Urban Underrepresented Youths' Positive Experiences in an Informal Science Education Program*

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ABSTRACT: Making informal science education relevant and meaningful to students from low-income or ethnically minority groups is becoming an important issue in informal science education. However, there are only a few empirical studies about pedagogical approaches on the positive experiences of youth from minority and low-income families in informal science education settings. This study was conducted in an out-of-school science program for urban underrepresented youth in the United States. The main purpose of this study is to understand the youths' lived experience and personal history and how these factors meaningfully shape their experience in the program. Based on the understandings of the youths' lived experience in the program, the researcher describes what pedagogical approaches of the program make it more meaningful and relevant for them. By choosing culturally relevant pedagogy (or CRP) as a framework, it was found that the program's pedagogical approaches which support; 1) community building through learning and teaching science together and 2) treating young people as professionals are deeply related to the youths' positive experiences in the program and positive outcomes such as improving interests in science, self-esteem, social skills and identity as an active member in society.

Key words: underrepresented youth, informal science education, culturally relevant pedagogy

Ⅰ. Introduction

Despite nationwide educational efforts to solve problems of inequity in science education, a relatively low percentage of youth from low-income and non-mainstream populations are successful in science achievement and pursuing science related careers (Fadigan & Hammrich, 2004; National Center for Educational Statistics (NCES), 2011). While there are many factors that affect the science achievement gap between youth from minority and majority racial groups, unequal informal science education opportunities are argued as one of critical factors that expand this gap (Dierking & Falk, 2010). In fact, a significantly higher percentage of youth from dominantly white and high-income communities participate in informal science education programs than youth from low-income and minority communities (LaLonde et al., 2006). However, a higher percentage of certain groups participating in informal science education programs is not the only issue causing inequity in informal science education; it is also the programs themselves. Larson (2000) argues that youth from majority ethnic groups get more benefit from participating in informal science education programs than youth from low income, minority communities because the programs have been developed and designed based on a dominant western view of science or culture. In other words, informal science education programs themselves can make minority youth participants as minorities in informal science

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learning communities (Larson, 2000).

Making science education relevant and meaningful to students from low-income or ethnically minority groups is a more and more important issue in science education (Basu & Barton, 2007; Burke, 2007; Fusco, 2001). Over the last two decades, informal science education programs targeting youth from minority or low-income communities have been increased to solve the problems of unequal informal science education opportunities. However, there is little study about pedagogical approaches for the positive experience of youth from minority and low-income families in informal science education settings (Bell, et al., 2009). This is partially because historically critical pedagogical frameworks for the students from minority groups were developed with a focus on finding the reasons of achievement gaps in school science education settings. The history of multi-culture education is relatively short in the Republic of Korea. Recent literature about multi-culture education in informal education settings such as museum focus on program development for Korean people to change their perceptions about students and people from diverse background (Kang & Seo, 2011) and how to reconceptualize the role of the museum as an educational setting for diverse students (Joo, 2016).

This study is presented to understand pedagogical approaches in an informal science education setting that was designed to make the program more relevant to youth from underrepresented[1] urban communities. This study was conducted in an out-of-school science program for urban underrepresented youth, located in a science museum in a large Midwest city in the United States. For the purpose of the study, first I decided to understand the youths' lived experience and personal history and how these shape their unique meaning of their experience in the program. Next, based on our understandings of the youths' lived experience in the program, I describe what pedagogical approaches of the program make it more meaningful and relevant for them. I chose culturally relevant pedagogy or CRP as a framework to describe the program's pedagogical approaches and suggest ways of how CRP could be interpreted in informal science education settings.

Ⅱ. Theoretical Background: Culturally Relevant Pedagogy in Informal Science Education Setting

Student's science achievement is mutually complementary with their social identity, ownership of science knowledge, and experiences of science practices (Basu & Barton, 2007). Advocates of critical pedagogy have suggested that we need to broaden the purpose of education not just for improving students' interests or achievement in science but also for empowering them to be active members in science learning communities and build their identity as active social members (Erickson & Mohatt, 1977; Gay, 2000, Sleeter, 2001; Villegas & Lucas, 2002). Making science education relevant to a student's community or social needs is also one of the important objects of informal science education. As many researchers show, improving students' interests in science, engaging more students in science, and considering their identity as active social members have been identified as important outcomes of informal science education programs (e.g. Fusco, 2001; Falk & Storksdieck, 2005).

