Chapter 5
Reality Pedagogy and Urban Science Education: Towards a Comprehensive Understanding of the Urban Science Classroom

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Problematising Science Education for Urban Students of Colour

Science education is traditionally framed as a field of study that focuses on the teaching and learning of science across the educational spectrum (Cheung and Keeves 1998). It also encompasses all fields of study that are related to the education of students in the sciences (DeBoer 1991; Duschl 1998), Consequently, it has a broad scope and functions to meet the needs of all students in all science classrooms through a variety of means. While this broadly defined definition of science education serves to address the needs of the various constituencies within the field of science education, it does not provide enough focus on the needs of specific populations who have traditionally been marginalised from success in the sciences. In particular, students of colour in urban settings who have been reported to not be as successful in the sciences as their counterparts of other racial and ethnic backgrounds, and in other settings, have not had their particular needs addressed in science education (Norman et al. 2001; Tate 2001). This is not to say that science educators do not discuss the teaching and learning of urban youth of colour in urban setting. In fact, researchers who consider these issues are scattered across the landscape of science education. However, a specific focus on the needs of these students is not a prevalent strand of the research. I argue that this issue persists because of the lack of a concerted effort to specifically address the needs of urban youth of colour in science classrooms. Efforts to specifically address the needs of these populations and other progressive approaches to research and practice are slow to becoming accepted within traditional science education and the preparation of science education researchers (Jablon 2002). I argue that this is neither a reflection of blatant disinterest in the needs of urban

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youth of colour nor a conscious bias against these students. However, it is a reflection of a combination of a deep-seeded disinterest, pre-existent, under-explored and institutional biases, and an inability of the field of science education to evolve quickly enough to meet the needs of a growing and significant component of the constituency in schools.

The Silencing of Urban Youth Voice in Urban Science Education

In accordance with existent approaches to science education, researchers opt to engage in studies that align with the more dominant paradigm of studies which focus on more 'familiar science education topics' that require embedding in multicultural issues in order to be truly effective (Aikenhead 1993). Important approaches to science education – such as constructivism, the nature of science and pedagogical content knowledge – can be ineffective in urban classrooms without a specific focus on the needs of the most marginalised students within urban science classrooms and how they make sense of, or can benefit from, the use of these topics. Compounding the aforementioned issues are challenges such as the historically scattered nature of urban youth attendance in schools (Steward 2008), the impact of larger societal issues such as globalisation and gentrification of urban education (Lipman 2004) and, that within the spaces urban youth of colour inhabit, student voices are not heard and therefore do not inform educators and researchers about the types of approaches to teaching/learning that best serve them (Cook-Sather 2002). The above phenomena point to the fact that students of various ethnic and racial backgrounds across many urban contexts endure a plethora of issues that function to silence them in science classrooms, with science education as a discipline reaffirming this silencing.

This phenomenon (the silencing of the urban students) is often swept under the rug through a focus on broad-based approaches to science education that focus on initiatives that rightfully push for, among other things, an effort to provide all students, across backgrounds, with the same resources (Bybee 1995). The thinking behind this approach is that the equitable distribution of resources and instructional strategies across contexts will allow for some equal focus on the needs of students whether they have traditionally been marginalised from attainment in science or not. The strength in this approach is that it stands as an effort to reverse historical practices that have removed resources from youth of colour because of their societal positioning as not having the ability to be successful in challenging subject areas like the sciences. The weakness in these types of proposals is that this effort becomes ineffective because the provision of equal resources for all students at this point in time in science education necessarily maintains existent achievement gaps and the effects of inequitable practices.

Urban Science Education

The Needs of Urban Youth in an Urbanised World

Urban science education research, which in its true form focuses substantially on the needs of urban students thorough an understanding of their realities both within and outside the classroom, breaks from the traditional paradigm and focuses explicitly on what can be gained from the teaching and learning of science from the urban student's perspective. In efforts to focus on and consider the information for science teaching and learning that comes with this perspective, particular attention must be placed on the societal positioning of marginalised populations across the globe and the negative associations that comes with this labelling.

The current and ever-growing rise of globalisation and urbanisation serve as a charger of sorts for a focus on the experiences of the marginalised in urban settings and the reform of their schools (Lipman 2004). The effects of globalisation on the demographics of urban areas across the world has been described as particularly problematic for researchers in fields such as urban planning and economics, where the sheer numbers of people within urban settings and the creation of new urban settings where they have never before existed, has become overwhelming (MacLeod 2002). In fact, researchers have reported that, in 2009, more than 3.3 billion of the Earth's 6.6 billion people will be urbanised, rising to 5 billion in 2030 (UNFPA 2008).

