

## EN LA LUCHA/IN THE STRUGGLE: RESEARCHING TO MAKE A DIFFERENCE IN MATHEMATICS EDUCATION

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*In this plenary I reflect on the research I have shared over the past many years of participating and presenting in PME and PME-NA conferences to identify three intellectual divides that continually challenge and motivate my scholarship. I discuss how these intellectual borders (mathematics/education; expert/novice; research/teaching) create adversarial relationships and unwarranted hierarchies in our field and among ourselves. Although these divides have been with us for a long time, I contend that these are far more dangerous than we might realize. These divides prevent us individually and collectively from imagining new and creative solutions to the perennial question about how to improve the quality and equity of mathematics education. I propose a reflexive and collaborative approach to identifying and problematizing the intellectual divides that challenge our goals and commitments to pursuing research that makes a difference in the very communities that we seek to serve.*

*En esta plenaria reflexiono sobre las investigaciones que he compartido durante los muchos años que he participado y presentado en las conferencias de PME y PME-NA para identificar tres divisiones intelectuales que continuamente retan y motivan mi trabajo académico. Discuto cómo estas fronteras intelectuales (matemáticas/educación; expert(a)/novato(a); investigación/enseñanza) crean relaciones adversas y jerarquías injustificadas en nuestro campo y entre nosotros(as). A pesar de que estas divisiones hace mucho tiempo que están con nosotros(as), sostengo que éstas son mucho más peligrosas de lo que podríamos darnos cuenta. Estas divisiones nos impiden individual y colectivamente imaginar soluciones nuevas y creativas a la eterna pregunta de cómo mejorar la calidad y equidad de la educación matemática. Propongo un enfoque reflexivo y colaborativo para identificar y problematizar divisiones intelectuales que desafían nuestras metas y compromisos de hacer investigación para contribuir a las comunidades que queremos servir.*

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### Introduction

I became a member of this organization in the year 2000 when I attended and presented at my very first PME-NA conference in Tucson, AZ. I was an early career faculty then and had just become a new mom. I traveled with my 5-month old in tow and my mother who looked after baby while I was presenting and attending the conference. I have fond memories of Tucson and continue to have a feeling of being *con familia* within this organization. Little did I know then that I would be back in Tucson 16 years later as a plenary speaker at this very conference. PME-NA has been a nurturing community in which to share my works in progress, test out my ideas, and learn and grow as a scholar. I have attended almost every year since the year 2000, in fact I counted a total of 18 publications in PME and PME-NA proceedings.

It is with trepidation that I accepted the invitation to deliver this year's PME-NA plenary address. I admit that plenaries are not my thing. Delivering a conference plenary has never been one of my professional aspirations. I much prefer dialogical and more interactive presentations and workshops where I can engage with the audience rather than standing in a podium talking at the audience. When I asked the program committee why they had chosen me the response was that I am the poster child for this year's conference theme: "*Sin Fronteras! - Without Borders!*" as I am someone who is constantly crossing geographical, cultural, linguistic, and intellectual borders. I could see their point

and decided to accept the invitation. After all I am not one to back down from a challenge or from stretching myself beyond my comfort zone.

I am engaged in mathematics education research because I strive to contribute to improving mathematics education in ways that align with the goals and values of democratic and anti-oppressive education. I am especially interested in learning and teaching practices that redistribute power and challenge stereotypes and hierarchies in the mathematics classroom, and this has pushed me to see social interactions from multiple perspectives and theoretical lenses. I approach my work in collaboration with colleagues, schools, and teachers committed to social change. I do this work across three countries, Dominican Republic, Canada, and the U.S. Within mathematics education I straddle the worlds of elementary/secondary education, of formal/informal mathematics, of theory/practice and of equity/excellence debates and debacles. More importantly, I have learned to embrace the tension and burden of working within and across these many communities and boundaries.

While it is true that my work crosses boundaries this is not unique to my scholarship. I would argue that we are all in some way or another navigating multiple personal and professional communities that require us to negotiate interactions that challenge us and that nurture us. So I am here not to claim that I have something unique to share or to stake claim to a piece of intellectual property that is solely my own. To the contrary, the work I have done over the past 20+ years as a mathematics educator has been possible because it has taken a whole village of collaborators who have helped me to keep front and center my commitment to anti-oppressive education and to remain hopeful that as math educators we can make a difference. So my approach to this plenary is to reflect on the kinds of boundaries I have had to cross throughout my career, taking stock of the work I have presented and published at PME-NA, to make visible intellectual divides that I consider dangerous and worthy of bridging and eventually take down.

