of a modified Cortes, Rogler and Malgady bicultural scale in three ethnic groups in New York. *Cultural Medical Psychiatry*, 33, 451-472. doi.org/10.1007/s11013-009-9142-6
- Mitra, D.L. (2004). The significance of students: Can increasing 'student voice' in schools lead to gains in youth development. *Teachers College Record*, 106(4), 651-688. doi.org/10.1111/j.1467-9620.2004.0035
- Morrier, M.J., Irving, M.A., Dandy, E., Dmitriyev, G., & Ukeje, I.C. (2007). Teaching and learning within and across cultures: Educator requirements across the United States. *Multicultural Education*, 14(3), 32-40.
- Muniz, J. (2019). *Culturally responsive teaching: A 50-state survey of teaching standards*. <http://newamerica.org/education-policy/reports/culturally-responsive-teaching>
- National Center for Educational Statistics. (2020). Racial/ethnic enrollment in public schools. United States Department of Education. https://nces.ed.gov/programs/coe/pdf/coe_cge.pdf
- Natriello, G. (1984). Problems in the evaluation of students and student disengagement for secondary schools. *Journal of Research and Development in Education*, 17, 14-24.
- Pasternak, D.L., Harris, S.D., Lewis, C., Wolk, M.A., Wu, X., & Evans, L.M. (2023). Engaging culturally responsive practice: Implications for continued learning and teacher empowerment. *Teaching and Teacher Education*, 122. Doi:10.1016/j.tate.2022.103976
- Patterson, C.J., Kupersmidt, J.B., & Vaden, N.A. (1990). Income level, gender, ethnicity, and household composition as predictors of children's school-based competence. *Child Development*, 61, 485-494. doi.org/10.1111/j.1467-8624.1990.tb02794.x
- Pedler, M., Yeigh, T., & Hudson, S. (2020). The teachers' role in student engagement: A review. *Australian Journal of Teacher Education*, 45(3), 47 – 62. doi.org/10.14221/ajte.2020v45n3.4
- Phakiti, A., Hirsh, D., & Woodrow, L. (2013). It's not only English: Effects of other individual factors on English language learning and academic learning of ESL international students in Australia. *Journal of Research in International Education*, 12(3), 239-258. doi.org/10.1177/14752409135135

- Rachmadtullah, R. & Kusmaharti, D. (2018). Education as a culture process. *International Journal of Urban and Regional Research*, 5, 131-135.
- Sadker, D. & Zittleman, K. (2016). *Teachers, schools, and society: A brief introduction to education* (4th ed.) New York, NY: McGraw-Hill.
- Sadker, D., Zittleman, K., & Koch, M. (2016). Gender bias: Past, present and future. In *Multicultural Education* (pp. 83-100). (Eds.) J.A. Banks & C.A. McGee Banks. Indianapolis, IN: John Wiley & Sons.
- Santos, A.C., Simoes, C., Cefai, C., Freitas, E., & Arriaga, P. (2021). Emotion regulation and student engagement: Age and gender differences during adolescence. *International Journal of Educational Research*, 109 (2021), 101830.
- Schneider, W. J., & McGrew, K. S. (2012). *The Cattell-Horn-Carroll model of intelligence*. In D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (p. 99–144). The Guilford Press.
- Sianjina, R. R. (2000). Educational technology and the diverse classroom. *Kappa Delta Pi Record*, 37(1), 26 – 29.
- SimSchool: *Understanding the AI*. (2018-19). simSchool library. www.sim-school.org
- Smith T.W. (2013). Interpersonal Circumplex. In M.D. Gellman & J.R. Turner (eds). *Encyclopedia of Behavioral Medicine*. Springer, New York, NY. doi. [org/10.1007/978-1-4419-1005-9_1584](https://doi.org/10.1007/978-1-4419-1005-9_1584)
- Staats, C. (2015-16). Understanding implicit bias: What educators should know. *American Educator*, 29-33.
- Student Voice Definition*. (2013). The Glossary of Education Reform. <https://www.edglossary.org/student-voice/>
- Szabo, L., Zsolnai, A., & Fehervari, A. (2024). The relationship between student engagement and dropout risk in early adolescence. *International Journal of Educational Research Open*, 6 (2024), 100328. doi.org/10.1016/j.ijedro.2024.100328.
- Vygotsky, L.S. (1962). *Thought and language*. Cambridge, MA: MIT Press.
- Wallace, T.L., & Chhuon, V. (2014). Proximal processes in urban classrooms: Engagemetn and disaffection in urban youth of color. *American Educational Research Journal*, 51, 937-973. doi.org/10.3102/0002831214531324
- Yogeeswaran, K., Devos, T., & Nash, K. (2017). Understanding the nature, measurement, and utility of implicit intergroup biases. In C. G. Sibley & F. K. Barlow (Eds.), *The Cambridge handbook of the psychology of prejudice* (pp. 241–266). Cambridge University Press. doi.org/10.1017/9781316161579.011