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## **Risks Worth Taking? Social Risks and the Mathematics Teacher**

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**Abstract:** In this article, we explore notions of risk as perceived or experienced by individuals involved in mathematical education. We present this exploration in the form of vignettes, each illustrating a form of risk: a parent's reaction to classroom "propaganda"; a teacher trying to do justice by her students; a teacher confronted by his administration; and a college professor who believes university policy to be unjust. Each vignette sheds light on areas in which teacher education may offer additional support in fostering the mathematical knowledge, pedagogical sensitivity, and social awareness required to foster, what are in our view, much needed risks in the mathematical (and otherwise) education of pupils. Following the vignettes, we offer a discussion of factors that contributed to the risks perceived or experienced by teachers: neoliberal discourses, and the powerful cultural scripts that leave teachers feeling that they must hold all control, authority, and knowledge.

*Keywords:* risk, mathematics education, social justice, liberation, teacher development.

### **Introduction**

The project of education is fraught with immense vulnerabilities faced by both teacher and student, yet the nature of risk in education is different from more calculable risks in other fields of endeavour. Notions of *risk* – mathematical or otherwise – are broadly interpreted in the literature. Risks manifest themselves within mathematical activity, social activity, and within interactions of the two. Risk necessarily refers to a future event, to one or more behavioural choices, the probability of which is amenable to calculation (Pellizzoni, 2011).

In our perspective, mathematical risk extends beyond probability theory – and includes risks associated with expanding, applying, or re-imagining one's mathematical understanding and the potential of mathematics to yield understandings about broader, complex, and social issues. Indeed, recent research has shed light on the power of mathematics in preparing students to understand and address issues of social injustice (e.g., Gutstein, 2003, 2006; McCoy, 2008). Teaching mathematics for social justice can offer students "instruction that includes the mathematics deemed necessary for success in the current [school] system while simultaneously providing students an opportunity to use mathematics to expose and confront obstacles [in society]" (Bartell, 2011/2013, p.1). Critics of current school systems have pointed to the responsibility of "teachers and the education system to extend possibilities for human development" noting the difficulties of fulfilling such responsibility given the tendency to pay "more attention on test results than personal development" (Watson, 2006, p.3).

Researchers point toward the role of mathematics in empowering those who are marginalized as it can offer a means through which to interpret social institutions, traditions, and potential political reform (Skovsmose, 1994). Gutstein (2006) writes of the importance of using mathematics to change the world, as it can foster in students a sense that they are "capable of making change" and may help

them develop “a sense of social agency” (p.27). In line with these perspectives, Bartell suggests, “The purpose of education is not to integrate those who are marginalized into the existing society but rather to change society so that all are included” (2011/2013, p.3). While such orientations toward mathematics education resonate within academic communities, they appear contentious in the public sphere where traditional views of “teacher” and an expectation of the austere neutrality of mathematics still abound. Promoting critical perspectives on social issues is positioned as “brainwashing” and the idea that children might take action to initiate social change is viewed as “politically motivated” and “risky” (Reynolds, 2012). Such perspectives are largely unsubstantiated, though we agree that confronting them involves risk.

A socially just view of schooling emphasizes the educational aim of “emancipation from traditional custodianships and intellectual sensibility” and is positioned as “a pathway to human flourishing, both personal and social,” and as such is fraught with “inescapable risks” (Smyers & Hogan, 2005, p.119). At stake is what “*students become as human beings* as a consequence of what [they] experience as learners” (Smyers & Hogan, 2005, p.115, emphasis in original). In particular, the transformative process of becoming a mathematics teacher, in our view, requires a liberation from restrictive, but popular, conceptions of what is, and for what is, (school) mathematics, and includes the inherent and multifaceted risks faced by the individual committed to the activation of new perspectives on familiar ideas.

