

## Preservice Science Teachers and Cultural Diversity Awareness

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### Abstract

Preservice science teachers hold a number of existing beliefs and expectations for their students from culturally and linguistically diverse (CLD) backgrounds. Many teacher education programs (TEPs) provide diversity coursework, multicultural education courses, and field experiences to better prepare preservice teachers for the CLD classroom. A questionnaire which included the Henry (1991) Cultural Awareness Diversity Inventory (CDAI) was used to examine the preservice science teacher's cultural awareness and sensitivity based on TEP coursework and field experiences. Findings suggested that the majority of participants were from predominantly White, middle class backgrounds and did not perceive their culture as different from their CLD students. However, they did exhibit some awareness of culture, linguistic, and ethnic identification for their students.

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### Introduction

Teacher beliefs and expectations play a significant role in student performance (Bryan & Atwater, 2002; Johnson & Atwater, 2014; Irvine, 2003; Pajares, 1992). Teacher predisposition as it relates to cultural diversity is an increasing concern for teacher education programs TEPs (Walker-Dalhouse & Dalhouse, 2006). Many TEPs grapple with adequately preparing their preservice teachers for the culturally and linguistically diverse (CLD) classroom (Barnes, 2006). A review of the literature for cultural diversity and preservice teachers revealed that there has been little change in the quantity of studies, research methods, topics addressed, and literature gaps for this topic between 1998-2004 (Trent, Kea, & Oh, 2008). Consequently, Trent, Kea, & Oh (2008) call for more research and a more comprehensive agenda relative to preparing preservice teachers for the CLD classroom.

Research on preservice teacher cultural diversity awareness is lacking and there is a need to further investigate the role cultural diversity awareness plays in teaching CLD students (Walker-Dalhouse & Dalhouse, 2006). Over the past decade TEPs have made more concerted efforts to better prepare preservice teachers for the increasingly diverse classroom (Liggett & Finley, 2009), but there is still much work to be done. Fortunately, today TEPs recognize the role that multicultural education courses (Asher, 2007), culturally relevant pedagogy (Johnson & Atwater, 2014), and field experiences play in the development of the preservice teacher. Subsequently, many programs offer required diversity and multicultural education courses and promote policies that emphasize the importance of culturally relevant teaching (Cochran-Smith & Zeichner, 2005 as cited in Liggett & Finley, 2009; Finley, 2000; Gay, 2000).

Researchers have identified various strategies to promote preservice teachers understanding of diversity (Barnes, 2006; Butler, Lee, & Tippins, 2006; Moore, 2008) and enhance the likelihood that they would implement theories and multicultural content learned in their TEPs and promote social justice in their own classrooms (Liggett & Finley, 2009; Moore, 2008; Nelson, 2008). One research study examined the role that teacher reflection using videotaped analysis plays in helping the teacher identify and recognize their own hidden assumptions and biases exhibited while teaching (Nelson, 2008). Cone (2012) demonstrated that preservice science teachers who participated in community-based service learning, developed beliefs about what characteristics effective teachers possess similar to the literature on effective teachers of diverse students. She also suggests that although preservice teachers hold a number of beliefs about CLD populations, these preservice teachers are still able to identify characteristics of an effective teacher of CLD students (Cone, 2012). This research is promising because it demonstrates that teachers can envision or understand what it is to be an effective teacher to all students regardless of their students' backgrounds.

According to Moore (2008), it is also important to provide opportunities for preservice science teachers to have discussions that promote reflection to better understand the role of power and language on science teaching and learning. Bryan and Atwater (2002) assert that teachers often hold different expectations for students in science relative to the ethnicity and gender of the student. There is also a soft bigotry of low expectations that exists relative to teacher perceptions of who can do science which often conveys hidden messages. Moreover, in the U. S. there has been a systemic misuse of science from an historical context that has perpetuated a system that is lacking in both equity and social justice in science teaching and learning (Green, 2014). Unfortunately, many students who are CLD through the hidden curriculum receive messages that that they are not intellectually capable enough to pursue STEM careers (Green, 2014). In addition, the perception that science and STEM is for "White, males, in lab coats" has perpetuated a stereotype that has disenfranchised many CLD students STEM pursuits and impacts interest, motivation, and attitude in STEM.

