

## DRAMA IN THE SERVICE OF MATHEMATICS AND SOCIAL JUSTICE

### DRAMA A SERVIÇO DA MATEMÁTICA E DA JUSTIÇA SOCIAL

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#### ABSTRACT

In this essay, I argue that drama can be put in the service of mathematics education to promote social justice and human rights. The use of basic and simple theatre techniques in the classroom, in particular those involving mapping activities that bring people, land, and numbers together, can enhance the role that mathematics education plays in the fight for justice across the globe. In a world where ethnic cleansing, refugee and immigration chaos, and climate catastrophes are on the rise, human suffering is widespread. It affects 7 billion people worldwide, that is, 99 percent of the population living on planet Earth. Meanwhile, the combined wealth of the richest 1 percent will very likely overtake that of the other 99 percent of people in 2016. The numbers clearly show the situation is quickly getting worse, not better, by any global or local measure. What can we do? This article presents an introduction of a promising attempt sprouting worldwide at bringing mathematics and theatre together to promote a better understanding of the ways in which mathematics can be embodied, brought into our body and under our skin, in order to empower communities to make sense of the world we live in and help create it.

Keywords: Drama; Social Justice; Mathematics Education; Theater; Indigenous Rights.

#### RESUMO

Neste ensaio, argumento que o drama pode ser colocado a serviço da educação matemática para promover a justiça social e os direitos humanos. A utilização de técnicas básicas e simples de teatro em sala de aula, particularmente, aquelas que envolvem atividades de mapeamento que congregam as pessoas, a terra e os números podem reforçar o papel que a matemática desempenha na educação e na luta pela justiça em todo o globo. Em um mundo no qual a limpeza étnica, o caos dos refugiados e da imigração e as catástrofes climáticas estão em ascensão, o sofrimento humano é generalizado, pois afeta 7 bilhões de pessoas no mundo, ou seja, 99 por cento da população que vive no planeta Terra. Enquanto isso, em 2016, muito provavelmente, a riqueza combinada dos 1 por cento das pessoas mais ricas ultrapassará a das outras 99 por cento. Esses números mostram claramente que, por meio de qualquer medida global ou local, a situação não está melhorando, pois está piorando rapidamente. O que podemos fazer? Este artigo apresenta a introdução de uma tentativa promissora, que está brotando em todo o mundo, que é a de agregar a matemática e o teatro para a promoção de um melhor entendimento das maneiras pelas quais a matemática pode ser incorporada, trazida para o nosso corpo e sob a nossa pele, com o intuito de empoderar as comunidades para fazerem sentido do mundo em que vivemos, ajudando a criá-lo.

Palavras-chave: Drama; Justiça Social; Educação Matemática; Teatro; Direitos Indígenas.

## 1. Theatre of the Oppressed in the San Francisco State University Classroom

The first questions I pose to my Liberal Studies students at San Francisco State University (SFSU) is: Do the 20 million students enrolled in colleges and universities in the United States give these statistics due consideration, as they could, using basic mathematics instruction? Could the working class and mostly ethnic minority students at SFSU seriously reflect these numbers in respect to their own lives, and the lives of their loved ones by creating analogies that help understand what it takes to fight against rising inequality and heightened oppression in the U.S. and worldwide?

Drama activities in the classroom – mostly cultural, ethnicity, and other thematic maps; emotional warm-ups using images and numbers; and writing and performing skits and short plays - have the power to bring up generative themes that embody the unrelenting need for all students to get to know, exercise and defend human rights for all peoples, and to work on the promotion of social justice in local communities. Over 10 years of using the Theatre of the Oppressed repertoire of games and exercises at SFSU and beyond, we have learned that real-life drama, enacted in the classroom or out in the street, is a powerful pedagogical tool to get students to use dialogue and mathematics to best reflect about and act upon their own oppression. These are situations that are all too common on college campuses across the nation: rising student debt, racial discrimination, sexual assault, mental illness, hunger and scarcity. Mathematics education appears as a force in more than 500 plays written and performed by SFSU students, following the Theatre of the Oppressed methodology: here, numerals are not mere numbers, but signs and symbols of social relationships, as I have argued before (Ferreira, 2015).