From a critical pedagogy perspective, learning science is a social process. It is dependent on a student's interactions with his/her peers, community members, and teachers in the given informal education setting. On the other hand, teaching is also a process of learning from the learners' about their community, culture, and knowledge from everyday life experience and living places. Based on critical pedagogy, many pedagogical frameworks have been suggested for ensuring a positive

1) Throughout this paper when "underrepresented" groups or communities are referenced it refers to girls/women, people of color, and people from low-income households.

educational experience for historically marginalized students from minority or low-income communities (Gay, 2000; Gonzalez, 2005; Ladson-Billings, 1995; Lee, et al., 2004; Sleeter, 2001). The frameworks have been given many names, such as critical pedagogy (Freire, 1970; 1973), culturally relevant pedagogy (Ladson-Billings, 1995), culturally responsive teaching (Gay, 2000; Sleeter, 2001; Villegas & Lucas, 2002), inclusive science teaching (Brown, 2002; Gess-Newsom & Southerland, 2000), or culturally congruent instruction (Lee, et al., 2007). For informal science education, these frameworks share three important pedagogical beliefs: 1) about students' academic ability; 2) social identity development; 3) and values of cultural knowledge and experience from the students' cultural heritage and community. I purposefully chose the term culturally relevant pedagogy, or CRP to describe how each of these beliefs could be interpreted in the informal science education setting.

First, the CRP approach shares a belief that all students can be academically successful if they are given accessible goals in a learning context. As Gay (2000) addressed, students from different cultures are likely to encounter more obstacles to school science achievement than "those who think, behave, and express themselves in ways of mainstream cultural norms" (pp.77-78). Social contexts that make minority students see themselves as minorities in science learning communities need to be considered as more critical factors than the simple correlation of cultural and language barriers and low achievement in science learning (Muller, Stage, & Kinzie, 2001). In the informal science education setting, institutional level practices of normative whiteness could impede the out-of school program involvement of minority students (Hurd, 2008). If an informal science education institution or a program focuses on improving minority students' academic achievement by using topics chosen based on what is relevant to school curriculum and the needs of majority society, the program can become another social context that makes minority youth a minority group in science learning. In an informal science education context, setting goals which are accessible to students implies that it is important to set goals other than academic achievement. Some more accessible goals could be increasing interest in science or stewardship for our environment and helping students be more aware and critical of current science issues in our society. A teacher's beliefs of what society has deemed is best for both his/her teaching and his/her students' learning in science could increase the achievement gap between minority students and mainstream students (Tobin & McRobbie, 1996). Helping the youth to accomplish these goals without feeling that they lack scientific knowledge, experience, or family resources is also an important factor that can make informal science education programs more accessible for youth (Fusco, 2001).

Second, CRP approach advocates that students can positively develop their identities as active social members if they are encouraged to be productive members of a community or society. In most cultures, youth are placed in a nebulous social position when they have outgrown childhood but aren't yet accepted as adults. Thus, their role as active social members is ambiguous in terms of their right to participate in decision making for the society and their actual contributions to the society. Often times, as expressed in youth development literature, minority youth are even dealt with as trouble makers with problems like early pregnancy, drug use, or violent activities in their schools. Kurth-Schai (1988) argues that the underestimation of youth's ability as inactive member of society is the result of the current legal and education systems, in which the major task of youth is academic achievement, not participation in socially approved productive work or important decision making in their community. Because of the school's definition of the success of youth development such as success of academic achievement, youth struggle with "conflicting perceptions of their abilities and inadequacies, rendering their social presence inconsequential and their social power invisible" (Kurth-Schai, 1988, p.116).