One of the most predominant issues in STEM education addresses strategies for promoting and enhancing STEM participation for students from traditionally underrepresented and underserved groups in STEM. The number of individuals in the

U.S. earning STEM degrees is of great concern given the low proportion of people in the U. S. persisting in STEM fields relative to other industrialized nations (e.g. Japan, China, and Singapore) (Goonewardene, Offutt, Whitling, & Woodhouse, 2012). Over the past several decades the U.S. ranking relative to the proportion of college students earning degrees in engineering and science has dropped significantly from 3rd to 17th (Goonewardene, Offutt, Whitling, & Woodhouse, 2012). Initiatives by federal funding agencies (e.g. NSF) have emphasized the importance of enhancing the U.S. competitiveness in STEM, while promoting STEM education and STEM diversity in a number of national agendas (Bayer, 2012).

In this increasingly technological and global economy promoting STEM participation, engagement, and career interest as early as possible is essential to provide more opportunities for students from CLD populations to persist in STEM (Owens, Shelton, Bloom, & Cavil, 2012).. Given the widening achievement gap in science education it is critical that preservice programs provide more meaningful science learning opportunities for each student in their classroom (Nelson, 2008) regardless of their socioeconomic, racial/ethnic, cultural or linguistic background. There is also a significant need to promote a learning environment that is nurturing and welcoming for students from traditionally underrepresented groups in STEM (Norman, 2014). Researchers have described numerous factors that adversely impact and pose challenges to the participation of students traditionally underrepresented in STEM (Cone, 2014; Norman, 2014; Pringle & McLaughlin, 2014; Rascoe, 2014; Russell, 2005; Russell, 2014; Suriel, 2014) Beginning teachers often grapple with understanding and implementing strategies that promote equity in teaching relative to their rapidly changing student demographic. Consequently, it is critical that science teacher educators prepare preservice teachers to promote equity and provide quality science learning to all students (Nelson, 2008). This, in turn will advance and broaden the scientific and technological workforce both nationally and globally.

### **Teaching in the Culturally Diverse Classroom**

Teachers are increasingly finding themselves in classrooms with students from CLD backgrounds that differ from their own (Brand & Glasson, 2004). More specifically, the population of Latino/as is increasing steadily in the American educational system (Suriel, 2014). In addition, the number of Spanish speaking English Language Learners (ELLs) is expected to continue to rise (Fry & Gonzales, 2008) with 80% of ELLs speaking Spanish as the first language (Gandara & Rumberger, 2009). On the other hand, the vast majorities of public school teachers are female, White, in their twenties, from middle class backgrounds, monolingual, and culturally encapsulated (Cozart, Cudahy, Ndunda, & VanSickle; 2003; Melnick & Zeichner, 1998; U. S. Department of Education, 2009). Although the student population in our public schools has become more diverse, the racial/ethnic makeup of the teacher population has not shifted much over the years (U.S. Dept. of Education 2009). Unfortunately the aforementioned statistics can be unsettling when juxtaposed with the fact that students in are not just multiracial and multiethnic, but diverse along the lines of linguistics, religion, economics, and ability (Ladson-Billings, 2000). Moreover, the globalization of education (Hutchinson, 2014)

has resulted in more immigrants in our schools than ever before and the ethnic/racial, cultural, and economic make-up of the classroom continues to become increasingly diverse (Suriel, 2014; Wallace, 2000).

The majority of teachers in public schools attended schools and lived in communities with very few people culturally, racially or ethnically different (Larke, 1990; Milner 2005). Irvine (2003) coined the term “cultural discontinuity” asserting the negative interactions that can occur between teachers and their students due to the lack of understanding of student culture. This lack of understanding often results in teachers essentially ignoring their students (Irvine, 2003). This can also have extreme consequences on teacher attitudes and expectations (Delpit, 1996; Howard & del Rosario, 2000) resulting in miscommunications, biases, lowered expectations, and inequities in the educational process (Reiter & Davis, 2011). Research indicates that students from ethnic groups or backgrounds that differ from their teachers are also more likely to face stereotype threat (Steele, 1997). One of the unfortunate repercussions of cultural dissonance or discontinuity is described as disjunction or lack of “cultural synchronization” (Irvine, 1990; 2003). Research has also demonstrated that preservice teachers often have existing stereotypical beliefs about students from diverse backgrounds (Patel & Crocco, 2007; Sleeter, 2001a, 2001b; 2005) that inevitably lead to inequities in the classroom. Teacher prior cross-cultural interactions, preconceptions, and behaviors have an impact on the development of students both socially and academically (Brown, 2004a, 2004b). Reiter & Davis (2011) have also emphasized the growing cultural mis-match between teachers and their students which eventually results in cultural and ethnic ignorance. Though it is important to emphasize that English-speaking, White female teachers can be effective and successful teachers of students from ethnically, culturally, or linguistically diverse backgrounds (Ladson-Billings, 1994), the many challenges they face as new teachers can be further exacerbated by cultural disjunction or dissonance.

