Urban Teachers' Perceptions and Practices of Culturally Relevant Science Teaching

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Abstract: This formative evaluation study presents a professional development program, "Earth Science Systems for Teachers (ESST)" held in a Midwest State in the United States. This study investigates how a professional development for urban teachers affects the teacher participants' perceptions of using the urban environment for their science teaching and their lesson unit development. The purpose of the program was to help urban teachers create science units using the urban geologic environment and its connection to urban students' everyday lives. The participant teachers' daily journal entries during the program, their lesson plans before and after the program, as well as their teaching reflections were collected as major data source. The teachers' daily journal entries were analyzed qualitatively and their pre-post lessons were analyzed quantitatively using a lesson plan analysis tool, Culturally Relevant Science Teaching Perspectives (CRSTP) was developed by the author. The lesson analysis tool was used to assess teachers' science lesson plans in the perspective of culturally relevant pedagogy and place-based pedagogy. The major findings include: 1) The teacher participants' field experiences in urban geologic sites and urban environments help the teachers to change their perceptions of using the urban environment as a teaching resource and 2) there were significant differences in their pre and post lesson unit scores based on CRSTP ($P<.01$). The implications of this study are also discussed.

Key words: culturally relevant teaching, urban science teaching, professional development, place based education.

Introduction

Urban teachers' science teaching practices are not separated from their perceptions of urban students as well as the urban environment (Burke, 2007; King, Shumow, & Lietz, 2001; Solomon, Battistich, & Allen, 1996). Unfortunately, the majority of urban teachers experience geographic and social distance between themselves and their students (Marx, 2006). Because of the socio-cultural barriers between urban teachers and their students, teachers often perceive their students' academic skills, knowledge, and motivation to learn based on mass media's negative images about urban low-income minority communities (Rothenberg, 1997). Urban teachers' perceptions about urban students and the urban environment affect their practice of science teaching (Lee, Hart, Cuevas, & Enders, 2004) and consequently affect their students' science achievement (Gay, 2000; Lee, 2004). First, you need to describe the feature of urban teachers'

To close the socio-cultural distance between teachers and urban students, many professional development programs for urban school teachers have been developed (Fideler, Foster & Schwartz, 2001). However, the majority of the programs do not cover many of the intended objectives (Blank, de las Alas, & Smith, 2007). In fact, most of the programs focus more on improving urban teachers' scientific content knowledge rather than improving their understanding of urban students and the urban environment (*et al.*, 2007). Science teachers' knowledge of the local environment is important to make science more relevant to the students (Fusco, 2001; Osisioma & Moscovici, 2008). Urban science teachers need to improve their understanding of the urban environment as well as of how to use the urban

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environment to make their science lessons more relevant to their urban students.

Studies about professional development programs that used the local environment (or place-based approaches) have shown that the teacher participants improve their confidence and classroom practice of using the local environment as a result of attending the programs (e.g., Hall & Buxton, 2004; Meichtry & Smith, 2007). However, there is little research about teachers' perceptions of urban environments and how their perceptions are reflected in their lessons.

This study presents a professional development program, Earth Science Systems for Teachers (ESST), that was designed based on the place-based approach and culturally relevant pedagogy. The purpose of the program was to help urban teachers create science units using the urban geologic environment and its connection to urban students' everyday lives. The purpose of this study is to determine ESST's impact on urban teachers' perceptions of the urban environment and their culturally relevant classroom practices. The specific questions addressed in this study are:

1) In what ways is the ESST program contributing to the teachers' perceptions of the urban environment and their view of urban science teaching?
2) In what ways is the ESST program contributing to teachers' lesson plan development in the perspective of culturally relevant science teaching?