Recently, the importance of youth service experience in a community has been argued not only for their identity as active social member but also for educational progress (Spring, Dietz, & Grimm, 2006). Unfortunately, youth from low-income communities have fewer opportunities for engagement in civic life because they are exposed to fewer adults modeling this engagement, and experience a lower rate of family engagement (e.g. Wilkenfeld, 2009). More notably, schools with high rates of students in poverty are less likely to offer civic education opportunities than schools with low rates of students in poverty (Kahne & Middaugh, 2008). From this perspective, making informal science education programs more relevant for youth means that the programs should offer opportunities to minority youth to provide service for their community as active social members who can make important decisions and do productive work in their communities or in a larger social context (Fusco, 2001).

Lastly, and most importantly, advocates of CRP believe that minority youth have valuable experiences and knowledge from their home and culture that could be drawn upon to connect their lives to school content knowledge (Burke, 2007; Lee, et al., 2004; Fusco, 2001). Urban students' knowledge, experience, and practices from their home culture and history is referred to as "funds of knowledge" (Basu & Barton, 2007; Gonzalez, 2005). For example, urban students' funds of knowledge could include their experience of teaching their siblings, cooking meals for their families, and gardening. Urban youth's funds of knowledge should not be considered as barriers to learn science, but as complex sources of knowledge for learning (Gonzalez, 2005; Muller, Stage, & Kinzie, 2001). Using urban youth's funds of knowledge as a teaching resource makes them more engaged in science learning (Davies, 2006), makes their science learning more meaningful and relevant in their lives (Bryan & Atwater, 2002), and sustains their interest in science (Basu & Barton, 2007). If an informal science education setting allows youth a context in which their funds of knowledge can be shared with their peers, they can contribute to construct new knowledge that could be shared with others regardless of their backgrounds. Working with youth from marginalized groups for developing a multicultural exhibit or set of activities for a common audience would be an example of this approach.

The three perspectives of CRP are interactive and complementary for ensuring youth have successful informal education experiences. In this study, we describe how the program affects positive youth development such as developing social skills, self-esteem, competence in teaching, and confidence as scientifically literate citizens. I also try to understand how the program's characteristics structure the program to be more culturally relevant to the youth using the CPR perspectives. I hope this study informs a larger conversation about how to design program and curriculum for out-of-school science programs for youth, specifically urban youth from low-income households and minority racial/ethnic groups.

Ⅲ. Methodology

The purpose of this study is to uncover the meaning of the experience of youth from historically marginalized racial groups or low-income communities in an informal science education program and how the program is meaningful and successful in terms of the youth's needs and social context. I chose phenomenology as a research methodology (Van Manen, 1997). The most important purpose of phenomenological research is to find the meaning of human experience through examining how human beings make sense of their experiences and transform experiences into consciousness, both individually and as shared meaning (Patten, 2002). However, our "common sense" pre-understandings, our suppositions, assumptions, and the existing bodies of scientific knowledge are considered a problem that predisposes us to interpret the nature of the phenomenological questions (Van Manen, 1997). I believe that phenomenology doesn't mean the subjective way to see the world and human experience. As Van

Manen (1997) said, "in human science, subjectivity means that one needs to be as perceptive, insightful, and discerning as one can be in order to show or disclose the object in its full richness and in its greatest depth". Also, "objectivity means that the researcher remains true to the object". In this perspective the researcher becomes in a sense a guardian and a defender of the true nature of the object.

1. The researcher

This study is based on the researcher' interpretations of how the program affected youths' positive development and how their experience in the program meant different things to each person. The researcher is from outside the program. She is an international researcher in science education. She brings her experience as a secondary science teacher and perspectives from her experience in a different culture to interpret the youth's experiences.