On all counts, these social risks involve trust, autonomy, and vulnerability where teachers and learners experience tensions between and amongst individuals and ideas as they are shaped and structured by the systems within which mathematics education exists. Though calculable uncertainty creates structure and organization in a complex world, non-calculable uncertainty prevents humans from being prisoners of an inevitable path: the future and innovation cannot be predicted by that which is statistically knowable (Pellizzoni, 2011). Bayesian theories of subjective probability refer all probabilities to the agent’s knowledge, “because relative frequencies are only sample data of past events that influence subjective probabilities of future events” (Pellizzoni, 2011, p.797). Building on this perspective, we view the subjective risks associated with the intersection of mathematical and social activity as relative to an individual’s perspective and knowledge. Such risks are not calculable. They are a projection of sample data from past events – risks experienced in the past and their corresponding consequences – onto the possibilities for future events. Thus, while an individual may “weigh” the perceived risks inherent in a particular course of action, it is their subjective interpretation of past events which influences their expectations for the future. For us, this raises an important question: to what degree should past events (in mathematics education) determine which risks are worth taking? Though we do not attempt to answer this question, its consideration informed our approach in this article.

Through a collection of vignettes, we explore notions of risks that were perceived or experienced by mathematics educators attempting to address issues of social justice in their instructional practice, and we consider factors that may have contributed to these perceptions or experiences. Our vignette’s present an *account-of* risks, while our discussion provides an *account-for* them. Account-of refers to descriptions which avoid as much as possible evaluation, interpretation, or explanation, while an account-for interprets, analyses, and explains (Mason, 2002). We conclude with a discussion of key themes arising from the vignettes. One of these is the way in which neoliberal discourses shape false “value neutrality” leading to immense risk-taking when social justice issues – perceived as “biased” – are taken up by teachers. The second point of discussion is the way in which traditional and conventional approaches to mathematics learning rely on cultural myths of “teacher control,” leading to risks when disciplinary knowledge is expanded to take on social justice. In our discussion, we pose

important questions for teachers and teacher educators to consider about both current practice, and the potential to transform mathematics learning by taking risks with curriculum and pedagogy.

## **Vignettes**

### **Taking Risks in the Syllabus**

Bob Humphries took a deep breath before he knocked on the Department Chair's door. The email requesting the meeting didn't specify its purpose, but Bob was almost certain he knew what it was about. Syllabi had just been submitted for review; Bob had taken a big risk now that he had achieved tenure.

"Have a seat, Bob," Tony said as he gestured towards the conference table. "I wanted to talk to you about that paragraph at the end of your syllabus."

"Tony, since the day I started teaching here, I've been vocal about these concerns at just about every faculty meeting. Nothing in that syllabus or that paragraph is untrue – in fact, if anything it's an invitation to get our students to engage in some research and critical thought about the implications of grading on a curve" (for example, Hout, Jankowski, Lucas, Swidler & Voss, 1996). Tony glanced at paragraph in question again:

The instructor assigns grades based on evidence of your mastery of the skills and ideas on which the course turns. He considers the grading policy promulgated by the Department of Mathematics and Statistics which requires him to adjust grades on the curve to be manifestly unjust and to verge on irrationality. He will definitely not lower any student's grade in order to conform to that policy. He thinks that if you are well-to-do, you should consult a lawyer wherever you have concrete reason to believe that application of such arbitrary policies has deprived you of grades to which your performance entitles you. If you are not well-to-do, you are well acquainted with injustice and have, of necessity, learned to live with it.

"But the message, Bob, you know it's not quite what we hope to convey to our students. It's a well-accepted institutional practice, and one that's not unique to this university."

"I'll say it again, Tony: there's nothing false in that syllabus, and if I'm not mistaken, I can exercise my academic freedom in drafting the content of any and all syllabi."

"You know I respect you Bob, and I'm not going to argue it. But I have to submit these to the Dean, and I wanted to give you a chance to make revisions, if you want, before she sees it."

"Send it along as is, please, Tony."

Bob stood at the copier 3 days later, making a duplicate of the folder he'd labeled "Bell Curve" in preparation for his meeting with the Dean. The dossier was filled with references that supported his position on the syllabus controversy. The meeting mirrored the conversation he had with Tony, and the Dean could not argue with Bob's position.