Theatre of the Oppressed, or TO for short, is a set of collective and creative techniques, games, and practices invented by the legendary Brazilian theatre director Augusto Boal (1931-2009) to promote social and political change (Boal, 1993 [1975]). In this essay, TO gives educators, students, individuals, and communities a few tools to analyze and transform their actions within contemporary situations affecting their own lives. Boal was inspired by the work of the renowned Brazilian educator Paulo Freire (1921-1997), who created his philosophy of popular education working with the illiterate poor of the Brazilian Northeast (Freire 2006 [1970]). Starting in the late 1940s, his innovative approach to literacy emphasized peasants' ability to generate knowledge collectively, using *generative terms* – such as land, water, food, transportation – that conveyed their life conditions and worldviews. Freire's Pedagogy of the Oppressed, also known as PO<sup>1</sup>, enabled people to see themselves as historical actors, capable of organizing on their own and creating social change.

The discussion that follows is based primarily on the classroom use of two books that link together mathematics education and PTO: 1) *Mapping Time, Space, and the Body. Indigenous Knowledge and Mathematical Thinking in Brazil*; and *Acting for Indigenous Rights. Theatre to Change the World* (Ferreira 2015, 2013). Although most courses I have taught in Anthropology and in Liberal Studies (LS), which I am highlighting in

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<sup>1</sup>Because TO and PO are so closely related, the field is often referred to as PTO. For more information here, visit [www.pto.web](http://www.pto.web).

this essay, are not mathematics courses per se, half of the students in LS become school teachers. However, only a quarter to a third of those go into Science, Technology, Engineering, and Mathematics (STEM) fields. The use of drama in the classroom has the power to increase these numbers, especially in respect to getting female students interested in going into STEM fields. Powerful student statements attest to that, as mentioned below.

## **1.2. The SFSU LS students in the School of Humanities and Liberal Studies**

Activities described and mentioned throughout this essay have been developed mostly for SFSU students in the LS program since 2013, and in the Anthropology Department, where I taught from 2003 to 2012. The goal is to help them integrate multicultural mathematics and science activities into their current and future educational careers. Minority students, most of whom seek teaching careers via the LS Program, should benefit from a science-rich environment, especially as we, educators, are able to make science and mathematics more relevant and approachable. Working class students, of all ethnicities at SFSU, are used to hands-on work: most work in construction, the food industry, cleaning houses and taking care of children, driving for Lift or Uber, and so on. They are hard workers, used to making their own discoveries and eager to participate in real-life problem-solving activities.

Students that have written and performed their own plays using PTO methodology mention a heightened interest in becoming mathematics educators, as well as computer programmers, engineers, family practitioners, microbiologists, and a gamut of other STEM careers in high demand today. Here is DeMonde, who wrote with his teammates, the play *Titans of Mavericks: Extreme Surfing in California* in 2012, “Theatre of the Oppressed really helped me develop an interest in oceanography. Surfing to me was only about having fun. Because I had to explain to my team how exactly I go into those giant waves, the tide, the angles, and act it all out in front of the whole class, I started taking a scientific approach to it. This, in turn, made me a better surfer. I am applying to oceanography programs nationwide”.

SFSU students bring from all over the world a rich array of knowledge and life-experiences that often get overlooked or dismissed. All too often, the science, mathematics and technology studied in schools are limited to the major accomplishments of the Western world. Ethnomathematics, as an inherently interdisciplinary movement, is dedicated to bringing alive the contributions of non-Western peoples to the field of mathematics. However, what are the effective strategies at creating a learning environment that values and recognizes a diversity of cultural backgrounds and ways of knowing? Theatre of the Oppressed, with its vast repertoire of games and exercises, helps instructors and students alike increase our awareness of multicultural and real-world issues, while making science and mathematics more relevant and accessible for youth of all ethnicities. It is not difficult to get started with your own ideas as an instructor, using your creative mind and games and exercises suggested by the TO repertoire.

This is not to say that TO games and exercises can replace traditional mathematics instruction. Incorporating drama into the classroom, however, reaches out to students with unconventional learning styles. Drama incites students to bring out their real-life mental, physical and emotional contributions to the mathematics classroom. Whereas

math and theatre may seem to have little in common – the first, a hard science; the second, part of humanities - the ethnomathematics research program is what makes math and drama go hand-in-hand with school practice.