Theoretical Framework: Using Urban Environment for Culturally Relevant Science Teaching

Making science teaching relevant to students from diverse cultural and linguistic backgrounds has become more and more important in urban classrooms (Burke, 2007; Lee, 2004; Lee & Luykx, 2006; Fusco, 2001). During the last twenty years, researchers in multicultural education have suggested pedagogical frameworks for a positive educational experience for historically marginalized students (Gay, 2000; Gonzalez, & 2005; Ladson-Billings, 1995; Lee, 2004; Sleeter, 2001). The frameworks have been termed differently, such as culturally relevant teaching (Ladson-Billings, 1995, 2006), culturally responsive teaching (Erickson & Mohatt, 1982; Gay, 2000, Sleeter, 2001; Villegas & Lucas, 2002), instructional congruence (Lee & Fradd, 1998), or inclusive teaching (Brown, 2002; Gess-Newsom & Southerland, 2000). These frameworks suggest ways in which teaching can be more culturally relevant to historically marginalized students considering the issues of teacher cultural awareness, pedagogical orientation, curriculum topics, and teaching strategies, as well as its impact on students' scientific achievement (Gonzalez *et al*, 2005; Hammond, 2001; Hyland, 2009; Ladson-Billing, 1995; Murrell, 2000). The emerging characteristics of these frameworks can be summarized by Ladson-Billing's (1995) three broad conceptions of culturally relevant teaching: teachers' conceptions of self and others, social relations, and content knowledge as followed:

- Conceptions of self and others – culturally relevant teachers are aware of their own cultural identity and believe all the students' academic success by providing accessible goals and encouraging students to be a productive member of a community or society.
- Social relations – culturally relevant teaching foster students' cooperative work rather than competitive, individual achievement.. They also demonstrate a connectedness with all of the students and maintain fluid student-teacher relationships by seeing themselves as part of the students' home community.
- Content knowledge – content knowledge is not static; it is shared and constructed by the community of learners (Gonzalez *et al.*, 2005). Thus, the teachers need to respect student's knowledge, experiences, and

practice in their everyday lives as funds of knowledge and use these for science teaching.

Unfortunately, in the culturally relevant pedagogy literature, a teacher's knowledge of her student's community is not examined enough as a critical factor that could shape students' funds of knowledge (Barton, 2002; Gruenewald, 2008). Recently, researchers have theorized the importance of place in shaping peoples' socio-cultural identity, such as critical pedagogy of place (Gruenewald, 2003; 2008) and placed-based pedagogy (e.g. Smith, 2002). The place where people live is not just a space where they construct their socio-cultural identity but also a space where people perceive themselves as a part of the ecosystems surrounding them (Haymes, 1995; Smith & Williams, 1999). In science education, researchers also argue that the place where their students live is an important source to connect school science to urban minority students (Burke, 2007; Cochran, DeRuiter, & King, 1999; Fusco, 2001; Hammond, 2001; King et al., 2001). Therefore, urban places and the natural environment should be considered as fundamental factors for culturally relevant teaching.

The importance of using urban geologic sites and the natural environment for more culturally relevant science teaching also has been addressed in literature (Bryan & Atwater, 2002; Davies, 2006; Hall & Buxton, 2004). However, urban teachers still believe that covering content in standards, preparing students for examinations, and keeping the science classroom efficient are more important in helping urban minority students achieve success in mainstream society (Tobin & McRobbie, 1996). This is not only because of their lack of scientific knowledge about how to connect the urban environment to their teaching (Bryan & Atwater, 2002), but also because of their stereotypical and negative images of urban environments (Smith & Williams, 1999). For many urban students, regardless of their ethnic, cultural, or social background, the urban natural environment is where they experience the natural world and construct scientific knowledge about it (Gonzalez *et al*, 2005; Smith, 2002). By using urban geologic sites and natural environments that are familiar to urban students, a teacher can easily engage the students in teaching important science knowledge related to it (Smith & Williams, 1999; Smith, 2002), promote their science learning outside of school, and further help them to improve their science achievement (Davies, 2006).