2. Context

The Earth Discovery Team program, is an out-of-school-time program at a Science Museum, located in the urban center of a Midwest city in United States. The museum has a youth education center that is specified for youth education to encourage young people from underrepresented backgrounds to engage in experiential learning and work that develops their confidence in and appreciation for science, technology, engineering, and math (STEM) fields (i.e. Science, Technology, Engineering and Mathematics). The center annually engages approximately 100 youth 12−18 years old in volunteer and paid work opportunities. Youth work as museum volunteers or part-time, paid staff in small teams facilitated by adult managers. They educate museum visitors, build exhibits, develop community STEM projects/presentations, and do scientific research. The youth participating this program are empowered to take an active role in the planning, research, design, implementation, and evaluation of their own program and projects.

The Earth Discovery Team was one of the senior level teams (lead crews) in the youth science education center. The team was composed of 8 to 12 junior and senior high school students who were led by an adult program manager. The team provided public outreach activities based on the work of the research center and related earth science topics. By joining the Earth Discovery Team, youth learned about earth-surface processes, specifically those related to water, and the role humans play in affecting the processes; personally developed and strengthened teaching skills so they could educate the public (museum visitors and school outreach groups) about earth-surface processes; and became aware of STEM careers and explored educational and professional opportunities in these fields. The primary activity of the Earth Discovery Team was developing and sharing water-based earth-surface process activities with the public. The youth visited after-school program sites during the winter to share activities with elementary students. During the summer, the Earth Discovery Team facilitated activities for visitors in the museum's outdoor science gallery, the Big Back Yard. Between 2,000 and 5,000 museum visitors interacted with Earth Discovery Team members each summer.

When the outside researcher met the Earth Discovery Team youth they were preparing for their winter outreach season. Based on what the youth learned through teaching in the Big Back Yard during summer the team spent the fall (September-December) developing an outreach education program for the winter months (January-March). The audience for the outreach program was elementary aged students in school-based and recreation center-based afterschool programs. The youth developed earth science focused lesson topics such as environmental issues like urban water resource management and geological issues related to water movement. Earth Discovery Team members worked together to improve lessons from previous years and develop new lessons based on their interests. They pursued interests that arose from field trips, hands-on activities and research using earth science literacy standards and environmental education resources. The

program manager helped them find resources for lesson development, gave comments on what they developed, and supervised their overall work. The program manager also provided mentorship for the Earth Discovery Team members, helping them plan for higher education opportunities, finding and sharing information for college entrance and accessing financial support such as scholarships and grants.

3. Participants

Many youths from marginalized populations such as low-income individuals and ethnic minorities live in the urban area where this study was conducted. The narrowed definition of urban youth in this study is the youth who are from low-income families, are girls, and/or are people of color living in the urban area. This study is based on the lives of six urban youth who worked on the Earth Discovery Team. They were all urban eleventh and twelfth grade students (two males and four females) who attended school in the city's public school district-. One male student was Caucasian and all others were students of color from different ethnic groups (African American (n=1), Hispanic (n=2), Egyptian (n=1), Hmong (n=1)). All of them were born in the United States and from immigrant families (except African American girl).

4. Data collection

The data comes from three main sources: 1) intensive three-hour long observations at the program during the fall, including two, three to six-hour long field trips to sites along the River near the museum and the city's wastewater treatment plant and one and one-half hours observation of outreach teachings during the spring semester; 2) taped and transcribed interviews with six youth and the program manager, including informal conversations with the program manager (two, one- hour interview with the program manager and six, one-hour interviews with six youth); 3) artifacts, including lesson plans and youth reflections and blogs discussions about their experiences in the program through an internet site (http://Ning.com).

5. Data analysis

Van Manen's (1997) phenomenological reflection was chosen as an analysis method to find the essential themes of the youth's experiences in the program. The phenomenological reduction requires that the researcher attempts to hold as closely to the phenomenon as possible with the focus being on understanding the subject's experienced meaning instead of on descriptions of overt actions or behavior (Polkinghorne, 1989). For doing phenomenological reduction, first I had to check my belief and pre assumptions about the experience which I wanted to understand. I also tried to be aware of my own lens through which I was seeing the experience. Second, I carefully read the transcripts of the interviews and the observation (filed) notes to find the main themes of the data. The themes found by doing thematic analysis of text (interview transcripts) or observation were used as essential aspects of the experience for structuring the findings. I also tried to deconstruct some of youth's language and behaviors for more meaningful descriptions.