Teacher beliefs about students from CLD backgrounds are often a result of very limited exposure and lack of cross-cultural contact (Irvine, 2003; Johnson & Atwater, 2014). In addition, due to low expectations, preservice teachers assume that students from underrepresented or underserved groups are less academically capable than their White and Asian counterparts. Prior research also indicates, that White preservice teachers often expected that schools that consisted of primarily racial minorities would have higher discipline problems, and expected students to be less motivated, less gifted and talented programs, higher rates of child abuse, and lower levels of parental support (Walker-Dalhouse & Dalhouse, 2006). Unfortunately, teachers that are unfamiliar with the background and culture of students are especially insensitive towards the needs of their “minority” students (Sleeter & Grant, 1986), and the cultural gap between students and teachers continues to become more exacerbated (Ladson-Billings, 1999; Sleeter, 2001a). As to be expected these teachers also expressed low levels of comfort around Black students and English Language Learners (ELL) (He & Cooper, 2009; Terrill & Mark, 2000) and the many of them preferred to have field placements in majority White, middle class settings (Walker-Dalhouse & Dalhouse, 2006).

## Purpose of the Study

The purpose of this study was to discover preservice science teachers' perspectives on cultural diversity as described by their responses to a questionnaire which included the Cultural Diversity Awareness Inventory (CDAI). This study was also designed to gain insight into their knowledge of cultural awareness and sensitivity based on responses to the questionnaire. This research study through quantitative methods addressed the following research questions:

- 1) What is the general cultural awareness and sensitivity of preservice science teachers?
- 2) What are preservice science teachers' perspectives on culture and linguistic awareness when teaching CLD students based on their TEP diversity coursework and field experiences?

## Methods

### Context

This study was conducted at a southeastern public university. The science teacher education students in this study had all completed a semester-long diversity course and at least one field experience. The field experiences often include service learning in community centers or outreach centers, as well as additional classroom based settings. Overall, the researchers sought to discover the preservice science teacher's cultural diversity awareness prior to the internship. Preservice science teachers in this study were at the critical transition points in their program of study just prior to the internship (the capstone field experience). The quantitative methods used for this study promote a context free perspective with the intention of generalizing research findings to determine effects, causes, and examine relationships (Creswell, 1994; 1998, 2008). Quantitative data obtained from the questionnaire were analyzed using the Statistical Package for Social Sciences (SPSS) 16.0. Descriptive statistics of participant responses were generated and reported included frequency counts and percentages.

### Participants

Participants were all preservice science teachers in the Secondary Science Education program at a university in the southeastern part of the U S. The study consisted of 35 participants: 13 males, 22 females, 23 undergraduate, 2 Traditional Master's and 10 Alternative Certification Master's majors. The participants ranged in age from 18 to 23 years. Purposeful sampling was used since the preservice science teachers were the most appropriate sample based on the purpose of the investigation. The preservice science teacher's racial/ethnic identification was overwhelmingly White (European American) with one student who identified as African American/Black and one student who identified as Asian /Pacific Islander. All had completed at least two years of undergraduate work and had been formally admitted into the science-education certification program. Demographic information was obtained from the participants to obtain background information on participants (i.e. what high school they attended, where they grew up) to provide a context for the teachers background.

The questionnaire was used to gain information regarding the backgrounds of the participants through demographic questions. The majority of participants described growing up and attending schools in predominantly White communities. In addition, the majority of the participants in the study were from middle class backgrounds. When asked about their career goals, the majority aspired to be teachers on the K-12 level. First, 70% of participants responded that their respective high-school settings were in suburban communities. Approximately 71% stated that the socio-economic status of their community was predominately middle-class. The dominant ethnic group within their high-school was reported as European-American/White by 86% of respondents. Lastly, when asked what their future occupation would be 77% reported teaching in a k – 12 setting as their aspiration. In addition, participants responded to questions examining whether they felt the diversity foundation course and field experiences encouraged them to respect cultures different from their own. Responses were 40% strongly agreed and 51% agreed respectively, and 9% neither agreed nor disagreed.