ESST Program

Context

The ESST program was a summer workshop for urban schoolteachers located in a large, Midwestern city in US. Geographically, the city is located near the Mississippi River and has many small and large lakes near the urban area. The city is characterized by a high percentage of immigrant populations typically from Somalia, Thailand and other countries in Southeast Asia, and Latin America, among others. According to the district records of the city, on average their urban schools have 80% minority students, 70% of whom qualify for free or reduced school lunch programs. Most of the urban schools have bilingual programs (Spanish or Hmong) based on the percentage of their respective minority students as well as English as a Second Language (ESL) classes. Despite the high minority student population, 80% of the teachers instructing these students are white females.

Program Description

The program was composed as two weeks workshop with one camping weekend that had a special focus on field-based investigations involving shoreline and on-the-water investigations on three lakes and three rivers in the urban areas. The purpose of the program

was to help urban teachers create a new earth science curriculum to better meet the needs of urban students by considering a specific urban geologic site, in this case, urban water resources. Thus, most of the program activities were designed to improve the teachers' curriculum development skills by connecting urban students' everyday lives with urban geologic sites and natural environments. The program also had a special focus on the improvement of the teachers' culture awareness and their social identity. From the perspective of teachers' awareness of their cultural identity and culturally relevant teaching, the activities in the program can be roughly grouped into three categories: cultural awareness, assessment of students' funds of knowledge, and curriculum development.

- Cultural awareness activities include having teachers assess their own cultural identities and socio-cultural experiences and then having them share these with the other teachers. By sharing their own cultural background, the teachers learned that culture can be defined in various ways in addition to religious and ethnic backgrounds.
- Assessing students' funds of knowledge includes learning about urban lifestyles and the urban environment, developing assessment methods such as survey and interview questions, and sharing strategies they already use with other teachers.
- Curriculum development activities involve having teachers create a teaching unit that could connect the students' everyday lives with urban geologic sites and urban natural environments, such as rivers and lakes. The teachers described their ideas about unit development and shared these with the other teachers.

With each of the activities, teachers were asked to reflect upon their thoughts and ideas in their daily journal entries.

Methodology

The purpose of this study was to examine how the ESST program affects urban science teachers' perceptions of urban environments and their subsequent curriculum development. This study presents both qualitative and quantitative results from the teachers' journal entries as well as pre-post lesson unit analysis.

Participants

A total of twenty-seven urban teachers participated in ESST. From those, eleven urban teachers were purposefully selected for this study because they were identified as Caucasian teachers from urban schools. Overall, there was a wide range of experience with teachers reporting one to thirty years of teaching experience. Five teachers were secondary science teachers and six teachers were elementary school teachers. All of the secondary teachers and one elementary science specialist (a teacher who is hired for only science teaching in an elementary school) only taught science subjects but the other elementary teachers' average science teaching time was two hours per week. The teachers were also diverse with respect to their prior science background. Their science course experience ranged from having taken zero to more than fifteen post-secondary science courses. None of these teachers was certified to teach earth science in high school level. One teacher was teaching earth science in an urban middle school and one teacher was teaching environmental science in an urban high school.

Data collection

The data of this study came from two main sources: 1) teachers' daily journal entries which included their reflections about the program and their responses to daily questions and 2) teachers' the lessons they developed before and after participating in ESST and teaching

reflections. Before and after the program all the participant teachers in ESS were asked to develop lesson plans. The lesson plan analysis provided the researcher with information about teachers' lesson topics, content knowledge, and pedagogical approach about a larger unit of teaching (Jacobs, Martin, and Otieno, 2008). Instead of observing all of the participants' classrooms, participants were asked to develop an earth science teaching unit before and after completing the ESST program. Each teaching unit (pre and post) the teachers developed included at least three lessons for teaching earth science using topics in earth and environmental science, such as water cycles, climate change, and rock. Lastly, the teachers implemented the post lessons during the semester following the program and were asked to write reflections on their experience. Total forty five lessons were collected from eleven teacher participants.

