

## Reforming Science Teacher Education with Cultural Reflection and Practice

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**Abstract.** As classrooms increasingly become more diverse, teacher education programs should include opportunities for open discussions and authentic implementation of culturally relevant teaching. This study explores how preservice teachers (PSTs) in a science content/methods class, use reading, reflecting and writing in an innovative sequence outlined a lesson plan called a Transformational Reading Exercise (TRE). TREs require that PSTs read culturally relevant literature, reflect on their reading, and write their reflective responses rather than simply summarizing the reading. The TRE is followed by guided class discussions and the intentional application of those concepts in authentic after-school teaching environments called Family Science Learning Events. At Family Science Learning Events (FSLEs), PSTs can transform their thinking about themselves, attending students and family members, becoming more interconnected, more interdependent, more conscious of other cultures. Data collection and analysis from this study includes qualitative data from PSTs TREs and FSLE reflections and quantitative data from pre-/post-surveys regarding the importance of teacher quality characteristics. Results show a significant increase in PSTs appreciating culturally relevant teaching pedagogy and changes in PSTs personal perceptions regarding culture. Recommendations include reforming education courses to include use of structured reading/reflecting/writing sequences with intentional, authentic venues that incorporate meaningful culturally relevant experiences.

**Keywords:** culturally relevant teaching; teacher education; family learning events; cultural perceptions.

### 1. Introduction

The “culture of power” is a phrase used for those who are elevated with substantial control over money, people and political platforms for sociopolitical reasons. Groups of people that are part of the culture of power are typically white, upper and middle class, male and heterosexual. Classrooms have cultures of power where those with power generally take it for granted and are unaware

of its existence while those who lack power are more likely to note the personal effects of their perceived powerlessness on a daily basis (Delpit, 1995). Ladson-Billings (2006) states that educators are usually unprepared to handle or even recognize racial and cultural issues as they have their own personal biases, prejudices and perspectives that are often based from media stereotypes. Scholars such as Gay (2013), Ladson-Billings (2014) and Krutky (2008) explain that preservice teachers (PSTs) should conduct self-reflections for how they see themselves as people, questioning their own self-knowledge and perceptions regarding their own cultural competence as a means increasing their instructional effectiveness (Allard & Santoro, 2006).

From this recognition of cultures of power and their effects on teachers and students, two lines of thought emerge related to teaching and instruction. First is a focus on teacher practice as explained by Geneva Gay (2013) and identified as 'culturally responsive teaching.' The typical public-school classroom in the United States generally has teachers that are white, monolingual females with little tendency to interact in a substantive way with people of diverse ethnicities and cultures. Other populations of teachers also need to develop cultural consciousness and self-reflect as populations become more diverse (Allard & Santoro, 2006). Education programs should better prepare PSTs whose classes and schools will be culturally diverse, making culturally relevant teaching especially important for their future success.

The principles that inform the following have intentional elements to develop cultural awareness and increase self-reflection in preservice teacher education to engage diversity and operationalize awareness through practice. Teacher educators need to focus on preservice teacher conceptions and perceptions of race and culture as expressed in Ladson-Billings (2006, 2014) and referred to as culturally relevant pedagogy. We argue that teacher educators must include in their curriculum opportunities for preservice teachers to have intentional and sustained critical conversations regarding the culturally diverse students they will be teaching (e.g., Darling-Hammond & Bransford, 2005; Dover, 2013; Gay, 2013; Gay & Kirkland 2010; Ladson-Billings 2006, 2014; Sleeter, 2015, Valenzuela, 1999).

While the importance of culturally relevant teaching (CRT) is recognized in today's classrooms, the concept of engaging diversity can be an academic abstraction to PSTs because they have no practical experiences with students of color or students from different cultural and racial backgrounds as themselves (Gay & Kirkland 2010). Our surrounding school district comprises 57 different campuses where classrooms have a minority-majority of Hispanic students (38,000 students, 79.4% Hispanic, 4.0% African American, 13.9% White). Krutky (2008) indicated that it is critical that new teachers learn how to prepare both themselves and their students "for a world that is increasingly interconnected, interdependent, and diverse" (p.13). We argue Texas, the United States and the world must address those challenges and provide results from our study that suggest ways to meet those challenges. The primary purpose of this study is to identify pedagogical practices that use Krutky's (2008) recommendations in an education program where students individually and collectively increase their CRT knowledge and reflect about their own perceptions of culture while learning how to incorporate CRT practices in their teaching.

