Summit to Salish Sea: Inquiries and Essays

Volume 3 *Cohort 15* Article 7

10-31-2018

Uniting Passions: The Transformation of a Teacher

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Abstract

This presentation explores the formulation and evolution of an educator through the lens of mathematics, formal and informal settings. It leans on personal experiences, self-evaluation, and the process of developing a dream school that exemplifies environmental and mathematical learning.

Keywords: environmental education, formal education, math education

Break the Gut Feeling

Hello all, I come to you today as the educator, "Miss B". I have taken quite the journey to get to be able to stand in front of you today and present on a few of my deepest passions, I will not be talking about cheese however. I would like to acknowledge those that came on this land before us, that appreciated the Upper Skagit Valley for it's abundance of foods, medicines, and ever changing weather conditions.

I am going to begin this presentation with a brief, personal, meditation for us all. I will list some words and phrases to you and I would like you to notice your gut feeling and what comes to your mind. Allow yourself to feel any feelings that arrive as well as make any facial expressions you see fit. So before I begin, please close your eyes and take a deep breath. I will begin… sunshine, birds chirping, calculus, cedar trees, splashing in a creek, multiplication tables, building a snowman, the quadratic formula, nature, mathematics.

Open your eyes.

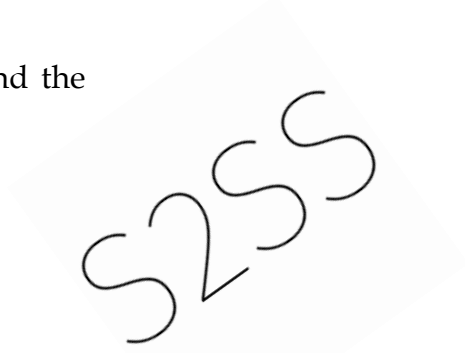
Please tell someone sitting next to you which words put a smile on your face, and which ones may have made you grimace.

Did anyone notice any themes within the words that I asked?

Please raise your hand if you had a positive gut feeling around the words that went with the nature theme?

Please raise your hand if you had a positive gut feeling around the words that went with the mathematics theme?

I desire to make more hands go up when words of mathematics are spoken through the use of the environment.



Introduction

David W. Jardine (1994), author, mathematician, and educator, wrote,

> *Mathematics is not something we have to look up to. It is right in front of us, at our fingertips, caught in the whorl of patterns of skin, in the symmetries of the hands, and the rhythms of blood and breath.*

I come to you today as "Miss B". I will be working through the transformation of whom I call "The Old Miss B" to "The New Miss B". The Old Miss B would say that she was a Math Teacher; The New Miss B is beginning to call herself an Environmental Mathematics Educator and finding ways to unite her passions together. I want to recognize the vulnerability you may witness throughout this presentation. I am not one to be able to "hide" my feelings and thoughts and I request that you support me through this process. You may experience the great human phenomenon of my eyes leaking. I want us all to remember that tears are a way of showing so many emotions, not only sadness, but love, passion, happiness, and excitement. I am incredibly appreciative of all of you that are here with open hearts, ears, and minds. Let's dive in.

I grew up in a family of formal and informal educators and was surrounded by the impacts of what a good education can have on a person, more to come on this in a bit. I knew at a young age, playing school with my brother and cousins, that I wanted to be an educator in some capacity but I was not sure in what capacity. This is my first passion – Education.

When I was in high school, English intrigued me, but Math inspired me. I was lucky enough to have Mr. Gregory Janish as a math teacher for 3 of my 4 years in high school. I managed to make it through AP Calculus with him as the lead and my closest friends along side me. Mr. Janish, who my senior year we referred to as "Greg", allowed me to see how learning math could be different than what I was used to in middle school, it did not have to be boring. Greg also taught me that it was okay to not be a straight A student. He empowered me to work hard and to be confident in my work, which allowed me to enjoy learning math. I knew I too wanted to teach Math by the end of my junior year of high school because of him. I also believe the pressure that was placed on me to decide on my career by then helped a little bit, another conversation for a different time. My second passion – Mathematics.