Data Analysis

This study utilizes mixed methods to analyze data. Qualitative and inductive data analysis methods (Patton, 2002) were used to analyze teachers' daily journal entries. First, the analysis focused on looking for variability and consistency in what teachers wrote about their perceptions of urban students, the environment, and using urban environments for teaching science. Common themes were found from the issues that the teachers consistently addressed. The teachers' lesson plans were analyzed by a modified lesson plan analysis tool based on the Science Lesson Plan Analysis Instrument (SLPAI), developed by Jacobs, Martin, and Otieno, (2008). I adapted the one main category as the main structure of the lesson plan analysis but changed the subcategories based on the theoretical framework of culturally relevant teaching. The teachers' lesson plans were analyzed quantitatively by using the modified lesson plan analysis tool called, "Culturally Relevant Science Teaching Perspective (CRSTP)". Therefore, the main purpose of CRSTP is to assess how a science lesson presents important aspects of culturally relevant teaching based on six categories: 1) Use of urban resources, 2) Responsiveness to urban students' cultural experiences, 3) Receptiveness of student diversity and equity, 4) Fostering cooperative learning community, 5) Student engagement, and 6) Assessment methods considering urban student's context (SES, Culture, Language). For more information, see Appendix. Each category was rated based on the 4 Likert scale: Exemplary (3 points), Developed (2 point), Needs Improvement (1 point), or Not Addressed (0 points). To present each teacher's unit score, I scored each lesson in the same unit using CRSTP and averaged them as a unit score. I also averaged the scores by the categories, as needed. The lessons were examined using independent double-scoring of 100% of the lesson plans (N=45) by three researchers, including the author, to ensure the validity. The average inter-rater agreement in this scoring was 87%.

Findings

Teachers' Perceptions Change about Using the Urban Environment as their Science Teaching Topic and Resource throughout the ESST Program

Through the analysis of the teachers' journal about their personal experiences in teaching urban students, I found that teachers had deficit images about urban students' socio-economic background, academic and language skills, and motivation to learn science before the program. In particular, teachers' deficit image about students' experience of the natural world was found to be related to their perceptions of urban environments and the urban natural world.

The teachers in this study believed that most of their students living in urban areas had low SES, low family support, lack of language skills, as well as low parental education level as compared to suburban students. Moreover,

because of their deficit image of students' low SES and family support, the teachers had stereotypical images of their students' academic skills, motivation, and interest in learning science. Most of the teachers also thought that urban students had not been exposed enough to the natural world because: 1) they believe that the natural urban environment is not sufficient in giving urban students outdoor experiences to connect their everyday life to the natural world, and 2) they believe that most of the low-income families are not capable to spend money and time to support their children's natural world experience. The following quote shows a teacher perception of the urban area:

> "As a science teacher who grew up in a rural area, I see the huge discrepancy between rural students and urban students in their connection to nature. In a city a concentrated effort needs to be made to experience things that are just a way of life in rural area. As nice as it is to have a park every 8 blocks in the city many of these parks are poor substitutes for nature. This makes connecting my students lives to nature all that more important." (Teacher journal entry on the second day of the program)

Because of their deficit image of urban students' experience of the natural world, the teachers might think that urban students lack interest in investigating the natural world and that they lack the knowledge and skills to investigate the natural world through scientific inquiry. In addition, teachers did not value urban areas as an important and relevant teaching resource to make their students more interested in learning science. Their deficit image of the urban environment is related to their image of urban students' experience and interest in the natural world as well as their instructional choice of using the urban environment.

