Promoting Youth Empowerment and Social Change In/Through School Science

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ABSTRACT

In this article, we discuss work from our collaborative research project, Community Engagement and Youth Leadership, a partnership between university scholars/activists with high school youth and their science teacher. A key goal of this work is to explore opportunities for youth empowerment through justice-oriented school science pedagogy. Equally important is communicating our work through the development/use/sharing of accessible conceptual and curricular frameworks that are grounded within the lived realities of science classrooms. It is our hope to engage with justice-oriented others in critical, loving reflection and dialogue on our (collective) efforts, as we join, connect, and grow global networks of social justice practitioners in science education. We look forward to your feedback.

May 2016

1 All place names and all student names are pseudonyms.
INTRODUCTION

Over the past decade, both broadening science and mathematics education to include technology and engineering as well as broadening the participation of minoritized groups in STEM education and careers have been ‘hot topics’ in science and mathematics education research and reform movements. Yet, in this same decade, few studies in science education have explored how students can be empowered to engage more critically within the “STEM movement,” and/or understand relationships between science, technology, mathematics, or engineering, social inequalities, and community justice—and even fewer studies have explored these issues within formal classroom settings. Perhaps there is a sense that this type of liberatory and/or transformative science education is not achievable in formal learning environments, given the constraints of testing and increased standardization. However, we argue, along with Williams and Atwater (2014), that in order to improve science learning opportunities (and overall sociopolitical conditions) for marginalized students, science teachers must “be committed to being change agents in the profession” (p.277)—and that while standards and testing constraints are political struggles with which we must continue to engage, change agents do not sit idly by until the pendulum swings toward what we know is best for minoritized students, schools, and communities. In this paper, we share experiences from a partnership between a college professor/university researcher (first author) and high school science teacher (second author), supported by our third author and fourth authors, doctoral and undergraduate researchers. Using a collaborative approach to our research, we committed ourselves to the co-construction and implementation of a ninth grade science curriculum designed to prepare students for youth leadership, community engagement, and social change through science education. (We hereto refer to this collaborative research project as Community Engagement and Youth Leadership through Science Education, or CEYLSE).

BACKGROUND

Through CEYLSE, our goal is to demonstrate that socially transformative, or ‘empowering’ pedagogy, can and should be infused throughout the curriculum, including (and particularly) within subjects largely viewed as “neutral” such as science. We reject the notion that states or politics can restrict or dismantle rich school learning experiences, particularly for marginalized youth, when the education debt owed to these students continues to be exacerbated by unjust funding policies and increased standardization of curricula in our most high needs schools (Ladson Billings, 2006). We caution that uncritical approaches to broadening participation in STEM can have the effect of engaging minoritized students (and communities) as “pawns” for increased local and global competitiveness (so often accompanied by increased militarization, environmental destruction, and/or economic gains that primarily benefit the wealthy elite), yet we are excited by the potential of a social reconstructionist approach to science teaching and learning, given the transformative role of science knowledge and practice when applied to local and global justice-related problems and phenomena, exemplified recently in the case of lead contamination in Flint, Michigan’s drinking water (see www.flintwaterstudy.org). We also recognize that there are many science teachers who share our concerns and are committed to teaching from a social justice stance, yet there are very few resources (e.g., real classroom cases, sample curriculum materials, etc.) to support teachers in these justice-oriented efforts. We therefore engaged with the construction of the ninth grade science curricula as a “design experiment,” in which we co-plan, implement, and reflect upon science lessons with a social justice
focus, with the ultimate goal of being able to share both resources as well as richer descriptions of social justice teaching and learning in school science.

CONCEPTUAL FRAMEWORK

We feel that one considerable challenge toward expanding opportunities for social justice science teaching, as mentioned before, is the dearth of conceptual and pedagogical resources that have been made available to classroom science teachers. In our own experiences as science teachers (Nicole – who goes by “Snook” and Sara) and science teacher educators (Sara), we have found that science educators who are open to justice-oriented teaching feel constrained by their own political and institutional contexts, but also by the lack of accessible resources and frameworks that inform or reveal how classroom science teachers can teach for social justice “on the ground.” We see this exemplified in the recent Rethinking Schools call for more articles that address social justice issues in science teaching (https://rethinkingschoolsblog.wordpress.com/2015/06/30/magazine-call-for-science-submissions/) as well as in research on how beginning science teachers are/are not able to implement the social justice approaches to science instruction they learned (about) in their preservice teacher education courses (Bianchini & Cavazos, 2007; Rodriguez & Berryman, 2002).

