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QUESTIONS OF TRUTH: ETHICAL AND MORAL WANDERINGS IN MIDDLE GRADES MATHEMATICS CLASSROOMS AND RESEARCH

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*This paper describes two researchers engagement with two teachers as they taught a middle grades mathematics course, *Current Events Math*, in a large urban school district. The researchers share bits of data and their ethical entanglements as they entered into the site to find the truth about what works in middle grades mathematics classrooms only to realize that truth cannot be found through research. They then grappled with the question of the purpose of research and their roles as researchers in the school and the academy.*

Keywords: Research Methods, Middle School Education, Equity and Diversity, Curriculum

Entanglements (Context/Site)

Suppose you were prompted to answer this question in the midst of the 2014 Ebola epidemic: What was the worst Ebola outbreak in history? How might you answer the question? What might you ask yourself? What tools might you use to determine the truth about the question? Middle school students in a charter school in a large urban school district grappled with this question and asked things like *What is worst? How do we measure worst? From whose perspective?* We too—researchers and teachers—found ourselves grappling with these and other questions: What is the interplay between the ethics and the mathematics? How do we raise and attempt to answer ethical questions in the current educational and political environment? What is the relationship between mathematics, truth, and ethics?

This study explores two middle grades mathematics teachers' concepts of ethics and truth as they engaged in a 12-week course. The course, *Current Events Math*, positioned students as researchers who studied current events and used mathematics to consider those events. Observations and interviews were conducted during the 2015-2016 school year and focused on the teachers' experiences teaching the course during 2014-2015 and 2015-2016. In this paper we consider multiple and overlapping layers of ethics: ethics of the researcher in the field, ethics of the teacher towards her students, ethics of the citizen in a community, and ethics of representation in the media.

Theoretical Perspectives/Ways of Seeing/Knowing

This study was composed through interactions between a mathematics educator, a doctoral student and former mathematics teacher, and two practicing mathematics teachers. The format and content of this study are informed by poststructural and post-qualitative perspectives. Though traditional empirical studies have their place in mathematics education, and there have been significant strides in the scope of qualitative research, some of "these versions of knowing express the sense that our inherited ideas have tended to underplay multiplicity, complexity and cultural specificities, none fully captures the postmodern analytical edge that invites a less certain space for research, pedagogy and practice" (Walshaw, 2004, p. 4).

We believe that there are multiple perspectives and versions of truth and that our ethical charge is not to attempt to boil down our impressions and data into one ultimate understanding or truth. Instead, we agree with Neyland that, "the primary ethical domain is not monotonous, regular or predictable; it is shot through with uncertainty and contradiction and cannot avoid ambiguity" (2004, p. 61). Mathematics is often given privilege as both true and unbiased, so it is particularly important to us that ambiguity is recognized within the field of mathematics education. Neyland (2004) refers to mathematics education as "paradigm case subject" (p. 62) in the postmodern ethical agenda

because “it is the curriculum subject that can be used to make the strongest case against the project of modernity in education more generally” (p.62). Neyland further asserts that “mathematics educators have the urgent task of undertaking a postmodern re-enchantment of mathematics and a postmodern restoration of the primacy of the direct relationship of responsibility between teachers and students” (p.63). The course, *Current Events Math*, is built upon the foundation of responsibility between teachers and students, which for these particular teachers also includes an outlook towards equity in the world. In considering equity, the students and teachers had to look closely at the numbers that are used to describe and represent events that intersect the lives of students and teachers.

Although numbers are largely seen for their face value by academics and society at large and mathematics is assumed to be objective and unbiased, numbers are often complex representations that are constructed and composed. Because of the complexity of their construction and their sometimes misaligned or ineffective representation, numbers can function to distance decision makers from moral and ethical decisions. In the mathematics course, the teachers and students questioned the truth(s) that different numbers told. In our research, we do not rely on numbers as evidence of a valid and reliable study. Instead, this study brings together data pieces that begin to deconstruct the neutrality of mathematics and numbers.