The central foundation regarding diversity is students bring their personal knowledge and experiences to the classroom and that encountering and discussing different perspectives enhances their personal perceptions. Yet personal power, or the lack thereof, and political biases can make incorporating diversity and equity in a college classroom a difficult process. (Rude, Wolniak, & Pascarella, 2012). Incorporating conversations regarding diversity and equity do not arise naturally in diverse preservice classrooms or content coverage. In addition, even when conversational space is purposefully provided, the presence of power and politics our classrooms often lead to silence and the unwillingness to engage in conversation regarding issues of race, ethnicity and cultural relevancy in curriculum and in classrooms (Gay & Kirkland, 2010). Preservice teachers must intentionally think about how their personal cultural identity will affect teaching students of different cultures (Darling-Hammond & Bransford, 2005; Lee, Poch, Shaw & Williams, 2012). Feelings of guilt and remorse are not enough to move toward the promotion of equality and creating a climate that supports social justice. Preservice teachers must be given the opportunities to examine their motivations and perceptions of biases and prejudices and move beyond them to avoid making these guilt-ridden decisions and actions in the future (Gay & Kirkland, 2010).

According to Krutky (2008), teacher educators need a “comprehensive model of transformational change that puts diversity at the center of the educational mission” (p.3). The approach that follows describes a way engage students that are PSTs in a life science content/methods course in learning about diversity and CRT. By integrating guided, purposeful opportunities for culturally relevant interaction with reflection, we challenge pre-service teachers to examine their own cultural assumptions via discussion using selected readings. These discussions are followed by live encounters teaching diverse students. We argue that CRT should not only incorporate culturally relevant content knowledge and pedagogical knowledge, but also personal consideration of how to create an inclusive classroom.

### **Course Inclusion of Culturally Relevant Teaching**

This study is informed by our understanding that becoming culturally relevant is an ongoing process that focuses on classroom interactions where preservice teachers (PSTs) have substantive and highly interactive conversations among themselves as well as with students and families in culturally diverse informal settings. Data from a required Kindergarten-8<sup>th</sup> life science methods course combined biological science content and science teaching pedagogy. Culturally relevant teaching (CRT) was intentionally included throughout the semester in meaningful ways through the creation of reading and writing assignments from selected CRT literature (e.g., Ladson-Billings, 1994). These different reading, reflection, and writing exercises were followed by three separate after-school experiential learning events (Family Science Learning Events) in ethnically diverse local elementary and middle schools. Family Science Learning Events (FSLEs) create intentional, authentic experiences that incorporate meaningful culturally relevant experiences that are related to science and have been conducted at over 80 different venues by the primary author (Ramirez, McCollough & Dias, 2016; Ramirez, McCollough & Dias, 2015;

McCollough & Ramirez, 2012; McCollough, McDonald & Canales, 2008). The reading, reflecting, and writing exercises and the FSLEs were required in the course, contributed to students' grades, and are explained in the course syllabus. This study reports how, for the first time, the FSLEs were preceded by reading, reflecting, and writing activities while applying culturally relevant teaching in a life science education course.

The overall course design strived to create an inclusive environment that engaged PSTs in conversations regarding diversity in classrooms. For example, readings from Ladson-Billings (1994) followed by personal reflection, written reflections and in-class discussions with additional information from other sources (Ramirez, McCollough & Diaz, 2015; Valenzuela, 1999) provided opportunities for personal introspection and productive classroom interactions. The instructions for these reading, reflection and writing exercises, known as Transformative Reading Exercises (TREs) are described in the methods section of the study.

Following TREs and classroom discussions, the course incorporated opportunities to apply experiential knowledge at three different FSLEs (Ramirez, et al, 2016, Ramirez et al, 2015, McCollough & Ramirez, 2012; Lee et al., 2012), which were part of the course syllabus and required PSTs attendance. These assignments and activities required that students continually think about and apply CRT strategies in the classroom and at the FSLEs, making those CRT strategies intentional and explicit in their writing and in the activities that they conceived and implemented at the FSLE.

This course design follows Kolb's (1984) classic learning model, where learning is the result of students engaging in a process in which they:

- Encounter new concrete experiences, such as a direct encounter with new people, perspectives and/or ideas;
- Reflect;
- Develop ideas and perspectives that can be applied to theories and rules that might describe the experiences; and
- Actively experiment to test ways to modify those ideas and perspectives in the future.

To support development, faculty must include intentional experiences and activities within our planned learning environments that provide a disruption, or event where students experience cognitive dissonance. Experiences need to challenge students to encounter diverse ideas, issues, and people, and give them multiple opportunities for active experimentation with diverse people and ideas (Lee, Williams & Kilaberia, 2011). This active implementation approach moves pedagogical practices from those that see students as passive receivers to students as active participants which is a more deliberate development of CRT and is far more likely to have a greater impact on students. Kuszewski's (2011) research found that active learning moved students from being a passive observer to active participant, because "you are lighting a fire in the brain - making more connections across association areas, increasing plasticity and enhancing learning" (p.2).