From a theoretical standpoint, following Ubiratan D'Ambrosio, *ethno* refers to the cultural context; *mathema* means to explain, to know, to understand; and *tics* comes from *techné*, the same root as art and techniques (1990, p. 5-6). It is inspiring and very useful to think of the link between mathematics and art. Take the riveting *Math and Dance* teaching manual, which proposes whole-body math & movement activities for the K-12 classroom (Schaffer, Stern, & Kim, 2001). The authors claim that dance and mathematics are more than equals, manifestations of the same interest in aesthetics and form, thought and expression:

We were inspired to try out our own ideas by the numerous choreographers, composers, visual artists and playwrights who have addressed mathematics, either by imbedding the ideas of mathematics into the art itself, or by treating the subject more topically. The more we delved into math dance, the more we encountered performers, mathematicians and enthusiasts who were also exploring these links (Schaffer, Stern, & Kim, 2001, p. 6).

The book *Math and Dance*, addressed to *everyone*, primarily “classroom teachers who want to introduce ideas in mathematics and dance in a vivid, memorable way,” addresses mathematics as a creative art. It offers dozens of learning activities that go beyond arithmetic, “with experience followed by reflection” (Schaffer, Stern, & Kim, 2001, p. 14). Drama, like dance, offers imaginative connections to and within mathematical thinking because they are creative pursuits, enrich one another, and involve kinesthetic learning.

## **2. Enriching the Classroom with Drama**

In *Africa Counts. Number and Pattern in African Cultures*, Claudia Zaslavsky (1973) was one of the first mathematics educators to call our attention to other peoples' and their cultures' contributions to science and mathematics. The book was followed by an astonishing collection of hands-on teaching manuals published in the next decades where she stated, repeatedly, that when we fail to include the contributions of other peoples to the mathematics curriculum, it is as if we wiped them off the map, as if they did not exist. Zaslavsky's work inspired the growth of the field of ethnomathematics using what is known as an inquiry-based and hands-on approach, or what we today call active-learning. Students pose questions of the world they live in and help create, collaborating with their teachers on the construction of meaningful and creative pursuits.

Drama in the classroom is being increasingly acclaimed as a powerful pedagogical tool that allows students, instructors, and the interested reader to become active partners in discovery. Working in teams – collaborative work - is of particular importance, in order to bring together individual trajectories and viewpoints toward collective understandings of the world experienced. Drama, and in particular TO games and exercises, as I argue here, including the creation of skits and short plays reflecting real-world issues faced by the students, can highlight the origins of numbers and counting, the idea of symmetry and mathematical proofs, modeling, number-bases and place-

value. In my own experience, mapping activities have been most successful at bringing out a variety of skills, including the interpretation of cartographic data. Students are able to compare their findings and creations with those of peoples from different times, places, and cultural and ethnic backgrounds.

In *Geometry. Activities from Many Cultures*, mathematician Beatrice Lumpkin sets out “to enrich the geometry curriculum with real-life examples from many cultures” (1997, p. v). The first activity she includes in the teaching manual is *Drama in the Service of Mathematics* (which this essay borrows its title from, with permission). The instructions read: *Write a scenario for a short play or skit that you can present to the class.* Lumpkin suggests that students select from a list of topics of science and mathematics, or use a theme of their choice. Her list includes: 1) Building a round house; 2) Inventing bricks; 3) The Invention of Agriculture; 4) Using sailboats; and 5) Planning the construction of the pyramids. All of these topics require historical research in teams, bringing out contributions from many societies, usually underrepresented in high-school and college curricula – African American, Latino, Native American, Pacific Islander, Asian American, and others.

It was precisely in the 1990s that the importance of drama in mathematics classrooms started garnering more attention. In *Math for Humans: Teaching Math Through 8 Intelligences*, drama is presented as one of the intelligences that Masoum and his collaborators (1999) argue can help mathematics educators in grades 3 to 8 bring out the diversity of ways of teaching and learning mathematics. It is in the new millennium, however, that theatre appears as an important tool in communicating mathematical concepts cross-culturally. In *A Study on the Effects of Mathematics Teaching Provided Through Drama on the Mathematics Ability of Six-Year-Old Children*, Serap Erdogan and Gulen Baran (2009) show that “the drama method has a positive effect on the mathematical ability of six-year-old children” (p. 79).

