

Hello and thank you Raymond for that introduction.

Before we begin, I wanted to share a little about myself, my past and present, so as to lay the proverbial groundwork for our time together today. It was a dark and stormy night as my mother toiled in labor for hours and... ok, let's not go back that far. I'll skip a few years ahead to the point where I started school... As a young student, I was always "ahead" in math. And when I say "ahead", I mean I had a brother who was three years older than me who spent countless nights as we lay in our cramped bunkbeds recounting the math he learned so I was "ahead" in my math knowledge before even walking into school. And so when I did walk into school, my teachers quickly noticed I had a propensity for mathematics. This led to praise and encouragement from both my teachers as well as my parents.

You see, I was never a great athlete when I was growing up - that was my older brother and my dad took a shine to him because of that - coaching him and his classmates in baseball. What it took for my dad to notice me was being good at math - and he encouraged me to get better through games like Bizz-Bang-Buzz. What? You don't know how this works? Well, you count, but any multiple of three, or a number with three in it you say 'Bizz', likewise 'Bang' for 5s and 'Buzz' for 7s. So, counting would go - 1, 2, BIZZ, 4, BANG, BIZZ, BUZZ, 8, BIZZ, BANG, 11, BIZZ, BIZZ, BUZZ, BIZZ-BANG... see how it can get addictive - feel free to play that on long road trips.

All this encouragement, all these rewards of praise, on top of the fact that I was then in turn labeled gifted and talented in math, led to my love of mathematics. This trend continued through middle and high school, where I always shone brightest in my math classes. My classmates too labeled me, and in a world where I could go unnoticed, I was noticed, and mostly in a positive way. Although, I often heard "Joe, you don't think like us...".

Anyway, all that to say, being "good" at math set me on a path, a path that led me to where I am today. I stand before you a 23 year veteran of teaching mathematics, having taught at 4 high schools across two different

states. I have taught almost every course imaginable (and some not so imaginable) in the world of mathematics. I also currently serve in a dual role where I teach half the day and coach other math teachers with the other half of my day. I am active in the math education community, from working here at the state level as recently Treasurer and now Partnership Chair for the Colorado Council of Teachers of Mathematics to working at the national level on the Curriculum Resources Committee for the National Council for Teachers of Mathematics- to recently being elected to their Board. And for much of my life I focussed on that mathematics piece. So much so that I would often name that MATH piece when introducing myself to others.

However as time went on, I evolved. I have written blogs and articles, I have been asked to present at many institutions across the country. I'm also a father and a husband. I have a wonderful wife who teaches high school english and three amazing children. I coach baseball for my son. I am active in his Boy Scout troop. I have helped my daughters sell countless Girl Scout Cookies. I write - both research based articles and poetry. I have coached - sports, Speech and Debate, and yes math teams. I have many hobbies including spending time in the gym, building - as facebook just reminded me, it was 5 years ago I made a toy box that my children still use - and hiking the National Parks (we are up to 33). And I say all of this - not to brag, but to illustrate a point.

I was once just math. I have become so much more than math.

You are so much more than math.

You are a star. We are stars... Well, I'm getting there. Allow me to digress for a minute:

Having three kids at home can have its challenges at time. Movie nights included. We have a hard time getting all three children to agree on a single movie. So much so that there are times where we as parents have to divide and conquer. For example, not too long ago, I had to take my son to the basement to watch "Wish" while my

wife and daughters stayed upstairs and watch the “Mean Girls” musical. For those that haven’t seen Wish, there is a song called “I’m a Star” and elements of that are captured in the ending reprise of “So I Make This Wish”.

These two songs bring to light two important lessons that I hope to circle back to - the first is, we are all stars. And the second is to think about that wish: to be something more than this... Not something different, not separated from, but something MORE. Just as I have learned that I am more than just one label - MATH - so I hope you learn that about yourself too (if you haven’t already).