In this study, three different FSLEs each held at different venues with different ethnic and socio-economic groups over the semester, provided the disruptive learning experiences required to create cognitive dissonance and

provided encounters with those of different cultures. These experiences required students to personally apply culturally relevant teaching strategies as well. In this way, they were doubly impacted – in a student role, learning what it means to be culturally relevant and in a teaching role while enacting teaching pedagogy during the FSLE.

## **2. Methods and Data Collection**

Texas A&M University - Corpus Christi is a Hispanic Serving Institution with Hispanic students comprising 48% of the student population. Study sample size consisted of forty-two students who completed all required assignments, 54% of PSTs were Caucasian and the remainder Hispanic, with total of 40 females and two males. STU requires that all Kindergarten through 8<sup>th</sup> grade education majors take two science content courses in physical and life sciences. The lead author has been integrating FSLEs as part of the reformed life science curriculum to include culturally responsive topics that relate to content for 12 years, implementing over 80 events while impacting over 2700 teacher candidates, nearly 7000 family members and over 500 K-8 administrators (Ramirez, et al, 2016; Ramirez et al, 2015; McCollough & Ramirez, 2012; McCollough et al, 2008). This incorporation included adopting Ladson-Billings' (1994) concept of culturally relevant pedagogy that rests on three propositions (and aligns with Kolb's 1984 model): (1) students are empowered when they are successful, (2) students be instructed to use and maintain cultural competence, and (3) students must develop a personal affirmation and direction to choose and to use critical consciousness in challenging the status quo. The lead author used these propositions in planning and implementation of the Family Science Learning Events (FSLEs) (Ramirez, et al, 2016, Ramirez et al, 2015, McCollough & Ramirez, 2012, McCollough et al, 2008).

As previously established, purposeful assignments and activities that engage students in learning about CRT must lead to experiences that challenged students to encounter diverse ideas, issues, and people. The class design contained two vehicles for this approach, six Transformational Reading Exercises (TREs) and three Family Science Learning Events (FSLEs).

### **Transformational Reading Exercises**

Transformational Reading Exercises (TREs) are reflective reading and writing assignments created by the lead author and included in the course syllabus. Students were required to read chapters in Ladson-Billings (1994), and other seminal works in science (Carson, 1962; Leopold, 1966; Wilson, 1992) asked to reflect on their reading, using a series of guiding questions, and asked to write the results of their reflection as a response to the piece. The directions/prompts for this reading experience were different from the usual read and respond exercise, making them 'transformational' as students were emphatically instructed not to summarize the article/chapter, but to respond to it in a personal way. PSTs were informed from the very beginning in class that they are expected to carefully reflect and respond and to think deeply about the topics they are studying. They were asked to carefully examine their feelings about what experienced during the reading and experience. They were advised to think the ramifications of their newly acquired knowledge and ideas, and

how this impacts their personal perceptions and their vision as a classroom teacher (Gay & Kirkland, 2010). They were encouraged to be passionate, opinionated, thoughtful and provide personal experiences and/or feelings in their written responses. The following written instructions accompanied the assignment:

'While you are reading the article, record your thoughts either on a word document or on paper if you prefer to write. These should NOT BE A SUMMARY of the article, but your thoughts, opinions, memories, reflections, etc., AS YOU READ THE ARTICLE. Passion, specific detail and elaboration are KEY to making this a TRANSFORMATIONAL reading assignment.... Remember - TRANSFORMATIONAL reading should help you transform thoughts, see new insights, think of things you have not thought before. It should be personal, compelling, provocative, creative. Some students write poetry, some draw pictures, some do both, some just write - and they write with passion and feeling. Think of it like playing a musical instrument --- don't just play the notes, feel them. Write like you are feeling the notes and think about how this will impact your future classroom.'

Following the reading, PSTs were asked to answer some questions regarding the article that required reflective, critical thinking. Rubrics were distributed prior to the assignment (see Figure 1).

#### Transformational Reading Assignment (TRE) Rubric

Title of project: \_\_\_\_\_

Student's Name \_\_\_\_\_

CATEGORY	10	7	5	1
<b>CLARITY</b>	Topic/subject is clear, though it may/may not be explicitly stated.	Topic/subject is generally clear though it may not be explicitly stated.	Topic/subject may be vague.	Topic/subject is unclear or confusing.
<b>Content: ELABORATION</b>	Elaboration consists of specific, developed details.	Elaboration consists of some specific details.	Elaboration consists of general and/or undeveloped details, which may be presented in a list-like fashion.	Elaboration is sparse; almost no details.
<b>Content: SUPPORT</b>	Support information is related to and supportive of the topic/subject.	Support information has minor weaknesses in relatedness to and/or support of the topic/subject.	Support information has major weaknesses in relatedness to and/or support of the topic/subject.	An attempt has been made to add support information, but it was unrelated or confusing.