Entanglements with “data” (methods)

The present study includes “data” from teacher interviews, classroom observations/field notes, photo elicitation, researcher journals, and student and teacher created documents. In considering these documents, the authors viewed them as co-constructed by the authors, participants, school, and students. These documents, from transcribed interviews to student journal entries, do not have single authors or sites of production. The following quotes speak to our views on data and representation: “a fieldnote fragment or video image – starts to glimmer, gathering our attention” (MacLure, 2010, p. 282), “always a body of statements to consider in which the individual words and sentences merely slumber” (Prior, 2003, p. 113), and

The aim is to ‘make materially visible the structure of representation as a trace of temporality and exchange, the fragments as mementos, as ‘presents’ re-presented in the ongoing process of assemblage, of stitching in and tearing out (Mitchell, 1994, p. 419 as quoted in Radley, Hodgetts, & Cullen, 2005, p. 278).

The researchers used writing as inquiry following Richardson and St. Pierre (2005), “but they were always already in my mind and body, and they cropped up unexpectedly and fittingly in my writing— figurative, fleeting data, that were excessive and out-of-category. My point here is that these data might have escaped entirely if I had not written; they were collected only in the writing” (p. 970). Through writing as inquiry, the researchers troubled their identities as researchers, former teachers and mathematics educators while acknowledging the complexity of their identities as women, mothers, and friends. Through these intersecting viewpoints, “data is fluid, a chameleon, able to take different “shades” of meaning based on the perspective of the researcher” (Koro-Ljungberg, 2015, p. 47).

As they navigated this research site with colleagues and friends, “ethics explodes anew in every circumstance, demands a specific reinscription, and hounds praxis unmercifully” (St. Pierre, 1997, p. 176). One researcher wrote in her journal, “So, I am here with so much uncertainty and also some confidence in that uncertainty is productive. I am asking myself, “How do I do representation knowing that I can never quite get it right?” (Pillow, 2003, p. 176).

From interview probes, to classroom interactions and hallway encounters, the researchers questioned the ethics of their choices. In reflecting on a transcription, Susan wrote in her journal,

I wonder if I should have probed when she said, “If they just knew me.” I paused. I thought about it. I think my reasons for moving on were two fold. One I was hesitant to get too personal on the first meeting and two I was worried about staying on topic and getting through the interview. I think that the first reason might be legitimate; the second in retrospect seems counterproductive. This adherence to the interview guide, is it productive for me? I do not think it is. Here the participant was offering me something emotional and I turned back to content, to math. I shut down this person who is saying she feels unseen. I didn’t see her or wasn’t comfortable seeing her. Ethically, I signaled that her story wasn’t important in the research. How do I come back around to this? I cannot right the wrong, but can I move forward in a way that is productive.

Throughout the research, the researchers began to “see” what they hadn’t been seeing. The classroom observations and interviews left the researchers entangled with the concepts and questions of truth and representation and feeling the persistent tug of positivism at their sleeve. Aren’t numbers, data, facts materialized manipulations of the cognitive processes involved in measurement? Numbers are “arrested ‘moments’ of measurement captured through technical decisions” (adapted from Knowles, 2006, p. 512). The research questions became questions about the research. How do we use mathematics/research to produce truths? How do we deconstruct “truths” created through mathematics/research that are dangerous or destructive?

Assemblage(s) (Results/Findings)

During 2014-2015, the students researched Ebola, Michael Brown, gender imbalance and violence towards women in the gaming industry, and gay marriage. In the 2015-2016 school year, topics included Rand Paul, air pollution in China, New Horizons, the European refugee crisis, head injuries in the NFL, and the use of sugar in food. Following is an assemblage of data pieces stitched together by the researchers, some conversations and observations related to these topics and some conversations that got at the larger goals and questions around this course. As mentioned above, one interesting thread that wove through the data was the idea of truth.