During the program, the teachers learned about the natural urban environment including the history of urban geology, investigating urban rock layers, water quality testing in lakes and rivers, rain gardens in urban building, and urban water resources. As a result, the teachers became more interested in urban geology and more comfortable doing field investigation in urban geologic sites. More importantly, the teachers began to recognize the urban environment as valuable for their science teaching. In regards to one of the urban geologic sites we investigated, one of the teachers commented, "Viewing Dayton's Bluff and drawing it benefited myself by forcing me to stop and notice details on something I had driven by thousands of times and it was really interesting realizing that there is science practically in my school backyard" (Teacher journal entry on the first day of the program). As the following quote shows, the teacher participants also started to look at places near their school as potential field trips and class topics:

> "I'm going to take up the same sort of water sampling experience with my students. We are located near the Wirth Park Lake or pond, and only a short way from Brownie and Cedar lakes. I plan to take my students over there and have them do water sampling and brain storming like we did. I'll also try to find some pond or lake near where they live and help them raise some more awareness to what they could do to protect the ecology of any lake or pond in their own neighborhood" (Teacher journal on the seventh day of the program).

The teachers also realized that urban geologic sites are valuable teaching resources not only because they could connect their students' everyday life experiences to environmentally important scientific knowledge, but also because it could improve the student's environmental stewardship and motivation to learn about

science.

> "I would like to use this lesson to help educate my students at their level that they can do things in their own homes to help the environment around them. We could take a walk around the neighborhood of the school and identify problem areas like clogged storm sewers or fertilized lawns. We could notice all the fluids on the ground from cars and talk about how these things affect our environment and even directly affects our drinking water. This would bring a large-scale problem down to a level that the children understand" (Teacher journal entry on the eleventh day of the program)

Even if the teachers perceive using geologic sites as a valuable teaching resource, it is not enough to guarantee that their teaching would be culturally relevant. Culturally relevant science teaching is not only about topics that are relevant to the students but also about the purpose of using the topics: empowering students by respecting their knowledge from their everyday life experience, practice, and culture. For example, one of the teachers addressed the reasons she chose certain science topics for immigrant families before the program.

> "I choose weather (as a teaching topic) because I work with a very diverse, often transient population. In my experience the students and families I work with are not familiar with MN's ever changing weather. Our children often come to school dressed inappropriately! The families often times don't realize how cold it will get for winter. Having four dramatic seasons is unique for people coming from other climates. I think it is important for students to learn how weather impacts our daily lives and environments" (Teacher journal on the first day of the program).

This teacher chose a very important and useful topic for immigrant families from different climatic regions. However, her purpose for teaching this topic was to deliver knowledge about the local climate rather than to empower the students to have valuable knowledge and experience about different climates. Before attending the program, some of the teachers were already considering students' everyday life experiences when they chose science topics. However, if the teachers still have a deficit image about urban immigrant students, using urban geologic sites does not guarantee that their science lessons are meaningful as culturally relevant science teaching.

The program activities designed to improve teachers' skills to assess their students' funds of knowledge helped the urban teachers to recognize that their students have their own valuable knowledge shaped from their experiences in the urban environment. For example, the program addressed how to make a short survey asking about significant parts of students' lives in relation to the urban environment. Some of the questions asked about how often they cook meals, their families' favorite activities, places they like to shop, whether they can swim or if they have experience with boating and canoeing, and the kinds of vegetables they eat. Throughout the program, the teachers noticed that they needed to develop more concrete methods to understand a student's home culture and prior experiences. During the activity, teachers had time to discuss various methods of gathering information about students' everyday life experiences. Some of them already had their own methods such as observation, having their students write letters to the teacher, interviews, and games like "two truths and a lie." One teacher addressed the importance of using direct methods to collect information about her students' experience and how she wanted to do that in her journal entry:

> "From today's lesson, I realized that I could

give my students a classroom survey or record their answers to help guide the direction in which I could teach. Trying to bridge different cultures and experiences is a great place to start…. I never have asked students directly about their lived experiences. A lot of times during the students play, we discover them acting out something from their home land (i.e. like a student pretending to harvest rice). We then ask them into explaining more about lesson into those experiences. I now know after this class that it is so valuable to ask students about past experiences so that we can use these as an opportunity to educate children" (Teacher Journal on sixth day of the program)

Overall, throughout the program, the teachers gained knowledge about the urban environment and recognized positive aspects of using the urban environment for their science teaching. It helped them to gain knowledge about urban students and their everyday life experiences related to urban geologic sites and environment. Then the teachers recognized the importance of understanding urban environments as part of students' everyday life experiences and gathering information from their students for more culturally relevant science teaching.

