Using a Simulated Teaching Environment to Support Career Technical Teacher Education High School Programs

Rhonda Christensen
Rhonda.christensen@gmail.com
Gerald Knezek
gknezek@gmail.com
Samantha Norton
University of North Texas USA

Abstract. Thirty-four students from a career and technical education high school course focusing on teacher education participated in simulation-based teaching exercises within simSchool. Pre and post Likert-style self-reported appraisals on seven scales in the areas of culturally responsive teaching, empathy and technology attitudes are being gathered from all participants. Preliminary findings revealed that a surprisingly strong relationship exists between culturally responsive teaching self-efficacy and cognitive empathy, to the point where empathy can be said to account for more than half of culturally responsive teaching self-efficacy. In addition, females were found to be higher on empathy than males.

Keywords: high school teacher education programs, empathy, culturally responsive teaching, career and technical education

Introduction

Teachers can make an impact on the future of children's academic and emotional well-being thus effecting their lifelong outcomes. Ensuring there are enough qualified teachers is critical for a good education system and a shortage of teachers has detrimental effects on the learning of students (Gerritsen et al., 2016; Sorenson & Ladd, 2018). In the US, as well as Europe, the teacher shortage has become a national concern (European Commission/EACEA/Eurydice, 2018). The shortage was made even more dismal by the COVID-19 pandemic (Lopez, 2021; Nguyen et al., 2022) causing school systems to staff classrooms with unqualified people who included parents (Sandoval, 2022) and even the National Guard military personnel (Poff, 2022). During the 2018–2019 school year, the national teacher shortage exceeded 120,000 vacancies (Wiggan et al., 2021). It is estimated that within the next decade approximately 1.5 million new teachers will be needed (US Dept of Ed., 2015; Wiggan et al., 2021).

The teacher shortages have been attributed to both recruitment and retention issues. There have been falling enrollments in teacher preparation programs for many years (Will, 2022), as well as teachers leaving the field for early retirement. Even when districts find qualified teachers, they often leave the field within a few years after beginning teaching (Gorard et al., 2023). It has been estimated that between 40 and 50% of teachers leave the classroom within their first five years in the profession (Ingersoll, 2012; Lindqvist et al., 2014). Some of the issues contributing to the teacher shortage are related to teacher pay, stress, discouragement and the lack of proper training and mentorship (Walker, 2019). Preparing future teachers to deal with the stresses of classroom management, accommodations of students, parent and administration expectations may be part of the problem that relates directly to recruitment of individuals interested in joining the teaching workforce.

Preparing future teachers for the diversity of students they will encounter is a challenge. Teaching is currently a predominately White, female profession and a gap exists between this demographic and the diverse student population that exists (Ingersoll et al., 2014; U.S. Dept. of Ed. National Center for Education Statistics, 2015). For example, 26.2% of students are Latinx (US NCES, 2015) while only 9% of the teacher workforce are comprised of Latinx teachers (Will, 2018) creating an even more difficult issue when the students are not English proficient.

Career and Technical Education

Career and Technical Education (CTE), also known as vocational education, aims to prepare students for the workforce but also increase educational attainment as US industries need college-trained workers (Ames, 2021). As labor market trends change, so does the need for programs that add to student competitive advantages in the labor and higher education markets. Schools with larger portions of students in CTE programs have higher school attendance and completion rates than those with lower enrollment (Plank et al., 2008). Accredited CTE programs have demonstrated increased motivation and learning, even for non-college-bound students (Castellano et al., 2003).

Many high schools in the US have career technical education courses that are focused on teacher education, hoping to encourage and prepare students to choose teaching as a profession with early experiences and courses. The listing of Texas high school courses focused on teacher education (TEA, 2022) is shown in Table 1.

In Texas the Practicum in Education and Training involves field-based internships where students partner with exemplary educators to receive hands-on experience as they design and deliver their own lesson plans (TEA, 2017). In addition, there are "Grow your own" programs in high schools with the same focus of preparing teachers to replenish their local teacher openings. One challenge for these programs is placement in schools for the number of observation and interaction hours that are needed.