Flash forward four years and by December 2013, I graduated from Canisius College with a B.A. in Adolescence Mathematics Education, and found an "easy" way to meld my first two passions together quite nicely. The question of "What are you going to do for your Master's Degree?" started to be asked quite often. Isn't it funny how we humans constantly ask people "What is next?". At a gas station outside of Silver Creek, NY in April 2014 I was reflecting on a conversation that I just ended with my boyfriend at the

time and his parents, both parents asking us "What are you two going to do for your Master's Degree?". I was toying around with the ideas of elementary education or school psychology, which my boyfriend at the time's father was a main professor for. As I filled up my car I felt the sunshine on my face and realized that I missed being outdoors for my job when it was not summer. At this point I had 8 summers under my belt working at a canoe tripping camp in Algonquin Park, Ontario – I LIVED for the summers growing up so that I could be outside 99% of the time. This thought had me thinking, "Is there even such thing as Outdoor Education? Could I get my master's degree in something to do with being outside AND education?" Lindsey MacDonald will vouch for me, that after the Google search I did that night, the rest is history! Finally, my third passion – the great outdoors.

I owe an immense amount of gratitude to Saul, Joshua, Lindsey, Nick, Gene and Tracie for allowing for flexibility within this graduate program to allow us graduate students to make some of the studies our own. When we were assigned the Natural History Project, I brainstormed for what I remember being a month or so on what topic I wanted to cover and eventually landed on the Fibonacci Sequence in Nature.

Elevator Speech time. The Fibonacci Sequence goes as follows, (0), 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, … in laymen's terms take the number you are on and add the previous number to get the following number in the sequence. Any way, this sequence is the basis for the golden ratio, golden angle, and golden spiral as well, which are seen all throughout nature. From the DNA in our bodies, to the bottom of some cones, our human hand, family trees of bees and rabbits, and nautilus seashells this mathematical phenomenon is everywhere. Last Spring was when I really began looking into how I can tie nature into mathematics education.

So What?

I realized that I had a lot of reflecting to do personally while I prepared for the end of this Master's Degree journey. There were questions that I wanted to answer as I navigated a few job interviews over the winter and I wanted to ask myself what it was that I really wanted to do. This is what was keeping me up late at night and I decided to get to the bottom of it.

Questions that I posed to myself:

- *Why Education?*
- *What characteristics do great educators have? Do I have any of these characteristics?*
- *Why High School students?*
- *Why Mathematics?*
- *Why Environmental Education?*
- *What does my Dream School Look like?*

I noticed within answering these questions myself that I kept a wall up within my responses, which is silly because I was asking myself. I realized I allowed my insecurities and my consistent battle of low self-esteem to take over, again. Enough was enough. So I asked my friends and family for help, people that love me, that have been my mentors, that have supported me throughout my entire life. I hoped to find more clarity in why I chose the path that I have and to see if anything could be revealed by their responses. Questions that I asked them were:

- *Do you have any thoughts about what qualities you believe I possess to be an educator?*
- *Has there been anything that I have taught you over the years?*
- *Was it obvious to you at some point that I would choose education as my career?*

Throughout this next section of my presentation, I will be answering these questions as well as integrating in responses that my family and friends sent to me, whether that was in the form of text or video. I ask that you suspend your judgments and to realize that if you asked your friends and families similar questions, I can guarantee they would shower you with love and support as well.

Why Education?

Emily's Mother, Shelly Baronich

As Emily's mother, I believe, Emily was destined to be a teacher. When she was a little girl, she and her brother, who is currently also a teacher, used to play school for hours in the basement. Their grandmother was a third grade teacher and would give them old workbooks and worksheets and they would literally play down there for hours. Giving homework assignments, correcting homework, and making report cards. Our friends would come over with their children and they would bring them down there and they would all play together. So school was a big part of her life since she was a little girl. She did very well in elementary, middle, and high school. She was a good student, always did her homework, always made friends, got involved, and she comes from a family of educators.

Uncle Dale Day:

Hello Emmy. I think the biggest impact for you going into education was probably the long list of educators in your life. Without realizing it you saw the kindness, concern and financial well being of people like grandma and grandpa, your dad, Aunt Denise and Aunt Ronda and of course me, Uncle Day Day. You've experienced your brother becoming a teacher, and you two are very close. Think about it: as far back as you can remember teachers were important in your life.

My Mom and Uncle hit a lot of the same points that I recognized when asking myself this question of *Why Education?*. I need to first thank Grandma Stephanie and Grandpa JB. Thank you Aunt Denise, Aunt Ronda, Uncle Dale, and Michael. Thank you, Dad – for all being formal educators. Thank you Mom, Grandma Eileen and Papa, every other aunt and uncle, cousin, friend, and acquaintance for being educators in my life as well. Thank you so much to my cohort, for all you have taught me since day one of this program. I have learned from every individual that I have come across and I believe that every individual is a teacher in some capacity. I realized this could be my profession at a young age and saw the benefits being an educator had – from the personal benefits of a great retirement, to health insurance, to time off, to having a family, to benefiting and impacting the lives of others in a (mostly) positive way.