While this research is often accompanied by how these demographics directly relate to the rise of slums, poverty and violence, I argue that science education is positioned to consider the positive effects of this urbanisation on the concentration of people who have been marginalised from, among other things, the learning of science. For example, immigrant families from certain Latin American countries, who travel to the USA and quickly become a high percentage of an urban neighbourhood, can be viewed as contributors to a lower socio-economic standing of a neighbourhood or can be seen as resources for shaping a more multilingual and inclusive science classroom. Students in a rural context who quickly become classified as urban students because of a sharp spike in population can be perceived as underprepared for using science to meet the job needs of an evolving and more technical society or can be utilised as resources for gaining insight into how science plays a role in shaping students' perceptions of self in an ever-evolving society. In the highly organic and continually changing urban spaces, progressive urban science educators can focus on initiatives that empower a large number of students to be full participants in science more than ever because of the high populations of the marginalised and socio-economically deprived who have become localised to urban areas. Globalisation, and the accompanying urbanisation of certain areas, can then be viewed as strengths that allow more complex and important work in science education.

Science Education in Urban Settings or Urban Science Education

Perceptions of urban students of colour as dangerous, uncivil and disinterested in school (Davis 1995), combined with the fact that youth of colour in these settings have traditionally not done well in science compared to their peers (NCES 2006), has caused urban science education to gain much popularity among certain scholars. While it is not necessarily supported as a field of study in its own right within science education, it is often fetishised and perceived as cutting edge or part of a new wave of research. Consequently, it has caught the attention of many scholars that position themselves as progressive. It also results in the advent of research that has a focus on studies in science education that exploit the recent intrigue in science education within urban contexts and utilise these contexts as a backdrop to their research that could have otherwise been omitted from the study. While a majority of these studies are intellectually sound and contribute to scholarship within the larger science education community, I argue that the continued pursuit of the urban context as backdrop or insignificant component of science education research could diminish the necessary attention to academic work within the discipline that exclusively focuses on a deep interrogation of contexts and the establishment of research that is undertaken to specifically address the needs of urban minoritised youth within urban contexts.

Context here refers not just to physical spaces beyond the classroom, but also to various interrelated phenomena such as cultural traditions, ways of knowing and being, and general sensibilities that are specifically urban. Understanding context in this sense lends to the understanding that 'scientists and non-scientists benefit by recognizing that attempts at mutual influence, multiple frames of reference, and "objective" information in science communication are not neutral but evaluated with other social influences' (Weber and Word 2001, p. 487), and that these influences impact on the ways in which conversations between students and teachers occur in the classroom. The interplay between 'Westernized' culture of science and the more communal ways of being of students in urban settings become glowingly apparent when research studies that are presented as urban science education do not thoroughly consider the contexts of urban settings. In fact, these studies only serve to affirm the established misconception held among students, teachers and academics that being of colour and urban are different from being able to be successful in school or science.

Moving Towards a Focus on Reality

Science educators who have begun to move beyond the use of the urban context as just a backdrop to their work, have began to uncover aspects of science teaching and learning that directly speak to the urban experience. These scholars have began to focus on sociolinguistic issues and ethnicity (Rodriguez 2003), socio-cultural

dynamics within the urban context (Roth et al. in press), developing democracy in urban science classrooms (Basu 2008), and addressing specifically urban issues such as homelessness (Barton 1998), socio-political action (Hodson 1999) and hip-hop culture (Emdin 2009). These studies move beyond *science education in urban contexts* to *urban science education* as a distinct field of study that is particularly focused on context and providing equity to urban students. In these studies, science teaching and learning and other foci of traditional science education studies, such as professional development or science curricula, serve as an adjoining focus to a thorough consideration of context. With this approach, the goal of developing mechanisms for improving science education is so intertwined with addressing the specific needs of urban populations that they cannot be teased out within an academic study. These types of studies consider the nuances of context through an understanding and exploration of the realities of the urban student experience.

Searle (1995) describes the concept of reality as an agreed-upon outlook on or about social life, based on how it is perceived or created by a particular group of people. He argues that reality is essentially based on 'facts relative to a system of values that we hold' (p. 15). Therefore, if urban contexts hold diverse populations who have shared understandings based on their various experiences, these populations can be said to have certain realities. These shared realities provide information about not only the influence of the contexts of urban areas on their experiences in classrooms, but provide information about how students react to the teaching and learning of science.