The teacher participants also thought that they should build good relationships with their students to make the culturally relevant lessons more effective. They thought that if the relationship between teachers and students was not good enough, students would not listen and be engaged in science learning even if the topic was related to their everyday lives. In other words, they saw the necessity of building good relationships with their students to make students really learn about the culturally relevant scientific topic. One of the teacher participants describes this issue as follows:

"Finding ways to connect to their lives is not always easy, as my life is so different from theirs. I do think finding connections is key, but also know that my relationship with them is what's on tap. If they know they can trust me…to be real with them…they will engage to some degree and be willing to listen. Establish connections, use something familiar and real…that can be fun" (Teacher Journal on the third day of the program)

How were the Teachers' Lesson Units Changed after the Program?

In this section, I attempt to describe how teachers' earth science lesson units changed as a result of attending the program by comparing the teachers' pre and post lesson units. We (the author and other two researchers) assessed the lesson unit using the tool, CRSTP. CRSTP has six subcategories to assess the teachers' use of the urban environment as a scientific topic and the teaching strategies and assessment methods relevant to the urban students' socio-cultural background (See *Appendix*). Table 1 presents the results of the statistical analysis using a pared T-test of pre and post lesson scores of each subcategory.

As Table 1 shows, on average, there was a significant difference between pre and post lesson CRSTP scores ($p < 0.01$). However, statistical significances vary between the sub-categories. For example, there were significant differences between pre and post lessons for the last three categories; Receptiveness of Student Diversity and Equity, Assessment Methods Which Consider Urban Students' Context (SES, Culture, Language), and Teaching Strategy to encourage Students' Engagement, but not for the others.

In the "Use of Urban Resources" category, I evaluated how much teachers' lesson topics address the urban environment in relation to the students' everyday life. Compared to the pre lessons, teachers attempted to use the urban environment more as a science topic but there

Table 1

Summary of Means, Standard Deviations, and T-Test Results for Scores on the Pre and Post Lesson Plan Analysis using CRSTP (N=11)

	Pre lessons		Post lessons		
CRSTP Subcategories	M	SD	M	SD	*P*
Use of Urban Resources	0.64	1.21	1.55	1.04	.043
Responsiveness to Urban Students' Cultural Experiences	1.18	1.47	2.00	0.89	.055
Receptiveness of Student Diversity and Equity	0.27	0.47	1.36	1.21	.006
Fostering a Cooperative Learning Community	1.00	1.18	2.36	0.92	.010
Students Engagement	1.64	0.67	2.73	0.47	.000
Assessment Method Considering Urban Student's Context (SES, Culture, Language)	0.45	0.69	1.91	1.14	.007
CRSTP Average	0.91	0.62	2.07	0.60	.000

*P<. 01, paired T test

was not significant improvement in this sub category because they did not directly address the relation of the urban environment with their students' lives. Even if many of the teachers were teaching about weather and water topics using urban environment, for example, they did not directly address how the topic related to the students' everyday lives.

In the "Responsiveness to Urban Students' Cultural Experiences", category I examined how the teachers respond to their students' experiences and how their knowledge and practices have been shaped by their different cultural backgrounds, as it relates to the science topics. Few teachers used specific cultural examples from the urban students and most of the teachers did not consider the students' personal experiences, knowledge, and practices so there was no significant difference in this subcategory.