Participants were asked if they perceived that the course on diversity provided experiences to interact with persons from different cultural backgrounds than their own. Participants reported that 54% agreed with the statement. Lastly, participants were asked if the coursework was strengthened by the diversity of cultures and socio-economic backgrounds of their fellow classmates. Responses indicated that 51% agreed, 20% disagreed, and 29% were neutral.

## Data Collection

### Questionnaire

The participants were administered a questionnaire which included three sections.

**Section one.** There were fifteen items developed to obtain basic demographic data including gender, age, citizenship, and ethnicity.

**Section two.** The Cultural Diversity Awareness Inventory (Henry, 1991). The CDAI is a self-administered 28-item questionnaire (Henry 1991 designed to "...assist the user in looking at his/her own attitudes, beliefs and behaviors towards young children of culturally diverse backgrounds" (p. 4) and the inventory is measures an individual's attitudes, perceptions, beliefs, and behavior toward children of culturally diverse backgrounds different than their own. The Likert-type scale scoring ranged from (1) Strongly Agree to (5) Strongly Disagree. The CDAI consists of five subscales which include the following: 1) general cultural awareness, 2) the culturally diverse family, 3) cross-cultural communication, 4) assessment, and 5) creating a multicultural environment using multicultural methods and materials.

**Section three.** This part of the questionnaire consisted of questions designed to obtain the participants' perspectives of their required TEP diversity coursework and field experiences.

## Results

The following section will provide research findings. First, a description of the participants' academic backgrounds is presented. Then the general perception of science-

education teacher certification and foundation coursework is provided. Third, Tables 1 – 6 will display the participants' responses to the specific CDAI instrument items. Of particular interest is Table 1 that displays the overall means and standard deviations of the 5 CDAI instrument sub-categories. Each table will provide the means and standard deviations for each CDAI item categorized by sub-scale and a brief paragraph will provide further information about participant responses.

### **CDAI instrument responses**

As discussed earlier the CDAI instrument is comprised of 28 items divided into 5 sub-categories. The 5-point scale for the survey items was Strongly Agree (1), Agree (2), Neutral (3), Disagree (4) and Strongly Disagree (5). Within each table the survey item or category along with item means and standard deviations are provided.

Table 1

#### *CDAI Sub-categories*

	<u>Mean</u>	<u>SD</u>
General Cultural Awareness	3.54	.633
Culturally Diverse Family	2.91	.360
Cross-Cultural Communication	3.15	.441
Assessment	2.89	.570
Multicultural Environment	3.12	.302

Table 2

#### *General Cultural Awareness*

<u>Statement #</u>	<u>Item</u>	<u>Mean</u>	<u>SD</u>
1	I believe my culture is different from the students I serve	3.28	1.12
2	Identify students by ethnic groups	3.82	.984
3	Prefer to work with students who share my culture	3.51	.807
5	Uncomfortable with people who have values different from mine	3.74	.885
7	Surprised at minority participation in traditional non-minority school activities	3.31	.900

Table 2 displays the participants' response to the CDAI instrument items focused on cultural awareness. A significant number of participants either disagreed (31%) or were neutral (29%) when asked whether they believed that their culture was different from the students they served. Approximately 46% reported they disagreed with identifying their students by ethnic grouping or

characteristics. Roughly 49% of the participants disagreed with the notion of having a preference for working with individuals who shared their respective culture. Additionally, about 57% of respondents disagreed that they would not be comfortable with people who had values different from their own.

Table 3  
*Culturally Diverse Family*

<u>Statement #</u>	<u>Item</u>	<u>Mean</u>	<u>SD</u>
6	Teachers should have unplanned (social events) interactions with parents outside school activities	3.17	.890
9	Necessary to include parent input in program planning	2.22	1.00
10	Experience frustrations in conferences with parents of different cultures	3.22	.807
15	During initial meetings, teachers should ask families their preference for ethnic identification	2.88	.718
21	Parents know little about assessing their own children	3.42	1.00
23	Should include family views of school and society in school program planning	3.17	1.09
24	Schedule individual education program conferences or program planning at parent convenience for special education students	2.28	.825

As shown in Table 3, approximately 31% agreed that teachers should ask families their preference for ethnic identification. However, in regards to this statement, another 49% of respondents were neutral. Approximately 46% and 23% of participants agreed or strongly agreed that parental input was necessary during program planning respectively.

