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Cover Page Footnote

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Since the publication of *Rethinking Mathematics: Social Justice By The Numbers* in 2005 (Gutstein & Peterson), there have been mathematics educators who have been trying to find ways to incorporate lessons that focus on social justice issues into mathematics classrooms. In that vein, a group of mathematics educators received a grant to create the website RadicalMath.org, a repository of social justice based mathematics lessons. The grant was also used to organize the first Creating Balance in an Unjust World conference that was held in New York in 2007 (CBUW, 2016). Since the initial conference, six additional conferences have been held, and more are scheduled for the future.

In addition to the conferences, a number of books have been published on the topic that provide theoretical frameworks for the focus on social justice in mathematics education, as well as examples of mathematics educators who have been using social justice issues in teacher preparation and professional learning programs (Gutstein, 2005; Stinson & Wager, 2013).

Even though mathematics educators have been promoting the idea of incorporating issues of social justice in mathematics lessons, there are relatively few teachers who have integrated these types of lessons into their instruction. Bratlinger (2005) described the pitfalls he faced when using social justice lessons in urban schools, including reinforcing negative stereotypes of communities of color, and the reluctance to discuss sociopolitical conversations in a mathematics classroom.

This article explores the dispositions of first year high school mathematics teachers who have used social justice lessons in their classrooms. The teachers' positionality and goals as social justice educators will be explored. The ways that teachers engaged their students will be explained. This article seeks answers to the following questions:

1. How do teachers position themselves with respect to race, ethnicity, gender?
2. What types of inquiry questions to teachers seek to answer about their practice?
3. What types of social justice goals to teachers create for themselves?
4. What did teachers learn from engaging their students in social justice tasks?

Method

UCLA's Teacher Education Program

The Teacher Education Program (TEP) at UCLA's Graduate School of Education and Information Studies has as its mission "To provide high quality pre-service education and to radically improve urban schooling for California's racially, culturally, and linguistically diverse children." According to TEP's Resident Year Guidelines, the TEP curriculum emphasizes the structural dimensions of inequity, the need for social and political activism, the centrality of multiculturalism, and the vital importance of understanding competing notions of race, culture, and identity (UCLA TEP, 2011).

The two-year graduate program provides an opportunity for qualified students to obtain both a California teaching credential and an M.Ed. in a combined, full-time, two-year program that maintains strict academic and professional expectations and practice. TEP partners with high-need urban schools throughout Los Angeles. These schools are vital sites of learning and development for aspiring teachers.

First year TEP students are referred to as novices. During the novice year, students

complete the requirements for obtaining a California teaching credential. This includes coursework, student teaching, and a state mandated performance assessment. Second year TEP students are referred to as residents. During the resident year, the students are full time teachers. The residents receive classroom support from a field supervisor, attend a weekly seminar, and complete a master's inquiry project.

Mathematics Methods

The coursework for TEP students working towards a single subject credential to teach mathematics includes a mathematics methods course. The mathematics methods course is designed in harmony with TEP's mission of teaching for social justice.

The Mathematics Methods course is guided by what we know about mathematics teaching and how students learn. Teachers explore a variety of instructional strategies as well as analyze elements of effective teaching as it relates to student achievement for all students but particularly, students who are second language learners in urban schools. Questions that help to inform the course include:

- What are equitable practices in a socially just mathematics classroom?
- How do we build a community of mathematics learners in our classrooms?
- What counts as mathematical justification?
- What kinds of classroom discourses and norms support student participation in mathematics?
- What are effective instructional strategies for teaching mathematics particularly to students who are second language learners?

The mathematics educators in TEP believe in and agree with what national mathematics organizations have written about Access and Equity in Mathematics:

- Excellence in mathematics education requires equity--high expectations and strong support for all students.
- Equity requires high expectations and worthwhile opportunities for all.
- Equity requires accommodating differences to help everyone learn Mathematics
- Equity requires resources and support for all classrooms and students (NCTM, 2000).

