

HOW NUMBER TALKS SERVE UNDERREPRESENTED STUDENTS AND LANGUAGE LEARNERS

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Number Talks are designed to nurture discourse-rich classrooms in diverse settings while, at the same time, advance the mathematical knowledge of every student and every teacher across grades K-16. So, I was especially pleased to be introduced to the work of C.J.E.M van den Boer while participating in an advisory capacity with Jana Dean during her Fulbright scholarship work at the Freudenthal Institute. In one post, Jana focused our attention on van den Boer, who studied the kinds of instructional practices that best support cultural minority students and language learners.

Jana wrote:

This morning, I read a summary of a study that points to a promising starting place for thinking about practices. C.J.E.M. van den Boer (1993) looked at what happened for cultural minority students in discourse-rich classrooms. In English, the title of her work is “If you know what I mean.” She found that minority students and their teachers often didn’t know what they didn’t know. In other words, neither teachers nor students were aware of gaps in conceptual understanding during the learning process and only became aware of problems after students failed final assessments and entrance exams. Students and teachers were not understanding each other.

Jana Dean 2/5/19

Jana drew on van den Boer’s work to identify a list of practices that show promise:

- *Giving students time to discuss and revisit problems.*
- *Formative assessment that makes students’ misconceptions visible for both teacher and student.*
- *High expectations for everyone.*
- *Keeping the context of contextual problems in the foreground during discussion so that students know that it is important.*
- *Students, not teachers, own and provide the answers so that students are not focused on simply trying to produce the answers their teachers want.*
- *Never say, “That is easy,” as such statements will discourage students from showing they are confused.*

- *Bring explicit attention to academic vocabulary and ask students to engage in it so that students will know that words are conceptually important.*

Jana Dean 2/5/19

I wish all teachers and students could fully experience what Number Talks have to offer this vision for mathematics education where students and teachers, alike, learn to have their own mathematical ideas and engage in meaningful mathematical discourse. While it is by no means the lion's share of what happens in math classrooms, this 15-minute routine has a lot to offer every teacher, at every level, who is working to cultivate a vibrant, relevant and inclusive mathematics classroom. When Jana posted her reflections, I sat down to write a quick response. Yet the more I thought about it, the longer I found myself writing. This paper is the result. My hope is that it will help to set in motion conversations among readers as they reflect together on the potential for Number Talks to help us all move forward, ever closer to our goal of empowering mathematics teaching and learning for every student and every teacher.

A little background on Jana's work seems in order. Jana has designed and is conducting a study of what Dutch schools do to meet the needs of language learners. She is "looking at the intersection of teaching practices that support powerful math instruction and the needs of language learners" (Dean, 2/5/19). I want to thank Jana for sharing her work with all of us. I've had the pleasure of working closely with her over the past several years and have always appreciated the thoughtfulness and drive she brings to her work. In her description of van den Boer's study, Jana puts words to the kinds of things I've been striving for during my long and deeply fulfilling career as a classroom teacher, teacher of teachers and parents, and in my work to prepare future mathematics teacher leaders. I hope that learning of van den Boer's work will help to support the many teachers who are working on their practice.

In writing, here, about Number Talks as a routine that helps support underrepresented students and language learners, I first offer some general thoughts about how they can be used to help secure discourse-rich classrooms that work for every learner. Then I go on to describe how they contribute to each specific practice Jana identifies.

It is clear, by now, that Number Talks get defined in many different ways. So it's important to let you know that I am writing from the perspective of Number Talks as we describe them in *Making Number Talks Matter* (Humphreys and Parker, 2015) and, more recently, in *Digging Deeper: Making Number Talks Matter Even More* (Parker and Humphreys, 2018).

Number Talks are a quick 15-minute routine that takes up just a fraction of mathematics instructional time. Yet the payoff they bring can be profound when it comes to the practices that Jana describes as “meeting the needs of cultural minority students in discourse-rich classrooms.” Number Talks can be a way to jumpstart these practices since they are all about helping *every* student find their voice in math class. And the beauty of it is that this routine can fully engage *every* student and *every* teacher at *every* level.

One of the most important things that happens when Number Talks are done frequently and thoughtfully in classrooms is that students and teachers learn a lot of mathematics together. Number Talks help create classroom communities where everyone knows that discussions around math problems are richer when more voices and points of view are shared, and where everyone – teachers, students, and, hopefully, parents – develops a deeper understanding of numbers and operations that are foundational to so much of mathematics.

Number Talks put each student fully in charge of deciding when and how to bring their voice to the public space. Students know they will never be called on during Number Talks unless they have volunteered. And they tell us that knowing they won't have to talk is what makes them want to talk. Providing this promise of safety affords many, many students the time they need to find their voice and time to build the courage to share it with others. And how great that while students are mustering the courage to share, they are still fully engaged in learning to think in mathematical ways.

Number Talks serve all students and teachers when it comes to each specific practice as well. It seems obvious to me that what Number Talks have to offer is both clear...and elegant. Here, I lay out my reasons why, one practice at a time.