For the category, "Receptiveness of Students' Diversity and Equity," I was looking at how much teachers address and give value to equity issues such as gender differences or socio economic differences between the teacher and students. Compared to other categories, this category examines gender issues and SES. This category shows significant differences between pre and post lessons because most teachers tried to avoid expensive equipment for teaching science and instead used equipment that the students could easily find in their own homes. This might be a result of the survey development activities in the program or related to the lack of school science budget. For example, many teachers used the school yard to collect or observe things such as rock samples and leaves.

In the category, "Cooperative Learning and its Fostering Community of Learners," I looked at the teachers' strategies to foster group or collaborative work. Most of the teachers tried to use group work but unfortunately, they did not consider the students' diversity in terms of grouping them. They grouped the students based mostly on gender, academic skills, and students' neighborhoods.

The "Student Engagement" subcategory improved significantly. This subcategory is evaluated by teachers' summative reflections about their lessons as well as our evaluation of their teaching strategies for engaging diverse students. Many teachers tried to use various hands-on activities that minority students can easily engage in. For example, one of the teachers used local maps and global maps for teaching water resources and tried to engage

students who are from countries that have serious water shortage issues. This was related to the students' home and cultural experiences. However, I also found that the teachers were concerned about classroom management issues when they were using more examples from their students' everyday lives. For the teachers, culturally relevant science teaching was challenging because on one hand, it was a good approach to make students excited about science topics but on the other hand, it made the class messy, loud, and difficult to manage.

In the category, "Assessment Methods Considering Urban Student's Context," I was looking at teachers' assessment methods in response to their students' language abilities as well as the accessibility of science learning resources in their home. There were significant differences between the pre and post lessons in this subcategory. Many teachers tried to use different assessment methods for their urban students who were from low SES families and different cultural and linguistic backgrounds. For example, one of the teachers recognized that writing and conventional test assessments would be very difficult for her students so she decided that discussions, posters, diagrams, and concept maps would be better ways for instruction and assessment. She also read assigned articles for her low language ability students before she gave homework because she thought that hearing background information is important to encourage her low language level students to read the article more carefully and spend more time on the homework.

Conclusion and Implication

Throughout the program, the teachers became more interested in learning about the urban environment and their perceptions changed so that they were able to create meaningful teaching resources to improve their students' motivation to learn science. Their scientific literacy also increased. Before the program, the teachers did not hold themselves accountable for their instructional skills or scientific knowledge. Instead, they attributed their students' lack of success on the students' ethic group, socio-cultural background, parental support, and natural environment surrounding their students' community. As they gained knowledge about urban students' knowledge and experiences related to the urban environment, they recognized that they needed to gather information about students' everyday lives. The findings of this study demonstrate that urban teachers' knowledge about the urban environment is very important in helping them change their negative views about urban environments as well as to value urban students' knowledge and experience.

As a result of this program, teachers also recognized that they needed to build stronger relationships with their students. Building relationships with students during science teaching is not an easy task for all science teachers, especially if a science teacher is not the classroom teacher of the students. Like the advocates of culturally relevant pedagogy have argued, building relationships with students is especially important if the teacher's background is different culturally and linguistically than their students. As I argued earlier, using students' everyday life experiences in urban places in science teaching is important but missing components of culturally relevant pedagogy. By using students' everyday life experiences and the urban environment, urban teachers not only can create a context where students can share their knowledge and experience but also make students feel that their knowledge is respected. This is a crucial step to making their science teaching more relevant to their students' everyday lives.

More importantly, it affects their lesson design for more culturally relevant teaching by using the local urban environment. Overall, there were significant differences between their average pre and post lesson scores based on the culturally

relevant science teaching perspective (CRSTP) (P<. 01). Specifically, there were significant improvements in the sub-categories of the CRSTP; Receptiveness of Student Diversity and Equity, Teaching Strategy to Encourage Students' Engagement, and Assessment Methods Which Consider Urban Students' Context (SES, Culture, Language). This means that in the post lesson, the teachers used more hands-on activities for teaching earth science, used more science learning materials that students can easily find in their home, and increased graphical assessment methods for low language ability students. However, the teachers still needed to consider and respect the students' funds of knowledge from their home culture, experiences, and practices in their everyday lives when they make cooperative learning groups and when they address certain urban environments during the class.