Since the adoption of the 1998 California Mathematics Framework and Standards, more students in California have had access to Algebra 1, a course considered to be a gatekeeper to college preparatory mathematics. While providing more access to algebra is a positive outcome, African-American, Latino, and low-income students continue to perform at considerably lower levels in algebra 1 than their White, Asian, and high-income counterparts, as reflected in standardized test scores (Ed Source, 2009).

Culturally Relevant and Responsive Education and Mathematics.

One strategy proposed by educators to improve the performance of low-performing students of color is Culturally Relevant and Responsive Education (CCRE). CRRE is a method of empowering students to achieve scholastically without abandoning their culture. CRRE includes using cultural referents as aspects of the curriculum, and developing relationships with students (Gay, 1999; Ladson-Billings, 1994).

Jones (2004) wrote that classroom atmospheres that provide equitable learning environments for all students provide students with choices in their assignments, use cooperative groups, and create caring communities. Jones (2004) also described the characteristics of culturally responsive

teaching in mathematics. In terms of pedagogy, culturally responsive teachers have knowledge of their subject matter, an ability to learn about their student's thinking, and the willingness to use culture to make curricular connections. Culturally responsive teachers understand and respect their student's cultural beliefs and values, respect their ability and competence, and are reflective of their practice.

Social Justice and Mathematics

One way of incorporating CRRE into the mathematics classroom has been the movement to infuse social justice issues into mathematical tasks. Gutstein (2005) presented six goals for social justice mathematics lessons:

- Develop an understanding of the sociopolitical, cultural, economic, and historical dynamics of racism, along with their interconnections
- Appreciate the complexity of different forms of racism (structural, institutional, individual)
- Develop and use analytical tools (such as data analysis, graphing, and mathematical modeling of social phenomena) to understand and dissect racism
- Support views, develop coherent arguments, and engage in group discussions to develop individual and collective analyses
- Develop an appreciation for multiple, alternative, and compelling perspectives while constructing their own independent knowledge
- Become active, get involved in actual struggles when possible and appropriate, and use their analytical tools to cut through and confront myths and historical inaccuracies

The mathematics educators in TEP made a conscious decision to incorporate social justice tasks from Rethinking Mathematics (2005) into our secondary mathematics methods classes. The first task we used from Rethinking Mathematics was "Driving While Black/Brown" (p. 16), a probability simulation to examine whether or not real world data on random traffic stops in a major metropolitan area represent a case of racial profiling. Another task we used was called the "Geometry of Inequality" (p.169) that examined the population densities and access to community resources in two demographically different residential areas. An additional task that teachers completed was the "Sweatshop Mathematics" (p.78) activity, where students used mathematics to investigate the pay and working conditions of workers in countries outside the US who make the clothes sold by the top clothing manufacturers in the US.

Inquiry Project

TEP residents receive their M.Ed. after completing their inquiry project in which they connect theoretical perspectives and methodologies that reflect their beliefs about teaching and learning in their own classrooms, and the relationship between their professional practice and student achievement. The inquiry project is written in three segments over the course of three academic quarters.

In the fall quarter, the TEP residents write about their own positionality, explaining how their background and experiences influence how they think about teaching and learning. The TEP residents begin formulating a focus for their inquiry project. They also write about what it means to work for social justice. In the winter quarter, the TEP residents develop an action plan and implement their inquiry project. They are required to write about what they have learned about social justice at this stage of the process. In the spring quarter, the TEP residents analyze the data from their inquiry project and discuss the implications. They

also write about what the inquiry process has taught them about what it means to work for social justice.

Inquiry Projects of TEP Residents Who Used Social Justice as a Theme

The author taught the math methods course for TEP residents during their novice year and the seminar course during their resident year. The author also provided support for the residents at their schools, visiting them two times a month and providing feedback on their progress as teachers. That being the case, the author was in a position to be able to see how many of the first year teachers implemented the social justice lessons they engaged in during math methods, or created lessons of their own. In the academic year that this article describes, out of fourteen TEP residents, only three engaged their students in social justice tasks, and/or made it the focus of their inquiry project.