Schindel Dimick (2012) organizes the literature on teaching science for social justice (TSSJ) into three primary groups, categorized according to the nature of potential opportunities for youth empowerment: (1) Social Empowerment, in which the goal of science teaching is to facilitate social relations (teacher-students, student-student) that are anti-oppressive, where both students and teachers are knowledge producers (Antrop-Gonzalez & De Jesus, 2006; North, 2008); (2) Political Empowerment, in which the goal is that students have opportunities to act upon and transform current inequitable conditions, e.g., classroom and/or societal (Chubbock & Zembylas, 2008; McQuillan, 2005), and (3) Academic Empowerment (Gustein, 2003; Freire & Macedo, 1987; North, 2009), in which the goal is that students are provided with the scientific knowledge and skills they need to be successful in school and in today’s society.

Using an empowerment framework for TSSJ, Dimick analyzed the practices of a white, male environmental science teacher working with minoritized youth in a high school science classroom. Her analysis pointed to the fact that attending to the multiple aspects of student empowerment in school science is much more complex than what is often revealed in current research. For example, while some students experienced a sense of political empowerment through engaging in the clean up of a local river, others felt academically disempowered, from the perspective that the activities they were doing were more like “Green club” and not really science. Erika expressed that “you could clean up [the river] a thousand times, but it’s still going to be dirty because the whole sewer backed up when it rains…so focus on something that you could change or work to change” (p. 1005). She also felt that “it’s still to me not science, because, yes, it’s environmental science, but we just doin’ stuff to help the environment. We’re not like necessarily studying the environment…” (p. 1007). Sean, however, felt that the river cleanup could change people’s attitudes toward environmental stewardship: “it actually teaches you compassion, because you just cleaned up a whole lot of people’s trash. So next time you think about throwing something on the ground, you probably going to think about it” (p. 1005). Another student, Denzel, exemplifies a socially empowering learning experience through participating as a member of the group who chose to create a music video for raising public awareness. In fact, this was the first time he had ever participated in the environmental science class, where previously he had sat through class with his head down on his desk. Dimick used these tensions to reflect
more deeply on the challenges of social justice science teaching in formal classroom settings and concluded that “continued research is needed to simultaneously investigate the practices of teachers engaged in science teaching for social justice and the experiences and understandings of students who learn and participate in these settings” (p. 1010).

In the collaborative research project described below, we have been particularly interested exploring (1) how/if the empowerment framework for science teaching (Schindel Dimick, 2012) can provide teachers (including Snook) with a way to frame their (our) pedagogical approach to justice-oriented science teaching, as well as (2) how the framework can help us document and share the work and research we have been doing in ways that can be more easily accessed, appropriated, modified, and/or critiqued by other practitioners.

**CONTEXT**

**The School & Community**

This study takes place at a public charter school, Leadership for Empowered Youth (LEY), located in a low-income area of a small city in the southwestern United States. The city has the sixth highest poverty rate in the U.S., for a city of its size, and is located in a state where racist-nativist policies have radically marginalized minoritized youth, families, and communities, who are frequently subject to racial profiling by border patrol agents, who are constantly negotiating drastic cuts to public services, and who are subject to inequitable treatment in schools—particularly with regard to the restrictions on home language use in instruction and inequitable access to resources, including highly qualified/high quality teachers. Furthermore, political and institutional assaults on liberatory and transformative pedagogies for Mexican American students, in particular, have resulted in the dismantling of Ethnic Studies programs that had previously demonstrated to be successful toward increasing retention rates and other similar opportunities to learn for minoritized youth (Cabrera, Milem, Jaquette, & Marx, 2014).

The school that is the site of our CEYLSE collaboration was created as part of a vision that emerged from a local non-profit organization, Youth Speak (pseudonym), whose mission has been to “ignite and support youth voice, infusing the community with the unique perspectives of young people.” The non-profit organization had supported youth philanthropic ventures and projects through providing resources, small grants, and support for facilitating community engagement among local youth. However, members of the organization felt that the work they had been doing with youth needed to be somehow moved up to another level of engagement. In other words, while Youth Speak had been successful at providing grants for projects, they felt less successful with regard to other aspects of their mission, such as building a cadre of civically engaged young people who were empowered to impact social change in the local and municipal communities. Specifically, Youth Speak wanted to find a way to more effectively support youth to advocate for themselves and their communities. The idea and vision behind creating a school emerged as a way to address this challenge, after which a series of World Cafes were held, in which families, community leaders, youth and local residents came together to develop a shared vision for the school. The school currently serves students from the local community, as well as students who have struggled to be successful in their former schools and whose families have sought out LEY as an alternative.