I use “in the struggle/en la lucha” in the title of this plenary to remind myself of Paulo Freire’s (1970) pedagogy of hope in which he discusses our struggle as educators to work within the system that oppresses us and that we seek to change. I am also channeling bell hooks’ (1990) idea of teaching to transgress where she calls on educators to challenge ourselves to find new ways of thinking about teaching and about learning so that our work “does not reinforce systems of domination, imperialism, racism, sexism, elitism.” (p. xx). It is in that spirit, of dreaming big and dreaming the impossible that I then take the opportunity of this plenary to identify intellectual divides that continually push me and my scholarship and that unnecessarily drain our collective energy to address the problems facing public education today. I use this opportunity to reflect on my own work and how it has been challenged by pernicious intellectual divides that create adversarial relationship and unwarranted hierarchies in our field and among ourselves.

### **Fronteras Intelectuales and Dangerous Divides**

Towards the middle of last century, in an influential lecture, C. P. Snow (1959) identified “two cultures” within academic circles that threatened the whole enterprise of the University as a place that values diversity of intellectual pursuits and epistemologies. A border crosser himself Snow spoke as a participant in both literary and scientific communities about the deep rooted divide between two fields—the literary intellectuals and the scientists—and how each exalted its own virtues by vilifying the other’s values. He described them as two polar groups: the literary intellectuals at one pole and at the other the scientists. “Between the two a gulf of mutual incomprehension. They have a curious distorted image of each other.” (Snow, 1959, p.4). Snow’s characterization highlighted that the literary intellectuals value nuance, subtlety, depth, responsiveness and imagination, whereas scientists will talk about those qualities as touchy-feely and fuzzy-minded subjectivism. Similarly, the scientists value rationality, objectivity and functional prose

while literary scholars consider those qualities dull, literal minded, and lacking depth of understanding.

In “Disciplinary Cultures and Tribal Warfare,” a chapter in her book “Scandalous Knowledge,” Herrstein Smith (2006) explains the dangers of creating intellectual camps and hierarchies and revisits C. P. Snow’s two cultures adding that the tendency to polarize, compare, and rank ourselves is part of what all social groups do, including academics and intellectuals. In academic circles this is known as the ideology of the two cultures and refers to our tendency to identify ourselves with one or more social groups (e.g., religious, ethnic, political, professional), to experience that identity through contrast and comparison to one or more other groups - or, in other words, to experience the world in terms of 'us' and 'them'. This is known as a tendency to self-standardize and other-pathologize, said another way “to see the practices, preferences and beliefs of one's own group as natural, sensible and mature and to see the divergent practices, preferences and beliefs of members of other groups, especially those considered as the 'other', as absurd, perverse, undeveloped or degenerate” (Herrstein Smith, 2006; p. 113). Another consideration is that this tendency to pathologize the other is self-perpetuating in that these are invoked and circulated as ideological narratives within and across various communities.

In mathematics education there are numerous intellectual divides to choose from (see Stinson & Bullock, 2012; Davis, 2004; Davis, Sumara, & Luce-Kapler, 2015). In the 80’s the quantitative/qualitative debate took center stage as did the constructivism vs. social theories of learning. The 90’s witnessed the cognition vs. communication, and acquisition vs. participation debates (Sfard, 1998), while the 2000’s experienced the sociocultural vs. sociopolitical divide (Gutiérrez, 2013). These debates have been played out in the intellectual domain and among academics and eventually have slipped into the everyday conversations of schools and universities as ideological narratives that cast polar opposite characters (reform vs. traditional) battling out intellectual wars. Although these debates have faded they still frame current conversations and practices in mathematics education. Furthermore, they fall into the dualistic intellectual tradition that Snow (1959) characterized as the ideology of the two cultures and that Herrstein Smith (2006) describes in her writings as the tendency to self-standardize and other-pathologize.