<b>STYLE Construction, fluency, syntax</b>	Demonstrates skillful sentence fluency (varies length, good flow rhythm, and varied structure), syntax is good, sentence construction solid.	Demonstrates reasonable sentence fluency with other items reasonable.	Demonstrates minimal sentence fluency with many mistakes in fluency/syntax/construction.	Sentence fluency is lacking with poor overall effort.
<b>Spelling</b>	No Spelling errors.	One spelling error.	More than a few spelling errors.	Entirely too many spelling errors - not acceptable.
<b>Overall Level of Reflection</b>	Beautiful, creative, innovative, extended writing reflection	Well done, met all requirements, not over the top but very satisfactory in level of writing and detail.	Could be better in originality and overall level of interest. Felt like a 'going through the motions' type of reading.	Not acceptable without major revisions.

**Figure 1: Transformational Reading Exercise (RE) Rubric**

The first TRE included an article written by the lead author regarding the importance of the ethic of caring in the classroom (McCollough, 2015). The TRE was graded per the rubric with feedback provided, but points were not recorded (this was not revealed until after the TRE was completed). Following the return of the first TREs to students, an exemplary response written by an anonymous peer was distributed to the students with the peer's permission, providing a standard of work expected in subsequent assignments. Students were also given a revision opportunity to improve their grade. Students reported that having an exemplary response to follow was very helpful, as they never participated in a reflective writing experience such as this one.

TREs were carefully scheduled through the semester to avoid overwhelming students during preparation for exams and FSLEs. Hard copies were required as students preferred this to submitting documents online (pilot study data) and allowed them to include artwork, photographs, and other documents in their submissions. This study will report on two of the TRE's assigned, "We Are Family" and "Culturally Relevant Teaching", both from Ladson-Billings *The Dreamkeepers*, (1994), chapters four and six respectively. This seminal work regarding effective teachers by Ladson-Billings (1994) described the idea of culturally relevant teaching as pedagogy intended to empowering students of different cultures. Briefly, Ladson Billings' chapter titled "We Are Family" (Chapter 4, *The Dreamkeepers*) discusses how teachers structure social relationships in the classroom and they extend those relationships outside of the classroom. Additionally, these culturally relevant teachers expected their

students to take responsibility for each other and to teach each other. In Chapter six, “Culturally Relevant Teaching”, Ladson-Billings (1994) describes how teachers helped students know that they (the students) were knowledgeable and capable beings. Even though these teachers were not always in agreement with their principals, principals deemed them as exemplary teachers. These chapters provided many examples of cultural action by empowering students of color intellectually, socially, emotionally and politically ultimately empowering them to challenge the status quo. Ideally, according to Ladson-Billings (2014), culturally relevant pedagogy can prepare students to become agents of change in society - not to just merely fit into society. It should be noted that these readings were purposefully assigned before any of the FSLEs took place.

### **Family Science Learning Events**

The second vehicle used in the study incorporated Family Science Learning Events (FSLEs). The lead author instructed and encourage PSTs to include culturally relevant science activities in FSLEs. The PSTs were expected to prepare, plan, and teach culturally relevant science activities to Latino families in informal, after-school settings throughout South Texas. To accomplish this task, the lead author required that each PST: (a) identify a topic that is relevant in science to our region. This topic must be related to the theme provided, (b) find life science content that is relevant and connected to the community, (c) prepare a seven to fifteen minute, culturally relevant science activity that requires participation from both the PST, the school students and their parents, (d) create a tri-fold poster (47.5' wide by 36' high) advertise their FSLE project and activity and incorporate English and Spanish translations on the poster, (d) present their activity to families that are in attendance throughout the one and a half hour event, and (e) submit a reflective report following the experience. Titles for these presentation boards were required to be in English and Spanish. Reflections were expected to be self-reflections of their perceptions during the event and reports of personal interactions they had with the families.

Prior to these events, there were many classroom discussions regarding culturally relevant teaching, how to incorporate culturally relevant teaching in the science classroom, and the importance of parental involvement in education (e.g., Darling-Hammond & Bransford, 2005; Delpit, 1995; Ladson-Billings, 1994). These discussions were designed to help the PSTs strengthen associations between Latino cultural experiences with science and increase their awareness regarding parental involvement in education. Prior to taking the Family Science projects/activities into the community, PSTs had a peer evaluation that preceded the first FSLE and received points per a rubric (see Figure 2), adding additional effort with peer feedback and revision.