Table 1. Secondary Courses for High School Credit in Texas

Level	Course Description
1	Principles of Education and Training & Principles of Human Service
2	Human Growth and Development, Child Development & Communication and Technology in Education
3	Instructional Practices & Teaching Strategies for Special Populations
4	Practicum in Education and Training, Project Based Research & Career Preparation I

Simulations for Classroom Observations and Practice Teaching

This paper reports on one strategy that was used to provide not only observation hours for these students, but also the opportunity to make classroom decisions using a simulated teaching environment. The simulation also includes targeted feedback to improve their teaching strategies and decisions. In addition, the simulation provides experiences with a variety of students learning needs as well as emotional needs.

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 has great potential in education by allowing educators to act within virtual environments, immediately applying theory to realistic yet controlled settings.

SimSchool is a dynamic, online classroom simulation program that allows the opportunity to practice teaching in 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. Using student profiles, 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, analyze the results, and enable adjustments to their instruction to ensure that all students are learning and achieving higher results (Girod & Schalock, 2002).

Methods

The Study

Each participant first completed an introductory modules instruction on the navigation of simSchool, and also about the feedback provided to the participants following each module. Each of the content modules required completion of at least three sessions of each module. Each session consisted of teaching the provided lesson for at least 15 minutes, reviewing provided feedback and reteaching the lesson with the goal of improvement based on the feedback. The average total amount of time spent actively completing simulations was 4 hours and 45 minutes.

At the end of each simulation session, participants received graphical feedback displaying degree of success at promoting academic, emotional and equity performance in the simulated class overall, as well as feedback regarding the degree of suitability of the instructional activities selected for each individual simulated student in the class. Figures 2 and 3 illustrate examples of graphical feedback as well as an observation report that participants receive.

Number	Name	Classes
simModule 1	Learning to Teach in simSchool	
simModule 2	Understanding Observation Reports in simSchool	
simModule 3	Classroom Management Grade 1	
simModule 4	PK Bunny Math	
simModule 5	K1 Synonym Spider	
simModule 6	PK All About Me - Encouraging Cultural Understanding	
simModule 7	(3-5) Bullying and Bias Crocodile and Ghost Bat Have a Hullabaloo (EQ)	
simModule 8	Classroom Management Grade 5	

Figure 1. Modules provided to the high school students in simSchool.

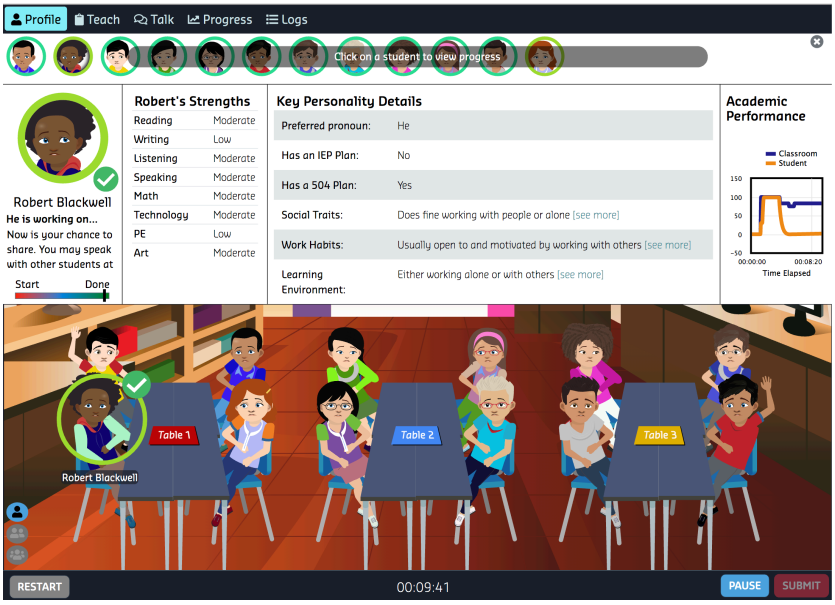

Figure 2. SimSchool classroom highlighting student profiles.