I will focus here on three enduring divides that have not had as much play as those named above but are ever present in our everyday practices as mathematics educators and fuel an “us vs. them” mentality as described in the ideology of the two cultures. These are: a) Mathematics/Education, (b) Expert/Novice, and (c) Research/Teaching. I contend that these divides may seem innocuous but are nevertheless more dangerous than they appear to be. As I looked back across my PME and PME-NA publications with these three divides in mind, I could see how these have been and still continue to be a challenge in my own scholarship but also to our field more broadly. Although I could see all three divides in each of these articles, when I considered which divide was most foregrounded the following groupings emerged—7 articles foregrounding (a) [the mathematics/education divide], 5 of them foregrounding (b) [the expert/novice divide], and 6 articles foregrounding (c) [the research/teaching divide]. Rather than synthesizing the three groupings I use one representative article (see below) to springboard the discussion on each intellectual divide. I purposefully picked articles that are 6-7 years apart so that they represent broadly the scholarship that I have been engaged in over the many years I have been a part of the PME and PME-NA organization.

1. **Mathematics/Education** –Crespo, S. (2000). Learning mathematics while learning to teach: Mathematical insights prospective teachers experience when working with students. In M. L. Fernández (Ed). *Proceedings of the North American Chapter of the International Group for the Psychology of Mathematics Education*, 22, (vol. 2, pp. 549-554). Columbus, OH: ERIC Clearinghouse.

2. **Expert/Novice** –Crespo, S., Oslund, J. A., & Parks, A. (2007) Studying elementary preservice teachers' learning of mathematics teaching: preliminary insights. (pp. 975-982). In *Lamberg, T., & Wiest, L. R. (Eds.). Proceedings of the North American Chapter of the International Group for the Psychology of Mathematics Education, Stateline (Lake Tahoe), NV: University of Nevada, Reno.*
3. **Research/Teaching** –Crespo, S. (2013). Getting smarter together about complex instruction in the mathematics classroom. *PME Newsletter (March-April 2013)*, pp. 4-5, Psychology of Mathematics Education (PME International).

### The Mathematics/Education Divide

Looking back at my very first PME-NA presentation I can see the mathematics/education divide prominently highlighting the separation between where and how teacher candidates can learn mathematics in their teacher preparation programs. I experienced this divide both in my own undergraduate education as I traveled from one side of campus, where I was studying mathematics and physics to the other side of campus where I was taking education classes. This structural divide continues to persist and is very present in my own practice as a mathematics teacher educator. The very structure of teacher preparation programs in general continues to reaffirm the mathematics/education divide by locating the learning of mathematics content in designated math courses and separating it from the learning of teaching methods contained in education courses. Embedded within the structure is also the assumption that learning to teach entails learning the content first and the teaching methods second (rather than concurrently).

In *Learning mathematics while learning to teach: Mathematical insights prospective teachers experience when working with students* (Crespo, 2000), I argued that prospective teachers engage in mathematical inquiry within their education courses and in particular when working directly with students. I provided three examples—posing tasks, analyzing students' work, and providing mathematical explanations—where teacher candidates could gain mathematical insights while learning educational methods and theories. This surely is no longer a controversial point, but at the time mathematics educators were just beginning to consider Ma's (1999) work and Ball and Bass' (2000) work describing the profound understanding of mathematics entailed in the work of elementary mathematics teaching. The push back from mathematics educators who dug their feet firmly into the mathematics side of the divide was intense, making anything that they did not recognize as mathematical sound crazy or simply stupid. Therefore, the process of selecting examples that were recognizable as mathematical by those holding dominant perspectives about mathematics was a challenge.

Let me provide a few illustrations. In Crespo (2000) I included several examples to illustrate the ways in which mathematical questions and insights arise when prospective teachers work on teacher preparation course projects that have them exploring mathematics with students. In one example I shared how, when interviewing a 2<sup>nd</sup> Grader about her strategies for sharing cookies among different number of people, a prospective teacher found her student conjecturing that if the number of cookies was even, it could be shared evenly among people, and that if the number of cookies was odd, it could not. The young student concluded this after having shared several even numbers of cookies, such as sharing 30 cookies among 3 and then 5 people. In this situation the prospective teacher found herself in a position of exploring this student's conjecture by offering her several more examples to have the student test her conjecture and see whether or not it does or does not work for other cases.

In another example a prospective teacher had adapted a mathematics problem (Watson, 1988) we had explored in our university class to try it out with fifth graders in her field placement. This problem read:



Three tired and hungry monsters went to sleep with a bag of cookies. One monster woke up and ate  $1/3$  of the cookies, then went back to sleep. Later a second monster woke up and ate  $1/3$  of the remaining cookies, then went back to sleep. Finally, the third monster woke up and ate  $1/3$  of the remaining cookies. When she was finished there were 8 cookies left. How many cookies were in the bag originally?