We recognize that the work takes place in a charter school, and that the charter school movement has been in many ways a tool for the neoliberal privatization of education. However, we believe that the charter
school in this study has provided an important contested space, in a region where political mobilization has been consistently thwarted. Before the opening of the school, a state senator reported being appalled that the charter was granted to Youth Speak, given that a primary goal of the school was to support youth in their development as change-makers and community organizers, commenting that there should be no place for politics in schools.

We do not argue that political mobilization and resistance must be abandoned, but we do argue that sites of contestation such as LEY are important. Schooling has undeniably been an apparatus for social reproduction—institutionalizing political and economic inequalities (Bowles & Gintis, 1976). Yet, the majority of the teachers and administrative team at LEY are Latino/a, with backgrounds in Mexican American Studies, in stark contrast to the overwhelming presence of Whiteness in most schools, including those serving predominantly minoritized students. The school director, a former Mexican American Studies teacher, describes the teaching staff as those who used to be “lone wolves” in their efforts to teach for social justice. At LEY, they have all been able to unite around a common vision and commitment to providing youth with educational opportunities they have, in many ways, otherwise been denied. Within such rigid and slow-to-change political constraints that characterize the state, minoritized communities have always found ways to enact self-determination. We are by no means arguing that the answer to educational inequality is the charter school movement. Rather, we propose that activism is often localized, inevitably contextualized, as well as incredibly complicated in practice, and, in this case, the school has created a pocket of resistance and hope in which marginalized students (and their teachers) are thriving.

Origins of Collaboration

Sara was connected to the school through colleagues who were familiar with her work and thought that she and LEY might be able to form a mutually beneficial partnership. In October of 2012, during LEY’s first year of operation, Sara went to meet with the school leadership team to discuss possibilities for collaboration. For a year and a half, Sara spent time getting to know the school, students, faculty, and staff, working as a volunteer advisor on the LEY curriculum development committee, coordinating field trips, and contributing to instructional planning, etc. In the summer of 2014, she began to collaborate with Snook around the development of a new integrated science curriculum.

The classroom that has served as the context for our collaboration since June 2014 has been the integrated science classroom. The integrated science course replaced the physical science course that had been previously offered as the required science class at LEY from 2012-2014. The goal of the integrated science class has been to introduce students to social change and community engagement in science through an issues-based approach to curriculum and instruction. The student population in the integrated science class is representative of the larger school population, with the largest percentage of students enrolled identifying as Latin@ (63%), followed by White (13%), African/African American (11%), and Native American (9%). Eighty-one percent of students enrolled are on free/reduced lunch.

The Community Engagement and Youth Leadership through Science Education (CEYLSE) Project: Exploring Possibilities for Youth Empowerment

Contemplating how curriculum and instruction can create opportunities for youth empowerment, Snook and Sara co-developed issues-based unit outlines and plans for integrated science, with attention to
experiences that would (1) provide marginalized youth access [i.e., via exposure, high expectations while providing necessary supports, etc.] to rich and meaningful science learning experiences; (2) facilitate a community of critical caring for each other—both socially and academically—and our communities; (3) attend to the science of environmental and public health and sustainability, particularly those issues that disproportionately affect low income communities of color locally, nationally, and globally, with an emphasis on student-identified issues and concerns about their community; (4) familiarize students with a wide array of fields, careers, and degree programs in the sciences via providing authentic interactions with community members who participate in those fields; (5) foster “change-maker” orientations in science among both students and their teachers through praxis, i.e., engagement with community science solutions; (6) authentically leverage students’ interests, experiences and funds of knowledge from outside of school.