Data for this article consisted of analyzing four different sections of the inquiry paper for each of the three TEP residents who used social justice lessons in their classrooms: teacher positionality, the inquiry question, teacher goals as a social justice educator, and teacher views of social justice. The insights from each of the three TEP residents will be described in turn.

Results

Jena

Positionality.

Jena identified herself as an Arab-American, the child of immigrants. While she comes from an affluent family and neighborhood, her Arab background had a profound impact on her identity, particularly growing up in a post-9/11 era. Jena's experiences volunteering in urban schools impacted her desire to want to teach students who had the least amount of resources.

Inquiry Questions.

Jena's inquiry question was related to helping her students view mathematics as a tool for "social justice and transformative agency" through the use of projects. She saw projects as a way to help unmotivated students connect to the mathematics content. Jena hoped to get to know her students at a deeper level through projects. She wanted to increase student engagement. Through her project, she expected to increase student interest in mathematics, improve their engagement in classroom activities, and increased critical thinking and dialogue. Jena's learning goals were for her students to become more aware of assets and deficits in their community (Mahmood, 2011).

For three weeks, students drew upon their prior knowledge both in terms of their math knowledge and their understanding of their community in order to answer the essential question: How can we become more aware of the assets and deficits in our community? More specifically, students worked in groups to identify a specific asset or deficit in their community that they wanted to research. For example, students could choose to research healthy food stores. They had to plot the locations of these assets or deficits in an x- y- axis within a defined radius (Mahmood, 2011).

Students developed a final end product as a final assessment of their learning. The end product included a graphic designed art piece inspired by their research, a coordinate map of the point of interest their group chose to research, calculations of the distance between these points of interest, the school, and other points of interest. Furthermore, students were required to write a summary of their research about assets and deficits in their community. They had the option to provide a call of action for their classmates and school community to address any findings that they encountered. (Mahmood, 2011)

Goals as a Social Justice Educator.

Jena's goal as a social justice educator was to help students' positively transform their communities. She saw social justice as using available tools to make positive change in your community. Jena felt that her project not only opened her students' eyes to problems in their communities, but also helped them identify assets in their communities. Jena also stated her opinion that it can be disempowering for students to be informed of the ways that they are oppressed. She felt that it is better for students to investigate their communities and come to whatever conclusions their investigation reveals.

Views of Social Justice.

Jena viewed social justice as providing opportunities for students to think critically about issues in their communities. Jena felt that if properly educated for social justice, her students would return to improve their communities after they have attained their education. She had come to understand how challenging it is to teach for social justice. Jena revealed how much time is needed to help students reflect on their own experiences as they make sense of the conditions in their communities. Jena recognized that in order for her students to engage in social justice lessons, she needed to address the language needs of her students, as well as their specific learning modalities. She was satisfied that, in the end, her students were able to complete the project and present their findings to community members.

Kevin

Positionality.

Kevin identified himself as "an educated straight Asian-American male in my late 20s, formerly of the upper-middle class and now firmly entrenched in the middle class." Kevin explained how his race, ethnicity, gender, and socio-economic status have influenced his beliefs and practices. He provided examples from his days in school and his experience working in corporate America. Kevin connected his experience volunteering for organizations that work with underprivileged communities to his desire to teach in urban schools.

Inquiry Question.

Kevin was interested in using his students' forms of resistance to engage them in a social justice mathematics lesson. He hoped that students would learn how to focus their forms of resistance towards improving the conditions in their communities. Kevin wanted to delve into elements of social justice, and since he was teaching a mathematics class, he used various activities to point out varying injustices and inequities that take place throughout the world, as well as in the neighborhoods of some of his students (Chang, 2011).