The prospective teacher chose to rescale the problem by changing the fractional number in the problem from  $1/3$  to  $1/2$ . By doing so, she made an interesting discovery, that is, that her students were able to arrive at the correct answer by using a restrictive solution method that in fact does not work for the original version of the problem. Students had approached the problem by multiplying the left over cookies by 2 ( $8 \times 2 \times 2$ ), basically doubling the left over cookies three times. Yet, even though this method works for halves, it yields an incorrect answer for thirds, fourths, and any other fractional part. This unexpected outcome launched the prospective teacher into her own mathematical investigation into the reasons for how and why such a minor numerical change could alter the nature of the original problem (Crespo, 2000).

I have made similar and related arguments about mathematics as a practice that occurs and is learned everywhere not solely inside mathematics classrooms and most definitely not solely in coursework offered in mathematics departments. I recognize the history of why and how disciplinary knowledge broke off and was elevated from the everyday knowledge and practices and the privileges that this affords to those of us in the field of mathematics education. However, to me mathematics is a human practice that belongs to all of us not solely to mathematicians (Bishop, 1990). Hence throughout my career I have argued that it is especially important for prospective teachers to consider their teaching as a site for mathematical inquiry and for problem posing with their students and to find ways to explore the mathematics that students learn in their communities and in out of school contexts. I have continued to address the mathematics/education divide in multiple ways and especially as I have increasingly foregrounded educational equity within the curriculum and pedagogy of the mathematics education courses for future elementary and secondary mathematics teachers. If concerns and push back about “where is the mathematics?” or “how is this mathematics?” were raised with regards to learning mathematics through learning mathematics pedagogy, the push back to infusing educational equity in the teaching of mathematics has been even that more forceful.

The divide between mathematics and education continues to be reflected in the intellectual but also in the physical divide found on most University campuses. This divide contributes to the lack of coherence and continuity in the curriculum and pedagogy of teacher preparation (Feiman-Nemser, 2001). Mathematics courses are offered in mathematics departments, taught by instructors who do not address questions that concern educators. Education courses in turn are offered in colleges of education and are typically focused on educational issues without attending to specific content issues. The mathematics methods course is also influenced by this divide. Instructors of these courses often assume that teacher candidates have to “unlearn” oppressive approaches to the teaching and learning of mathematics that they have picked up in the math courses they have taken. The rift between mathematics educators who work in colleges of natural science and mathematics educators who work in colleges of education is very palpable at my current institution and I suspect across many other institutions as well.

As a mathematics educator who has colleagues in the college of natural science and in the college of education I am constantly challenged by both sides to see their perspective while neither side seems to see their own biases and entrenched ideologies. One side asks and insists on raising the question of “where is the math” whenever the conversation is focused on educational issues that transcend the narrow particulars of the discipline of mathematics as constructed and practiced by research mathematicians. I constantly hear the “where is the math” question raised in faculty

meetings, in students' comprehensive exams, in dissertations, and in colloquia. My education colleagues, on the other hand, ask and insist on raising questions about whether mathematics as a discipline can be trusted to embrace democratic ideals when so much of what is wrong and objectionable about today's public schooling can be attributed to the way mathematics is used to exclude and deny access to college to a large majority of non-white students, not to mention the oppressive ways in which mathematics continues to be taught and learned in schools.

To be clear, I consider the mathematics/education divide as dangerous because it shapes interactions among ourselves with colleagues on our campuses and members of various other communities. It instantiates the tendency to self-standardize and other-pathologize discussed earlier. It forcefully comes into play when faculty is engaged in doctoral admissions or discussing prospective colleagues who have or do not have a so called "strong" mathematical background or do not have a so called "substantial" classroom teaching experience. With each side digging their heels more deeply into their own camp they continue to reproduce their perspectives and pathologize the other. The danger lies in how this divide breeds toxic and deficit discourses within our own academic communities which not surprisingly is expressed outwardly through our research onto the very communities we are hoping to help (Shields, Bishop, & Mazawi, 2005). This intellectual divide becomes normalized and replicated in our teacher preparation programs and travels to our partner schools. It undermines our goals to make mathematics a subject that many and more diverse groups of students engage with and enjoy, and a subject that supports the democratic values and ideals of public education. Not challenging this divide propagates the ideology that one field of study is more important than the other. It generates categories of students which are liberally applied to elementary prospective teachers and breeds the dominant narrative about elementary teacher candidates' "lack of knowledge" of mathematics. This issue speaks to the next divide — the expert/novice divide—which I discuss next.