While a few studies like these have brought out the strong contribution that theatre as a method of generating knowledge can bring to the mathematics classroom, a gamut of rather unknown studies (at least to me) was brought to light in 2015 by the Brazilian educator Hannah Lacerda. Her comprehensive literature review of how theatre can be put at the service of mathematics, entitled *Educação matemática e teatro: um panorama das pesquisas brasileiras* (Mathematics Education and Theatre: An Overview of Brazilian Research) presented in Chiapas, Mexico at the Inter-American Conference on Mathematics Education (IACME) in May 2015, highlights how mathematics, timidly but surely, has insinuated itself into theatre, the creative arts and sciences, and what she calls *digital mathematics performances*.

In her introduction, Lacerda mentions Ubiratan D’Ambrosio e Marcelo Borba’s (2010) characterization of mathematics education in Brazil as a *tapeçaria de tendências* (tapestry of tendencies), where one can find modeling, technology, ethnomathematics, philosophy, history, and politics, amongst other issues. The author’s goal is to think about the possibilities of theatre as one of the *threads* that compose this tapestry (2015). Her main research question is: *What is the vision about mathematical content that students express when they develop a PMD [Digital Mathematical Performance] play?*

Most of the authors cited by Lacerda write about the use of theatre to bring together art and science, including biology, physics, chemistry, and mathematics. A few of those,

however, dedicate themselves specifically to the relationship between theatre and mathematics. Lacerda cites Grützmann (2009), for instance, who looks at the training of mathematics teachers via theatrical games, and who concludes that learning mathematics requires a high degree of abstraction in order to relate content to reality, and that theatrical games allow for the improvement of the students' body expression and communication.

A similar argument is made by Poligccio (2012), whose work Lacerda (2015) also highlights, in respect to the power that theatre has to materialize highly abstract concepts and narratives in the mathematics classroom, and thus develop students' imagination and extrapolation. In her final considerations, Hannah Lacerda argues that very soon the relationship between theatre and mathematics will become a *tendency* in mathematics education given the growth of specific publications (books, scholarly articles), as well as presentations in scientific conferences, and membership in professional societies and scientific communities.

### **3. Acting for Indigenous Rights: Mathematics and Theatre in Indigenous Schools in Central Brazil**

My experience as a young mathematics educator in the Xingu Indigenous Park<sup>2</sup> began in 1978, informed by the popular education methodology of Paulo Freire. Freire's emphasis on dialogue and on people working with each other to transform the world materialized into short stories, memoirs, drawings, photographs, and maps published collectively in numerous newsletters, first-readers, atlases, and history books in the Xingu Indigenous Park and other reservations or territories where I worked. Through dialogues and debate, students were challenged to adopt more critical positions about the country and their lives. Like Freire, many educators viewed education as an effort to liberate people and not as yet another instrument to dominate them. The educator's insistence on situating educational activity in the lived experience of participants has opened up a series of possibilities for the way education has been put into practice in Brazilian schools, including Indigenous ones. Augusto Boal's Theatre of the Oppressed (TO) is one such methodology, which closely mirrors the dialogical and transformational aspects of Freire's critical pedagogy.

TO came rather naturally to students from 17 distinct Indigenous communities who attended the Diauarum School in the Xingu Indigenous Park, where I taught mathematics and Portuguese in the early 1980s. Dialogue and communication, so essential to Freire's theory of liberation, were often difficult given the students' varied cosmologies or worldviews and the 17 different languages they spoke. Only a few male adults who worked at the Diauarum administrative post knew some Portuguese. I developed educational materials in the Kayabi, Suyá, and Juruna languages, but these represented only three major spoken tongues. Therefore, the students and I had to develop other ways of communicating and producing knowledge. Aside from drawing, theatre kept insinuating itself into our activities, whether we were studying math, creating map books, writing newsletters, or re-writing history – from Indigenous perspectives, of course.