Oddly enough, after watching that movie with my son, I walked up to find “Mean Girls” finishing. And for those that know the musical, it ends with a number, “I See Stars”. Uncanny how two movies released so close have similar song... Here’s a clip of that:

And so, as the songs allude, I look out and I see stars - I see math stars. But I also see so much more than this. And I need you to see so much more in yourself than math. Yes, you are a math star - you have shown in many ways your talents as they relate to mathematics. But if this was your only talent, you’d be more like a laser - a singular beam of light. I’m here to tell you, or simply remind you, you are so much more, a great big burning ball of gas that projects in infinite ways... And to caution you not to see yourself simply as the math laser... to warn you how its so easy to fall in the trap like I once did, to see myself as just the chubby kid with no discernable talents or abilities other than math. So, just as a good speech coach would, I have crafted my time with you around this; the importance of seeing yourselves as not only math starts but so much more - so first we will look at the the problem with seeing ourselves as just one label, in our case the “good at math” and its effects, then we will talk about why its easy to fall into this pigeonhole, and finally, I hope we can truly see the stars we are as we find ways to see ourselves as so much more than this.

You're probably asking yourself, what are you talking about Dr. Bolz? Well, simply put, there are dangers of locking ourselves into a single label. Back in the day - when I was a wee lad in college, we learned about the notion of multiple intelligences as presented by Howard Gardner in his 1983 book. While this theory has been disputed, many believing that these intelligences are traits or talents, the ideas that I am building off still stand. At first glance at this list, seeing someone who shows talents and intelligence in mathematics may lead one to believe that they must have have considerable logical-mathematical intelligence. True. But is that all? Think about someone who is really good at math. There's so much more they possess. They can visualize a situation, think about the representations, both two and three dimensional. This shows a proclivity to Visual and Spatial Intelligence. But if this person who was good at mathematics had no way to share their abilities with others, they would never go noticed. Thus, they must also excel in Linguistic and Verbal Intelligences. In fact I would also add that math people show many elements of Musical Intelligence as they have a propensity to think in patterns. All of you here possess these intelligences, these talents - so much more than just math.

All that to say, Math was never meant to be boxed up in a tight little package. Being good at math is so much more than showing strong problem solving skills. When we see the world this way, we see so much more potential for where our gifts can take us.

We need to see math as something beyond that little package and realize that success in mathematics means so much more. And there's dangers to us if we don't.

The first danger of seeing ourselves as JUST the math person is - what happens to us when the math doesn't work? When we hit a road block? Well, we definitely fall down - but how do we respond? As a Forbes article from 2016 points out, when we succeed, our brain releases testosterone and dopamine. With repetition, this chemical release leads humans and animals alike to get better at that task as well as become more confident. This is dubbed the Winner's Effect. However, failure can lead to what's then aptly named, the Loser's Effect. In a study from Scientific American from 2009, when monkeys failed at a task they had been successful at, this led

to them performing this task worse and worse over time. While we are not monkeys, and have the cognitive power to overcome these feelings of failure, it is harder to avoid some of the pitfalls of the Loser's Effect when we build our identity around a single factor. For example, Forbes points out that we should avoid things like dwelling on our mistakes and winging them - or pretending they didn't happen - however, when part of our identity is challenged, it's hard not to fall for one of these pitfalls...?

I know some of you are saying "but Dr. Bolz, you don't know me - I'll never fail". And I hope you're right, however I have not met a student that has not, at some point, met their wall. For me, it was Abstract Algebra with Proofs in college. Our professor wrote the book and didn't understand why we struggled so much with the material that his 5-year old niece could master. As encouraging as he was, I struggled, and had to work and study hard - and settle for a B+ in a math class - my first ever.

In addition to feeling our identity challenged when we fail, another effect of pigeon-holing ourselves (get it - like the pigeon hole proof) into a singular identity like mathematics is that we get labeled that way. And it almost becomes like quicksand - the more we struggle to be known as something else, something more than math, the more those around us relegate us to that singular identity. "You don't workout, you're a math nerd" (by the way, I wear my math nerd label with pride), "You don't want to present to the class, you're good at the math, just stick with that", "You can't be a formula one racer, stick with the math formulas"!

Now that we understand what the issue is with confining oneself to one identity, we can look at why we sometimes fall into these pigeonholes. These causes can be boiled down to two primary sources: Rewards and Society.