- **Giving students time to discuss and revisit problems.**

This is ubiquitous to Number Talks, by design. Students and teachers have ongoing opportunities to keep working on their ideas and practices over time. Students take up new mathematical ideas on their own and have multiple successive opportunities to work out those ideas. They have ongoing opportunities, as well, to try on other students' ideas whenever they're intrigued.

Students want to talk about the mathematical ideas they have during Number Talks. Even those students who don't yet feel ready to talk publicly often approach the teacher at another time to share their thinking. And even when they're not talking, students get to hear and engage with new ideas and the related mathematical conversations that are ignited by their peers. Once a student has thought about a problem on their own, they want to be part of a conversation about the problem. Fortunately, whenever a student feels ready share, Number Talks are there as a safe and inviting place to begin.

- **Formative assessment that makes students' misconceptions visible for both teacher and student.**

Each and every Number Talk is a formative assessment, both for teachers and students. Students are trying on ideas and wanting to figure out why an idea works, or if it always will. And Number Talks are quick to reveal many "holes" in students' understanding of math; holes that most often differ from student to student. Moreover, Number Talks provide a safe space for students and teachers to confront their misconceptions and incomplete understandings...and time do something about it.

When it comes to the unavoidable mistakes that students and teachers make along the way, Number Talks give everyone time to confront those mistakes, encouragement to work on their ideas until they can figure out what's wrong, and an opportunity to pay attention to new insights gleaned along the way. Both teachers and students get to hear and see mathematical ideas, even in their infancy, on a daily basis and have the opportunity to pursue ideas that grab their attention.

- **High expectations for everyone.**

Number Talks are all about every student coming to know that he or she has mathematical ideas worth considering. They are inviting and engaging to students from a wide range of learning levels and across nearly every grade level, K-16. The beauty is that many students who have suffered over time from institutionalized low expectations when it comes to mathematics, find themselves liberated by Number Talks. For many, it is the first time they get to experience what it's like to have a mathematical idea; or make sense of math in their own way; or get to see and explore the multiple other perspectives that come from their peers. Number Talks are a great equalizer. Everyone is learning together as the learning community becomes accessible, productive, valuable on many levels, and valued by all.

- **Keeping the context of contextual problems in the foreground during discussion so that students know that it is important.**

Number Talks are, by design, devoid of context – that is, other than the context of numbers and operations themselves. This 15-minute routine can change students' relationships with mathematics though. And it changes their mathematical dispositions in ways that make the contextualized problems that happen during the rest of math class more inviting and accessible to more students. Simply put, it's empowering when students come to know that they can make sense of mathematics on their own and in their own ways, and that they can learn by engaging with the ideas, noticings, and wonderings of others.

During Number Talks, teachers and students alike want to hear what others are thinking about an idea. So, when it comes to Number Talks, it almost seems like the context is there – embedded in a process of striving to better understand numbers and operations, both for their own sake and for the sake of being able to make sense of information and situations in their lives. During Number Talks, students interact with naked number problems with the same mathematical dispositions we want them to bring to bigger contextualized investigations. And they bring to Number Talks the same kind of motivation and determination to make sense that we want them to bring to all of mathematics. Number Talks can help students resist their desire to put ideas to rest, or rest content when they're unable to make sense of things. Both teachers and students learn that understanding is deepened over time, and they come to know what it's like to work on a mathematical idea until it makes sense.

- **Students, not teachers, own and provide the answers so that students are not focused on simply trying to produce the answers their teachers want.**

Students are the ones having the mathematical ideas during Number Talks. And teachers get to have their own new mathematical ideas as well! Number Talks become a culture where students and teachers expect and rely on convincing mathematical arguments. They strive for this in their own work and look for it in the work of their peers.

Furthermore, teachers refrain from being any kind of arbiter of ideas during Number Talks. But the teacher is always busy listening to students, looking for evidence of how solid each learner's understanding is, and considering potential next steps based on what students reveal. Number Talks demand a lot of teachers.

- **Never say, “That is easy,” as such statements will discourage students from showing they are confused.**

Number Talks help students learn to embrace the idea of confusion or cognitive dissonance and come to understand that, with mathematics, a state of confusion can be an important and productive place to hang out. Students learn to no longer want to be told how to solve problems because they know the feelings of satisfaction that come from figuring things out. With Number Talks, both students and teachers come to view confusion as a natural part of learning. Everyone experiences, first-hand, that being confused is not something to hide or flee from. They learn, instead, that a state of confusion or cognitive dissonance often means that they are on the precipice of learning something new.

As Cathy Humphreys and I wrote in our latest book, *Digging Deeper: Making Number Talks Matter Even More* (Stenhouse, 2018), Number Talks can also go a long way toward helping students come to see mistakes as natural and even unavoidable. Number Talks are about kids testing out ideas. And when they do, they come up with ideas that don't always work. When this happens, students naturally want to figure out what's wrong, and why. And it's frosting on the cake that all kinds of ideas come up during Number Talks that are worthy of further mathematical investigation.

Students get good at telling each other that they don't want to hear "That's easy." They know from experience that efficiency is in the eye of each learner. And they learn pretty quickly that no idea is efficient when you don't understand it.