"Ultimately," she said at the conclusion of the meeting, "it's your right to leave it in, Bob. But I really wish you'd take it out. It's opening the Faculty up to all sorts of objections and problems."

### **Who Run this Motha?**

Many of the girls in Alex's grade 7 class had taken to singing Beyoncé's hit "Run the World (Girls)" (Nash, Knowles, van de Wall, Pentz, Taylor & Palmer, 2011) at recess. "Who run the world?" one chanted; "Girls!" the others replied.

“Who run this motha?”

“Girls!” (Nash et al., 2011)

While he encouraged positive messages of empowerment, he wondered if Beyoncé’s brand of “girl power” discourses helped to motivate, or concealed realities that needed to be openly discussed if any real change was to take place (see, for example, Pinto, 2011).

“Ready to do some math?” he enthusiastically asked the class one morning. He’d prepared a lesson that invited students to investigate wage inequity and the reasons behind it. He created a “Web Scavenger Hunt” with clues and links, which led the class to various current and reliable sources that outlined wage gaps. He also created simplified online visuals to help students visualize Charles and Grusky’s (2007) gendered “occupational ghetto” concepts, expose the ways in which women continue to face both segregation within occupations on two axes (the horizontal axis representing occupational types, and the vertical axis, representing hierarchical representation). The Web Scavenger Hunt culminated in students graphing wage differences and creating a display. This was a jumping off point for a social studies lesson that explored the reasons behind, and controversies surrounding, the data.

Alex was surprised to learn that an angry parent had called to complain about the “propaganda” in class, and sent an article over (Lukas, 2012). The school principal called a meeting with the parent. “Alex, remember we have an obligation to the parents. They are our customers, and we have to make sure our classes reflect community values.”

*Customers!?* Alex thought. “Look, I know we have to be tactful at the meeting, but the fact is the students went on an inquiry-based learning project, and used real data to solve a math question. This is good teaching. Authentic! Dare I say evidence-based? I don’t see why we’re even entertaining this complaint with a meeting. In a democracy, don’t we need to consider perspectives like this, even if we don’t agree? After all, don’t we all have an obligation to support this school board’s policy that encourages the teaching of controversial issues?”

Alex sat in the office with the principal and the student’s father to sort things out. The irony of three men discussing the issue at hand was not lost on him. He could hear the girls from his class sing, “Who run this motha?” Definitely not girls.

### **In a Position to Take a Risk**

Sonya was in her first year of teaching. She was meeting with Paul, who had been teaching at her school for the past 15 years. They were discussing a math project Paul recently gave to his class. The project was an inquiry-based exploration of the accessibility of healthy foods in poverty-stricken communities. Paul described the project:

“We had the opportunity to visit the local food bank. Before we went there, we went to a supermarket to purchase some non-perishable items that we could donate. I gave students a budget of \$2.00 each and watched while they navigated the aisles looking for items. After a while, students started teaming up to purchase larger items, and they started critiquing name-brand items versus discount items. They were super pumped when one of them found a good sale and shared it with the rest. When we got to the food bank, students had the opportunity to ask some of their questions, and then in class we unpacked everything. We focused on place value and numbers, but I think there is a good data management connection, so I’m going to try to bring them [students] back to these questions when we get to that unit.”

Sonya interjected: “I understand that teaching is not all about the curriculum, and that it’s possible, even necessary sometimes to take math outside of the classroom and into the real world, but how did you deal with students’ questions about poverty? I mean, they have nothing to do with the math curriculum, so like wouldn’t this make more sense in a social studies class?”

“Well, yes you do need to keep in mind the curriculum, but you also need to be able to move along the path with your students and not close any doors,” Paul responded.

Sonya was unconvinced. “OK, I do believe that it’s important to help students see how math can connect to issues in society, but to invest the amount of time that this project took... aren’t you jeopardizing the students’ learning? It just seems unfair to students to not spend more time on the math concepts outlined in the curriculum.”