From Pedagogy of Poverty to Reality Pedagogy

A focus on students' realities in research is directly related to a brand of pedagogy that also considers context and student experiences as the point from which effective teaching begins. I argue that if research and theory are to genuinely impact practice, then a focus on context and student realities within these contexts should match a reality-based pedagogy that it informs and that informs it. Reality pedagogy is an approach to teaching that begins with student realities and functions to utilise the tools derived from an understanding of these realities to teach science. Hodson (1999) provides a fertile ground for reality pedagogy in his questioning of urban schooling and questions such as: Whose view of reality is being promoted? Whose voices are heard? And why? He then ties this line of questioning to realities in urban science classrooms in later work when he states: 'In most classrooms, there is a conscious or unconscious reflection of middle class values and aspirations that serves to promote opportunity for middle class children and to exclude children of ethnic minorities and low socio-economic status, who quickly learn that their voices and cultures are not valued' (p. 790). Therefore, in order to answer these questions in ways that allow the voices of urban youth of a lower socio-economic status answer to the questions that Hodson posed, a move beyond the established approaches to pedagogy in urban settings is necessary.

This established approach to pedagogy found in urban settings is described by Haberman (1991) as a 'pedagogy of poverty' which emphasises certain types of practices which breed a certain reality in the classroom that causes students not to see the science classroom as a space of which they are a part. This type of pedagogy promotes a particular focus on basic skills and factual knowledge in science, provides little to no room for cultural relevance, and foregoes culturally sensitive pedagogy that promotes science language skills (Ladson-Billings 1995; Pomeroy 1994).

Defining Reality Pedagogy

Reality pedagogy acknowledges non-dominant standpoints of students and the nuances of their experiences outside of the classroom and utilises their position as 'other' as the point from which pedagogy is birthed. It considers the process of transitioning from a student's life world to the science classroom as a cross-cultural experience (Aikenhead and Jegede 1999) for which the culture of the student is significant in the classroom. When reality pedagogy is developed, transformative teaching is enacted and, consequently, research in science education within classrooms becomes informed by approaches to instruction that consider new approaches developed specifically for students in particular urban classrooms. Students define what effective instruction is and discuss how it is enacted in the classroom. This approach begins from the point where there is a consideration for what Cobern (1996) describes as the consideration of different cultural contexts that produce different sets of beliefs and realities. Cobern argues that these realities predispose individuals to feel, think and act in particular ways. I argue that an understanding of these realities, or efforts to understand them through research, provide information about what types of activities cause students to feel, think and act in ways that are conducive to learning science or that alienate them from it. When student perspectives on issues, such as ways to engage in certain activities in the classroom, ways to communicate with students, and means for enacting effective instruction are considered, feeling, thought and action that support science are enacted by students.

The goal here is not to change science or re-establish what topics are a part of the curriculum (which might be a necessary goal for some science education researchers), but rather an understanding of how the ways in which the specific science topics in the classroom are being delivered causes urban youth to feel, think or act in ways that are not conducive to their success in the classroom. Through reality pedagogy, the existing classroom reality, which might inhibit students from conceptualising and investigating the natural world, is questioned and a more comprehensive understanding of the inner workings of teaching and learning and their effect on urban youth are addressed. The outcomes of this questioning can be a challenge to what the teacher considers to be science and or science teaching and the distinctive ways in which it is traditionally delivered. However,

through this questioning, success, participation and effective teaching and learning are redefined in ways that allow students to feel as if they can attain them.

Enacting Reality Pedagogy

Enacting reality pedagogy requires an understanding of the student's communities and the use of this understanding to positively affect the teaching and learning of science. The goal for the teacher who enacts this pedagogical approach is to immerse himself or herself so deeply in student culture that it becomes second nature to find ways to develop student interest in, and natural affinity for, science. Embarking on the journey towards enacting this pedagogy is an opportunity for science education to bear witness to the realities of those within urban settings.

Bearing witness is connecting to the ways in which individuals are denied full participation in society, as well as being able to identify and make connections with these individuals' experiences, despite the fact that one might not have physically experienced or seen all of the same things (Oliver 2000). Reality pedagogy is teaching based on witnessing and acknowledging that traditional science education and structures both within and beyond the classroom have negatively affected the ability of urban students of various racial, ethnic and cultural backgrounds to connect to science. Therefore, a pedagogical approach that has components both within and outside of the classroom is necessary for connecting urban youth to science.

