The main aim of education should be

to produce competent, caring,

loving, and lovable people.

Nel Noddings

If we are to reach real peace in this world

and if we are to carry on a real war against war,

we shall have to begin with the children.

Mahatma Gandhi

Orwell was wrong.

It's not Big Brother we have to fear.

It's Huxley's Brave New World

Wherein the truth drowns

In a sea of irrelevance.

Paraphrased from Neil Postman

Introduction

Nel is sitting in my grade eight mathematics class with her hand raised confidently in the air. It's June and the classroom feels like a tropical jungle.

"David," she says, "just for the fun of it I've listed two full pages of occupations that require no use of mathematics beyond the simplest arithmetic. I'll bet good money that I don't need algebra for my next 80 years on the planet."

Snickering from the class.

"How many of you feel this way?" I ask, a single drop of sweat sliding down the side of my face.

Three quarters of the class cautiously raise their hands.

I try not to appear nervous but the jungle air is constricting my lungs. Chairs scrape. Even those who were carving words of farewell into the desktop look up expectantly. I move to block the door. Too late. Nel has started a revolution.

Open any of the math textbooks or glance through the professional magazines and you will see that Nel has an excellent point. Middle school is a wasteland of pizza party math, where youth are meant to gleefully calculate the number of possible outfits they can select for the party, and delight in figuring out the volume of the pizza box, how many slices each should get and how much it will all cost.

"Nico can put the distance between Pluto and Mars into scientific notation but he can't explain the magnitude and impact of the U.S. military budget."

There are activities to measure flag designs and calculate the radius of wheels. Students are asked to compare the height of the CN Tower to that of Death Valley. Is that toaster marked $29.95 fifteen or eighteen percent off of the original price? How many fries fit in the regular sized serving container? What if I super size-it?

Speaking with parents and teachers everywhere, educator and author Alfie Kohn asks the following question: Which is larger, 4/11 or 5/13? The answer, he says, if you're thinking from the students' point of view, is '**who cares**?'[1] And so, too, with fries and flags, toasters and towers: *who cares*?

There are two intertwined problems at play here. The first is that most people understand that there is a correct answer to Alfie's fraction question and, as a result, have come to believe that all we have to do is 'pour' into students 'the way to do it' and presto, they can do math. Paulo Friere describes this as the "banking concept" of education. Teachers act as experts and "deposit" truth into students, who are passive depositories. The first problem thus has to do with the *process* of math instruction, or perhaps the process's philosophical underpinnings.

1 Kohn, Alfie. *The Schools Our Children Deserve*. Houghton Mifflin Company, New York. 2000. p. 141.

"Vivian can develop the formula for finding the area of a parallelogram but she can't compare the rate of people per square metre in a homeless shelter to the same rate for a home in Rosedale."

Friere notes that "whereas banking education anesthetizes and inhibits creative power, problem-posing education involves a constant unveiling of reality. The former attempts to maintain the *submersion* of consciousness; the latter strives for the *emergence* of consciousness and *critical intervention* in reality."[2]

"Whoa...!" some teachers respond. "Hey, now. 'Submersion of consciousness'? 'Critical intervention in reality'? I thought this was math class, where we figure out how many cups of flour we need for our tortillas!"

Which brings me to the second problem and the reason for this book, the problem of *content*. As teachers came to realize that the more relevant the material to the student, the better it's learned, we ended up with pizza party math. Objects in students' real lives could be used to "do math upon". Surely, however, there is more to real life math than rummaging around in kitchen closets to measure the volume of the Twinkies box or the can of Ravioli. We must distinguish between using things in the world around us to do math, and using math *to understand the world around us*. One is deceitfully artificial, a straw man. The other is dangerous, for it encourages people to think, and possibly, to act.

To restate: **relevant** content is that which will engage the learner in their social reality. Now if you're thinking about the vast majority of people on the planet, social realities tend to be awash in inequity and injustice. Fortunately, there are many opportunities to address that injustice, as long as you're learning about the issues in the first place. **Maththatmatters** is a group of assignments designed to bring that content into the classroom.

There are two main objectives for this text. The first is to offer math activities that can be used to teach and reinforce the math skills that teachers are required to have their students learn. A text that does not address the skills outlined in curriculum documents is a text destined for a dusty shelf.

"A'amer can calculate how likely it is that he'll roll a sum of four with two dice but he can't explain the chances of reaching age four in Sudan."

The second is to provide content that captures and increases student interest in justice, fairness and kindness, replacing purposeless content that furthers no student's ability to engage with their social reality.