Table 4  
*Cross-Cultural Communication*

<u>Statement #</u>	<u>Item</u>	<u>Mean</u>	<u>SD</u>
4	Uncomfortable with people who speak non-standard English	3.51	.981
12	Regular curriculum should include ESL for non-English speaking students	2.62	.942
13	Students' spoken language should be corrected by modeling without explanation	3.45	.918
14	Sometimes non-standard English should be accepted	2.80	.843

Table 4 provides data associated with the cross-cultural communication sub-category. Responses indicate that 49% did not feel uncomfortable with people who spoke non-standard English. Roughly 43% of participants agreed with sometime accepting non-standard English in the classroom setting. When asked about including ESL for non-English speaking children in the regular curriculum approximately 46% and 34% of respondents agreed or were neutral respectively. Lastly, 49% of participants disagreed that a student's spoken language should be corrected using modeling without an explanation.

Table 5  
*Assessment*

<u>Statement #</u>	<u>Item</u>	<u>Mean</u>	<u>SD</u>
18	Students should be referred for testing if learning difficulties appear to be cultural or language differences	3.05	1.05
19	Adaptation in standardized assessments are questionable since it alters reliability and validity	2.91	.742
20	Gives standardized or intelligence tests in child's dominant language	2.71	1.10

Responses to the assessment sub-category item were the focus of Table 5. When asked whether an adapted standardized assessment instrument's reliability and validity was questionable 54% of the participant's responded neutral, 23% agreed and 20% disagreed respectively. 29% of participants agreed that standardized or intelligence tests should be provided in the child's dominant language. If a student's learning difficulties appeared due to cultural or language differences 31% of participants agreed that the student should be referred for testing.

Table 6  
*Creating a Multicultural Environment Using Multicultural Methods and Materials*

<u>Statement #</u>	<u>Item</u>	<u>Mean</u>	<u>SD</u>
8	Teachers should provide opportunities for children to share cultural differences	1.97	1.01
11	Solution to communication problems of certain ethnic groups is child's own responsibility	3.77	.807
16	Accept the use of ethnic jokes/phrases by children	4.37	.770
17	Sometimes accept racial statements	4.45	.852
22	Teachers should not be responsible for teaching ethnic customs and traditions	3.11	.900
25	Teachers should make program adaptation to accommodate diversity	2.34	1.08

26	Displays and materials should reflect at least three cultural groups	2.82	.923
27	Student job assignments (i.e., group work) should rotate regularly and equally in job assignments	2.20	1.10
28	Cultural knowledge should affect teacher expectation	3.14	1.00

Table 6 displays the findings related to sub-category creating a multicultural environment using multicultural methods and materials. When asked about accepting ethnic jokes/phrases from children, 54% strongly disagreed and an additional 29% disagreed respectively. Approximately 63% strongly disagreed with sometimes accepting racial statements in the classroom. A slight majority of respondents, 51%, were neutral when asked should cultural knowledge affect teacher expectation. Finding solutions to communication problems wasn't seen as a complete responsibility of children in certain ethnic group by 67% of the respondents. Lastly, 51% of participants supported making program adaptations to accommodate diversity.

### Discussion and Implications

This study examined the cultural awareness and sensitivity towards culturally and linguistically diverse students of 35 preservice science teachers relative to diversity coursework and field experiences. The two research questions were as follows:

- 1) What is the general cultural awareness and sensitivity of preservice science teachers?
- 2) What are preservice science teachers' perspectives on culture and linguistic awareness when teaching CLD students based on their TEP diversity coursework and field experiences?

Preservice science teachers enter TEPs with a number of preexisting beliefs, expectations, and preconceptions about teaching and learning (Cone, 2012). According to Bryan and Atwater (2002) and Johnson & Atwater, (2014) it is imperative that teacher educators understand more about the beliefs and characteristics that preservice science teachers hold when they enter TEPs. This insight may promote experiences that help these students understand the role their beliefs play on the success and achievement of their students.