### **The Expert/Novice Divide**

Another divide always present in mathematics education is the categorization of experts and novices. I consider this to be another dangerous divide because the experts become the norm by which everyone else is judged and evaluated. It creates a hierarchy and a social reward system that promotes a rush to mastery which undermine and shortchanges the process of learning. Additionally, if the category of expert is associated with natural talent as it is often the case for mathematics and for teaching, gaining such expertise becomes unattainable for novices—let those be elementary age students or teacher candidates in undergraduate mathematics content or methods courses. Worse still, it suggests that only a few can ever be experts in the teaching and learning of mathematics.

In *Studying elementary preservice teachers' learning of mathematics teaching: Preliminary insights* (Crespo, Oslund, & Parks, 2007), I worked to conceptualize a study that explored how prospective teachers learn to enact the practices of posing, interpreting, and responding (PIR project) during teacher preparation courses and experiences (Crespo, 2006). In that PME-NA presentation I argued that prospective teachers were most likely learning mathematics teaching practices that had not yet been documented in the mathematics education literature because the dominant research frames and tools were focused on a very narrow set of desirable teaching practices. If the window for what constitutes an expert performance is narrowly defined, then the bulk of what can and will be observed would be classified as not meeting expert quality, and by default they become novice performances or worse considered as examples of not very good teaching.

In the 2007 PME-NA research presentation (and at a later PME-NA presentation in Crespo et al., 2009) I discussed how and why we decided to revise our initial assumptions about expert/novice enactments of teaching practice. As a member of another research project, the TNE project (Battista et al., 2007), I was able to use similar research tools in order to explore the relation between mathematics knowledge for teaching (MKT) and PIR practices (see Table 1). Working on both these

projects at the same time allowed me to see quite a few strange results that called into question assumptions about what experts and novices do/don't know and can/cannot do in their teaching of mathematics. Results from the TNE-Math surveys for example which were administered concurrently to prospective teachers at different stages in the program (studying math content and study math methods) had us looking at a number of very strange results such as a decline in mathematics knowledge for teaching (MKT) as prospective teachers transitioned from learning about content to learning about teaching practice.

**Table 1: TNE and PIR teaching scenarios focused on two-digit subtraction**

TNE Project – MKT Scenario	PIR Project – Teaching Practice Scenario
<p><b>W1.</b> <i>Imagine that one of your students shows you the following strategy for subtracting whole numbers.</i></p> $\begin{array}{r} 37 \\ -19 \\ - 2 \\ \hline 20 \\ 18 \end{array}$ <p><b>W1a.</b> <i>Do you think that this strategy will work for any two whole numbers?</i> Yes    No    I don't know</p> <p><b>W1b.</b> <i>How do you think the student would use this strategy in the problem below?</i></p> $\begin{array}{r} 423 \\ -167 \end{array}$	<p><b>PIR2a.</b> Imagine you are teaching a lesson about two-digit subtraction and you ask the class to explore different ways to solve the following subtraction. The students look puzzled. What do you imagine <u>saying</u> and <u>doing</u> next?</p> $\begin{array}{r} 37 \\ -19 \\ \hline \end{array}$ <p><b>PIR2b.</b> After giving students some time to work on the task you call on their attention and ask for volunteers to share their strategies. Imagine that one of the students shows the following strategy. What can you imagine <u>saying</u> and <u>doing</u>? Say a bit about what you would want to accomplish by saying and doing so.</p> $\begin{array}{r} 37 \\ -19 \\ - 2 \\ \hline 20 \\ 18 \end{array}$

Another curious result was uncovered when the PIR team compared the prospective teachers' MKT and PIR responses to tasks such as those in Table 1. In his 2009 PME-NA presentation Brakoniecki (2009), then a graduate research assistant to both projects, reported on prospective teachers who had participated in both the TNE and PIR projects. He showcased three prospective teachers who had correctly addressed the MKT question about generalizing a student subtraction algorithm using negative numbers (see Table 2). All three teacher candidates showed that they could apply the alternative algorithm to a new example. However, their instructional responses to the PIR teaching scenario were all very different (see Table 2) and raised all sorts of questions for the PIR team about the relationship between MKT and PIR practices. So here we have three novices, Dean, Becky, and Lisa (all pseudonyms), who demonstrate that they can do the mathematics that is required to assess the validity and generalizability of an alternative computation algorithm that a student may offer in their classroom, but each of them responds quite differently to a hypothetical teaching scenario. Becky disapproves and does not seem to appreciate the value of this algorithm, Dean seems willing to accept students' algorithms as long as they can show and explain their work, and Lisa makes connections between the standard and alternative algorithms as she expresses her view that there are "more than one way to solve a problem."