I take it as a given that there are expectations, *copious* expectations in fact, that teachers are bound to address, and so I would be remiss if general curriculum strands were not linked and listed at the beginning of the book for easy reference. These allow the person using this resource to *substitute* portions of their existing program for **maththatmatters** assignments and feel confident that the students are practicing the required skills. To put it another way, these assignments are not intended to be heaped on top of the mountain of work that already exists on your plate.

Maththatmatters questions the value of the content in our current texts and resources. If we want to encourage students to make the world a better place for everyone, to think in terms of possibilities, it not going to happen easily if we spend classroom time with pizzas and ravioli cans.

2 Freire, Paulo. *Pedagogy of the Oppressed*. Continuum. New York. 1986 p. 68.

The assignments examine the here and now; for example, child abuse in "Breaking the Silence", and more distant issues that may still shape our day to day lives; for instance, the General Agreement on Trade in Services in "GATS Terrible!!" No lesson is meant to be the definitive word on the subject: all lessons are meant to fall under a general social justice perspective or umbrella.

In *Manufacturing Consent*, Noam Chomsky talks about the idea of "intellectual self-defense", which has to do with helping people to have the cognitive skill to protect themselves from deception. My hope is that the topics listed above will contribute to intellectual self-defense, but above and beyond students having a capacity to do mental Judo to protect themselves, I'd like them to think about how we might make the world better for others.

"Antonino can figure out his daily paper route salary using an algebraic equation but he can't use a pattern to show how violence on television and aggression in the world are related."

"To say that all students must somehow be prepared for the privileges and responsibilities of democratic citizenship seems right, but what role does mathematics play in this?"[3]

Nel is back again, prodding me to explain how, exactly, math can be used to engage more fully in a democracy.

"Have you seen the Wal-Mart commercial?" I ask.

"You mean the one with the bouncing yellow cartoon face, carrying a bow and arrow and wearing a Robin Hood hat?" she replies. "He leaps around the Wal-Mart store shooting arrows at the posted product prices, knocking them lower and lower."

"That's the one. What do you know about Robin Hood?"

"He steals from the rich to give to the poor." The deep irony of a Wal-Mart-created Robin Hood washes over me.

I prod. "How does a store afford to give us all of those deals? Surely the owners of Wal-Mart don't want little Robin roaming around cutting away at their profits…?" We're about to get into difficult questions that have very complicated answers- many that require mathematical thinking.

Numbers are used all of the time to manipulate people. Numbers used in marketing tell half-truths, or really, very narrow slices of truth. All parts of the political spectrum produce statistics to advance their own agendas. Crucial patterns and relationships (studied in what we call algebra!) are routinely hidden from view. In a democracy, and in the social justice movement in particular, mathematicians of all ages will be required to continually point out how numbers are *repeatedly* used to *facilitate oppression*, and more importantly, how numbers can be used to promote honesty, equity, fairness and kindness.

Although some people give their perfunctory "moo" at election time, really it's difficult to participate meaningfully in a democracy if you don't understand the issues upon which you are voting. I'm speaking broadly now: voting includes the choices we make as consumers, choices we make around how to spend our time, the community projects that we're involved in, the emphasis that we place on particular social issues over others, and the boxes that we tick at the polls. Voting in ignorance is like trying to pick out a thoughtful gift for a stranger: you might get lucky, but probably not.

In a system of education, and specifically math education, that focuses so much of its time and resources on skills based education, memorization, regurgitation, standardized testing and reams upon reams of math problems whose content is immaterial, we miss a huge opportunity. We miss the opportunity to engage students in democratic process and increase their interest in social justice advocacy. To interact with students as if they are empty vessels to be filled with facts and figures is to "disconnect…students [from their] social realities and from issues of equity, responsibility, and democracy."[4]

Math is a particularly useful language to use when talking about quantity and quality, about relative relationships, about connections and probabilities. Math is excellent for describing similarities and point-

3 Noddings, Nel. http://www.ed.uiuc.edu/EPS/PES-yearbook/92_docs/NODDINGS.HTM July 23, 2003.
4 Macedo, Donaldo. *Chomsky on MisEducation*. Rowman and Littlefield Publishers, Lanham Maryland. 2000, pp. 4-5.

ing out differences, tracking trends and describing patterns. We communicate ideas to others whether we describe and explain our world using bar graphs or body language. And certainly, questions of how much, how often, how similar and how different can be questions of justice.

"Ramona can sketch the front, top and side views of a cube but she can't use angles to interpret a boundary dispute between the provincial government and a First Nations community."

The difficult thing about these lessons is that the questions that they raise are rarely captured with simple answers. In pilot lessons we moved toward better understandings of the topic using math, without ever completely understanding. Such though is life.