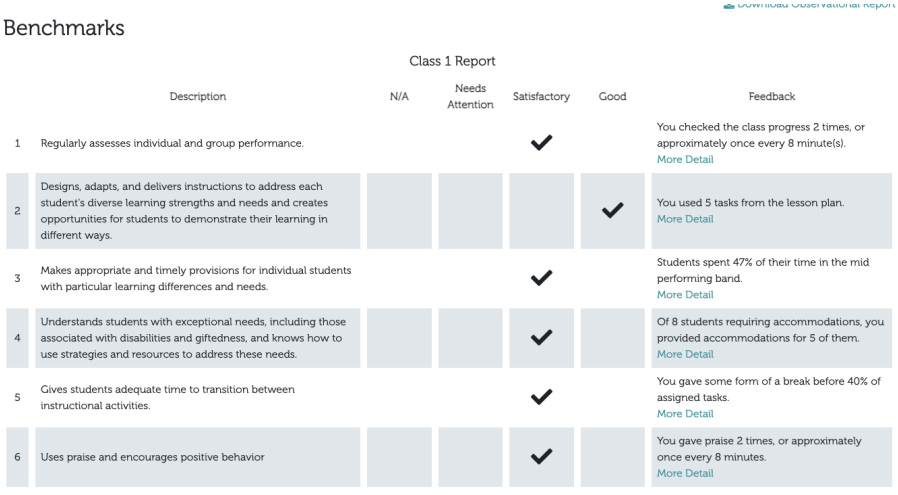

Figure 3. Benchmark feedback after teaching session in simSchool.

Participants

Thirty-four students from the career technical education course focused on teacher education participated in a simulation-based teaching. Students were instructed to complete at least five of the eight modules provided. Each of the modules, after the first two instructional modules, was completed three times with feedback after each session. In addition, students completed pre and posttest surveys that focused on culturally responsive teaching self-efficacy, empathy, resilience and teaching and general dispositions toward technology. All participants were in their final year of high school in the state of Texas. The sample included 24 females (70.6%) and 9 males (26.5%). The ethnicity of the participants included 4 (12.1%) Black/AA, 6 (18.2%) Hispanic, 22 (66.7%) White and 1 (3.0%) Other.

Instrumentation

Participants completed pre and posttest surveys in addition to the data that were collected during the simulated teaching practices. The list of survey instruments is described in more detail.

1. 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. While the original survey was longer, 25 items from the survey were used for this project data collection. Participants were asked to indicate their level of confidence in each of the items below by choosing a response between 1 and 6. These ratings range from 1 = Strongly Disagree to 6 = Strongly Agree.
2. The 28 empathy items were selected from two separate survey instruments. The first 22 items were selected from the first two factors from the *Empathy Quotient* survey developed by Baron-Cohen & Wheelwright (2004). The original 60 item survey revealing included three factors which were labeled cognitive empathy, emotional reactivity and social skills (Lawrence et al., 2004). The first two factors from the Empathy Quotient were selected for this study. Six items from the *Thinking and Feeling instrument* (Garton & Gringart, 2005) were deemed appropriate for the current study. After completing reliabilities for this set of data, the scale was found to be more reliable without item 25, so it was removed from the Feeling and Thinking survey instrument items for analysis as a scale. Participants were asked to indicate their level of confidence in each of the items below by choosing a response between 1 and 6. These ratings range from 1 = Strongly Disagree to 6 = Strongly Agree.
3. The Resilience in Teaching-Related Situations is an 8-item Likert survey in which participants selected from 1 = very true of me, 2 = untrue of me, 3 = somewhat untrue of me, 4 = somewhat true of me, 5 = true of me, and 6 = very true of me.
4. A four item dispositions toward technology was created to determine the comfort level the participants have with technology. The participants selected one statement that best described their feelings toward technology from the following items:
    a. I avoid using technology as much as possible.
    b. I use technology a lot but it's just a tool for me, not a hobby.
    c. I enjoy working with technology and learning new ways to use it.
    d. I often help my friends with their technology problems, and I like showing them how to use technology in different ways.
5. Participant were asked to select their #1 use of technology in their free time from the following choices:
    a. Talking/emailing with friends or family members
    b. Playing games
    c. Listening and downloading music
    d. Getting information about places to go and things to do
    e. I only use technology for my schoolwork
    f. I don't have any access to the Internet outside of school
6. An additional item was included related to the importance of having access to technology to their education. The option for response included unimportant, somewhat unimportant, somewhat important, very important.

Reliabilities for each of the scales were calculated for this set of data. After examining the alpha with items deleted, it appeared that two of the scales were much stronger with one item removed from each. Therefore, the subsequent analysis was completed with the removed items. As shown in Table 2, estimated reliabilities ranged from .763 to .959 which is considered respectable to very good (DeVellis, 2012).