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<sup>2</sup>Xingu Indigenous Park is in the state of Mato Grosso, in central Brazil.

Because communicating verbally and in writing was a challenge, given the variety of languages (most of the indigenous languages did not have a written code yet), students introduced the topics they wanted to read and write about in our cultural circles, using body language. In 1981, we put together our first play at the Diauarum School: using no words but only actions, *Fishing on the Xingu River* conveyed the everyday practices of local communities, who relied heavily on fishing for survival. The techniques for attracting and catching a huge variety of freshwater fish in the Amazon basin were so wide-ranging that we quickly developed games to introduce these practices to the local villagers and to our neighbors and visitors, Indigenous or not. We then wrote about these varied practices in different languages in our multiple community-based publications.

Here is a list of a series of narratives, told both orally and first presented in written form in our monthly newsletter *Memória do Xingu* (Xingu Memory) by The Suyá, Kayabi, and Juruna peoples, and often performed in our Diauarum school house in the Northern part of the Xingu Indigenous Park:

- The origin of rivers; The woman who dated a tapir; The old man who taught the boy how to hunt; The man who roasted his wife; Long ago, we did not know airplanes; When the Suyá people first arrived in the Xingu Park; The History of the Tracajá turtles; The sons of the moon; When we didn't have fire; The history of night; The history of the shaman who went looking for a woman to marry; The man who turned into a monkey; When the Kayabi did not yet know the white men; Food from long ago; The suffering of the Kayabi people; The history of measles; The history of my life [there are dozens of life-trajectories]; First contact with the Arara people in Altamira; Meeting about the Altamira dam [in the Amazon]; I forgot how to weave a basket; Our sacred ceremonies are coming to an end; The difficulties I faced in the city; How we built our new Tuiararé [Kayabi] village; The situation of the Kayabi people in the Xingu Park today; The history of the sloth; How the first Juruna person was born; How humans divided into different peoples; How the Juruna conquered the night; How the Juruna found water; How the Juruna learned how to plant food; The man who turned into a jaguar; the man who didn't know how to hunt and lost his hands; How the Juruna first arrived in the Xingu Park; When the Juruna killed the first colonizers; The first contact between the Juruna people and the white men.

As the reader can tell from the titles, a sense of time, space, and the body emerged strongly from these narratives that mostly touched on what is known in anthropology as *origin or creation myths*. They recount the beginning of the world, when animals first taught humans to become people by occupying the land, and learning how to conquer fire, make tools, hunt and fish, build houses and canoes, and grow fruits and vegetables for their sustenance. These narratives are then followed by detailed accounts of the first contacts between indigenous peoples and their colonizers – mostly fur trappers and gold hunters, as well as a gamut of European explorers, such as naturalists, botanists, and the like.

Most of these narratives were told, performed and written down in the 1980s and 90s (Ferreira 1994). However, they date back, in most cases to *antigamente* – a long time ago that usually takes us back to the origin of humankind, from the perspective of

indigenous peoples in central Brazil. The narratives then move forward quickly, to the time period when the colonizers first entered the Xingu River basin in the late 19<sup>th</sup>, and all the way up to the late 20<sup>th</sup> century. As the narratives unfolded, the territories were clearly being mapped with specific reference points, such as rivers, mountains, burial sites, boulders, old villages and plantations, palm tree groves, animal mating grounds, and so on. The next step, documenting all this activity, took the form of cartographic maps, reproduced in many history, math, and map books published by many indigenous organizations and their supporters throughout Brazil (Ferreira, 1998).

Mairawê Kayabi, an indigenous leader who participated as a guide in government *pacification fronts* of isolated peoples still in the 1960s, 70s and 80s in and around the Xingu Indigenous Park, brought time, space, and the body together in his succinct explanation of how indigenous peoples in Brazil – and elsewhere in the Americas – measure time today: “Instead of Before Christ and After Christ, for us it should be BW and AW. It was after the white man came that everything changed (Ferreira, 1994, p. 9).