Tonight, you are here to be A-WARDED for your mathematical achievements. Let us not misconstrue the two terms - award and reward. An award is given when a job is well done, a reward is given to encourage a specific behavior or action. While tonight may or may not be the first time you have been awarded for your abilities in

mathematics - we have all been rewarded for our abilities whether that be from the attention and affection of a loved one to a physical reward. I truly believe you all deserve the awards you are receiving tonight. However, rewards can be a double edged sword. They can be great as Kohls et al found in their 2009 work published in developmental science, social and monetary rewards caused increases in task performance in children, although the extent to which that reward benefitted the child depended on their personalities. Rewarding does have its benefits - and I know I'm always open to monetary rewards - sorry... remember, poor teacher here... However, rewards can have consequences too. The Alliance Against Seclusion and Restraint published in 2023 how rewards can have negative effects including creating a fixed mindset and creating a masking effect. What this means is that when we are rewarded for our accomplishments, we begin to see ourselves as fixed in that category - we have been rewarded for our work in math so we must be good at math - but also that we begin to mask ourselves within that identity, hiding other parts of ourselves that do not garner those rewards. Wear that mask long enough, believe in a fixed mindset long enough, and that's who we become.

For me, I found myself because of math. And it opened doors. But it became who I was as it was the only way society validated me.

And speaking of society, therein lies another cause for people like us, math stars that shine bright, to pigeonhole ourselves into being "the one good at math". There are a few reasons that society is to blame... bad society... The first is one that I hope that you all as math people understand. Society tends to see things in the binary. In their 2021 work, "Binary Thinking and the Limiting of Human Potential", Shelton and Dodd discuss how binary constructs offer two mutually exclusive ways of thinking (man - so many math terms...). In our case, you're a math person or you're not. This binary thinking, as Shelton and Dodd point out, leads to an inherent hierarchy. In the case of mathematics, that hierarchy can be a double-edged sword - math people are the first ones your peers go to when they need help calculating a tip, but the last when picking teams for kickball. This binary leads to systems of oppression and marginalization. And here you thought that this was just math. But

we, as math people, know that the world is far from binary. Far from even decimal. Heck, we live in a world that is far from linear. Our world is an infinite world with infinite, multi-dimensional spectrums. Yet, society - though society - still views many things, including math people, in the binary. This, in turn, reinforces the far-fetched notion that we are just “math people”.

Society also has a fear of mathematics. As Jo Boaler, professor of mathematics education states:

“A high level of intensity of negative emotion around mathematics is not uncommon. Mathematics, more than any other subject, has the power to crush students’ spirits, and many adults do not move on from mathematics experiences in school if they are negative. When students get the idea they cannot do math, they often maintain a negative relationship with mathematics throughout the rest of their lives.”

Because society has a fear of mathematics, when they find those, like us, who excel at math, they put us on that math pedestal. Let me ask you a question; show of hands:

How many of you have played Monopoly?

How many of you were made to be the banker by those you played with?

How many of you felt entitled to take a service fee from the bank as the banker?

Kidding - not really... But my point is this. Society fears math so they want to place those of us that excel in math in positions of math power. But we all know, with great power comes great responsibility. Here, that responsibility is to not let that power go to our head and define us - and not to take those extra \$500 bills from the Monopoly bank.

So, as we have seen, its easy for us to fall in the label of being the “math person” even though we are not just a math person and its negative effects as well as examined a few of its underlying causes. So goodnight.

Kidding. Of course, I’m going offer you some StarFatherly advice. First though, I want you to visualize drawing a star. For me, I always went up down, left, right, and back to start. Do it with me - up, down, left,

right, back to start. Good. Now remember, you are a star, one that shines so very bright - and if you need help, here's a few things to remember:

UP: look up - and what do you see? Well other than this old looking ceiling. But if we were outside, you would see sky. That's the first step to remembering you are more than just a math person is to look up and see the sky and remember, the sky is the limit. I'm going to give you some advice that may go against what others have told you in the past, but think about looking up at the sky, especially at night. If you want to see the beautiful night sky, stars, moon and all, you gaze around, you don't focus in on one spot. If we think in terms of our life, when we set life goals, like being the next world renowned mathematician, our vision remains set on a single target and we miss the vast array of possibilities. While goals have their place, the danger of goals is that it can limit our possibilities. For example, when I entered college, my goal was to graduate with a degree in Mathematics. I was ready to go - I was to be the first in my family to graduate college. I was set. And I was so focussed on that goal, and being that singular math student, that I lost sight of myself. I didn't think I could do anything other than math. And then I finally looked around. I let my gaze wander to see the whole sky... and after a lifetime of growing up in a household that struggled to make ends meet, I settled on a career that is notoriously underpaid... yeah I have some issues to work on... The point is, don't limit yourself. I know I'm only one example - so let me share the story of Jack. Jack was a student of mine about mehnaljr years ago. He was like you, brilliant in mathematics - a shining star - and taking all the high level courses. However, when he got to college, he left his options open. He is now finishing up a PhD program where he is focussed on climate change resilience mainly looking at how to build flood resilience for farmers in India. Jack wrote to me recently and indicated that he gets "a lot of satisfaction out of doing a job that lets him think hard every day and work on projects that have the potential to do something legitimately helpful for people". Jack was a gazer, not limited to one specific goal, and because he could see the sky as the only limit, his impact is profound. So, we know to look up, let the sky be our limit and not narrow our focus and limit our possibilities.