Table 2. Reliabilities for the Survey Scales

Measures	n	No items	alpha	Items deleted	No items	Alpha
CRTSE	34	25	.969			
Cognitive Empathy	34	13	.928			
Emotional Reactivity	34	8	.617	Delete item 13	7	.776
Thinking/Feeling	34	6	.707	Delete item 25	5	.763
Resilience	34	8	.837			

Findings

Findings reported in this submission include scale reliabilities, descriptives for scales and items and correlations between scales. As shown in Table 3, culturally responsive teaching self-efficacy was already relatively high with a 4.72 mean on a 6-point Likert scale. Both importance of technology for education and feelings about technology were rated on a 4-point scale. Frequencies of the responses for number one use of technology in free time is shown in Tables 4.

Table 3. Descriptives for Measurement Scales

Measurement Scale	Mean	Std. Dev	N
Culturally Responsive Teaching Self-Efficacy	4.72	.627	34
Cognitive Empathy	4.51	.608	34
Emotional Reactivity (7 items)	3.57	.696	34
Thinking/Feeling	4.21	.650	34
Resilience	4.44	.667	34
Importance of Tech for Education (4-point scale)	3.44	.613	34
Feelings about Technology (4-point scale)	2.50	.826	34

Table 4. Frequency Responses for "Number one technology use in free time"

Free Time Choices	Frequency	Percent
Talking/emailing with friends or family members	12	35.3
Playing games	8	23.5
Listening and downloading music	10	29.4
Getting information about places to go and things to do	2	5.9
I only use technology for my schoolwork	2	5.9
Total	34	100.0

Individual item descriptive statistics were calculated for each of the scales to provide a sense of the lower and higher means for each area. The items, means and standard deviations for the culturally responsive self-efficacy items are shown in Table 5. The highest rated mean was for "I feel confident I could build a sense of trust with students" while the lowest rated mean was "I feel confident I could implement strategies to minimize the effects of mismatch between students' home culture and the school culture". Posttest data are being collected to determine areas in which the simulation teaching environment may improve their self-efficacy in these areas. Table 6 includes all empathy related items labeled by the three scales of cognitive empathy (CE), Emotional Reactivity (ER) and Thinking/Feeling (TF).

Table 5. Culturally Responsive Teaching Self-Efficacy Descriptive Statistics

I feel confident that I could…	Mean	Std. Dev
1. …adapt instruction to meet the needs of students.	4.71	.871
2. …obtain information about students' academic strengths.	4.76	.781
3. …determine whether students like to work alone or in a group.	4.97	.758
4. …identify ways that the school culture (e.g., values, norms, and practices) is different from students' home culture.	4.62	.888
5. …implement strategies to minimize the effects of the mismatch between students' home culture and the school culture.	4.29	.906
6. …assess student learning using various types of assessments.	4.71	.676
7. …obtain information about students' home life.	4.65	1.012

8. …build a sense of trust with students.	5.15	.784
9. …establish positive home-school relations.	4.91	.793
10. …develop a community of learners when my class consists of students from diverse backgrounds.	4.82	.673
11. …use my students' cultural background to help make learning more meaningful.	4.59	.743
12. …identify ways in which how students communicate at home may differ from the school norms.	4.65	.691
13. …obtain information about students' cultural background.	4.68	.589
14. …design a classroom environment using displays that reflects a variety of cultures.	4.68	.727
15. …obtain information about my students' academic weaknesses.	4.91	.753
16. …help students to develop positive relationships with their classmates.	4.85	.821
17. …revise instructional material to include a representation of different cultural groups.	4.59	.701
18. …critically examine the curriculum to determine whether it reinforces negative cultural stereotypes.	4.53	.961
19. …help students feel like important members of the classroom.	4.88	1.008
20. …identify ways that standardized tests may be biased towards culturally diverse students.	4.53	.896
21. ….use examples that are familiar to students from diverse cultural backgrounds.	4.50	.826
22. …explain new concepts using examples that are taken from my students' everyday lives.	4.68	.912
23. …obtain information regarding students' academic interests.	4.74	.898
24. …use the interests of students to make learning meaningful for them.	4.82	.936
25. …design instruction that matches students' developmental needs.	4.74	.864