- **Bring explicit attention to academic vocabulary and ask students to engage in it so that students will know that words are conceptually important.**

Number Talks provide a rich opportunity to begin to accomplish this. As students try to communicate their ideas, lacking the mathematical vocabulary that would be helpful, a teacher can casually say something like, "Mathematicians have a word for your idea. They call it..." Students are most often eager to learn vocabulary when it helps them communicate their thinking more efficiently. So as a teacher, we can "drop in" the vocabulary during Number Talks, but we do so fully aware that a student would, and should, take it up only when it labels a relationship they understand.

I don't, at all, mean to imply that enacting Number Talks well can be done easily. Far from it. Some teachers take to Number Talks like ducks to water. They recognize pretty quickly what they have to offer. Yet, others have a really hard time getting Number Talks going or keeping them going. Many teachers have an added burden of fear and discomfort with mathematics that makes this even harder, but these teachers can benefit greatly from Number Talks.

Most all teachers will need time to develop new beliefs about what it means to do mathematics, and time to learn to trust that all students have mathematical ideas worth listening to. On top of all this, when students do begin to share, deciding what to do with their ideas involves constant on-the-spot decision making. Learning to really listen to students, assess their understanding in the moment, and make myriad decisions like whether or not to respond to a student's idea and, if so, when? and how? or where to go next? are givens with Number Talks. Number Talks require constant decision-making on the part of teachers and this is not at all easy to do, especially when getting started. There have been so many times over the years when I've been grateful that the practice of Number Talks is so wonderfully forgiving for teachers and students who are working together to figure out this new classroom dynamic.

If Number Talks are to become a transformative and ubiquitous part of mathematics classrooms, then they'll need to be taken seriously by all involved. Teachers will need support. Making a change of this magnitude is hard work, and those teachers who are working alone to advance their practice face especially big challenges. As teachers attempt to take a deep dive into the practice of Number Talks and all they have to offer, they need and deserve supportive colleagues who are interested in the work, supportive administrators who encourage them and provide ongoing learning opportunities, and supportive parents. Over the past two decades, I have had the opportunity to share Number Talks with tens of thousands of parents throughout the country – in communities as diverse as inner-city settings with deep rooted poverty and multiple languages spoken in classrooms, to very privileged communities such as those found in the Silicon Valley and in the Greater Birmingham Area of Alabama. I have found that, nearly universally, when given opportunities to learn, parents love the idea of Number Talks and want them happening in their children's classrooms.

At the same time, Number Talks turn on its head the ways we have always thought about and taught arithmetic. We can't expect parents to understand a shift of this magnitude if we don't help them to. It's hard for parents to support something they don't understand, and hard for teachers to do something well that their community doesn't support. So providing opportunities for parents to learn about Number Talks is vital. Practices such as doing them with parents at back-to-school nights or with students at school board meetings can go a long way toward securing community-wide support for Number Talks. I have found non-English speaking parents grateful to be included in parent math night through the use of equipment for simultaneous translations that allows workshops to be simultaneously translated into multiple languages. Many school districts have this equipment available, and if they don't they should.

Finally, a word about my own personal experience with Number Talks and my current work with them provides important context for this paper. In the early 1990s, Kathy Richardson and I invented Number Talks while working with teachers in Edmonds, WA. I first tried them out with a class of fifth graders in Bellingham, WA, and then with large groups of students, teachers, parents, and university mathematicians, scientists, and educators in communities throughout the country. Much of my work over the years has been studied by external research teams.

I currently co-direct, with Cathy Humphreys, a state-wide project to prepare next generation mathematics teacher leaders in Washington State. With a grant from College Spark Washington, the Mathematics Education Collaborative (MEC), a non-profit I started with Patty Lofgren in 1998, is currently designing and delivering a Number Talk Leadership Academy to prepare a state-wide cadre of Number Talks Support Team Teachers. We work with grades K – 16 teachers from throughout the state who have varying levels of experience with Number Talks, and varying levels of experience with student-based mathematics teaching and learning.

One of the questions we've been studying in our work here in Washington is whether or not taking a deep dive into daily Number Talks can help transform mathematics classrooms in ways such as those suggested by van den Boer's work. We are only half-way through this 3-year project, so our findings are tentative and very preliminary at this time. It is exciting, though, to work with a statewide cadre of future teacher leaders as we try to figure this out together. As in MEC's past work, this project is a "delayed leadership model." So, this cadre of teachers is working on Number Talks in their classrooms in preparation for leading a series of MEC-developed Number Talks PD sessions for teachers, administrators and parents in their own schools and school districts.

In closing, if Number Talks are to flourish and realize their potential, then teachers and their school and district communities will need to first recognize their value and then take the necessary steps to move forward with purpose. Number Talks are one of the very most promising innovations to happen in mathematics classrooms in decades. And there is abundant and gathering evidence that they are, indeed, well worth the effort.

As we all continue to do this work, I look forward to learning much more about the interplay between Number Talks and the principal practices outlined herein, and more about how Number Talks can be used to fully engage underrepresented students and language learners in ways that also meet the needs of every learner.

References:

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