As their conversations continued, Sonya softened her position and said she might consider doing such a project with her own class – but after some adaptation. Paul was happy to collaborate in re-designing the lesson, and the conversation ended there.

Later, on reflection, Paul mused:

“I think it takes a great leap of faith to become comfortable with the uncomfortable. What’s motivated me over the past five years is my graduate work. I learned about many different modalities of teaching, different philosophies about math and math learning and different ways of thinking about particular math topics. This has definitely helped me justify my teaching methods, and has maybe made my approach feel a little more ‘comfortable’.”

### **What Math is All About**

Leslie was teaching an integrated math and science unit on ecosystems where students worked in groups, moving through different learning centres. There were resources and guiding questions at each centre, but essentially the students were able to discover and research about almost anything that they wanted in relation to the topic of that particular centre. During one work period, Leslie’s principal came to observe the class. They had what Leslie considered a “weird” exchange. The principal was curious as to whether Leslie was going to incorporate what was currently happening in the world – there had just been a major natural disaster, a tsunami, and the principal thought it would make a great current events segment.

Leslie happily informed the principal that there was one eco-centre dedicated to global climate change and natural disasters and that the students had a choice as to what they would like to study. Leslie sensed the principal wasn’t too pleased with her response. She then listened as he proceeded to tell her how science and math are important:

“Science is only good to teach one thing, procedural writing, and that’s why we’ve taken that part out of the literacy program. Most of these kids are going to end up in workplace math, so what they need to know are the basics. They need to know about percents and finance, things that will actually be relevant to their lives. Generally, math is a study which contains questions and definite answers. There’s usually one right answer and many wrong answers. Having a debate or discussion on such a topic [climate change] is not suited for any math course. There are more efficient and less debatable ways to explore math concepts. The last thing a teacher would want is to be accused of spreading propaganda.”

Later, Leslie reflected on this exchange:

“I’ve experienced a lot of negativity from colleagues, including administrators, along the lines of not really understanding what I’m trying to accomplish and that I couldn’t possibly be teaching the students as I’m not standing in front of the class and that the students are relatively ‘noisy’. It seems like a great number of teachers are quite uncomfortable straying too far from the prescribed curriculum or textbook, lesson, long-range plans. In reality, taking risks is part of the job, but also feeling that you have support from your administration in taking those risks is paramount. Having a supportive base or foundation to take these risks is important.”

## **Discussion**

In our discussion of the vignettes, we account-for the risks involved by interpreting them via two separate, but complementary, lenses: the imposition of “value-neutrality” and a broadened view of mathematical knowledge for teaching.

### **Neoliberal Discourses that Promulgate “Value Neutrality”**

A common theme in the vignettes just presented is the tension between a desire to “do” social justice in mathematics education, and a belief that schooling is or should be “value neutral,” which includes avoiding controversial topics. In Vignette 1, Bob wanted to call attention to injustice by way of a seemingly neutral grading policy – something university administrators do not want brought to the fore. In Vignette 2, Alex attempted to infuse a social justice mathematics project to specifically address the interests of his students, and invited them to unpack “girl power” discourses. He faced opposition from a “customer” and was not supported by his principal. In Vignette 3, Sonya had the impression that addressing social justice issues would jeopardize learning about mathematical concepts – suggesting that somehow mathematics needed to be divorced from social issues to maintain an air of neutrality. In Vignette 4, the principal suggested that incorporating climate change in math or science might lead to an accusation of “spreading propaganda” – an indirect implied assumption about avoiding controversy and adhering to something like value neutrality. In all cases, teachers took on perceived risks in order to infuse social justice into students’ mathematics experiences. And in all cases, the substantive nature of social justice issues was perceived as controversial.