Ⅲ. Discussion of Cross-cutting themes: Interpreting the program's pedagogical approach through the lens of CRP

While the youth have various experiences in the program that can be interpreted differently based on each youth's unique personal history and culture, the Earth Discovery Team program commonly affected their positive development in the following ways: developing their teaching skills and communication skills, developing their identity as active social members and self-esteem, and improving their interests in science, scientific literacy, and environmental stewardship. I believe that these positive outcomes are related to the

program's pedagogical approaches that support; 1) Community Building through Cooperatively Learning and Teaching Science, 2) Treating Young People as Professionals, and 3) Providing Systematic Support for Science Knowledge and Teaching Skills. In the following, I discuss these three cross-cutting themes of the pedagogical approaches through the lens of CRP; how the program situated the youth as active social members, and how the program encouraged the youth to use their knowledge from their culture and everyday life experience.

1. Community Building through Cooperatively Learning and Teaching Science

Cooperation was a thread that ran through the entire teaching process, from researching, developing, and practicing the lessons to teaching and reflecting on their experience. In the process of choosing new topics, the Earth Discovery Team members needed to study the topics and teach their peers. When someone found an interesting topic, he or she shared it with other members to get consensus that it fit with the overall goals of the program. When an idea got agreement from other members, the members worked together to find an appropriate activity. The youth worked in pairs or groups of three to research and develop lesson plans. They worked together to choose topics, research activities, and practice teaching the activities. They got closer to reaching their goal of teaching the younger students by working in small groups to teach each other the activities. Each small group taught the rest of the group and then they all discussed ways to improve the activity. After this the groups worked to revise their activities and then re-teach them to the other group members. Sometimes it took a week or a month to make sure that the activity was ready to go. The time frame for developing lessons took longer than if the program manager would have taught the entire group but the youth developed more ownership and mastery of the activities this way.

During the outreach season they continued to work together to facilitate the learning activities for younger students. They actively supported each other as they took turns teaching activities at the sites. They engaged in reflection after each teaching session and during meetings held between teaching sessions. By sharing successes and challenges from their teaching experience they talked about appropriate methods to deliver content knowledge. The youth helped each other think more deeply about the purpose of teaching and what they needed to consider to be more effective teachers. The cooperative working experience made them feel part of a learning community that was successful because they supported each other.

Feeling that they have a community or common culture they could share together promoted positive interactions among the youth and consequently helped them improve their teaching skills, social skills, and communication skills. For example, Shani had science knowledge from her reading and teaching skills that had been developed through the experience of teaching her siblings, but showing it to her peers was a challenge for her. Shani had a personal problem. She had been struggling with depression for about four years and had eating disorders. She moved to different schools because her parents thought that the schools were the source of her problem. Every time she moved to a different school, she struggled to make friends. However, In the Earth Discovery Team, Shani's science and environmental interest and knowledge played a very important role in developing lesson plans and helping other team members understand science concepts. When she needed to explain scientific concepts to others, she checked their misconceptions by asking simple questions first and tried to do her best to find an easy way to explain the concept or find appropriate examples for it. Consequently, the process of teaching others about science helped her to develop her social skills and speaking skills in front of many audiences.

> "I want to be something involving science. I'm still deciding on what I should be but I think its important, what I'm doing now here, because I know that is

important for the future. I know I'm going to be working with a lot of people, interacting with them, and I don't know. This place helped me develop my speaking skills because I used to be really shy. I would say nothing, I would just be in my corner, not saying anything. But here is a place for me to put my ideas out there."

Being respected for her science knowledge and the opportunities of helping other youth members made Shani more socially active. For Shani, the Earth Discovery Team became a place where she could meet people who can make her happy and feel accepted anytime. Expressing what she liked most about the job, she said, "Well I like the people, they make me laugh. I just like the environment, it's a place I can come, even if I don't have work." Shani believed that she had a place where she was accepted as a friend as well as an expert in science. For Shani, the co-teaching experience helped her show her science knowledge without being shy and to be more open minded to get feedback from her peers.