Jaclyn Danvir, Emily's younger cousin:

> *I am not surprised that she chose education as her career path, the math part I question. When we were younger, she always played school. We would go camping and we all had to be her students. She loved being the teacher and that's a memory that I will never forget. That's when I first realized that it could be her career path." -*

My cousin, Jaclyn, also realized before I knew, that I would be an educator. It is true, my brother and I would play school after coming home from school, some may call us crazy, but look at what career path we both chose! Reflecting on the last 26 years of my life the way that I was raised and what I deemed as "fun" allowed me to see the career path that I would take.

Thinking of the question "Why Education?" again, I believe being an educator is one of the best professions available and I would argue that you save and impact lives as an educator. With my experience teaching at a Catholic school as well as a public school, I know there were interactions with students where I felt I made an impact.

While I was teaching in a public school back in Wellsville, New York, I had the opportunity to work with a variety of students, 120 unique souls in total. A personal story I have is with a freshman student, they were in year one of the two year Algebra course I taught. They moved to Wellsville at the beginning of October and were navigating making friends, feeling comfortable, and developing ways to do well in school. This student had a rough home life, divorced parents, living with their older sister and her boyfriend, and not feeling as though they had a place. Early on in the school year, my student continuously asked to come and keep learning math during their study hall, which lead to my student spilling their heart out to me as well as reminding me that math was their worst subject. I worked closely with the student to be sure they were achieving the best they could, not only in math but other subjects in school. I provided support for the student and a space where they felt comfortable and at peace for part of their day. Upon my resignation, my student thanked me for pushing them to

achieve their best as well as provide a safe space for them to learn and to feel comfortable. This student was not a straight A student in my classroom, but their drive and determination was inspiring to watch and foster.

I recognize that some students look to their teachers as a mentor and may ask for advice because they are unable, or unwilling, to find the advice with in their friends or family. When I had my own mathematics classroom, I was not only teaching Algebra, but life skills as well. I quickly realized that there was more to being a teacher than simply teaching the curriculum the state set in place for you.

Justine Affronti, Emily's life-long best friend:

> *As an educator, you are able to directly affect the lives of others. This gives you a platform to influence future generations to promote social justice as well as the importance of mathematics/environmental studies on innovation and conservation.*

Ronda Baronich, Emily's Aunt

> *Ok so you caught me grading papers [on a Sunday afternoon] and wondering who in their right mind enjoys doing this when there are so many more fun things to be doing ☺ Then I remember that we do what we do because we love the same things – we love people and being social, and we love learning and sharing our knowledge and experiences.*

Teaching feels right. My Aunt Ronda and I have had multiple conversations about why we grade papers over Thanksgiving break, which I would help her with growing up, and why we work our tails off when we could be out riding snowmobiles a bit longer. We love educating. We love helping others. Our work is fulfilling – isn't that what we all want? To be fulfilled by our career?

My final thought around my first passion, Education, is how comfortable I feel when I am teaching. We learned a bit about "flow" in Gene Myers' class this past quarter and when I am teaching I am in my flow state. Although I tend to always get butterflies before teaching something new, those disappear when I begin and I get lost in educating others.

When I think of the educators that helped shape who I am, the traits most had were they were caring, patient, kind, intelligent, aware, selfless and "real". These educators all cared deeply about my learning journey and they were willing to take time out of their busy schedules to help me if I was confused or needed extra time to focus on my work. The educators were all multiple steps ahead of the game; they always seemed to have their lives together and their work together as well. They were "real" in the sense of wanting to know what I was doing in my life, they did not hide themselves from their students, and they were tough on their students wanting the very best out of every

individual. Compared to other educators that I had, those that made an impact did not have walls up between themselves and their students, they made their classrooms run as a community and everyone showed respect to each other. My Uncle Jeff gave me some words of wisdom,

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What characteristics do great educators have? Do I have any of these characteristics?