It is important to raise preservice science teacher's level of awareness of diversity and the role culture and language play in teaching and learning. There is a significant amount of untapped talent and unlimited potential (Russell, 2005) among students from traditionally underrepresented populations and science teachers play a critical role in identifying and nurturing this talent.

#### Cultural Diversity Awareness Inventory (CDAI)

**General cultural awareness.** As shown by results in Table 2 relative to the General Cultural Awareness the majority of participants disagreed or responded "neutral" when asked if they believed their culture was different from their students and almost half did not agree with identifying their students by ethnic group, and having a preference for

working with students from their same ethnic or cultural background. The majority also believed they were comfortable around people with different values from their own. Based on these findings it would seem that participants interact with students from culturally different backgrounds in their TEP. Findings like this highlight the importance of addressing the colorblind mentality (Cochran-Smith, 1995; Johnson, 2002; Lewis, 2001; Milner, 2005). When students from the majority do not consider they are different or describe differences in their students this perpetuates the hidden curriculum and denies how culture or race/ethnicity impact perceptions. Lack of acknowledgment of student culture, background, gender, etc. can inadvertently promote negative stereotypes for certain students (e.g. African American, Latino/a) typically underrepresented in the STEM areas. If White teachers consider themselves as “culture-free” this is a concern because awareness and valuing of culture plays an important role in teaching and learning. Some researchers have discussed the importance of providing activities for students to write autobiographies and explore their own cultural background so students can identify themselves from cultural perspectives as well (Moore, 2008). This can help them become more understanding of the importance of the cultural backgrounds of their students especially when teaching CLD students.

**Culturally diverse family.** Participants were asked their perceptions of the culturally diverse family relative to ethnic identification of their students. The majority of participants did agree that they should ask families what ethnic identification they preferred. Moreover, relative to school program planning (i.e. IEPs) most participants agreed that parents were important and necessary towards the student’s progress. This is important because teachers need to be able to communicate their student’s progress to the parents and parents need to be aware of how the child is progressing. According to survey results participants expressed that they did not need to identify student by their ethnic group but the majority did believe they should ask families their ethnic identification preference.

**Cross cultural communication.** Preservice science teachers’ addressed their level of comfort communicating with parents of ELLs. The majority described themselves as not uncomfortable with people who did not speak Standard English. The majority also agreed or felt neutral relative to including ELLs in the regular curriculum and correcting student’s spoken language with an explanation. This may demonstrate that the participants understand the importance of acknowledging language diversity and efforts to accommodate ELL to promote their success. More science teacher educators and TEP need to require preservice science teachers integrate pedagogical strategies that support English Language acquisition addressing the challenges that emergent bilinguals (EBs) face in science (Suriel, 2014). This will also promote a more action-oriented, transformative and inclusive curriculum where teachers are advocates (Suriel & Atwater, 2012), for equity and social justice for all students in the science classroom can be realized (Suriel, 2014).

**Assessment.** Participants were also asked to address their perspectives on assessment for students who do not speak English as their dominant language. Moreover, distinguishing learning difficulties from what were actual cultural or language differences

was also addressed in the questionnaire. Based on the questionnaire results it appears that participants may not understand the critical role that culture and language play in assessment of student learning since the majority of student's responded neutral about the validity and reliability of adapted standardized assessments. Though a small percentage (29%) did believe that standardized test should be provided in the child's dominant language as well as recommending a student for testing if learning difficulties seemed to be attributed to language or culture. It is imperative that preservice science teachers understand the role of assessment in informing the teacher of a student's performance while at the same time understanding that standardized test are not really "one size fits all" and are normed against populations often very different from the students that take the exam. Culture and language also play a big role in test performance relative to the impact of test anxiety as well when students from culturally diverse backgrounds may be intimidated by not only the test but the testing environment, proctor, etc. This along with language and interpretation differences based on culture can adversely impact a student's test performance.

**Creating a Multicultural Environment.** The last subcategory addressed perspectives on creating a multicultural environment. The majority of participants did not feel it was acceptable to allow racial or cultural insensitivity in their classroom. They also supported a classroom that accommodated diversity and efforts to promote cultural and racial sensitivity. These findings are not surprising because it is to be expected that preservice teachers would work to ensure that their classroom was a welcoming environment and not promote racial or cultural insensitivity. However, one was that the majority of participants were neutral relative to accepting if or awareness of cultural knowledge of the teacher impacts their expectations. Lack of knowledge does impact how teachers interact with CLD in the classroom since this may convey the message that the teacher as apathetic to a student's culture. This also relates to the initial participant responses that seemed to show that teachers often see themselves as colorblind which can also show them as culture blind.