Rather than using content and questions that lead the learner to simple numerical answers, devoid of real meaning, many of these assignments are designed to get students and teachers to ask more difficult questions, like the following:

- Who's perspective is this? What influences and shapes the person with this perspective? *Cui bono*? Who benefits? Is there a conflict of interest?
- What information is missing and why is it missing? Might missing information lead me to different conclusions?
- Do I trust the truthfulness of the information before me? Why or why not? What proof do I have?
- What do opponents of this perspective say?
- Do all perspectives carry the same value? Which ones are more compelling and why?
- How might I further complicate my thinking about this?
- Whom does this perspective or situation hurt? How does this affect me personally?
- How might I have some personal responsibility for this situation? What can I do to make it better? What has already been done to make it better with which I can connect?

"Real life math you can actually do something with."

Keiran

students speak

These are topics that can link with learners' growing sense of global awareness and optimism. And ideally they provide ideas to connect to an immediate community where possibilities for action exist. Talk without action is the fastest way to create cynics.

These assignments touch on topics like abuse, capital punishment, childhood death due to poverty, suicide and racist government policies. They look at genocide and the appropriation of Native land. The workings of greed and deception are served up for investigation. This work is not what I call "cotton candy equity" (looks big and impressive, but not much substance).

But far from creating a deep cynicism, **maththatmatters** is meant to promote intelligent skepticism. Friere writes, "Problem-posing education is revolutionary futurity. Hence it is prophetic (and, as such, hopeful)...it affirms [people] as beings who transcend themselves, who move forward and look ahead... for whom looking at the past must only be a means of understanding more clearly what and who they are so that they can more wisely build the future."[5]

5 Freire, Paulo. P*edagogy of the Oppressed*. Continuum. New York. 1986 p. 72.

Molly in grade eight, expresses her hope and optimism at the end of one of her assignments. "As a final thought, I don't think this is going to be solved by next year, or the year after. In fact I don't even think it'll be solved in ten years, but, if we keep on working, we'll eventually figure it out." And if Molly and other students are thinking in those terms, we're moving in the right direction.

Throughout the process of writing this book teachers have generously shared with me some of their concerns. Perhaps you will identify with some of them.

"I can't add more on top of my math course, because there's no time– I have to report on over 100 expectations, all in 10 months. Already I have to move at the speed of light to cover the basics."

Maththatmatters assignments are meant to gradually *take the place of components of your program*. Many of the standard intermediate level expectations can be assessed using these activities (teachers have reassured me that they can easily modify them for lower and higher grade levels).

For the tentative at heart, it's possible to start by introducing as few activities as you wish: perhaps only one in the first term to see how it goes. When you get a sense that you can speak to the expectations and generate assessment material (and more importantly that the students enjoy the assignments), you can supplement more activities.

Many of the activities also include expectations from more than one "strand". What this is meant to do is demonstrate to learners that often skills (and knowledge) are far more intertwined than we make them out to be. What this means for you as a teacher is that a single assignment might generate multiple bits of assessment for a report card. For your convenience the strands have been listed in the next section.

"We can't make the world better if we're living in a bubble."

Tessa

students speak

"I don't know anything about social justice issues and advocacy– how could I possibly facilitate math classes on patriarchy, homophobia, and the workings of multinational corporations? That's way out of my league."

These activities are meant as an invitation to you to step down from your role as the expert and to engage with the students as a learner yourself. In this context it is *preferable* for you to say, "I don't know the answer." What *is* required of you though is that you help people to ask probing questions. Your role is as a problem-poser. "How will we figure this out together?"

Each assignment begins with some written background information that is meant to spark discussion. The background is not a Ph.D. thesis, it's only a little part of a story. It is usually, however, enough to begin to explore the topic with the group together without having to do any research before you start.

The information in each assignment will not only provide opportunities to do math to understand the topic, but will also naturally create questions that have answers that are not provided, and this may lead students to follow those pathways. Whether further information is found in a library book, on the Internet, or by talking with Aunt Olivia, the class as a whole contributes to a broader understanding of the topic in a follow up class or classes. You determine how much time to follow those pathways.

To reiterate, you don't need to know anything about social justice, you must only have an interest in asking questions. Friere would say that the traditional relationship between teacher and student is re-constructed so that "both are simultaneously teachers *and* students."[6]

"Keigan can calculate the circumference of Bippy the Hamster's running wheel but she doesn't understand how many innocent people fall within the impact zone of today's nuclear missiles."

"Aren't these assignments going to be out of date fairly quickly, with all of the real-life numbers and statistics that you use?"