The supportive learning environment built in the team was not just important for their teaching and social skill but for their own learning and successful school life. In the case of Manuela, being an Earth Discovery Team member was initially important for Manuela not only because she could get money for her but also because her school life, grades and homework, could be carefully supported by the adult staff in the program. Manuela really needed a supportive adult who could help her pass the reading, writing and mathematics classes to graduate high school. Because of a lack of academic support from her mother and older siblings, Manuela had not experienced being carefully cared for throughout her academic progress and pursuing a higher education until she joined the program. In the following quote, Manuela described how having supportive adults from this program encouraged her to pursue her further education.

"They (the program managers) encourage me to do more so if you want to do this or that, you can learn how to do better. They send emails about all the scholarships you can apply to, it's really good I have this job because they really want to help you. If you have a problem or something, you can come to them, because I have trouble reading and math, that's my trouble in school, reading is the most, I can read it, I know what they mean, but if I've never seen them, I wouldn't know what they are. What I like about this job is they help you, you can come here and bring your homework and they'll help you, you can stay an hour after work and stay with them and they'll help you to understand. I like how they communicate with us and stay with us."

For Manuela, being cared for by supportive adults for furthering her education meant more than just help; it meant providing hope for her future. Because of that she was always excited about talking about her high school graduation, college entrance, and receiving potential scholarships. The supportive environment that the program provided made Manuela have hope for her postsecondary education.

Like Shani and Manuela, the Earth Discovery Team was a safe social space for other team members that invited them to show their personality and share valuable personal knowledge with their friends. The supportive atmosphere and kind feedback from other members encouraged each other to share more content knowledge about environmental science, use their knowledge for teaching, and improve their science knowledge, teaching and communication skill for teaching younger students, and more importantly make them to have hope for postsecondary education.

2. Treating Young People as Professionals

The primary goal for the youth was to be teachers for younger students and museum visitors. This was not an easy task for them because they did not have previous experience teaching in public settings, nor solid science knowledge. The program gave the youth a unique opportunity to use their funds of knowledge by giving them a responsibility to develop science lessons. The youths' teaching experience at home such as teaching siblings, their experiences at different jobs, their skill to handle electronic devices, their creativity, as well as their own science knowledge were all respected by the program

manager and used for accomplishing their task of developing science lessons and teaching. Throughout the process of developing lesson plans, the program manager's role was not a leader or teacher but a mentor and helper for the youth.

The program also situated the youth as science teachers through systemic supports. Employing the youth as paid museum staff was an intentional program component. It was very important part of the program because it helped the youth think of themselves as responsible and active social members doing socially approved productive work. The youth were paid and given training to teach museum visitors or younger kids throughout the program. The experience of being a paid employee is different from volunteering at a museum. While volunteerism appeals to some youth who feel powerless to effect change of current educational approach in the museum or object, paid employment opportunities make them feel that they are doing something to make truly systemic change. In the interviews, most of the youth said they were proud of themselves because they are paid science teachers and they are responsible for teaching younger kids as well as museum visitors. For example, Daniela has a strong identity as Mexican and American, in this context of learning about and working with environmental topics she was confused with what she could do for society as an immigrant. Before Daniela got this job at the museum, she was working at the local mall as a temporary employee passing out food samples. She described the job as "just a job doing what the employer wants." Daniela described her work teaching at the museum and outreach programs as a big task and a big responsibility compared to her prior job. Daniela said that the most important thing she learned through the teaching experience on the Earth Discovery Team is responsibility. She said, "What young children would learn is depending on my knowledge and skill." The experience of being such as big responsible person doing socially approved productive work for children's learning actually helps her develop her identity as an active social member, a science teacher.