Table 6. Descriptive Statistics for Empathy Items for Three Scales

	I feel confident that I could…	**Mean**	**Std. Dev**
CE	1. I can easily tell if someone else wants to enter a conversation.	4.71	.799
ER	2. I really enjoy caring for other people	4.91	.933
CE	3. I can pick up quickly if someone says one thing but means another.	4.62	.954
ER	4. It is hard for me to see why some things upset people so much.	3.12	1.008
CE	5. I find it easy to put myself in somebody else's shoes.	4.59	.743
CE	6. I am good at predicting how someone will feel.	4.29	.676
CE	7. I am quick to spot when someone in a group is feeling awkward or uncomfortable.	4.74	.828
ER	8. If I say something that someone else is offended by, I think that that's their problem, not mine.	3.50	1.080
ER	9. I can't always see why someone should have felt offended by a remark.	3.32	.912
ER	10. Seeing people cry doesn't really upset me.	3.65	1.300
CE	11. Other people tell me I am good at understanding how they are feeling and what they are thinking.	4.59	.821
	12. I can easily tell if someone else is interested or bored with what I am saying.	4.44	.824
	13. I get upset if I see people suffering on news programs.	4.06	.983
CE	14. Friends usually talk to me about their problems they say that I am very understanding.	4.79	.808
CE	15. I can sense if I am intruding, even if the other person doesn't tell me.	4.50	.929
ER	16. Other people often say that I am insensitive, though I don't always see why.	3.24	1.017
ER	17. I usually stay emotionally detached when watching a film.	3.24	1.156
CE	18. I can tune into how someone else feels rapidly and intuitively.	4.32	.684
CE	19. I can easily figure out what another person might want to talk about.	4.21	.808
CE	20. I can tell if someone is hiding their true emotion.	4.38	.954
CE	21. I am good at predicting what someone will do.	4.50	.749
TF	22. I tend to get emotionally involved with a friend's problems.	4.38	.985
TF	23. I often get affected by things I see happen.	4.32	.878
TF	24. I often feel worried about people that are not as lucky as me, and feel sorry for them.	4.24	.890
	25. I think people can have different opinions about the same thing.	4.79	.770

TF	26. When people around me are nervous or worried, I get a bit scared and worried too.	4.06	1.071
TF	27. When I am angry or upset at someone, I usually try to imagine what he or she is thinking or feeling.	4.12	.844
TF	28. When I am arguing with my friends about what we are going to do, I think carefully about what they are saying before I decide whose idea is best.	4.29	.836

Note. CE = Cognitive Empathy, ER = Emotional Reactivity, TF = Thinking/Feeling

Table 7. Descriptive Statistics for Resilience Items

Resilience Items	Mean	Std. Dev
1. I can learn and grow from experiences that set me back.	4.94	.886
2. Even if I suffer great challenges at school, I don't give up easily.	4.41	1.158
3. I am brave to take on difficult challenges at work and school.	4.47	.929
4. When encountering challenges, I keep active and try continually to solve the problems.	4.56	.705
5. I can decrease my stress through exercises or leisure activities that I enjoy.	4.38	1.129
6. I try to think positively in negative situations.	4.29	.970
7. When encountering frustrations, I can appropriately control my negative emotions.	4.47	.788
8. I can forget about unhappy things quickly so that I don't dwell in negative emotions.	3.97	1.141

Findings for Gender

One way analysis by gender was completed for the following measures: CRTSE, Cognitive Empathy, Emotional Reactivity, Thinking/Feeling, Resilience, Importance of Technology in Education, and Feelings toward Technology. Only the emotional reactivity empathy scale revealed significant (p = .021) differences between male and female with females being significantly higher than males.

Correlational Relationships

Some interesting relationships emerged using correlational analysis. The culturally responsive teaching self-efficacy measure was significantly correlated with cognitive empathy, thinking/feeling empathy, resilience and importance of technology in education. The strongest correlation was with cognitive empathy (r = .767, p <.01) followed by resilience (r = .558, p = .001). Other strongly correlated measures included thinking/feeling empathy, resilience (r = .547, p = .001) and the reported importance of technology in education (r = .505, p = .002). Of the three empathy measures (cognitive empathy, emotional reactivity and thinking/feeling), only cognitive empathy and thinking/feeling scales showed significant relationships (r = .422, p = .013). As shown in the dendrogram of Figure 4, a Hierarchical Cluster Analysis (Dunn-Rankin et al., 2014) of the non-technology scales listed in Table 8, illustrates that Culturally Responsive Teaching Self-Efficacy (CRTSE) has the greatest affinity with (shortest path to) Cognitive Empathy, and still strong alignment with Resilience and Thinking/Feeling (ThinkFeel). By way of contrast, Culturally Responsive Teaching Self-Efficacy (CRTSE) is far away from Emotional Reactivity (ER), which aligns with the lack of significant (p < .05) correlation between Culturally Responsive Teaching Self-Efficacy and Emotional Reactivity in Table 8.