> In order to meet this challenge [increasing racial, cultural, ethnic diversity among the populations attending urban schools] teachers must acquire the cultural competency for creating productive and inclusive learning environments, building academic capability among all students, and forging solid relationships with students' families and communities… (Murrell 2006, p. 81)

In my work with beginning teachers who work in urban schools, I have been able to guide them towards enacting reality pedagogy by incorporating certain practices into pre-service coursework and guiding them to utilise the information from these activities in the classroom when they begin teaching. While this is not a complete protocol or an outline of what should be the steps taken to enact reality pedagogy, it is a set of steps that I have implemented and found successful in helping teachers to move towards its implementation.

Steps Towards Reality Pedagogy in the Classroom

Teachers can visit student neighbourhoods/physical contexts once a week and communicate with people in neighbourhoods, such as store owners. Teachers can observe and take notes on phenomena in the neighbourhood and work towards using them as examples and analogies that relate to the science curriculum. Teachers can spend time listening, observing and participating in artifacts from student culture

(including music, specific types of dialogue and other activities). Also teachers can verify the accuracy or effectiveness of their notes, observations, examples and analogies with students in structured dialogues and discuss how these artifacts can be used in the science classroom with students.

The teacher can deliver the lesson based on studies of notes, observations, examples and analogies discussed with students in structured dialogues. Teachers can videotape the classroom when these artifacts are used as part of the pedagogy as they can invite students into dialogues and uses the videotape of the classroom as a jumping-off point for discussion. (Participants in the dialogue view the videotape of the classroom, identify part of the lesson that needs to be improved and develop plans of action for improving the lesson.) Teachers and students can return to the classroom to implement the plans of action discussed in the dialogues.

A Focus on the Three Cs: Co-generative Dialogues, Co-teaching and Cosmopolitanism

In the steps to enacting reality pedagogy mentioned above, one of the most important steps is the first C (co-generative dialogues). These are the structured dialogues mentioned above that occur among students and their science teacher at least once a week for discussing what goes on in the classroom (Tobin et al. 2003). In groups of four to six students, participants engage in dialogues, sometimes based on video from the classroom, and discuss student perspectives on what is going on in the classroom. Through the enactment of this practice, student realities are investigated and issues that they have with the classroom are allowed to be brought to light and addressed in the classroom.

In conjunction with co-generative dialogues, co-teaching (the second of the three Cs) is a practice that allows both students and teachers to take on the role of teacher. In this process, students and their teacher return to the classroom to implement plans of action from co-generative dialogues. This step fits in with the final step in the in-school rituals listed above. In its enactment, it allows the student to take on responsibilities traditionally reserved for the teacher and allows the teacher to learn about student realities. Furthermore, it allows the student to take on the traditional co-teacher role by assisting the teacher in teaching science. In other words, the implementation of plans of actions from co-generative dialogues necessitates that students who are involved in the dialogues begin to share responsibility for the classroom through co-teaching. The last C (cosmopolitanism) is a philosophical tenet that is evident in the classroom when a co-responsibility for one another and a valuing for each other's realities is part of everyday experiences in the classroom. When cosmopolitanism is enacted, there are multiple co-generative dialogues being enacted, endless instances in which co-teaching with students are in place, and connections between the teacher and students and students with each other are more of the norm than the exception.

Conclusions

The goals of this chapter are to present how urban science education requires a thorough understanding of student realities that go beyond what is available through conventional approaches to science education and to articulate the need to focus on context through a valuing of students' reality. The chapter shows that the combination of a constantly renewed awareness of the role of context in urban science education, a focus on the realities of the urban student experience that is often masked in science education, and a thorough focus on practical steps that can be taken to begin moving teachers towards reality pedagogy provide new approaches to researching and teaching in urban science classrooms. The combination of the approaches to science education, the challenges to the field of study, and the tools for enacting research and pedagogy presented throughout this chapter move science education towards a more comprehensive view of the urban science classroom in the sense that it exposes aspects of the classroom that are not traditionally prominent and guides the field towards new approaches and new discoveries. Focusing on the contexts surrounding the urban science classroom through student realities presents an approach to science education that opens up new ways for understanding what has worked for urban students in science classrooms and what has not, while concurrently allowing teachers and researchers to uncover approaches to improving urban youth experiences in science classrooms that exist, but have not been given an opportunity to work.

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