Kevin engaged his students in two different social justice activities. The first activity that he did with the students was to show them a series of graphs detailing the highest math course taken by ethnicity, as well as the highest degree earned related to the highest math course taken. While the class was analyzing these graphs, there was a discussion as to what kind of perceptions these statistics create within society. Students also discussed the social justice aspect regarding the race of the students that do poorly, and what possible causes attributed to the data showing up this way. The students wrote reflections about what the graphs meant to them, how they felt about this particular data, and what they wanted to do about it (Chang, 2011).

The next activity was the "Geometry of Inequality" (Gutstein & Peterson, 2005) lesson plan, mentioned earlier. Students were placed in groups of 4 and were asked

to define types of community landmarks (liquor stores, community centers, and movie theaters) and compute a reasonable ratio of each of those landmarks to people. Afterwards the class came together and compiled each group's ratios on the whiteboard. Next, the students worked together to compile the population density of South Central Los Angeles, and estimate the number of community centers, movie theaters and liquor stores that should be in South Central Los Angeles, based on their estimations. Afterwards, the actual statistics at the time of the Rodney King incident (1991) as well as the actual statistics for these landmarks in Manhattan Beach, CA (a mostly-white, financially comfortable community) were revealed. The students wrote a reflection regarding their use of math in this activity as well as what were the social and political reasons for what could lead to people rioting (Chang, 2011).

The point of these activities was to get students to see more instances of injustice and to hopefully inspire some of the responsiveness that they so often engage in when they feel some sort of oppression themselves. Ideally this would then be channeled into how these issues relate to their lives and what they can do in response (Chang, 2011).

Goals as a Social Justice Educator.

Kevin saw being a social justice educator as providing access to students and bringing them to their highest potential. He also felt a social justice educator inspires other educators to activism. Kevin's perspective on social justice has developed from thinking about it in terms of social protest, to engaging students in social justice lessons some time in the future, to engaging students in social justice right now. He also felt that teaching for social justice requires being deliberate about it. The evidence Kevin provided to support the connection between his inquiry project and social justice is the way that his students reacted to the information they received during the lessons. Many of the students indicated that they wanted to do their best in school in order to improve the conditions in their communities.

Views on Social Justice.

Kevin felt that lessons that connect to student's lives and incorporate multimedia, increase engagement. Kevin also felt that the inquiry process has improved his lesson facilitation. He referred to his lesson on the geometry of inequality as an example of how teaching these lessons are an act of social justice. What Kevin has learned about teaching social justice lessons is the positive impact it can have on students. Kevin hopes that the motivation generated through engaging students in the lessons will result increased desire to continue their education.

Sally

Positionality.

Sally describes herself as growing up white in a suburban neighborhood, the child of a university professor and a medical technician. Sally provided a detailed explanation of how her race, class, and gender have impacted her beliefs and practice. She gave examples from her school experiences, as well as her home life to demonstrate her thinking. She described how her school and home experiences influenced her decision to want to teach in urban schools.

Inquiry Question.

Sally's inquiry question was about creating Youth Participatory Action Research (YPAR) projects to make Algebra 1 more meaningful. YPAR challenges systemic oppression or oppressive social structures in five main ways:

i. It suggests the necessity of

community collaboration or working as a collective for youth empowerment.

ii. It centers the voices and highly values the experiences of young people of color, a historically and present-day ignored group.

iii. The nature of YPAR projects is specifically geared towards challenging the unjust experiences of marginalized youth.

iv. It changes the way teachers or adult allies are understood – as supporters of the research-activism.

v. It changes academia by directly challenging the status quo of who researchers must be and who should be listened to. (Full, 2011, p. 27)

Prior to starting her inquiry project, Sally learned that InnerCity Struggle, an organization located in the area of her school, was going to be engaging in a Food Justice Campaign beginning soon after the start of the YPAR project. It turned out to be perfect timing for her students to contribute research to this campaign, and then advise and participate in the activism of the campaign (Full, 2011).