Student Name:			
Title of Family Science Activity:			
Category	Scoring Criteria	Points	Scored Evaluation
<b>Organization</b> 20 points	Sequence of the presentation is easy to follow using visual clues provided. ( <i>Clues may include numbers, letters or arrows.</i> )	10	
	Text is simple and large enough to be read from a minimum of four feet away. ( <i>A standard, easy to read text is used. Both capital and small-case letters are used.</i> )	10	
<b>Presentation</b> 25 points	Graphics dominate the poster visually with text playing a support role. ( <i>Use graphics, cartoons, and figures when possible.</i> )	5	
	Presentation has a clear, culturally relevant lesson that incorporates science in an overt and obvious fashion.	10	
	Title clearly describes the activity presented. ( <i>Title is easily understandable and is written in English and Spanish.</i> )	5	
	Artistic elements of the poster are subtle and do not distract from the message of the poster. ( <i>Scientific posters present information clearly.</i> )	5	
<b>Scientific Activity</b> 55 points	The activity is fun and appropriate for student and parent and is engaging for student and parents.	20	
	Scientific information is presented in a clear and straightforward manner. This activity has a scientific purpose and intention and is culturally relevant.	25	
	The overall science in this activity and poster is <b>obvious</b> .	10	
<b>Score</b>	<b>Total Points</b>	100	

Figure 2: Rubric for Family Science Event peer evaluation

The PSTs were asked to write a written report of each FSLE experience, whether positive or negative, followed by reflections regarding the interactions with families that they remembered as impacting their involvement with the families as well as their teaching. For example, they were asked to describe specific conversations and interactions that they had with parents, students and administrators that attended the event. They were prompted to describe their thoughts and impressions of those that were ethnically different from themselves. These reflections were debriefed with conversations in the class and helped build a consensus through classroom practices that support student engagement through discussion.

In summary, students were adequately prepared for both FSLEs and TREs with classroom instruction regarding the researched theoretical framework and intended purpose for each exercise. Peer- and self-evaluations with feedback preceded the assignments, and class time was given for cultural discussions and encounters such as interactions with classmates of different ethnicities, learning science content outside of textbooks, and teaching pedagogy from the CRT literature. In the cases of the FSLEs, the public provided a supportive and positive environment in the after-school settings where these events took place. In many cases, explicit prompting and other guidance was provided in the form of written and spoken feedback from the instructor as tasks were assigned and assessed at every event, and in all cases, opportunities provided for revision and chances to improve their work. The research literature tells us that having adequate time and class structure for collaborative learning is necessary to give students the opportunity to develop their competency (Darling-Hammond & Bransford, 2005) and build in class relationships, creating trust between one another.

### **3. Data Analysis**

Following data collection of written reflections from FSLEs, the pre/post teacher quality survey, and two TREs, data was analyzed qualitatively and quantitatively as appropriate. This mixed method analysis gives more dimension to the study in that multiple data provide corroboration across different approaches, resulting in an uncovering and reporting of the conclusions based on researched explanations.

#### **Written reflections following Family Science Learning Events (FSLEs)**

Three separate FSLEs were conducted during the semester with students using the same activity/project at each venue. Venues included a public Kindergarten through third grade school in a middle-class socio-economic area, a middle school in a low socio-economic area, and in an elementary school in a low-socioeconomic area, all having a high percentage of Hispanic family attendees. Written reflections from each of the events were collected from students and were analyzed or coded using NVivo software and used the *Intercultural Knowledge and Competence VALUE Rubric (IKCVR)* (Association of American Colleges and Universities, 2010). IKCVR suggests a systematic way to measure our capacity to identify our own cultural patterns and to compare them

with others. According to the authors, the IKCVR rubrics are designed for use in evaluating and discussing student learning.

NVivo is a qualitative software program designed to code and retrieve qualitative data. Ideas can be stored in annotations and rich text memos that can be coded, linked and searched (McCullough, 2005). The categories for codes were created using the IKCVR (AAC&U, 2010) framework, and other codes emerged that described common teacher qualities. All relevant data were broken into data bits and were grouped by theme utilizing the IKCVR (AAC&U, 2010): Knowledge (cultural self-awareness), Skills (empathy), Skills (Verbal and nonverbal communication), Attitudes (Curiosity) and Attitudes (Openness). A miscellaneous category was created for data that seemed relevant but did not seem to fit a category that had been generated (McCullough, 2005).

### **Pre/Post Teacher Quality Survey**

PSTs completed a survey the first-class day which contained questions related to CRT, parental perceptions regarding Hispanic families and attitudes toward education, the value of FSLEs and a question where six characteristics related to teacher quality were ranked by students in order of importance. Following the semester, students from the class were contacted via email and asked to complete the question regarding ranking the same six characteristics for post-test analysis. Thirty-two of those students responded, for a response rate of 76%. These were qualitatively analyzed using a *t*-test.