Jeff Danvir, Emily's Godfather:

> *Teachers are dedicated and work long hours. Teachers do everything they can to make their classrooms safe and welcoming for their students. Teachers love helping children. There are times when it seems the teacher is the only one who takes an interest in a child's life. Most people never know how much work a teacher does outside the classroom. When everyone else is watching TV, the teacher is working on lesson plans or correcting papers. When on vacations the teacher is always looking for ideas to use in the classroom. Teachers help students to grow. The teacher is rewarded when that student finally "gets it."*

And my friend Danika, who I spent last summer teaching with, passed along wisdom as well,

Danika Troupe, Emily's friend:

> *Someone who is passionate in sharing knowledge. Someone who believes in the coming generations. Someone who can tailor their teaching to the individual. Someone who recognizes the challenges of each kid and does not get frustrated by them. Someone who works to alleviate inequalities through love, compassion, and energy.*

Do I have these characteristics and qualities? Before I began reflecting on what characteristics I believe I had as an educator, I wanted to listen to what friends and family had to say. For those that know me well enough, they know that I tend to have lower self-esteem, I beat myself up a lot, and that it is hard for me to recognize positive qualities within myself. I also am incredibly uncomfortable hearing words that should make me feel good. This part was the hardest for me to do because I felt that I was self-absorbed and selfish for looking inside, but I did it anyway. The Old Miss B continuously battled these insecurities and the New Miss B is working really hard on overcoming these insecurities. To set up my thoughts I first want to extend gratitude to the family and friends we will hear from now,

Jessica Krzemien, life-long best friend:

I cannot give specific dates but I can guarantee you that you helped me get through high school by breaking down the problems at hand and helping me solve them. You show patience and you are extremely empathetic, maybe even too much. You feel deeply and that is how I know you care. You care about every single person in your life. I honestly cannot picture you as anything else but an educator.

Hannah Newell READS

You have so many qualities that lend to being an amazing educator, but the things that jump out above the rest are your kindness, empathy, and desire to support those around you.

Denise Danvir, Emily's Godmother:

You are patient, a go-getter, adventurous, and kind. You put your heart into all you do! You're a planner, yet are flexible enough to change gears on a dime! You bring a wealth of experience and information and continue to gather knowledge along the way!

Suzi Porter, Emily's Aunt:

You have many qualities that will make you a strong educator. Passion for learning and teaching, drive and motivation to always improve, thirst for knowledge, patience and kindness, are only some of what it takes to be a memorable educator in youth lives of today. You have all of these qualities and so much more to offer.

It has taken me a full 26 years to recognize and own my personality traits that I have found to make me an educator. I love helping others and I love watching students finally "get" it. I care for my students and have always wanted what was best for them. I find joy in grading papers and watching my students continue on their learning journey. I appreciate what was written to me and have been able to realize that I do have what it takes to be an Educator.

Time to dig a little deeper into my mind, why do I care so much about educating high school students? Why do I care about mathematics so much? Why do I care about environmental education? These questions are at the core of what I continuously inquire about in life…

Why High School?

High School students are at an age where they begin to understand who they are and aim to "be like an adult". I am drawn to the high school age because I can better relate to

the high school students and find it nourishing to be a support for them. Personally I am able to better communicate with high school students and believe that they are able to understand why they make the decisions that they do. I grew up with a father who was a high school educator and administrator as well and I was able to see the benefits of being in that position to the students that he had throughout the years. The apple of the teacher's desk does not fall far from the tree! High School students need to be fostered and encouraged to follow their hearts and dreams.

I dabbled, as Hannah Newell would say, in Elementary Education when I shadowed my Aunt Denise for a brief stint. I was quick to learn, and solidify, that I was not meant to teach the little ones. Although I love kids and spending time with them, I am terrified to have a classroom of twenty-five six year olds all to myself, thus middle school and high school it is!

Why Mathematics?

Math feels like a lost art. I owe my career decision to my high school math teacher, Greg, as mentioned before. I absolutely was not a straight A math student (which I try to remind my students from time to time) but the fact that Greg taught me how to care about the work that I did and how to properly study and work hard made me realize how important math was, and how fun it could be. I realize that not everyone's minds work the same way, and I really am not sure if my mind is purely mathematical or analytical – but I knew early on that I would much rather spend hours working on my math homework than write an essay for my social studies or English teachers. Apologies to my brother, Michael, who is an amazing Social Studies teacher. Numbers fascinate me and I like how you can work and work and work and eventually (most times) get an answer out of what you are working with.

Over the last few years I have noticed that Math is represented everywhere and I was observing more of it in my every day life outdoors. Just like with education, I want to share this passion of math that I have with people, so maybe they can be inspired and intrigued as well. I noticed that I could easily unite my first two passions together because people have been doing that for years – MATH EDUCATION, it's a thing! But could I mix in my third passion? Before answering that question, let's discuss …

Why Environmental Education?