While the teacher participants' field experiences in urban geologic sites and urban environment change their perceptions of urban students and urban environment, they needed to study more about students' cultural knowledge and experience related to the urban environment. Continuous support from the school and district such as financial, time support for field trips, workshops for learning students' cultural knowledge and experience are needed. Quality science teaching for specific problems and contexts, such as urban science teaching, is important for improving students' scientific achievement. It can happen if urban teachers have continuing support for learning the specific context of students' everyday lives, culture, and places they live. The information collected from this study could be used to reformulate the program and give some feedback to stakeholders including the State Department of Education, as well as scholars and program developers who are interested in developing professional development programs for urban teachers.

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Appendix

CRSTP Subcategories and Lesson Plan Scoring Rubric

CRSTP Subcategories	0	1	2	3
Use of Urban Resources (How much the teachers address urban environment as science topic and its relation to their students' everyday lives)	The lesson does not address any urban environment	The lesson addresses urban environment but does not address its relation to the student's life	The lesson poorly addresses urban environment and its relation to the student's lives	The lesson clearly addresses urban environment and its relation to the urban student's life
Responsiveness to Urban Students' Cultural Experiences (How teachers address their students' experiences, and knowledge and practices that have been shaped by their different cultural backgrounds in relation to the science topics)	The lesson does not address any experience, or practices related to the student's cultural back ground	The lesson addresses students' cultural knowledge, experiences, and practices but it is not directly related to the science topic	The lesson addresses students' cultural knowledge, experiences, and practices but it is poorly related to the science topic	The lesson addresses students' cultural knowledge, experiences, and practices and it is directly related to the science topic
Receptiveness of Students' Diversity and Equity (How much the teachers address and give value to equity issues, including gender and SES differences, in choosing science lesson topics and preparation of materials)	The lesson does not address any gender issues and does not give consideration to the low SES or low family support students	The lesson addresses gender issues and give consideration to low SES and low family support but its not directly related to the lesson topic or material preparation	The lesson addresses gender issues and gives consideration to low SES and low family support but it is poorly related to the teachers' choice of lesson topic or material preparation	The lesson addresses gender issues and gives consideration to low SES and low family support and it is directly related to the teachers' choice of lesson topic or material preparation
Fostering a Cooperative Learning Community (What teaching strategies were used to foster students' collaborative work with respect to students' cultural background and the knowledge they brought from their everyday life experiences.)	The lesson does not address strategies for cooperative learning	The lesson addresses the strategies for cooperative learning but does not consider the students' cultural background, experience, and knowledge from their home	The lesson addresses strategies for cooperative learning but considers the students' academic skills rather than their knowledge and experience from their home	The lesson addresses strategies for cooperative learning and considers students' cultural background, experience, and knowledge from their home as well as their academic skills

CRSTP Subcategories	0	1	2	3
Student Engagement (Teaching strategy to engage students from diverse cultural and linguistic backgrounds)	The lesson is a traditional lecture and does not address any strategy to improve student engagement	The lesson addresses strategies to improve student engagement such as hand–on activities but students' language and academic abilities are not considered	The lesson addresses strategies to improve student engagement considering students language, and academic abilities but not cultural knowledge and experiences	The lesson addresses various strategies considering students cultural background language and academic skill and shows evidence of high student engagement
Assessment Method Considering Urban Students' Context (SES, Culture, Language etc.) (The teachers consideration of the students context in choosing assessment methods)	The lesson does not address any consideration of students' context in choosing and addressing assessment method or materials	The lesson addresses the consideration of assessment method for the students context but does not develop specific methods	The lesson addresses the consideration of assessment method for the students' context but the method is poorly connected to the students' context	The lesson addresses the consideration of assessment method for the students' context and describes various methods depending on students' context