Views like those expressed in the vignettes – that education is or ought to be value-neutral – have “made something of a comeback in recent years” (Roberts 1998, p. 30, in Pinto, 2012). Value-neutrality is alluring in that it suggests one can avoid making choices, thus standing above or avoiding controversy. In truth, all educational choices involve values. Deciding what is “worth knowing” or “most important” are value-laden acts (Pinto, 2012). Mistaking value neutrality as a characteristic of education undermines the goal of social justice. Items that appear in curriculum documents privilege certain knowledge, skills, and attitudes. For instance, in mathematics, “axiomatic systems are greatly valued over less systematic forms of deduction including problem solving, calculation and unsystematised proofs” (Ernest, 2007, p.7), yet “such values have only been prominent during a small part of the history of mathematics” (p.4). In particular within mathematics, values underpin the conventions, approaches, and nature of what are viewed as acceptable ways of engaging in the discipline (Ernest, 1998). Why, then, are some packets of knowledge, or skills, or attitudes, viewed as value-neutral or controversial? Part of the answer seems to lie in the pervasiveness of neoliberal discourses that have dominated education policy and practice since the 1990s (Pinto, 2012; Wright, 2012).

Neoliberal positions are portrayed as neutral, while opposing positions are constructed as ‘political,’ and contrary to common sense (Pinto, 2012; Roberts, 1998). Social justice is perceived by the public (including parents) to have “a strongly progressive bent, and the idea of political manipulation

creates fiercely negative reactions among parents” (Reynolds, 2012). Reynolds (2012) offered the example of a PETA poster angering a parent as a social justice initiative for bringing politics into the classroom. Yet, any decoration – whether poster, image, or anything else – would be equally value-laden. Some values, however, become “invisible” and perceived as unbiased (such as the salience of axiomatic systems in mathematics), while others (such as PETA’s stance) are labeled as biased, or even, according to the principal in Vignette 4, propaganda. The expectation of objectivity or objectivism as inherent to mathematics lends itself well to a value-neutral standpoint and precludes the socio-cultural nature of mathematics teaching and learning.

Considering the vignettes through a value-neutrality lens raises a number of interesting questions for teachers and teacher educators. We suggest that it is important to raise such questions for discussion during teacher preparation (as well as in our own research). By raising the awareness of value-neutrality traps, teacher educators may support prospective teachers in articulating the choices they might make in instructional situations that extend views of mathematics beyond traditional expectations. In our own teaching, we have raised for discussion questions such as: What “values” exist in your school that are so engrained they become invisible? In textbooks or other curriculum artefacts you regularly use, whose values, perspectives, and positions are reflected? Whose are absent? Why or why not? Thinking critically about the curriculum policy that impacts your work, what underlying assumptions exist that are invisible? Whose perspectives or views about mathematics are privileged in policy? What risks does a teacher take when he or she takes a social justice approach in a mathematics classroom? What systemic factors (policy, parents, administration) exist? What factors might make a teacher more or less likely take social justice risks?

### **Broadening Disciplinary Inquiry and Knowledge**

Gutstein’s (2006) model of Teaching Mathematics for Social Justice identified changing the learner’s orientation towards mathematics as one of its central aims. He described the importance of helping students transition “from seeing it [mathematics] as a series of disconnected, rote rules to be memorized and regurgitated, to a powerful and relevant tool for understanding complicated, real-world phenomena” (p.30). Similarly, teaching mathematics *through* social justice (that is, contextualizing mathematics within issues of social justice) can require and foster a similar shift in orientation. However, this also requires a shift in orientation towards mathematics *teaching* (Mamolo, 2014) -that is, teachers must emancipate themselves from the view that mathematics is either “right” or “wrong”, that there is one privileged solution or approach, that the end result of a mathematics problem should be neat, tidy, and absolute. In the context of the real world, and especially with respect to issues of social justice, ambiguities and values cannot be avoided.

Watson (2006) emphasizes “the role of teachers and the education system to extend possibilities for human development” (p.3). In our view, enacting such an orientation requires breaking away from traditional views of teacher as the authority, in control of the knowledge to be learnt by students. Breaking away from tradition, as our vignettes suggested, is laden with inherent risks. For teachers to perceive that risk-taking is possible and worthwhile requires a position in which they have either the appropriate standing within their workplace to do so, or a knowledge-base which allows them to justify such teaching decisions. We interpret elements of both in our vignettes, but for the purpose of this discussion focus on the latter.