My love for the outdoors has been with me since birth. Although I dislike the smell of skunks and in my childhood ran back into the tent or pop-up when the scent of one went up my nose, and I am not a huge fan of black flies or mosquitos – mostly because they adore me – and I really have quite the fear of a cougar attacking me anytime I am outside – I really do love the outdoors. I never realized how much Environmental

Education I was exposed to in my lifetime thus far. Growing up, our family would look at animal tracks, with the help of my Grandpa Baronich of course, and determine if we were really looking at a deer track or some made up creature. I learned about Gardening with my Papa Rochevot and watched how meticulous he was with his gardens and learned why he planted, what, when he did. I paddled many fresh water lakes in Algonquin during my summers and was able to see that landscape in all seasons by the age of 22. I believe the winter trip up to Source Lake, Algonquin Park, Ontario was the first time that I really noticed seasonal changes to an area that I held dear to my heart, besides my place at home.

On this winter trip to Source Lake in February 2013, I was able to see the trees that lined Pathfinder Island clearly, get up close to the cedar bows swaying lightly in the breeze. I was able to see how crisp the snow made the air and scene appear. I was able to experience this place I thought I knew very well, in a different way. We walked across the lake, where we paddle every summer night to stare up at the stars, throw back a few beverages, and tell deep stories and secrets. Where young campers learned how to canoe for the first time and some even experienced swimming in open water for the first time. We walked around the island, but not on the path one could find *on* the island, but on the frozen lake. We built a snow fort and had a fire in the middle of the lake as well. This experience was disorienting at times as memories of what I was used to doing in the place filled my mind, but it was magical that I had the opportunity to experience one of the closet places in my heart during the Winter as well.

I knew I had a love for the outdoors and our environment but I wasn't sure how to foster my love for it further. Environmental Education has always been in my life, as I mentioned in some examples earlier, but it was not integrated (that I can remember) into my Public Education.

I noticed early on in this graduate program how impactful Environmental Education could be on a person. Personally, all of the sketching that we were required to do, though I wasn't the biggest fan of, made me realize I needed to slow down, notice, wonder, and find that inner nature-loving child that I knew I had. The true impact happened during my first exposure to NCI's three-day program offered to fifth grade students, Mountain School. I saw students' eyes light up in wonder of their world. I experienced students inquiring about every detail imaginable in nature. I saw students *smile* about their learning experience. It was after this first session, that I knew I made the right decision to move out here and pursue a Master's Degree in my third passion, the Environment.

Conclusion

Over the last 20 months of graduate school, we've learned what characteristics make up Environmental Education. I constantly said to myself – well this relates to formal education, why isn't it used in "teacher's college" (as Nick would say). Asking students to SLOW DOWN the process and take their time while they learn would be crucial to

having a successful classroom, a first mixing that went on in my mind. I often caught myself wanting to speed up some processes that we did in this graduate program, but I understood it was because of the education I had. I quickly realized that I wanted to make a change within public education, for what I believe would be better. I want to be clear that I absolutely LOVE the fact that I am a product of public education. I believe growing up in a public education system has absolutely shaped who I am and also growing up in a small rural dairy town may have helped as well. I was not aware of how impactful my small town upbringing was to me until my friend Justine wrote to me saying,

> *I believe growing up in a small community is one of the many reasons why you have such a desire to become an educator. Growing up with such supportive families in such a tight knit community has taught us the importance of caring for others. This I believe has given you a sense of moral obligation to help others especially those whom are less fortunate than we are.*

The small town life that I lived helped me realize that there could be flexibility in public education as well, my teachers had averaged size classrooms (20-25 students) and I graduated with 168 other people so we were a small school. My hometown of Springville, New York, population around 4,300, absolutely showed me how to care for others and to look out for people. I agree with my friend, Justine, not only growing up with a family of educators who proved early on that they were caring individuals, but living in the community that I did helped shaped me into the educator I am today.

A final Question that I asked myself was **What does my Dream School Look like?** While brainstorming, this is when I began to unite my three passions; mathematics, education, and the environment together. Although my dream school is not solely teaching the single subject of Math outside all day long, I know what you are all thinking, What a bummer.

My perfect school consists of educators that understand what students need. What are students' basic needs? Our society has determined that students need English, History, Science, Math, and a Foreign Language – what about trades? What about outdoor experience? What about basic life skills? In my dream school, teachers work together to create multidisciplinary lessons that cover students' needs. Administrators and teachers run the school but many decisions are influenced and controlled by the students. There is wholeness within the curriculum and the school is a community.