Now, let's look DOWN. See your feet down there. Wiggle your toes... give them a stretch. Tell them I'm almost done and it will be ok... Ahhh... Now, remember when you learned to walk. Ok - well maybe you can't remember that. But what I want you to remember when you look down and see your feet is that learning to walk isn't something that just happened. It took small steps. Little changes, adaptations, growths... Learning to rock, then scoot, then crawl, then pull yourself up, lots of falls, and finally - BOOM - you're walking. As we expand ourselves, as we let our light shine in other areas, its going to take time to make those other areas just as bright as our math light. We can't expect to perfect new talents or skills in an instant. To put it in math terms, think about the power of growing 1% better each day. We can experience exponential growth which over the course of a year can lead to significant growth. However, if we let our failures define us, and proceed to get 1% worse at whatever it is we are trying to master, we are going to lose significant ground. Once upon a time, I decided to become a runner. In order to honor my father who never had his chance, I signed up to run a half marathon. I didn't step outside and run 13 plus miles on my first go though. It took time. I had to train. I had to aim to get a little better, run a little farther, run a little faster, run with better endurance each time. And when the day of the race came, not only was I successful in completing the race without stopping, but I also had my best time to date. If we want to change, if we want to grow to be more than the "math person", we have to understand that it will take time and it may not come as easy as math did for us. But as Therodore Roosevelt once said, "Nothing in the world is worth having or worth doing unless it means effort, pain, difficulty...".

Up... Down... Now, LEFT and RIGHT - meaning, we need to keep our eyes open for what is on the periphery. Opportunities will abound. You have proven yourselves more than capable, and opportunity for growth and ventures into territories unfamiliar will present themselves. Be on the lookout for those opportunities. One such opportunity came for me when I simply said "yes" to an unknown. I received an email saying I was nominated to attend the Elevating and Celebrating Effective Teachers and Teaching Conference - whew try saying that five times fast... By saying yes and attending this conference, I became roped in with wonderful leaders across the country but also more locally. They encouraged me to lead and to write. They published my writings and asked

me to perform my pieces at a variety of events. This led to others seeking me out for my expertise as well as even more speaking events. All that eventually led to where I am now - today. All because an opportunity arose on my periphery, something I wasn't looking for, and I said yes. And I embraced the challenge. And I grew. And you will too - so look to the periphery and embrace those opportunities.

Up... Down... Left... Right... and BACK TO START! Never forget where you came from. All of us here have experienced success in mathematics. I hope that mathematics remains a part of what you do in your future. I know that not every career that you will enter though will be steeped in mathematics. But being phenomenal in mathematics has taught you so much more. You have the ability to problem solve. You have the ability to think creatively. You have the ability to reason abstractly. You have the ability to understand the world. To read the world. To right the world. To write the world. You have gained so much from mathematics. Keep that with you. But your past, good or bad, does not define you. It has led you this far. But it does not control your future. Only you have that power.

You all are phenomenal, brilliant math students in your own right. You are stars. You are math stars. But you are math stars and so much more. Don't let mathematics be the only thing that defines you. If you need help along the way, draw your star. Look up and remind yourself, "the sky's the limit". Look down and remember that learning something new, mastering a new skill takes practice, time, and patience. Look left and right and be open to what may appear on your periphery. And then look back at yourself, moments like this, and remember all that you have learned because of where you came from, because of mathematics. You are stars. We are stars. I see stars. So many stars tonight. I see stars. You shine as bright as day. I'll look out for you. We'll light each other's ways. You ARE ALL STAR.