### **Analysis of TREs**

Forty-two students completed all TREs, reading several chapters in seminal science and education literature. For this study, two chapters regarding culturally relevant teaching will be discussed. *The Dreamkeepers* (Ladson-Billings, 1994) TREs and associated instructions were clearly explained as previously described. Rubrics were distributed with each assignment and graded per the rubric and essays were copied before returning to the students. Names were removed from copies to provide anonymity and secured. The co-authors were trained in designing and assessing the reading and reflective writing exercises and shared this expertise during a university sponsored professional development session attended by the lead author. These same faculty members assisted the author in qualitatively analyzing the TREs using the IKCVR (AAC&U, 2010) rubric. Coding was done separately for each student for each of the two chapters assigned. Using the IKCVR (AAC&U, 2010) as a framework in identifying characteristics of what constitutes understanding cultural diversity/culturally relevant teaching, the following values were assigned for each of the six categories previously described:

- One point - minimal awareness; student demonstrates no real knowledge of cultural diversity/culturally relevant thinking.
- Two points - novice; student demonstrates an awareness of other's cultures in relation to their own.

- Three points – expert; student elaborates beyond the TRE and identifies a great awareness of cultural diversity/culturally relevant teaching.

During the evaluation sessions, the authors recorded comments that provided evidence for the coding in each category. The coding of all students and the categories had an inter-rater reliability of 89%.

#### 4. Results

The purpose of this study was to identify ways to create authentic, intentional experiences for PSTs to engage in culturally relevant teaching and create agents of change. These preservice teachers were involved in a planned curriculum with the desire to create an understanding of who they are as people, questioning their knowledge and assumptions regarding their own cultural competence while learning to master techniques for instructional change. The following results provide evidence from the study that show development and engagement of cultural consciousness.

##### Pre/Post Teacher Quality Survey

PSTs (n=42) completed a pre/post questionnaire where they ranked the following characteristics in order of importance for teaching and instruction:

- Classroom management
- Content knowledge (knowing the subject matter)
- Caring about my students
- Being a culturally relevant teacher
- Understanding the culture of my students
- Pedagogical knowledge (knowing how to teach).

When comparing the ranking of the characteristics of effective teachers, paired *t*-tests revealed that on the pre-test given the first day of class, there was little importance attached to be a culturally relevant teacher. The most important item indicated on the pre-test was ‘caring about my students,’ followed by ‘pedagogical knowledge (knowing how to teach).’ ‘Understanding the culture of my students’ was considered least important on the pre-test, placing last on the list, with ‘being a culturally relevant teacher’ the second to last of least importance. However, at the end of the semester, there were significant increases in importance/value of culturally relevant teaching. ‘Pedagogical knowledge (knowing how to teach)’ ranked most important on the post-test. Rated as second most important was ‘understanding the culture of my students’ and third, ‘caring about my students’ followed by ‘being a culturally relevant teacher’. When pre-tests were compared with post-tests in *t*-test, there were significant differences between the two test results. A *p* value of 0.002 from the paired *t*-tests revealed a significant increase in the perceived importance of being a culturally relevant teacher who understood the culture of their students.

## Transformational Reading Exercises

Data collected were the TRE reflections from the two different Ladson-Billings (1994) chapters (note: separate from pre-/post-tests described above). The three faculty members used the IKCVR (AAC&U, 2010) for qualitatively coding the TRE reflections. For the purposes of this study, the following categories were selected from the IKCVR (AAC&U, 2010) to rate the questions and reflections: Knowledge (cultural self-awareness), Skills (empathy), Skills (Verbal and nonverbal communication), Attitudes (Curiosity) and Attitudes (Openness). Because the class did not include information regarding 'Knowledge of cultural worldview frameworks' (the second item listed on the IKCVR), this item was excluded from rating. The three faculty members reviewed the forty-two TRE compositions and qualitatively rated the data using the three-point system for each category that is described above (Knowledge, Skills, Attitudes, etc.)

Results revealed that the Chapter 6, 'Culturally Relevant Teaching' had a much higher informed level of information (expert) than Chapter 4, 'We Are Family' as seen in Table 1.