Some of the lessons are a look at a particular time period, for example the economics of what was going on in Canada in the 1990s. Or how Chinese immigrants were treated in the early 1900s. But it's true. Some lessons are time dated and the patterns will change. Of course this is an opportunity to get students to look at when the data was generated, ask whether or not they think it's changed at all (and in which ways) and find a way to update the numbers on their own.

"It just makes more sense to learn about things that matter."

Zoe

students speak

I'm afraid that the students won't learn the math skills as well. I know if I give them a drill sheet that I can tell quickly at the end that they either have the skills or they don't.

Although the curriculum is ten kilometres wide and about one centimetre deep, many educators (supported by substantial research) now realize that effective learning requires depth and that if you spend time to develop it, *the results far surpass skimming the surface*. Steven Zemelman and his colleagues note "covering less in more depth not only ensures better understanding, but increases the likelihood that students will pursue further inquiry of their own at later times."[7]

"You, yourself can learn. Teach them about equity and justice so that some day they will teach their children about what they've learned and then the world will be a more peaceful place."

Zack

students speak

But let's not forget the issue of content. Remember that **maththatmatters** is concerned with a *particular sphere of knowledge*, because you can still have a constructivist classroom where students are actively finding the volume of a pizza box. In the end, thinking about things that have real meaning is more likely to promote learning.

6 Freire, Paulo. *Pedagogy of the Oppressed*. Continuum. New York. 1986 p. 40.
7 Zemelman, in Alfie Kohn, *The Schools Our Children Deserve*. p 143.

What do I do with a classroom of students who function at different ability levels?

The very nature of open-ended assignments is that students can work to their own ability level. Students who complete the same assignment rarely hand in the same responses, and the variety of thought can become the starting point for classroom discussion.

The material seems biased to me– sort of Left leaning. That doesn't seem to be neutral and objective. It's too political.

All material carries bias of some sort. Really the question is whether or not we want to spend time educating for peace and social justice. If we do, let's admit that bias and get to work.

Getting students to be sceptical of any teacher or person that claims that they are neutral or objective is important. We all bring to our classrooms and our lives a perspective on the world. Students are buried in math classrooms that avoid these subjects like the plague: how can that be neutral and unbiased? Of course it can't.

"Now's the time to learn."

Kathryn

students speak

I'm worried that the principal or the parents will get upset. I'm not sure how much I want to rock the boat– it's my neck on the line.

There is undoubtedly the possibility that you may raise eyebrows with some of these lessons. Of course, this is one of the goals of education- to challenge people to think beyond what they're used to, beyond their comfort zone. Although it may not be easy, I always suggest to the teacher participants in my workshops that we, as members of a generally privileged profession, have an obligation to use our privilege to make the world better. And that means taking a stand when it's not popular.

At the end of the day, each of us will decide how far to push the envelope based on our own unique circumstances. But let's not make decisions based on convenience or on assumptions about how others will react. There are 50 lessons in this book- choose ones that you believe are reasonable starting points and progress as you become more comfortable. Let's not forget as well that we can engage parents in discussions that will create parent advocates- an easier job when what you're trying to teach has clear value. Engaged and excited students will help put parents more at ease as well.

"Actually, I have never understood math better. Not only do I understand the general skill, I can also begin to understand the world better. And if I understand the world better I can change things. And knowing that is one of the best things in the entire world. There is no way to describe that feeling."

Xochil

students speak

David, you work at an alternative school devoted to social justice. Everyone is on board....parents, principal, staff and students. It's not the same at my school. I'd be alone doing this work.

To my way of thinking this is all the more reason that you should give these lessons a try. Students who don't see their reality within the classroom are isolated and at risk. Imagine their surprise and interest when you start to talk about things that actually matter to them.

Building networks is important. Another teacher or two who can be convinced to give a few lessons a try will be very helpful. Asking other subject area teachers what topic they're working with and then integrating a related math lesson has been very successful for me. And although I do work at an alternative school, I still need to advocate for this approach to parents. They've never experienced these types of math lessons and so must have an opportunity to wrestle with the idea of linking math and social justice. Most parents want what's best for their children... it's a matter of helping them to see that this is clearly more helpful than the usual math materials.

If you have more questions now than you did when you began reading this resource, that's probably a good thing. Experimenting with the assignments in approach and focus has been, for me, the best way to make math classes more interesting. And relevant.

It's time to say good-bye to pizza party math. Good luck.

"You do the math because you're curious- is it really true that needle and syringe exchange programs reduce HIV infection? Seriously? But wait, looking at this graph, it might mean this! No one's really curious about the fate of pizza slicers, I mean, it just ends up being: who cares? Does this matter? What the hell? Why am I doing this?"

Tessa

students speak