Truth from Experience

The students engaged in a study of concussions in professional football. In this unit the students collected and analyzed data and statistics about the likelihood of concussion for particular positions. The working groups in the classrooms were intentionally constructed with one football player in each group. As the students did their analysis there was tension between the *truth* presented by the numbers and the *truth(s)* brought by the group members founded in their experiences on the football field. Is truth running full speed ahead, hearing your breath in your own ears and feeling its moisture on your face, and then a bone crunching hit from the side and the sudden scent of grass and mud? Or is this truth: cornerbacks suffered 10% of the total concussions reported by the NFL in 2013 (Breslow, 2014)? Which is more valid, reliable, and believable? Which one *counts*? How might these truths influence the students’ belief in a number?

Truth, Bias, and Prejudice

Truth(s) arose out of biases and numbers and new truths were created through numbers to undo prejudice. As the class researched the shooting of Michael Brown in Ferguson and the subsequent protests, mathematics helped them to understand the injustices that had been occurring there. Elisabeth stated in her first interview,

Looking at the race issue in Ferguson became a question of math actually. So why do some people feel like it’s not fair or not equal? What we could do with Ferguson was to look at the population numbers and the arrest records. We could look at records of police stopping individuals and keep track of those statistics by race over time. As we looked at these numbers

and converted them into a percent, because that was the math we were looking at. When we equalize numbers we're not just looking at the number of people, but we are looking at a number that is kind of stabilized by percent by having the same denominator. The kids were able to say, "oh that's not, that doesn't seem fair." If 70% of the people you know, if they only represent 30% of the community but 70% are stopped, they begin to see that there is inequality there. So then you can go back to the original question of why are there riots, and kids can say "oh because it really doesn't feel fair because out of ten people, 7 of your friends have been stopped by the police, but if you're white only 3 of your friends have been stopped by the police. As a black person, you're like, "hey everybody gets stopped by the police", and as a white person, you're like, "really do we get stopped by the police?" So that piece, that particular instance was getting at the core of why is there rioting aside from the emotional piece there was math behind it. There was math that could help kids understand how somebody who wasn't like them might feel.

When we spoke to Ayesha, who self identifies as Pakistani-American, about what she hoped students would take away from the course, she also spoke about truth from bias, but from a different perspective:

Susan: What are you hoping that students will take away from the course?

Ayesha: A sense of responsibility.

Susan: To whom or to what?

Ayesha: To those around them

Susan: What would that look like?

Ayesha: People who are conscious of what is happening around them and are willing to speak up, are willing to try to get more and willing to change if, not changing the world, changing their environment. Or if you are at the airport and you have someone who is very different that comes and sits next to you being comfortable in that situation.

Susan: Um huh

Ayesha: You know I hope that that is what they get out of it. Looking at me as their teacher is learning that it is ok and if they hear something in the media then they will be like there must be a different side of the story as well or what are the numbers to help you be more conscious.

As we worked together on this research project, we began to recognize that numbers and mathematics help people to see injustices and to recognize prejudices, but that they also have effects that increase bias and prejudice. Then how do we know which number to trust?

Multiple or Conflicting Truths

As mentioned at the start of this paper, the students and teachers studied the Ebola outbreak in the spring of 2014. The class researched the outbreak and asked, what was the worst outbreak in history? To answer this question, they had to wrestle with questions like, *What is worst? And worst to whom or for whom? Does worst mean the highest total number of deaths, or the highest percentages of deaths per infection, or the percentage of the total population that was infected and died during the outbreak?* Elisabeth talked about these multiple or conflicting truths—the idea that “truth” can be used by anyone to pursue any agenda:

I worry sometimes that the idea of social conscious or justice can be used by all people to pursue any agenda. I can say there's uncertainty, and I can say everyone can find their own truth, but the bottom line is the math can help us differentiate between exaggeration and what's really there, so we talk again about the rounding situation looking at politicians and what they say. If we look at the real, the numbers we can actually know, and then the media or politics can change them or

turn them and look at them from another direction, and say no they mean this, but we just looked at them do we think that and why?