For this project, there were three main waves of data collection: before the project (letter and survey), during the project (ethnographic notes), and after the project (reflective survey). The two main ideas Sally collected data on was students' opinion of the significance of math, and students' development as research-activists. Sally saw this project as an opportunity to assist students in applying critical thinking and data analysis to the real world. Sally believed that YPAR would empower youth to change their world for the better (Full, 2011).

Goals as a social Justice Educator.

Sally saw socially just education as using a culturally relevant and critical pedagogy to empower young people. Sally wrote about how her experiences with her inquiry project made her more determined to teach from a social justice perspective. To her, teaching for mathematics for social justice meant allowing students to participate in research that showed them the power of mathematics as a tool to interpret their world. Sally discussed her feelings of apprehension with regards to teaching using YPAR, but her inquiry experience so far has convinced her that she is doing the right thing for her students.

Views on Social Justice.

In describing what she learned about what it means to work for social justice, Sally mentioned creating the action plan and worksheets for her project, and building closer relationships with her students. Sally didn't feel as her perspective on social justice has changed since the beginning of the school year, but the inquiry project has allowed her put her beliefs into practice. Participating in the inquiry project inspired Sally to develop more YPAR projects for her students, as well as participate in national debates around social justice and mathematics education.

Discussion

An analysis of the inquiry projects reveals some differences, and a lot of similarities. I will address each of the research questions in turn.

How did teachers (TEP residents) position themselves with respect to race, ethnicity, gender?

Two of the teachers identified themselves as persons of color, and one identified herself as white. Two of the teachers were

female and one of the teachers was male. All of the teachers came from well-to-do backgrounds. In each case, the teachers described experiences in their personal lives that influenced their desire to become social justice educators.

What types of inquiry questions do teachers (TEP residents) seek to answer about their practice?

Two of the teachers used activities from Rethinking Mathematics that were modeled in the Mathematics Methods course, and one of the teachers created her own social justice lesson. All of them found that engaging students in social justice lessons increased student motivation and participation.

What types of social justice goals do teachers (TEP residents) create for themselves?

The teachers endeavored to empower their students to reach their academic goals and transform their communities. They saw the use of social justice tasks as a way to help students meet these community-based goals. Teachers felt a need to be explicit about their social justice goals with their students. The teachers also described the need for students to conduct their own research to see the power of mathematics as a tool to fight injustice.

What did the teachers (TEP residents) learn from engaging students in social justice lessons?

The teachers wrote about the time it takes to help students engage in reflection on the conditions in their communities. Teachers felt that social justice lessons increased student engagement and participation. Teachers also believed that social justice lessons improved their relationships with students.

Based upon the data gleaned from the master's inquiry project, it was clear that these three teachers were predisposed to engage their students in social justice tasks based upon the perspectives they brought to teaching. The challenge for mathematics educators is how to influence the other eleven TEP residents who chose not engage their students in social justice tasks. A future study could analyze the inquiry papers of these TEP residents to look for similarities and differences between them and the teachers who did use social justice tasks in their instruction. This information could assist mathematics educators to redesign their courses and support systems in ways that would support more teachers to engage their students in social justice tasks.

Conclusion

Many states, including California, have adopted the new Common Core State Standards in Mathematics (CDE, 2010). The Common Core Standards include eight Standards for Mathematical Practice (SMP). The SMP's describe how teachers are supposed to engage students in mathematics. These standards are:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning

The examples presented in this paper demonstrate that, when implemented well, social justice lessons allow students to engage in the SMP. I also feel that promoting the implementation of the SMP is a way to encourage more teachers to engage students in social justice mathematics lessons. It begins with engaging teachers in social justice tasks and encouraging them to try them in their classrooms. Teachers also

need to have a community of practice to share ideas, successes, and challenges.

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