Twenty years later, in the early 1990s, I found very similar generative themes elicited in northern California by the Yurok and other indigenous peoples amidst whom I conducted doctoral fieldwork on the social causes of diabetes mellitus. The Yurok genealogies that I traced – family maps or *people in trees*, as the Yuroks called them – referred back to the gold rush in the 1850s, when their ancestral land was taken away from them, when people died of infectious diseases and of starvation, when children were taken away from their parents and placed in boarding schools against their will, when their languages and sacred ceremonies were lost, when marriages into white families was encouraged and often required, when diabetes became wrongly associated with the notion of *Indian heritage*. The connections were obvious: Brazil followed the assimilation policies for American Indians dictated by the U.S. government: the reservation system, confinement in boarding schools, ultimately, genocide. The maps that applied to the Suyá, Kayabi, Juruna, and other indigenous peoples in Brazil also made sense in the U.S.: history repeated itself in more than one way.

The real surprise came to me a decade later, in the early 2000s, in the networks of analogies SFSU minority students traced in their plays they wrote and performed in my classes. Indigenous students, also known in the U.S. as Native Americans or American Indians, usually comprise only 2 to 3 percent of the class. These are first, second, third generations of immigrants. The Ethnicity Map, Activity 1 shown ahead, brought out all of those associations amongst students that did not seem to be there in the first place, highlighting what makes them similar to one another, rather than what draws them apart. This activity, followed by others and a link to where you can find the details, will bring you into full gear of how to begin to put drama in the service of mathematics.

### **3.1. Activity 1: Ethnicity Map: Introducing Ourselves**

**Overview:** In a guided mapping activity, participants move around the room to create an ethnicity map based on their own, and their ancestors', immigration history.

**Outcomes:** Participants get to know each other and where they come from; Participants become more aware of the ethnic diversity that surrounds them; and Participants learn how to read an ethnicity map using key terms and skills that they are introduced to.



**Time:** 15 - 20 minutes.

**Materials:** None (but see below if you choose to expand the activity).

**To the Facilitator:** Optimum group size: 20 or more participants. This activity can be adapted to any discipline in High School or College, or to any participants aged 14 or above (the age depends largely on the debriefing questions listed ahead).

### **3.1.1. Getting Started**

- Explain that the main goal of this activity is for students and the instructor to introduce themselves. You may add other goals depending on the specific topic of your class or workshop.
- If you are confined to a room, move all furniture against the walls to create an open space. If you are at a park, find a flat, dry area where participants can move around.
- Have all participants gather in the middle of the room or the area you are using. The center represents your current location (San Francisco, Chicago, New York, etc). Ask them to indicate where North is (without the help of cell phones), and then South, East, and West. Explain that following your cues, they will move in those directions, starting with their place of birth, then those of their family members.

### **3.1.2. Begin the Map with Cues**

- a. Now that we are all gathered here in \_\_\_\_\_ (name of city), let's move toward the direction where we were born. Keep the cardinal points in mind as you move. (Participants may stay where they are, move slightly, or move far away from the center).
- b. Begin with yourself, stating your place of birth. Include the state or country. (Have them state their positions quickly. To get it started, begin with yourself. Participants will likely start adjusting their positions as they learn where others are from).
- c. Now move to where one of your parent's was born. State where that is. (Go around participants quickly eliciting the information).
- d. Now move to where one of your parent's was born. State where that is.
- e. Now move to where one of your grandparent's was born. State where that is. (At this point and beyond, some participants may not know the locations. Ask them for an approximation or to take a wild guess).
- f. Now move to where one of your great-grandparents was born. State where that is. (At this point, depending on who your participants are, you will probably see clusters forming around the space. At San Francisco State University, for example, the largest concentration is often in Asia, followed by Europe, and Latin America).

- g. Take notice of what is going on. Does this configuration reflect the ethnicities we find in this school (or neighborhood, or city, etc.)? (As students comment, you may ask more specific questions about immigration, for instance, using statistics or other information. At this point you may also choose to document this configuration on a hand-drawn map on the board or on another surface, so that you can later expand the activity to the campus, a park or nearby area, as mentioned ahead).
- h. Now let's go back to where one of your grandparents was born. And now back to where one of your parents was born. And now back to where you were born. And finally back to the center.
- i. Now that we are all back together where we began, let us all, one by one, say our names and something you would really like everyone else to know about you. It may be related to this class (or workshop) or not. (To get them started, you may say something about yourself, such as: *I really like singing while I cook*, or *my favorite film is Angels in America*, and so on. Students at SFSU often mention their upcoming graduation or new job, eliciting applause; their favorite videogames, food preferences, pets, etc).
- j. Now that we know a bit about each other, let's give ourselves a big hand of applause!