> "I think responsibility is a big thing, that's my first job I used to work at a mall, at the food court, I used to pass out samples, people would ignore you, sometimes it was annoying… then when I came here, it was a big change, I never expected learning about … responsibility, I think it's my big task, as Tom (the program manager) mentioned we got to come up with ideas about how to learn in a way, that's a big responsibility, putting in our hands what the kids are going to learn."

Manuela also said that what made her life in this program meaningful is the experience of being equally respected and doing socially approved productive work (teaching) for younger kids in her community. Being a staff, science teacher, was a very important role, especially for Manuela. When she was fifteen, she was working at a fast food store. She remembered that her manager always was angry and did not like the fact that she could not do a lot physically. "I was young, she just looked down on me, maybe because I was Mexican and she was white. How she was treating me was not right." Compared to her prior jobs, what she really liked about working on the Earth Discovery Team was her ideas and opinions were respected and accepted. Manuela shared, "I like how they respect us and how they respect our school, flexible schedule, I really like how this job is. If I could do it for a long time, I would."

Most of the youth expressed a belief that teaching younger kids about science was very valuable work because they could help them to be more aware of water quality and stewardship and knowledgeable about our environmental problems. It seems like Manuela developed her identity as a social member who can contribute meaningful things to the dominant society through her teaching experience. As she learned what she was doing was important and respected in the society she became more interested in science. Manuela also developed strong environmental stewardship about urban water resources and water quality throughout the program. She seriously thought about urban river water quality and how her everyday life style affected local water quality and encouraged her friends and

boyfriend's family to recycle.

> "Before, I didn't know a lot, I wasn't interested in science, and then coming here, learning, now I'm here, lots of stuff about science, I learned about the environment, how it works, how we went to the water plant, I didn't know that, I didn't know the water – it's built around what we have it, filtered around the river and like I didn't know that, it was interesting. What I learned is the environment, I never knew about watershed, I never knew none of that, but when I started working here, I learn a lot of things. We do environments, water, what you can do to save our environment, it's really good, learning and explaining and teaching kids. I'm concerned a lot (about water quality), I made my boyfriend's mom recycle, now we recycle because of me, just telling them, did you know this? I just come home and tell them, now that we recycle and raking leaves, pollution too, we rake leaves, take them off the street, changing oil or something, making sure they clean it, I'm the kind of person who tells them oh don't do that…."

In Manuela's case, clearly, becoming more interested in science, being aware about environmental issues in her community and changing her and her family's environmental behaviors are positive outcomes of the program. However, a more important thing that made her life in this program meaningful is the experience of being equally respected and doing socially approved productive work (teaching) for younger kids in her community.

3. Providing Systematic Support for Science Knowledge and Teaching Skills

The program also systematically helps the youth be science teachers by supporting their content knowledge and teaching experience. First, the program supported their content knowledge and field experience about urban water resources and the urban environment through various field trips, hands-on activities, and learning resources. For example, the team took a trip that traced the erosion and retreat of a natural waterfall. They visited several historic and geologically significant sites along the river and discussed the roles humans and the area's geology played in shaping the river in this part of the city. They also visited the Metro Wastewater Treatment Plant which treats the majority of the city urban area's wastewater. The youth learned about connections between their water use and the health of the Mississippi River watershed. Through these field experiences, the youth developed more concrete ideas about important topics of urban water resource management and water quality. They used their new experiences and knowledge about urban water resources when they chose topics and activities for the outreach teaching.

Second, the youth gained teaching experience by facilitating hands-on science activities for museum visitors throughout summer teaching period in the museum's yard and by teaching peers while they were developing lesson plans. Through these less formal teaching experiences, they had time to think about teaching others in a public setting, get some ideas about the teaching topics, as well as develop their teaching skills. By having experiences pre-teaching in the yard, engaging in content-rich field trips, and teaching practice with peers, the goals of teaching younger kid in urban area became more accessible for the youth.