Lack of teacher knowledge about student culture promotes and communicates the "hidden curriculum" and further marginalizing students from culturally diverse backgrounds. Research by Moore (2008) with preservice elementary science teachers demonstrated the "power of knowledge" if teachers are to effectively teach in diverse urban elementary classrooms. Though the setting and teaching level is different from this study these tenets are still transferable and apply to all students relative to teaching students of culturally and linguistically diverse backgrounds. Participants in Moore (2008) understood the importance of getting to know their students and it is essential that students build a rapport and relationships with students if they are to effectively teach students from diverse backgrounds. According to Moore (2008) preservice teachers that lack experiences with diversity need more opportunities to learn about cultural differences and understand how to make multicultural connections in the context of science teaching and learning.

After analysis of quantitative data the majority of preservice science teachers did exhibited some cultural awareness and sensitivity. They expressed intolerance for racial

and cultural insensitivity in their classroom (through racial/ethnic jokes, phrases, etc.) and acknowledged it was important to accommodate diversity and promote multiculturalism in their classroom through displays of materials and program adaptations. They also acknowledged the importance of communication between the teacher and parent of culturally diverse students (especially relative to language diversity). As mentioned earlier many teacher education programs have designed and integrated courses that address diversity and multicultural education into their curriculum to better prepare preservice teachers for the increasingly diverse classroom. The majority of teacher education programs have at least one multicultural education or diversity course (He & Cooper, 2009) with a field experience similar to the course that students in this study take as part of their program of study. However, the impact of courses and field experiences can have mixed results where some students have a good experience and others encounter classroom and field experiences that reinforce negative stereotypes.

Moreover, consistent with prior research the “practice” of reflecting, discussing and debriefing relative to the preservice teachers field experiences needs to be structured in order to heighten cultural awareness and cultural competence (He & Cooper, 2009). Subsequently, it does seem like the course activities and field experiences impact the preservice teachers understanding of diversity similar to research by He & Cooper, (2009).

### **Conclusion**

According to Barnes (2006) preservice teachers that understand their own beliefs and attitudes become culturally competent teachers. Preservice science teachers hold their own attitudes and beliefs about diversity and TEPs need to continue to provide more enriching field experiences as well as integrate more courses that allow students to examine their own culture and beliefs. If students gain a better understanding of their own culture and the role it plays in how they view the world then this will better enable them to understand the role culture plays in how they teach and how students learn. Moreover, it is essential that preservice teacher educators promote experiences that go beyond the textbook (McClanahan & Buly, 2009) if we are to address the cultural biases that many students enter programs with and raise expectations for success and excellence in science for students from culturally diverse backgrounds.

Current research has identified frameworks, challenges, and ways for promoting equity and multicultural education in STEM to enhance the cultural diversity awareness of preservice teachers (Asher, 2007; Atwater, Russell, & Butler, 2014; Barnes, 2006; Butler, Lee, & Tippins, 2006; Cone, 2014; Johnson, 2002; Liggett & Finley, 2009; Moore, 2008; Walker-Dalhouse & Dalhouse, 2006). This study demonstrated that preservice science teachers possess some cultural awareness and sensitivity; however, this study did leave to question at what levels their cultural diversity awareness impacts their teaching which indicates a need for further research. Many TEPs have integrated multicultural education courses, more diverse field experiences, and policies to promote diversity and equity in However, TEPs need to be careful of “one shot courses”, and unsupervised field experiences in diverse settings especially when the field experiences are often dimensional in their diversity. Primarily this is not enough to challenge existing misconceptions and beliefs about CLD individuals. The challenges that TEPs grapple

with are increasingly pervasive given the lack of teachers of color, and overwhelmingly monocultural White teacher population that are not from the typical teacher population demographic. Another major challenge for science teachers is the increasing dropout rate of Latino/a students and ELLs (Brown & Rodriguez, 2009), as well as low performance on standardized tests by ELLs (Suriel, 2014). To address the need to promote the STEM participation of ELL students researchers have recommended strategies for promoting cultural congruence in the science classroom such as, “triangulation of science, English, and Spanish languages” (p. 223) as described by Suriel (2014).