Elisabeth talks later in the same interview about interpretation in mathematics:

[Understanding] how to read a graph how to interpret numbers that people use really helps you understand data presented as fact or truth in the media, and so I think you could, I mean statistics are used to support arguments. Numbers are used all the time to validate people's positions on things because somehow that quantitative data feels nonnegotiable. You know a number is a number is a number, and you can't, you know... So understanding what those numbers mean allows you to take a more critical look at whether it's true. You know how you interpret those numbers whether you believe them or not. It's really easy. I think a lot of people come out of school feeling like-- math is hard, math is not something that I understand entirely. So they are willing to take numbers at their face value and what I know to be true is that we interpret numbers in the media and in statistics numbers are interpreted.

Ayesha spoke about her recognition that there are multiple ways to present a topic to students:

When I read something before I show it to my students, I am reading it with a very keen eye. Like what do I want the students, like so there's bias there. So, yeah, it's there. I do want them to have all of the perspectives, so sometimes I will choose something that I don't agree with, like I want them to know the truth, and so I will throw that out. But yeah, I think it does impact because even though I am being fair and providing all the things I'm sure that there are people out there that don't do that because they want that one point of view....

So, if we know there are multiple truths, then there will be conflicting truths. How might middle school students handle this? Ayesha describes a conversation she had with three students about evolution. One student said, "You can't believe in science and god, you can only do one." Ayesha replied, "I believe in science and god. I believe in evolution and god." Another student remarked, "You can't do that if you go in a church, and you tell them you want to be a scientist; they are going to say get out." Ayesha went on to wonder, "they are already starting to have these thoughts so I am wondering when they started and how they have come to this age at 11 or 12 years old *knowing* these things..." As a team of women, a team of teachers, researchers, teacher researchers, etc., we found ourselves grappling with what it means to know something in mathematics and in the research we are doing around the teaching of mathematics. What happens when you have multiple and conflicting truths in mathematics and in your research "spaces"?

Students Becoming Capable and Critical Mathematicians

Susan: How do you view the students as they come to you and what's your goal for them as they...?

Ayesha: So, I actually, having taught some of the students before, I do have preconceived notions of some when they come, and I have concerns or expectations based on those preconceived notions. Some of them hold true and some of them don't, but my goal for each of them is that they find some joy. I guess in doing math that was a little bit challenging, so that they could know something, so that they could learn something bigger than math out of it.

Susan: What's bigger than math?

Ayesha: That they could know something that was real or true about the world because of math. And I, or that they could just know that they could know. Like, "I can figure this out. I've got this skill that allows me to know this thing or to think more deeply about this thing." I think that's the piece that feels... I want the kids to feel empowered to be able to ask questions when they see numbers anywhere and to know like, "oh, they got those numbers from

somewhere. I could get those numbers and check. I could know that. I could do that thing that they did. Maybe I can't do it right now, but someday I could do it." Anyone of them I would want them to think like, "I could be a NASA scientist. Really, there's so much more to it than just this rate business. But I see now that it's not as scary as it seems to take 5.88 billion and divide by 460,000 to find out the km per minute. I could do that." So, I want them to feel like-- one, I can do that, and --two, I want to do that. I would love for them to think to be thinking I want to do this.

As Elisabeth talked about the course and her hopes for the students, truth came up as well.

Reflection leads us to know things about ourselves that we maybe didn't know before and I think of that in terms of truth, I believe something about this situation and looking at the numbers about it. It may have changed and that for me is now the true thing about this story. And math informed that or helped inform that true thing about the story. That idea of value in math, there are some numbers that are just the numbers and you don't, there's not much you can do but the truth of it I guess, the truth of those numbers is for kids is I can know this I can figure out how to do this. I can know this and that knowing feels like the truth in some ways like it's not a mystery anymore even if it is a mystery, there is a door open to the mystery so I can go through it and figure it out.

What does it mean to prepare students as mathematicians? As critical citizens? As truth seekers? Is questioning all numbers productive or is it crippling? When is questioning too much? When does it just hurt?