Table 8. Correlational Relationships Among Culturally Responsive Teaching, Empathy and Technology Scales

		CRTSE	Cognitive Empathy	Emotional Reactivity	Think Feel	Resilience	Imp Tech Educ	Feel Tech
CRTSE	Pearson Corr.	1	.767**	.281	.383*	.558**	.444**	.084
	Sig. (2-tailed)		.000	.108	.026	.001	.008	.636
	N	34	34	34	34	34	34	34
Cognitive	Pearson Corr.	.767**	1	.154	.422*	.547**	.505**	-.058
Empathy	Sig. (2-tailed)	.000		.385	.013	.001	.002	.745
	N	34	34	34	34	34	34	34
Emotional	Pearson Corr.	.281	.154	1	-.123	-.131	.180	-.272
Reactivity	Sig. (2-tailed)	.108	.385		.488	.462	.307	.119
	N	34	34	34	34	34	34	34
Thinking	Pearson Corr.	.383*	.422*	-123	1	.418*	.358*	.085
Feeling	Sig. (2-tailed)	.026	.013	.488		.014	.037	.634
	N	34	34	34	34	34	34	34

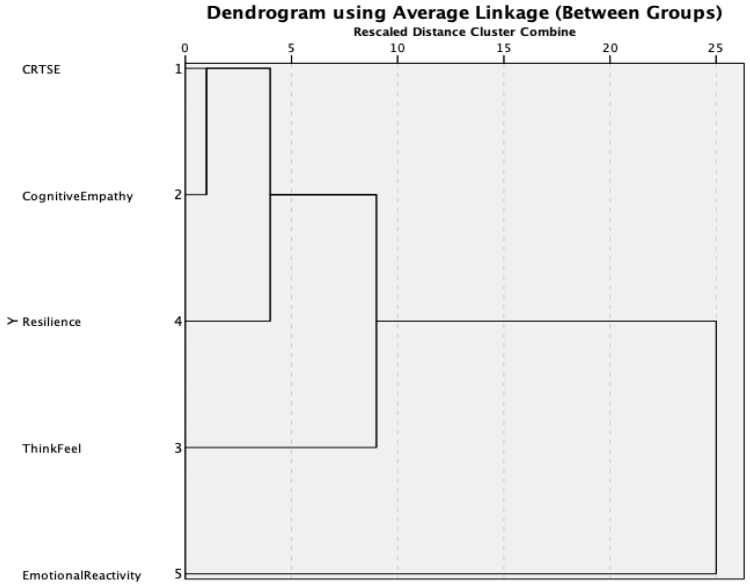

Figure 4. Hierarchical cluster analysis of relationships among five measurement scales.

Proximities Among the Constructs Represented by Instrument Scales

A multidimensional scaling analysis (MDS) was conducted using the procedure ALSCAL to further explore the relative proximities of the constructs represented by the strengths of associations (correlations) illustrated in the dendrogram of Figure 4. A two-dimensional solution was found to account for 99.6% of the psychometric proximities (distances) between the five scales analyzed, based on study participant Likert ratings viewed across all subjects. As shown in Figure 5, when viewed along dimension 1 (X-axis) CRTSE lies in close proximity to Cognitive Empathy and far away from Emotional Reactivity. When viewed along dimension 2 (Y-axis), both CRTSE and Cognitive Empathy lie close to the Y-axis origin, midway between Resilience and Thinking / Feeling. Thus, CRTSE and Cognitive Empathy, from a two-dimensional best fit proximity perspective, form a tight-knit cluster on their own. This adds perspective to the strong association reported between CRTSE and Cognitive Empathy in Table 8 ($r = .767$, $p < .01$) and graphically illustrated in Figure 4, in that Figure 5 illustrates that the study participants perceived these two measures as tightly knit and comparatively distant from all others.