### 3.1.3. Debriefing the Activity

After sharing an aspect of themselves with the group, ask participants to mill around and greet each other with a handshake, high-five, fist-bump, or other gesture. Then discuss the activity by asking questions like these:

- *To what extent does this mapping activity reflect the ethnic diversity or ethnicity of this campus/neighborhood/city?* (At SFSU, the facilitator may want to point out that 1/3 of the class has moved East or Northeast to Asia, where their ancestors come from; approximately 1/4 has moved South or Southeast to Latin America; another 25% have moved North or Northeast to Europe, and the remaining 25% are scattered East, in Africa, and in North America, remaining in the SF Bay – accounting for the 0.3 percent of Native Americans that graduate at SFSU annually. This is what a minority institution looks like, in the SF Bay Area!<sup>3</sup>).
- *Is ethnicity the same as race?*<sup>4</sup>
- *How do you choose to identity yourself on campus and why?*

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<sup>3</sup>“SF State ranks high for graduating minority students”. See <http://news.sfsu.edu/sf-state-ranks-high-graduating-minority-students>. Accessed on November 5<sup>th</sup>, 2015. The study, conducted since 1990, looked at 2.76 million degrees granted at the bachelor's, master's and doctoral levels in the U.S. in the 2012-13 academic year. The rankings appeared in the October 9<sup>th</sup>, 2014, issue of *Diverse Issues in Higher Education* Volume 31, Issue 18.

<sup>4</sup>Here, you might want to explain that: 1) there is only one race, the human race, and that everyone on this planet is 99 percent alike; and 2) ethnicity *is how people define themselves and are defined by others* on the basis of genealogy, language, and culture, which includes religion. In this respect, a person may have more than one ethnicity, in fact multiple ethnicities, such as Latino/a, American, Jewish, Muslim, Native American, Somali, Aboriginal, and so on. Some ethnicities we choose, others are imposed on us. For more on the topic, see Ahmed, 2002.

- *How do you identify yourself in your own community?*

### 3.1.4. Optional Activity

Expanding this mapmaking activity into your campus or community. You can expand this activity to the grounds of a College or High-School campus, highlighting the local geography, topography, biology, and of course, the cultural and ethnic diversity. For mathematics teachers, you can explore several topics, including scale, coordinate systems, projection, proportions, and much more. Health educators can create maps locating specific health services or identifying health hazards, such as sources of pollution. Mural art, too, is a rich field to engage in mapping, as we have done at SFSU, because it reveals much about the local history and its peoples. Check out the ways in which this Ethnicity Map has been expanded at SFSU using Theatre of the Oppressed, in interactive mapmaking activities using Google maps, video making, muralism, and more<sup>5</sup>.

It is this simple: games and exercises, inspired from Augusto Boal’s Theatre of the Oppressed and Paulo Freire’s Pedagogy of the Oppressed repertoire, have the potential to inspire students to foster an interest in mathematics education. Table 1 shows a list of issues (topic plus conflict, which makes an issue) that students at SFSU chose to write about and performed in class, and in public venues, such as in conferences, and on the street for a broad audience that are related to mathematics education.