Discomfort in Ethical and Moral Work

As they planned the final unit of their course, Susan sat in on the planning session. The teachers began by saying that they did not want to take on a topic that was too depressing. They had just finished 10 weeks of difficult discussions during which students and the teachers were asked to bring more of themselves into the work of school than is typical. Halloween was just around the corner, so the teachers decided to begin a unit on candy. As they got further into this unit, they found that looking critically at this issue was also quite troubling. They watched videos about the use of sugar to hook consumers on particular products, and the damaging effects of sugar on our bodies. How is it that they always ended up in the place where they were discussing things that were troubling? Are we finding disturbing *truth(s)* because we are looking for them? Or are they there whether we look or not, and it is our ethical duty to deconstruct them? What are the ethical and moral repercussions of bringing students and other teachers into the work of looking beyond the singular truth represented? Looking beyond the number and beyond the norm?

Denying Access to Truth

Susan witnessed a conversation between the two teachers where one teacher was relaying to the other that she would not be able to teach enrichment math, *Current Events Math*, in the next term; she would be teaching a remediation math course instead. She was disappointed to have this switch and that there would be no enrichment math classes in the next term. She also expressed understanding that there were 7th graders that really needed support in their math and therefore it was okay to teach the remediation course. Susan asked the question, why is it that we think that we have to teach a remediation mathematics course in a different way than an enrichment mathematics course? Weren't the skills taught in the *Current Events Math* course important for those students in the remediation course as well? How would teaching basic or foundational skills out of a workbook to the 7th grade students function? Would they see themselves as distant from the mathematics, consumers of it, rather than as in relation with it? Don't we want all students to be critical readers of mathematical truth(s)?

Wonderings (Implications?)

Though we resist the term findings, there are important questions that this study brings to light that could be asked in other places and spaces. The multiple and overlapping layers of ethics: ethics of the researcher in the field, ethics of the teacher towards her students, ethics of the citizen in a community, ethics of representation in the media, are ever present, and even as we make moves, the context changes and we wonder how to move responsibly. In Todd's thinking about responsibility, ethics and relationships, she stated,

what counts as ethical in Levinas's thought is not encapsulated within rule-governed behaviours, ethical codes, or moral precepts that can be secured through stable significations. Rather, the ethical lies within the very ambiguity of communication, within that which slips our cognitive grasp and possession.... For Levinas, communication is inherently ambiguous because it gestures beyond any stable meaning toward the very otherness of the other that marks her as radically distinct from myself. And it is this relation to the other as one of unknowability where the ethical promise – and risk –of ambiguity lies. (2003, p. 33)

If we think back to the football players, we wonder about the truth of experience understood through relationship with others. Should the other students have believed a person they had a relationship with who had experience with the topic or the number derived from many instances and published by scientists?

Is the responsible, ethical thing to do to continually create new interpretations and representations based on the particular context? We are still stumbling and stammering in the moment knowing there is no "right" to get to, no certainty that can calm us. Is the calm then in the acceptance of the ambiguity as promise and the willingness to continue to question, and to ask, and to wonder, and to disrupt?

Rather than concluding we resist conclusion following Koro-Ljungberg (2010). "Instead, unpredictable attentiveness and unexpected relationship with the Other could activate researchers' responsibility and thus enable open and humble data interpretations, as well as study conclusions that avoid definite closure" (p. 608). We question and question and question. In what ways do experience and "truth" interact as we take up teaching—and researching the teaching of—mathematics? How does our distance from a particular construction of a number influence how we read that number and its truth? How does bias impact what we doubt and what we believe? In what ways does the mathematics we "know" interact with these biases? What happens when faced with a problem with multiple or conflicting truths? Do ethics drive the solution? Or mathematics? What, or who, wins? By asking these and similar questions and remaining ambiguous in our understanding of how they might be answered, perhaps we can begin to answer Neyland's (2004) call to "re-enchant" mathematics and mathematics education.

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