**Table 1: Total score for all students (n=42) for each category in the IKCVR (AAC&U, 2010).**

<u>Chapter Title</u>	<u>Knowledge: Cultural Self Awareness</u>	<u>Skills: Empathy</u>	<u>Skills: Verbal and nonverbal communication</u>	<u>Attitudes: Curiosity</u>	<u>Attitudes: Openness</u>	<u>Total</u>
We Are Family (Chapter 4)	22	22	34	32	30	140
Culturally Relevant Teaching (Chapter 6)	76	63	70	62	69	340

A paired *t*-test indicated  $p=0.005$  ( $t=10.09$ ,  $df=4$ , SE 3.92). Therefore, there is a significant difference in the thinking, personal feelings and general interpersonal skills that support positive interactions in different cultural contexts (Bennett, 2008) between the responses written by students to the two chapters (and related activities). Ladson-Billings describes chapter four ("We Are Family") as the way classroom social interactions are structured, and chapter six ("Culturally Relevant Teaching"), as the way that teachers' culturally relevant teaching strategies go beyond the classroom content and instructional strategy (Ladson-Billings, 1994).

Note that in the class schedule, Ladson-Billings (1994) TRE chapter four ("We Are Family") assignment included a literature review and discussion of the history and theoretical background of culturally relevant teaching. The TRE for chapter six of Ladson-Billings (1994), ("Culturally Relevant Teaching") was assigned *after* these lectures and associated information had been presented,

presumably adding to the level of information (expert, in many cases) written in students' chapter six reflections.

Data support this statistically significant change in growth, self-awareness and affective perceptions between chapters in that PSTs' comments from chapter four, "We Are Family" (Ladson-Billings, 1994) are predominately superficial and lack deep understanding or personal importance: (pseudonyms used for all quoted responses)

- "The culturally relevant classroom is where the class is set up in diversity, not one particular race." - Lauren, future elementary teacher.
- "Culturally relevant means that classroom is fair and runs smoothly for students to work together." - Marisa, future elementary teacher.
- "I do think it's important to get to know our students as people, but honestly I don't know how I feel about seeing student [sic] outside of school." - Susan, future elementary teacher
- "When I first started to read this article, I felt sure I wouldn't be 'that' teacher who unintentionally hurts her students. Then I was worried I might be by accident. Now I'm sure as I read more, I will not be 'that kind of teacher'." Nikki- future elementary teacher.
- "Culturally relevant teachers use strategies that engage the community within his/her classroom." - Sonia, future elementary teacher
- "It's amazing how these teachers go out of their way to spend time with students away from the classroom.... One of the things I'm nervous about is finding ways to have out -of-school interactions with my students." - Lydia, future middle school teacher.
- "Culturally relevant teaching isn't just one big thing, it is a series of actions that together make a classroom functional and effective." - Aimee, future elementary teacher.

Student responses to chapter four, "We Are Family" lacked depth, specificity and were often superficial when asked to define what culturally relevant teaching meant to them. Students indicated they enjoyed reading the chapter and wanted to learn more, but the data clearly indicate that students were not really contextualizing the true nature of culturally relevant teaching.

Following this TRE, students heard a lecture, engaged in class discussion regarding culturally relevant teaching, and began to explore their own feelings regarding culture and perceptions and misconceptions. In addition, they were provided with videos that gave examples of culturally relevant teaching. Following these experiences, the TRE from chapter six, "Culturally Relevant Teaching" (Ladson Billings, 1994) was assigned and the following comments from student reflections help illustrate more depth of understanding and personal investment in CRT:

- "In the article, they were going over the Vietnam War and there was a Vietnamese girl in the class. She brought in pictures, maps, and letters to show to her class. This is an example of making your classroom culturally relevant." - Denise, future elementary teacher.
- "I feel cultural [sic] relevant teaching is having a bag of M&Ms, different colors, some different sizes, but they are all in one bag (class).... The

colors can stand for races. Well [sic] they all have different lives and experiences, but all have one thing common, wanting to learn and succeed. Using all this background can help one another succeed or get where they want to be because they're a team family now where they can feel safe and protected through and [sic] physical or emotional experience they may have." - Leanne, future elementary teacher.

- "My definition of culturally relevant teaching at this point ...is teaching that reaches a child/student on a whole other level, a level that digs deeper into who the child is, how the child relates to the content, and how each and every concept becomes purposeful and relevant to the individual. This is teaching that truly becomes an art." - Katrina, future elementary teacher.
- "This made me want to keep reading, it was like I craved the different emotions that the reading or lesson was bringing upon me." - Megan, future elementary teacher.
- "A culturally relevant teacher provides intellectual challenges by teaching the highest standards and not to the lowest common denominator." - Jose, future middle school teacher.