| <b>Title of Short Play and Bullet</b>                                                                                                                                                                                                                                                                                        | <b>Related TO Activity</b>                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>The Ultimate Citizen.</i> Amy and her parents think that there is only one way for her to become the ultimate citizen like her sister – go to College, get married, have kids, buy a house. But, Amy cannot afford this lifestyle, as the minimum salary in California is not a living wage. She has other plans in mind. | <i>Below the Poverty Line.</i> Families and students adapt to worsening economic conditions. Using an imaginary currency, make a chart listing process for necessities such as rent, utilities, bus fare, shoes and other items of clothing, milk, bread, and other food staples (Activity 6.2, p. 96).                          |
| <i>Going Bananas.</i> This play is about the labor rights of Guatemalan women and men, looking at the exploitation of labor in central Guatemala at the turn of the 21 <sup>st</sup> century.                                                                                                                                | <i>The Power of Emotions.</i> Participants practice a range of positive and negative emotions without any specific reasons for feeling this way, using only numbers. Following cues, they mill around the room as they shift the quality of their emotions to less and less positive, and then back again. (Activity 4.1, p. 43) |
| <i>War at Home.</i> Upon his return, a soldier develops PTSD because of the challenges he faces adapting to a new environment after his traumatic experience in Afghanistan.                                                                                                                                                 | <i>Another Vision of the World.</i> While participants act out a scene from <i>War at Home</i> (or any other play), others may intervene to create a different vision of the world and a better outcome. (Activity 6.7, p. 101)                                                                                                  |
| <i>Stars in the Sky.</i> A team of college athletes becomes stranded in the Andes after a car accident, and they find their way back to town following the stars in the sky.                                                                                                                                                 | <i>What should we do?</i> The audience interviews characters from the play asking them exactly how they went about using the stars to guide them back to safety. (Activity 7.5, p. 142)                                                                                                                                          |
| <i>Salmon Wars.</i> A Native American family                                                                                                                                                                                                                                                                                 | <i>Reading about the Salmon War.</i>                                                                                                                                                                                                                                                                                             |

<sup>5</sup>See the Right to Know Project at SFSU: <http://online.sfsu.edu/rtknow/index.html>.

|                                                                                                                                                                                                                                     |                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| that has been kept from fishing on their own reservation needs to provide salmon to 300 guests for a healing ceremony. Fifty fishermen and women set out in dugout canoes on the Klamath River and accomplish the task in 24 hours. | Participants read articles about the facts and figures that led to the depletion of the Klamath salmon stock. (Activity 5.2, p. 77) |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|

*Table 1: Titles of plays, synopsis, and related TO activities<sup>6</sup>*

To get you started, there are many sample exercises for energizing, focusing and connecting during the process of writing and performing your own play, or else guiding others in the process<sup>7</sup>! (Table 2).

| <b>Sample Exercises to Raise Energy</b>         | <b>Sample Exercises To Increase Focus</b>          | <b>Sample Exercises For Image Theatre</b>   |
|-------------------------------------------------|----------------------------------------------------|---------------------------------------------|
| The Power of Emotions (Act. 4.1, p. 43)         | Metamorphoses (Act. 4.6, p. 48)                    | Speaking the Inner Voice (Act. 4.4, p. 46)  |
| Nothing Human is Alien to Me (Act. 4.2, p. 44)  | Over the Top (Act. 5.5, p. 80)                     | Before or After (Act. 5.4, p. 79)           |
| Living Sculpture Activities (Act. 5.3, p. 78)   | Things that go Bump in the Night (Act. 6.3, p. 97) | My Someday (Act. 6.5, p. 99)                |
| Following the Master (Act. 6.1, p. 95)          | The Model Child (Act. 6.4, p. 98)                  | Living Sculptures (Act. 7.3, p. 140)        |
| Expressive Trees and Flowers (Act. 7.1, p. 138) | What Should We Do? (Act. 7.5, p. 142)              | Reconstructing the Crime (Act. 7.4, p. 141) |

*Table 2. Sample exercises to raise energy, increase focus, and to practice image theatre<sup>8</sup>*

#### 4. Final Thoughts

In my experience, these games and exercises have proven to be a highly effective tool for teaching critical thinking, social change, and human rights in classrooms across the globe. Now, I am arguing that drama should be put in the service of mathematics to generate more interest in STEM careers, and to promote social justice. As Augusto Boal put it, Theatre of the Oppressed is a “rehearsal of revolution” (1985 [1975], p. 141). So let us get our hands dirty and our feet wet and spring to action!

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<sup>6</sup>All included in *Acting for Indigenous Rights. Theatre to Save the World* (Ferreira, 2013). Retrieved from [www.indig.umn.edu](http://www.indig.umn.edu).

<sup>7</sup>All of these exercises can be found at [www.indig.umn.edu](http://www.indig.umn.edu).

<sup>8</sup>Image Theatre is a series of silent exercises in which participants create embodiments of their feelings and experiences.

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