Teachers in other research avoided taking risks in the classroom when they perceived themselves as lacking sufficient subject-matter knowledge, and so they relied heavily on textbooks as a professional crutch, and for intellectual support (Pinto, McDonough, & Boyd, 2011). Given that textbooks tend to under-emphasize social justice in their “conventional” treatment of subject matter (e.g., Pinto, 2007),



reliance on them works against social justice aims. Teachers' confidence in challenging publicly what they themselves are only just learning may be low for fear of undermining their classroom authority (Nuthall, 2004; Pinto, McDonough, & Boyd, 2011). For example, when asked why he felt the need to conform closely to the textbook, a high school teacher Philip explained, "Well it's basically because of my inexperience, I guess you could say, like, if I was probably more confident with the subject matter and the curriculum" (Pinto, McDonough, & Boyd, 2011).

Paul's musing in Vignette 3 reflected a similar sentiment in that his more extensive experience with mathematics created a 'broader' comfort zone and as such minimized certain risks. Sonya's concern that students' questions about poverty would have nothing to do with mathematics resonated with the difficulties prospective teachers can have in noticing relevant mathematical concepts when contextualized in issues of social justice (e.g., Mamolo & Martin, 2013). Similarly, the principal in Vignette 4 and the parent in Vignette 2 both conveyed very particular (limited) perceptions of what mathematics (and consequently mathematics learning) "should look like." Conventional and enduring "cultural myths" (Nuthall, 2004) place the teacher in control (at the front of the class with quiet students), the curriculum and textbook as the authorities of what and how students should be taught, and undebatable truths as the requisite knowledge to be acquired. There are risks involved on all three counts – social risks involved in managing a class that seems "out of control", subject-matter risks in diverting from prescribed approaches, and an intersection of social and subject-matter risks in negotiating disparate interpretations of mathematical "truths."

In accordance with Mason and Davis (2013), we interpret teachers' disciplinary knowledge of mathematics as a mode of being which influences how learning situations are structured, how student actions are interpreted, the flexibility with which teachers respond to such actions, and the in-the-moment decisions teachers make to foster and support student success. So again we ask: What factors might make a teacher more or less likely to take a social justice risk? What ways of being with mathematical knowledge can support or hinder such risk-taking? How can teacher educators support such ways of being?

### **Conclusion**

Ernest (2007) argued that "it is no longer enough to claim that [values] are outside of its proper subject matter" (p. 11). The four vignettes presented here point to the ways in which teachers experience risk when attempting to address social justice issues in mathematics classrooms. Prior research as well as anecdotal experience (especially Reynolds, 2012) suggest that some teachers shy away from more topics out of fear of antagonizing parents – a that fear is rooted in avoiding risk by estimating noncalculable probability.

We recognize that taking risks in the classroom is dangerous business – especially in light of contemporary, prescriptive neoliberal policy that governs classroom practice, and the accompanying accountability apparatus that attempts to enforce compliance. Yet, the compelling goal of helping students flourish (Smyers & Hogan, 2005), in our view, justifies the risks associated with transformative mathematics education. To that end, this paper offered four examples of ways in which mathematics teachers took on risks associated with social justice. We identified some of the systemic and structural barriers that they faced. We also posed a number of questions in our discussion that we hope mathematics teachers and teacher educators will take up. These questions offer an invitation to reflect on the opportunities and strategies that may move teachers and teacher educators towards transformative mathematics education.

Our paper raises a number of issues that warrant future research. We believe that an agenda of narrative or case study research providing examples of successful transformative mathematics education – which would go beyond merely instructional descriptions to include the risks taken – would provide a useful basis for professional learning and transformative practice. As well, additional research detailing students’ perspectives on engaging in social justice mathematics education would shed light on how such undertakings affect students and their learning. The research suggestions just described might also be beneficial in informing policy production at the district, province/state, and national levels.

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