During the summer of 2014, we worked alongside other LEY teachers to identify several overarching themes for the Integrated Science curriculum that were connected to LEY students’ interests, as well as pressing local and global science-related justice issues, that could guide instruction in integrated science:

- **Understanding ourselves:** The neuroscience of adolescent development, trauma, and mental health, sex and gender
- **Water contamination and water rights in our community and on Native lands:** Historical and scientific analysis of water contamination & water rights in local and Native communities throughout the state;
- **Ebola:** Study of viruses and Ebola transmission in the context of learning about othering and marginalization in science-related social issues
- **Sustainability, resource distribution, and justice:** Organic and sustainable community gardening, soil science, pesticide use, nutrition and health, food deserts and their relationship to socioeconomics, homelessness, urban planning

We worked collaboratively to compile resources and curriculum materials around these themes, with particular attention to local community resources (including guest speakers, activist projects, community organizations, field trip sites, etc.). Throughout the year, we revised and refined our unit topics to accommodate students interests and concerns as students, through integrated science as well as their other courses, became increasingly informed about and engaged with school/community sustainability issues (e.g. organic gardening on campus, rainwater harvesting) and local community problems (urban heat island effects, “climate readiness,” water rights/use, disproportionate access to green space, homelessness, etc.). Sara, Corey, and Inyene attended the integrated science class weekly (sometimes more often) to document through field notes the instruction as well as interactions in the classroom. We also interviewed the majority of the students, asking them to share their thoughts about science, their science class, and their own sense of empowerment in/through science learning. In the sections below, we share how these themes and related activities created opportunities for academic, social, and political empowerment.

**Academic Empowerment**

Given the vast range of prior academic experiences represented among students in the integrated science classroom, we approach “scientific knowledge and skills” broadly—focusing on the scientific content as much as we focus on the 21st century skills needed to understand and use scientific information to more critically engage with science-related social issues. We recognize that, by virtue of their status as minoritized students from economically oppressed communities (as reflected by the 80% of students on
free- and reduced-lunch), many of them enter the school reading well below grade level and with significant academic gaps. We also want to underscore that developing critical consciousness (reading the world) goes hand in hand with reading the word. In practice, students need opportunities to learn and read a variety of text genres in science. Snook and Sara worked to help students access the often complex texts (e.g., including government documents, journal articles, news stories, science fiction, data tables and graphs, etc.) through purposeful heterogeneous grouping (by reading levels), guided instruction and one-on-one support, content literacy strategies such as text renderings, reciprocal teaching, and other reading-to-learn tools. Snook also provided opportunities for students to develop critical science literacy while developing traditional academic literacies. For example, during a unit on the trichloroethylene (TCE) contamination that had occurred in the lower income neighborhoods several years prior to this study, students evaluated how claims about the risks of TCE varied depending upon the sponsoring agency. Snook used this example to lead a discussion on how/why the government, or corporations, fund certain types of studies over others, and/or how different studies conducted by different agencies can be strategically used to support particular claims. Students also considered these discrepancies in the context of understanding why communities in the affected areas still distrust the scientific findings indicating that the contaminant is measuring at “safe” levels.

Students represented their understandings of core ideas in multiple ways, through scientific posters, reports, journal writing, artwork/animation, models/prototypes, demonstrations and presentations to the community during LEY exhibition nights. We feel that providing all students with multiple opportunities to present in front of their peers and the community is an essential part of academic empowerment – and activism. Snook regularly asked student groups to present their ideas and their work to the class. We have observed peers acting as members of a “scientific panel” in Snook’s class, asking questions and evaluating claims made by fellow student presenters. Students also need access to particular types of social capital that are required for gaining access to academic (i.e., career-building) opportunities. Snook and I worked together to prepare and submit conference proposals related to the work that we and students had been doing in the integrated science class. Students applied and interviewed (with the CEYLSE research team as the review panel) for opportunities to present what they were learning about social justice in science at local and national conferences, including the New York Collective of Radical Educators (NYCORE) in New York City and the Teachers for Social Justice (T4SJ) conference in San Francisco. We worked together (authors, students, school faculty) to raise funds for the travel/lodging of student presenters, through crowdsourcing, door-to-door canvassing of local businesses, etc. Student presenters met weekly after school and during their spring break with Sara and Snook to strategize around fund raising and prepare and practice their presentations.

For us, then, the academic emphasis of the integrated science curriculum centralizes students being supported to develop critical literacy skills, with a focus on using scientific knowledge and practices toward engaging with local and global science-related issues of justice. While some may argue that our more globalized approach to science education has the effect of “watering down” the “hard science” content, and is therefore not academically empowering, we counter that these types of project-based and contextualized experiences provide access to the types of gifted ‘pull out’ programs generally only available to an elite group of students (see Tolbert, Knox, & Salinas, in press). We also argue that an exclusive focus on “just the facts” will never prepare students who can use science knowledge and skills in the service of democratic engagement and change-making.