**Table 2: Three prospective teachers' responses to MKT task and PIR teaching scenario**

<b>Responses to MKT task</b>	<b>Dean Response to PIR task</b>	<b>Becky Response to PIR task</b>	<b>Lisa Response to PIR task</b>
Correct Responses to TNE task  $\begin{array}{r} 423 \\ -167 \\ \hline -4 \\ -40 \\ \hline 300 \\ 256 \end{array}$	I would ask the student to re-write the problem and show each step they took to get to their answer.  I would want the students to learn the importance of showing their work and how they can use it to retrace their steps in a problem	I do not like this way – Math for higher on is going to be a lot harder if they learn this now.	This strategy can work. The student knows that we start in the ones column. $7-9 = -2$ . The tens column is also correct, as $30-10=20$ . Now what the student did was combine -2 and 20, to get 18. We got the same answer. I would want to let the class know that there is more than one way to solve a problem, and it is important to remember that subtraction of multiple digit numbers involves multiple subtractions, depending on how many places are in the number.

So what is a mathematics educator to do with these prospective teachers' responses, classify them as high MKT but then low (Becky), medium (Dean), and high (Lisa) with respect to their instructional practice? What are we to do with prospective teachers like Becky in our teacher preparation courses? Fail them and tell them they are not qualified to teach students? We seem to be willing to do so when they do not know the mathematics and not so willing to take such a stance when they do not know teaching practice. These initial insights made it clear to us that without reframing our assumptions about expert and novice performances of PIR practices we would continue to recreate and reinforce the same type of instruments and make the same kinds of claims about prospective elementary teachers. This would mean and we would continue to propagate the circular and dead-end deficit discourse about students and their teachers (Comber & Kamler, 2004). In Crespo, Oslund, and Parks (2007) we shared our revised definitions which then led us to design new kinds of teaching scenario instruments, ones that invited teacher candidates to provide multiple not just one response to the teaching scenarios, and ones that invited a more dialogical representation of their practice (see Crespo, Oslund, & Parks, 2011).

In the PIR project we were then able to document more of prospective teachers' strengths (could do and were able to do) than deficits. More importantly, it led us to propose another type of teaching scenario tasks that positioned prospective teachers as creators (not just as reproducers) of teaching practice. In this new type of teaching scenario prompt prospective teachers represented a whole class mathematical discussion in the form of a classroom dialogue. I argue that these kinds of dialogical scenarios elicit different kinds of representations from prospective teachers that make visible more of the complex and nuanced ways in which they imagine mathematics teaching practice. Unlike much of the research on prospective and practicing teachers of elementary school mathematics, my PIR project documented many ways in which prospective teachers take up the student-centered and equity-oriented pedagogies they are studying during teacher preparation. I argued that by researching



dialogical representations of mathematics teaching researchers and teacher educators can learn more about how prospective teachers transform what they are studying in teacher preparation courses into purposeful and principled teaching actions. This new insight would not have been possible without challenging and questioning the expert/novice divide that is so engrained within mathematics education's research/teaching practices, which is another divide I discuss next.

### **The Research/Teaching Divide**

The research/teaching divide has been in the education research landscape for a long time as educational research was initially conceived as research *on* teaching and not *with* or *by* teachers. The animosity and distrust between teachers and researchers in the past and still in the present is reminiscent of Snow's (1959) characterization of the two cultures and it can be related to the longstanding divide between the theoretical and the practical. Researchers characterize teaching as resisting change and teachers characterize educational research as irrelevant to their problems of practice. The research/teaching divide became even more heated when some educational researchers proposed the notion of the teacher as researcher, which raised all sorts of debates, push back, and controversy (Cochran-Smith & Lyttle, 1990; 1999). As someone who studies her own teaching practice and who collaborates with teachers and students in the research process I have had to negotiate this divide and address questions about whether my scholarship counts as research or whether my research has made any impact in the everyday practice of teachers. These are questions rooted in the process of self-standardizing and other-pathologizing that I alluded to earlier. The tendency to vilify other perspectives rather than embrace the diversity in our field is very much alive and well in our own academic backyards.