Ⅳ. Result

This study started with a simple idea of what makes informal science education programs more culturally relevant for urban youth. My journey to answer this question started with finding the meanings of the youth experience in the program. I found that each youth has a different meaning of his/her experience of the informal science education program based on his/her personal history and interests. For the youth who need support for their schooling and lives such as parent students like Manuela, the Earth Discovery Team was an important opportunity not only because she had supportive adults and money for living expenses but because she was respected as a paid science teacher. The authority as a science teacher for developing lesson plans was an

important component to develop her identity as an active social member as well as to increase her interest in learning science and developing her environmental stewardship. For the youth who had a strong cultural or ethnic identity, like Daniela, she came to know that she could be an active member of American society without rejecting her identity as Mexican by doing a socially approved productive work. She also developed her personality as a more diverse person by meeting urban youth from other ethnic backgrounds. For the youth who are good at science but not as social, like Shani, the Earth Discovery Team gave her a place where she could be among peers in an accepting community and consequently develop her social skills by sharing her scientific knowledge. I also found the following common themes from the youth's positive experience: that their experience on the Earth Discovery Team helped them be more social, trust each other and be environmental stewards.

Ⅴ. Discussion and Implication

Dierking (2007) argues that the critical factors correlated with positive effects of most informal science programs are supportive adults with high expectations who work hard to establish positive relationships with youth and share curriculum and activities that were interesting, personalized and meaningfully related to their daily lives. There is no single answer for making informal science education programs that are personalized and meaningful for youth from minority and low-income urban communities. However, I tried to identify what would be a most common and powerful pedagogical approach to help them be active social members and become more interested in learning science. There is increasing evidence that the most effective education and mentoring programs for these youth are based on strong human relationships between participants: teacher-students, program manager-youth participant/employee, or mentor-youth mentee (Dubois & Neville, 1997; Koke & Dierking, 2007). I argue that the strong relationships between the youth could be built by recognizing that each participant is an active member of the program emotionally and cognitively. We also argue that the recognition of being accepted is made in the situation that their knowledge is respected as an important resource to pursue goals within the program. In other words, they should be treated as professionals, in this case, science teachers and have opportunity to provide service to their urban community by teaching science.

The findings of this study imply two important pedagogical approaches for the instructional level. First, the supportive adult (program manager or teacher) needs to respect the youths' prior knowledge from their cultures and everyday life practices and create a program atmosphere in which they feel accepted and respected. Second the supportive adult should provide opportunities for the youth to use their funds of knowledge to accomplish their tasks or pursue the goals of the program. Using a pedagogical approach of learning and teaching collaboratively was one of fundamental factors for the successful experience of the youth. This is also supported by other literature (Gonzalez, 2005; Hammond, 2001; Hyland, 2009; Ladson-Billing, 1995; Murrell, 2000). Many positive results of cooperative learning such as academic achievement and peer relationship are found in academic studies (Roseth, Johnson, & Johnson, 2008). For successful cooperation in learning, the goals of the separate individuals need to be linked together so there is a positive correlation between their group goal attainments (Johnson, Johnson, & Scott, 1978).

The findings of this study also imply that institutional support is another important component the helps youth develop their identity as active social members. Supporting their science learning through field trip experiences and supporting their teaching skills by offering the opportunity to teach museum visitors prior to their actual community teaching were considered pedagogical supports to improve their science knowledge and teaching skills. More importantly, hiring the youth as staff members, and giving them authority as teachers to develop lesson plans for community service were critical factors that made the youth think of themselves

as active social members.

Every student deserves to experience success in his or her school and work place. The experience of being respected and being treated as a professional can change a young person's self-esteem and, possibly, his or her life. A young person's science learning experience can be facilitated differently depending on what pedagogical approach teachers or informal science education programs and institutions choose. The belief that every youth has some funds of valuable knowledge no matter what his/her level of achievement of academic science knowledge, cultural, ethnical, and SES background is the key of CRP. The Earth Discovery Team is an example of a group of young people who are experiencing success on multiple levels (e.g. science learning, gaining work experience, and becoming active citizens) and could be considered a culturally relevant out-of-school science program for urban youth. This study is meaningful in that it provides a good example for developing a museum program for various students not only in the United States but also in other countries around the world.

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