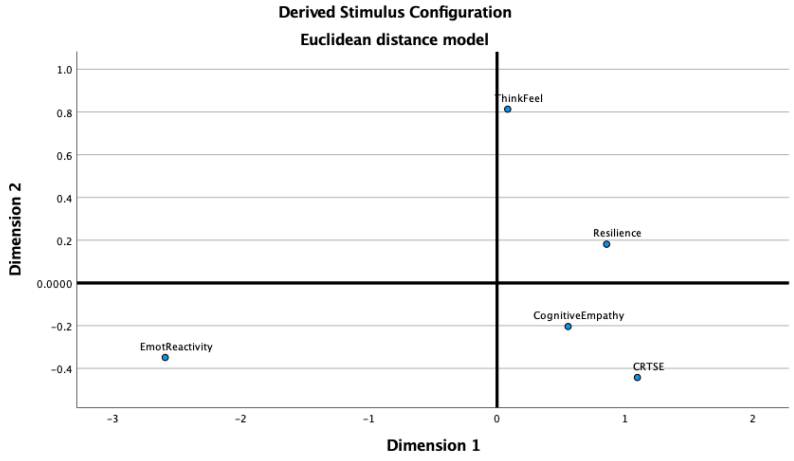

Figure 5. Multidimensional scaling analysis of relationships among five measurement scales.

Discussion

One interesting finding from this study is the emergence of a strong positive relationship between empathy and culturally responsive teaching self-efficacy. The magnitude of the positive relationships found varied from r = .383 for Think/Feel to .767 for Cognitive Empathy. The latter strength of association would be considered very large according to guidelines provided by Lenhard & Lenhard (2022). Since the reported associations are Pearson Product Moment Correlations, Cognitive Empathy can be said to account for 59% (.767 x .767 = .588) of Culturally Responsive Teaching Self-Efficacy among the participants in this study. Dispositions such as empathy have been shown to assist future teachers in realizing their vision of culturally responsive pedagogy in their future classrooms (Warren, 2018). When the discovery of this strong relationship is combined with another finding from this study, that the females tend to be more empathetic than the males ($p < .05$), one might predict that females will tend to be better culturally responsive teachers than males. This could be one positive side effect of the often-reported imbalance between male and female teachers in the USA, where females are reported to make up more than 75% of the K-12 teaching workforce (Loewus, 2017; National Center for Education Statistics (NCES), 2018. As reported by Boyle (2024), women were not always dominate in the US teaching workforce, but have been for more than 100 years with ample evidence of positive effects on society in spite of societal perceptions that teaching in the US as a profession is not generally held in high esteem or financially rewarding.

New teachers often struggle in their first year and many go on to leave the field. An important disposition related to remaining in the teaching field is resilience (Tait, 2008). Grothberg (1997) has defined resilience as the capacity to overcome and even be strengthened from adverse experiences. Resilience and self-efficacy have been linked as related concepts (Tschannen-Moran & Woolfolk Hoy, 2001). Developing teacher efficacy and resilience appear to play an important role in new teacher success (Tait, 2008). Resilience was shown to be highly related to culturally responsive teaching practices in this study of high school students on the track to be teachers in the future. Finding ways, such as simulation experiences with targeted feedback, may be one tool to use in the aim for teacher retention.

Another interesting finding is that culturally responsive teaching does not appear to be strongly associated with other types of empathy measured in this study. Additional research is warranted to determine why. Also warranted is further study of why a strong positive association (r = .444, $p < .01$; Table 8) between the perceived importance of technology in education (rating categories in Table 9) and higher score on Culturally Responsive Teaching Self-Efficacy (CRTSE) emerged, but there was not a strong association between CRTSE and participants' feelings toward technology. This finding may simply indicate that teachers proficient in culturally responsive teaching (and perhaps other important pedagogical practices) also tend to recognize that technology plays an important role in 21st century education, regardless of their own personal likes or dislikes for technology in general.

Conclusion

Analysis of pretest data gathered from 34 students enrolled in a career and technical education high school course focusing on teacher education indicated that the instrumentation employed produced reliable measures, and provided evidence that the Culturally Responsive Teaching Self-Efficacy measure is closely aligned with Cognitive Empathy. This was a pilot study to determine whether using simulations in the high school career focused course of teacher education might be useful not only in increasing the number of observation hours students complete, but also using targeted feedback within a simulation that can improve confidence in teaching. Post test data will be analyzed to determine whether pre-post changes in the study's key measures have occurred over the time span when participants completed simulation-based teaching exercises within simSchool.

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