The research/teaching divide has always puzzled me. As a teacher I have always considered myself a researcher of the mathematics I was teaching and of my students' learning, simply stated I considered myself a student of my students' mathematical thinking and learning. Therefore, I find the divide between education practitioners and researchers to be unhelpful and unnecessarily elitist. As a doctoral student I wrote a comprehensive exam paper titled "*What does research got to do with teaching?*" where I explored the contentious relationship between research and teaching and argued that the two had more things alike than things that were different. To me learning, teaching and researching are similar practices rooted in people's desire to inquire and understand what they do not know. Hence, research is no more than another learning practice that has been uprooted from the everyday practices of people and their communities (this is a similar point to the one I made earlier in relation to the mathematics and education divide).

As a researcher interested in educational experiences that are empowering and transformational for students and their teachers I see the boundary between teaching and researching as an unproductive divide. In my work, teaching involves research and research involves teaching, the two are deeply intertwined. In *Getting smarter together about complex instruction in the mathematics classroom* (Crespo 2013), I describe an example in my scholarship where research and teaching seamlessly collaborate to advance the goal of promoting equity in the mathematics classroom. Complex instruction (CI) is a collaborative teaching method that addresses inequitable teaching and learning. Applying the theory of status generalization to classroom interactions Elizabeth Cohen (1994) interpreted students' unequal participation in the classroom as a problem of unequal status. Unequal status breeds competitive behavior which in turn undermine everyone's learning. Status issues are rooted in societal expectations of competence for students who fit and do not fit the dominant culture's views about who is and not intellectually capable. In the mathematics classroom status issues come into play when students from non-dominant groups participate (or not) in learning activities. Rather than seeing students who under participate in the classroom as either disengaged or unmotivated, Cohen (1994) saw these students as systematically excluded from learning

opportunities not only by their teacher but also their peers, but more importantly by the classroom structures which endorsed rather than disrupt competitive forms of interactions among students.

But complex instruction seeks to not only understand unequal participation in the classroom, it seeks to engineer instructional structures and practices that could disrupt unequal peer interactions in the classroom and to promote a more collaborative learning environment. Rather than setting up the classroom as a competitive space for learning where some students rise to the top and some sink to the bottom, complex instruction sets up the classroom for collaboration and as a place where everyone is expected to succeed and to contribute to a greater understanding than it would be possible by one person alone. In a complex instruction classroom, no one is seen as more or less smart. Instead everyone's capacities, abilities, and experiences are acknowledged, valued, and nurtured as resources in the classroom.

Consistent with CI's theory about collaborative participatory learning—that no one is as smart as all of us together—my complex instruction colleagues and I have engaged in this work in ways that require and value each other's perspectives. We realize that simply talking about these issues and becoming aware of them is not enough. This work entails inviting practicing and prospective teachers to work with us on these ideas in the context of learning about lesson studies, which is unsurprisingly also a collaborative approach to teachers' professional learning. We design together complex instruction math lessons and investigate together questions about students' access, participation, and learning in collaborative mathematics lessons (see Crespo & Featherstone, 2012; and Featherstone et al., 2011). This has created a collaborative network of researchers and practitioners with a common goal and who share teaching and research insights across institutional settings using all sorts of communication outlets including social media, teacher blogs, research and practitioner journal articles, book chapters and books, workshops, talleres, and community forums.

### **En La Lucha/In the Struggle—Mathematics Educators Sin Fronteras**

Returning now to the theme of this conference “Sin Fronteras/Without Borders” and how it might be possible to value and embrace diversity of perspectives in light of the issues I have raised here about the intellectual divides we manage to erect in the process of rationalizing and justifying our work as mathematics educators. Here I conclude with two approaches I have taken to counter my own tendency to self-standardize and other-pathologize by pursuing instead a more reflexive and collaborative mathematics education scholarship. A reflexive approach to mathematics education entails holding the mirror back to ourselves to identify ways in which we are complicit in the very things we criticize and seek to change. A reflexive researcher bluntly asks themselves whether their research is making things better or worse (Kleinsasser, 2010). In this case, consider how it is that we create intellectual divides with our own scholarship and practices. As I consider, for example, the extent to which my research reflects my commitments to anti-oppressive mathematics education, I have to wonder how to best represent these commitments through my research methods and practices, and whether my choices and approaches are making things better or worse.