### **Family Science Learning Event Reflections**

NVivo software identified several key phrases that indicated PSTs attention to and inclusion of culturally relevant teaching in their FSLE reflections. Examples of NVivo phrases included:

- Negotiation in allowing student to reach conclusion [regarding climate-change activities];
- Connect learning to social, political or environmental concerns;
- Assessing conceptual understanding vs. regurgitation of science content;
- Students intentionally work with others cooperatively;
- Asking 'why' instead of providing answers leads to more questions;
- Connections made to non-dominant cultures [Hispanic culture]:
- Noted different perspectives presented from different cultures;
- Learning expressed in various ways;
- Spanish titles provided on project boards appreciated by Spanish-speaking families;
- Preservice teacher is team player with family members and students;
- Big-picture analysis includes relevant applications to community;
- Preservice teacher assesses knowledge in cumulative fashion;
- Misconception of parental non-involvement or caring by Hispanic families addressed.

Student remarks included the following: (pseudonyms used for all quoted responses)

- "My perspective of the children was different as they learned along with the parents. Bringing in the community was a great way to watch the children watching their parents as learners and we were watching everyone learn together. There were lots of

smiles on the faces of everyone!" - Elisa, future elementary generalist teacher.

- "I watched children make connections between our everyday life and science. I had some families who did not speak very good English. But I saw that students have a natural curiosity for science. They would ask questions and then explain the answers to their parents in Spanish. The parents face would light up, they got it! I loved Family Science Night." - Alma, future elementary generalist teacher
- "The one thing I will remember from this event is how many people actually came and how many parents actually showed up with their children. It was nice to know that there are parents out there who support their child's education, whether Hispanic or White, and are willing to learn from college students who are younger than themselves." - Kelsey - future middle school science teacher

## 5. Conclusions and Implications

PSTs who are sensitive to the need to be culturally relevant recognize the importance of adding to the strengths of conceptual and cultural knowledge that their students and their students' families bring with them to FLSE, rather than being subtractive or assimilative in ignoring or removing and replacing this knowledge with that of the "culture of power" (McCollough, 2005; Valenzuela, 1999). The individual PST does not generally learn to handle their distress concerning different cultures or apply their understanding of privilege through course content alone. PSTs gained these skills by having frequent, intentional and authentic opportunities to practice these skills and reflect upon those experiences. TRES provided the opportunity to read and discuss different perspectives regarding culturally relevant teaching. FSLEs provided relevant, substantive opportunities for PSTs to explore different perspectives of different cultures and practice and refine both cultural and scientific communication skills in diverse contexts. These PSTs indicated they were interested in discovering and re-thinking their misconceptions. They wanted their learners to construct their own meanings and PSTs recognized that those understandings will begin with the beliefs, understandings, and cultural practices that students bring to the classroom (McCollough, 2005).

The process of helping PSTs to understand and apply culturally relevant teaching is an important one and should not be done too quickly. The process should be carefully planned and allowed to unfold while in the classroom or at the FSLE in a way that provides opportunities to self-reflect on their commitments and values, plan and practice their responses to the perspectives of others and learn that this re-development of personal perspectives is a life-long process. The use of inauthentic settings such as typical teacher education and professional development programs does not provide real experiences, but



instead substitutes handouts and notes that provide two-dimensional tools that lack implementation and are disconnected from the training event.

PSTs need authentic teaching contexts in which to develop culturally relevant pedagogy, implementing their own conceptions and practices, and reflecting upon their experiences with the intention to refine culturally relevant teaching in their instruction while learning the science content. Family Learning Events are not limited to science and can also include mathematics and literacy. Published data confirms that all stakeholders benefit from these community events including PSTs, inservice teachers, administrators, students and families (McCollough et al, 2008).

This study outlines how repetition and refinement of the family learning events three times per semester with the same project used at different venues is part of the process of experiencing and learning about culturally relevant teaching and changing perceptions regarding other cultures while increasing self-efficacy in teaching science (McCollough & Ramirez, 2012). While many of these PSTs are members of the “culture of power”, they learned to recognize the importance of embracing students and family members who were primarily Hispanic, use Spanish on their presentation boards at the FSLEs, and practice teaching a culturally relevant science topic in an engaging and authentic way.

In the future, it is our hope that preservice education programs will provide the time, space and support that help develop effective culturally relevant teaching pedagogy through reading, reflection, writing, discussion and practice. The development of culturally relevant teaching involves not only knowledge acquisition, but instructional space that includes reflection, experimentation with feedback and revision opportunities, and sites that provide authentic interactions with others from different cultures.

The authors realize the limitations of this study include locations that were local and had a relatively small sample size of PSTs. Future studies could include more PSTs (more sections of this class) in diverse communities. Regardless of the size and location, these spaces should incorporate responsive and authentic contexts of practice with goals that include continuous assessment of practice, reflection, revision and refinement. PSTs require knowing about issues regarding diversity and knowing about how to engage diversity in an experiential way. They need carefully designed opportunities and assignments that are intentionally designed as culturally relevant and provide time to reflect on their learning in spaces that are interconnected, interdependent and diverse.

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