Social Empowerment
In a socially empowering science classroom social relations between the teacher and students/among students are anti-oppressive. Students in the Integrated Science class work frequently in small groups on a variety of tasks. The process of facilitating non-dominating and anti-oppressive relations is ongoing, and also wrought with productive tensions. Rather than using the often heard mantra of “you can’t choose whom you work with, so you have to learn to work together,” learning to work productively together is constantly (re)presented as essential to effecting social change. In other words, the goal is not to help students learn to become better “worker bees,” or mimic the work of scientists per se, but rather to develop an ethic of solidarity. Snook and her colleagues continually remind students that changemaking requires collective problem solving, teamwork, and empathy.

We have observed that students are increasingly likely to encourage and support each other, though teasing and bullying still happens. Part of this is what we attribute to a defense mechanism that some students have developed, as a result of negotiating challenging life experiences (and inequitable socioeconomic conditions). Therefore, we do not feel that it serves students well to be punished harshly for these fairly natural reactions to inequitable conditions, but rather come to understand how and why they have developed such defense mechanisms—and how they can learn to use them more productively. In other words, anger is productive, but misdirected anger is hurtful and oppressive. Snook regularly uses conflict resolution strategies, such as talking circles and peer mediation to help students work through emotionally difficult situations as they arise. In individual interviews, students overwhelmingly report feeling that LEY provides a sense of family, whereas in their prior school settings, they often felt vulnerable, bullied, and/or uncared for. A student who was bullied at his former school shared that the main difference he has experienced between the two settings is that “here, people are kind.”

Though the process of facilitating social empowerment is ongoing, students have become increasingly adept at working productively in groups and supporting each other. Many students have learned to recognize both the social and learning challenges their peers experience – and we have observed them responding to these challenges with encouragement and understanding. For example, one of the students has some special needs that are quite pronounced. Snook asked him to present his work (a water filtration system he had been designing) in front of the class. One of the other students, who could typically be characterized as the “class clown,” observed his peer’s hesitancy and offered to go up to the front of the class with him, in solidarity, while the student presented. There was another instance in class where a student, Jaden, was trying to explain his theory on pollution but he was struggling to articulate his ideas. A few other classmates started to tease him about it. Mallory, another student in the class, scolded her peers for making fun of him and demanded that they give Jaden a chance to explain himself. Similarly, when Caleb was trying to explain the complexities of human-induced climate change, Belinda stopped talking to her friends to compliment Caleb on being so knowledgeable, while probing him to articulate his ideas further. These examples are representative of how we see students actively contributing to the development of a community in which they and their peers are both teachers and learners in science and social justice.

We see how students are also socially empowered as they learn to become more comfortable talking with adults. Indeed, speaking truth to power necessitates being able to communicate one’s ideas beyond one’s own peer group. Students are also encouraged to develop a sense of themselves as informed youth who have important—even groundbreaking—ideas and things to say:
I've always had a bad image of myself, like a really bad image of myself. I've been told all these horrible things growing up and I've always had a negative look towards myself. I used to feel like I was really stupid, I didn't understand anything, but I never had anything interesting to talk about. Now it's like, when people that my dad hangs out with, older people when they talk about stuff, I can add things in now and say stuff. I'm a little bit more aware about things when it comes to the science aspect. Which, I really like. (Melanie, Interview, Fall 2014).

**Political Empowerment**

Through the issues-based approach to the integrated science curriculum, students have been learning how to identify and act upon inequities in science and society. Students in integrated science have studied the science of their own neurological development as adolescents, Ebola virus transmission & risk perception as well as how the Ebola outbreak presented in the media had an othering effect on West African residents of Liberia, Sierra Leone, and Guinea, gender/racial identity and its relationship to science, energy use/coal mining and Native rights, water contamination and environmental justice—which included a culminating field trip to the Hopi reservation in which students, led by a tribal leader and indigenous rights activist, explored the effects of coal mining on Hopi sacred springs (see Tolbert & Bazzul, in press; Tolbert & Schindel Dimick, in press).