For example, one important commitment I made early on in my career was to write and speak in ways that are accessible, inviting, and free of academic jargon inasmuch as that is possible. This was partially rooted in my own experiences as a non-native speaker of English and the challenges of reading academic papers in a non-native language. Also as a teacher of mathematics I worked hard to demystify the aura of super human intellect that is associated with the very compressed shorthand of mathematical symbolism that keeps so many students in the dark and excluded from using and conversing in mathematics. More importantly, I am continually reminded to question my motives and my hopes for the educational research I choose to pursue by the words of Elliot (1989) one of the authors I read in grad school.

Rather than playing the role of theoretical handmaiden of practitioners by helping them clarify, test, develop, and disseminate the ideas which underpin their practices, academics tend to behave like terrorists. We take an idea which underpins teachers' practices, distort it through translation into academic jargon, and thereby "highjack" it from its practical context and the web of interlocking ideas which operate in that context. (Elliot, 1989; p. 7)

Yet as I hold on to this commitment I also consider the critiques other scholars raise about taking what seems to be a reductionist and simplistic route to explaining complex educational issues. In their view, such an approach to scholarship feeds into rather than challenge the distrust people have of academics and anything that sounds too intellectual or overly complex whether those ideas come from science or the humanities (e.g., Davis et al., 2014). I also understand that our words are critical and that how we name and talk about people, communities, and students matter and shape our thinking and practices. Therefore, I also participate in discussions that seek to clarify, object, and subvert particular terms and language commonly used in research and in practice, especially language that is offensive and degrading to the very students and communities that need us the most.

The point here is that I have come to accept that there is inherent tension and contradictions within the work we do as researchers in mathematics education and appreciate Elbow's (1983; 2000) notion of embracing contraries as a way to see beyond our tendency to polarize and take sides without fully understanding and considering opposing views. Sfard's (1998) discussion of two metaphors for learning (as acquisition and participation) also takes a similar stance about opposing and contradictory perspectives. I have tried out Elbow's ideas in a recent editorial (Crespo, 2016a) for the *Mathematics Teacher Educator* journal which I am currently serving as editor to promote a more educative rather than adversarial approach to reviewing manuscript submissions to the journal. I also explored Elbow's embracing of contraries in a recent publication (Crespo, 2016b) focusing on the challenge to disrupt our tendency to polarize mathematics teaching practice when selecting and using video representations of mathematics teaching. This is an issue that the National Council of Teachers of Mathematics (NCTM) Research Committee (2016) recently discussed and identified as a pernicious storyline that circulate and influence the public perception about mathematics education.

Collaborative research is another way in which I have chosen to pursue research in mathematics education. This is one approach that discourages me from building intellectual divides. I have come to the point of realizing that educational problems are much too big for any one of us to take on and solve by ourselves and that it will take literally a whole village of committed mathematics educators to make the kinds of changes we are all striving to make. All this within a world of higher education and academia that is driven by competitive policies and reward systems. Although this can create hostile working environments for faculty, it is worth investing in developing collaborative networks with colleagues. Operating under the tenants of complex instruction that together we can learn more than individually, and that each collaborator needs to be willing to learn from each other's perspectives, I continually renew my belief and commitment in collaborative mathematics education research. And as I alluded to earlier, my work is only possible by collaborating with colleagues from all walks of life that are committed to social change.

In addition to the example I offered earlier with my complex instruction colleagues with whom I wrote the book *"Smarter Together,"* (Featherstone et al., 2011) I have also collaborated with another network of educators committed to identifying and challenging oppressive forms of mathematics education research and to making our field more inclusive of diverse perspectives and practices (see Herbel-Eisenmann et al., 2013). Another more recent collaboration is a book of cases for mathematics teacher educators (White, Crespo, & Civil, 2016) which includes a collection of 19 cases from different authors highlighting dilemmas they experienced while teaching about inequities in mathematics education in the contexts of content and methods courses and professional development contexts. Each case includes commentaries from three different authors. Altogether the

perspectives of over 80 mathematics educators are included in this book. The conversations that we have had and that will continue to have around these cases are very exciting to me and gives me hope that together we can and will make a difference in shaping the future of mathematics education research. I am also hopeful that the future generation of mathematics educators will engage with diverse perspectives by embracing contraries, said another way, by building bridges rather than walls.

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