The aforementioned is especially important when trying to investigate what additional strategies and methods are needed to heighten the preservice science teacher’s knowledge on culture, language, diversity and the impact of these factors have on their science teaching, expectations, and interactions with their culturally and linguistically diverse students. Moreover, a review of the literature by Trent, Kea, & Oh (2008) suggested the need for more research on facilitating and supporting preservice teachers and cultural diversity awareness. However, the integration of diversity and multicultural education courses, and field experiences, and is often a challenge for researchers whose colleagues often do not value research on diversity and equity and often face much apprehension (Trent, Kea, & Oh, 2008). Another challenge in TEPs is the lack of consensus and/or interest strategies for enhancing not only course content to prepare culturally responsive teachers but more enriching field experiences.

This study was concerned with interpreting the preservice science teacher’s cultural awareness and their knowledge of diversity and multicultural education. Within the context of this study it is important to recognize that race structures our lives and preservice science teachers hold existing beliefs about teaching and learning relative to students from diverse backgrounds. Preservice teachers construct their knowledge based on their prior experiences and limited experiences can have an impact on teacher interactions with CLD students. The overwhelming majority of preservice science teachers in this study fit the demographic of most of the public school teachers across the nation. Although, participants described little tolerance for racial and cultural insensitivity they were neutral relative to the impact that lack of knowledge of their students cultural background has on teacher interactions and expectations. Although their responses were encouraging there is need for further research to examine the role this plays in their actual teaching and impact on student learning and motivation. Moreover, research has demonstrate that “well-intentioned” teachers when viewing videotapes of their own teaching recognize that they are perpetuating stereotypes and marginalized some students without even realizing it (i.e. only calling on students they were in close proximity to, calling on more males than females, and rarely calling on ELLs, etc.) (Nelson, 2008).

### **Future Implications**

The findings in this study do offer a glimmer of hope that the teacher education programs are on the right track to better preparing preservice science teacher for a CLD classroom. However, their superficial or low level of cultural awareness based on

responses to the questionnaires is a concern that must be addressed more systemically in TEPs. This will help preservice teachers better understand the role culturally responsive teaching plays in the science classroom and can also enhance their students' interest in science. In light of the findings for this study it is important to provide an overview of additional research that has provided insight into strategies for promoting cultural diversity awareness. Some of the recommendations include, a) recruit more TEP faculty from culturally and linguistically diverse backgrounds, b) increase the number of CLD students in TEP programs, c) provide curricular content that prepares both preservice and inservice teachers as culturally responsive teachers (Trent, Kea, & Oh, 2008). However, another major challenge is for TEPs to come to a consensus as to what culturally responsive teaching should look like (Trent, Kea, & Oh, 2008). Some researchers also call for a transformative curriculum (Banks, 2001; Banks and McGhee-Banks, 2004; Suriel & Atwater, 2012), transformation of theories in multicultural teacher preparation into practice (Gay, 2000), and centralizing multicultural education across the TEP as opposed to isolated courses and experiences (Cochran-Smith, Davis, & Fries, 2004 as cited in Trent, Kea, and Oh, 2008). Another key factor is providing more guidance and supervision for preservice teachers in their field experiences. Preservice teachers are typically placed in field experiences with CLD students with little guidance from TEP faculty. Unfortunately, these students seldom have the opportunity to follow up on concerns and challenges they may face in the placement to better understand the role cultural diversity awareness plays in teaching.

This study's conclusions are consistent with those by Walker-Dalhouse and Dalhouse (2006) who expressed optimism in preservice students' cultural diversity awareness and beliefs are shifting in the direction towards some degree of enhanced cultural diversity awareness. If science teacher educators are to prepare preservice science teachers to become effective teachers of students from CLD populations it is critical that research continues to examine how their cultural diversity awareness impacts their teaching. It is also important to examine how TEPs can promote more collaboration across programs and partner with school professional development programs to prepare beginning teachers for teaching effectiveness in CLD classrooms. It is also imperative to better understand how to provide more enriching, guided field experiences and multiple diversity concepts and strategies to promote equity in STEM teaching and ensure teachers do not discourage their CLD students from STEM participation.

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