The changemaker mission of the school has translated into a school organizational structure that provides time and space for students to translate some of the ideas they are learning about in their classes into action projects of their choosing. As part of these efforts, integrated science students have participated in ecological restoration efforts on site, such as creating a water harvesting system, building urban hawk houses, removing invasive species, and constructing a terrace garden where fresh vegetables are grown—with attention to both the economic and environmental benefits of their efforts:

We're developing a skill so [students and communities see that] 'you can do this at your own home at a very low cost.' You can actually do it more barn raising style where you have help. It doesn't matter what it is, they're learning the skills sets to then transcend that socio-economic status that they may have and saying well what can you do? What is accessible? If it isn't accessible than how do we create pathways for accessibility and how do we use the classroom, and how do we use the school as a venue, and a vehicle, and a hub, to actually engage in community development work. And empowerment falls within that, so the young person is transforming their world and at the same time transforming themselves. [LEY School Director, August 2015]

A group of students, under the mentorship of Snook, sought funding for a bridge building project for residents of the low income neighborhood in which the school is located. The bridge would allow residents to cross over the neighborhood wash during monsoon season, where currently there is no way for them to get across, presenting a challenge for elderly residents, etc. After several months of developing the idea and proposal, Snook and the students involved were called upon to present their idea to the municipal neighborhood reinvestment committee, who recently granted $230,000 of bond money to fund the project. The city will begin the planning and construction of the bridge in the fall. Students also planted shade trees for local residents to help mitigate the urban heat island effect that is much more pronounced in low income areas of the city than more affluent areas (related to inequitable tree cover, etc.). A student, Snoopy, in the integrated science class shared with us earlier this year:
I used to come home and I used to sit on the computer and do nothing. Now, when I get home, I'm researching. I'm writing. I'm drawing out plans. I am trying to figure out ways to solve issues that are happening everywhere. My mom, she's, "You're always busy now." I'm, "It's because I have something to do. I have something to do with my free time instead of just sitting on the computer doing nothing." (Snoopy, Interview, Fall 2015).

Snook commented that

By teaching students to critically think about social justice issues related to science and facing humanity and this planet, students become more aware of their locus of control; meaning, they feel empowered to be the change they want to see in the world. High school aged students often come to me with a hyper-centric sense about the world around them. It’s the “it’s all about me” phase of their lives…it is natural for them to feel this way at this point in their development. They will say, “That doesn’t affect me,” or, “The things I do or the choices I make don’t affect [them].” I believe that this stage of development is critical to how students will be, as their future selves emerge, and it is important for them to understand the deeper meaning of science content as it pertains not only to their personal lives, but to the world, as science is often what links us together. Often students are at a point in their lives when they do not feel like they can make a difference and they feel powerless. They are not given choices in their learning. Through leadership opportunities in the science classroom (i.e. student-led conferences, presentations of learning, engineering design challenges, project choice boards), students see themselves as changemakers NOW, whereas many, if not given the opportunity, may never feel this sense of empowerment. Additionally, inviting students to be partners with me in their learning even out the playing field. We are able to teach and learn from each other without the sense of a power dynamic that exists in many classrooms.

**CONCLUSIONS**

Our goal with the Community Engagement and Youth Leadership through Science Education (CEYLSE) project has been to explore the possibilities for, document, and share a justice-oriented approach to school science. We have also been exploring the usefulness of the empowerment framework (Schindel Dimick, 2012) as a conceptual tool for supporting these efforts. To date, we have found both of these pursuits to be fruitful as we continue to explore the possibilities and tensions of the work. One interesting tension we have found is that students in integrated science, despite feeling that they enjoy science class, they like science, and they feel their voices are heard in science class, and science instruction addressed social justice issues, they do not generally ‘identify’ as science people. In other words, there is evidence of ‘meaningfulness,’ yet the meaningfulness of instruction, in this case, at least, does not necessarily correlate with students’ science identities. We are coming to understand this tension, however, as a form of youth resistance and re/authorship, and are continuing to explore these tensions and possibilities in our research.

Finally, we are particularly interested in notions of how to build a cadre of support for science teachers equally committed to justice-oriented classroom teaching. We view solidarity as essential to the sustainability of teaching for social justice (as evidenced in our own work), but yet so often elusive in the field of science education. We are encouraged, however, by signs of a growing collective movement around social justice in/through science education. We welcome questions, thoughts and comments from our editors and readers and invite you to join our social networking site at https://www.facebook.com/groups/scienceteachers4socialchange/.
REFERENCES