My perfect school also lives on land for students to explore, learn to know, and form a relationship with. There is a garden and farm area where students learn how to produce their own food, cook it, and the food produced is offered for breakfast, snack, and lunches throughout the day. If you came to visit this school, you would recognize that students would be learning outside as often as possible.

At my dream school, teachers allow space for students to explore topics that excite them and have support from their teachers in that exploration. My perfect school is a PUBLIC school where money, as in cost of attendance, is not preventing students from receiving the education that they need and deserve. My perfect school also always allows for teachers to try new curriculum out *and fail*. If teachers are "forced" to teach X,Y, and Z in 1,2,3 order wouldn't they lose their creativity? If a teacher fails once, should they leave the system? We do not do that to students – so why do we do this to educators? I am not a parent, so I am unsure of what type of reaction this may bring to parents, knowing their child's teacher may have botched a lesson. But it is an idea I have for my dream school.

My dream school is made up of lot of windows, including skylights, to let in natural light instead of using lights in the classroom. Ideally, the school would be powered by renewable energy, like solar and wind. The students would take part in understanding how the school functions with this type of power. Students would have opportunities to participate in "green" classroom competitions to see which classroom could be the most energy efficient and sustainable. This information would be analyzed in upper mathematics classes where students develop materials for the whole school, school board, and community to see.

My dream school holds Kindergarten through twelfth grade. It took some time to decide on this type of "central" school thought, having kindergarten through twelfth grade in one building, but I recognized the importance (that I found missing in my education) of having students of all ages interact with each other, this creates more learning opportunity as well. A mentoring system would be in place where in sixth grade, you are assigned a kindergartener and you mentor them until they are in sixth grade. This would allow for an overlap with a senior mentoring a sixth grader mentoring a kindergartener.

At the end of the day, a school and its curriculum are pragmatic; it is up to the teacher to make education and learning come to life. This is where I see a perfect place for The New Miss B to step in. The Old Miss B would listen and do what her administrators would tell her, which is not a bad thing; it is what most teachers would do. She would not question them or ask to try something new. The New Miss B on the other hand, is going to see how far she can push, while respecting her administrators, but will fight for what she believes in as well. The New Miss B carries the confidence within herself to stand up for what she believes a great education is and she has the potential and skills to adapt and transform her classroom to fit the needs of all of her students. The New Miss B is working on being comfortable educating, no matter her footwear – heels or rainboots. Do you want to see an example of The Old Miss B versus The New Miss B?

Close your eyes.

Open them, now you will experience what The Old Miss B was like…

Old Miss B vs. New Miss B

Picture this, where we are all right now is our Junior Year Mathematics classroom. We are working on the infamous trigonometry unit and we have discussed SOHCAHTOA as a class, sine, cosine, and tangent. Today is the day to APPLY our new knowledge.

Old Miss B says to her students, "We are going to work on finding the angle of elevation. In your guided notes we will all look at question 1 together. Johnny, can you please read this problem aloud to us?"

Johnny says, "You are standing 20 feet away from a tree, and you measure the angle of elevation to be 38 degrees. How tall is the tree? Remember, the solution depends on your height, as you measure the angle of elevation from your line of sight, so let's assume, from eye level, you are five and a half feet tall."

Miss B, "Alright, who would like to help us set up this problem?"

Michael, "Let's draw a picture, Miss B! And label our angles and measurements."

Miss B, "Michael, you shining star! Great Idea! So let's draw this out and determine what trigonometric formula we will use. Any ideas?"

Johnny, "Let's try to use Tangent – because we have the angle, the adjacent side, and we are looking for the opposite side of the triangle."

Y'all get this picture? This is what I would call an SSF: Serious Snooze Fest and that is how I taught. I would model a problem for students, walk through one or two with them together, and then help them out individually – INSIDE. Imagining myself doing this for 30 years, "Um, No Thank You". Also thinking of the students I would be teaching, roughly 120 students a year multiplied by 30 years would be three thousand six hundred students that would have another boring, standard mathematics teacher. Math provides the opportunity for people to be engaged and to think broadly. The New Miss B has been finding ways to bring her students outside for similar activities, like the one above. She recently thought to herself, if I am having my students draw trees and hypothetically measure their height, could there be a way to bring them outside? The answer: YES. The **New Miss B** is here, with her rain boots ready, and we are going to take this lesson outside and measure a real tree's height! Are you ready for this experience (Appendix A)?

All of the instructors have been trained on how to measure a tree's height and how to use the tools that you will be using today – a (in)clinometer and a meter tape. Your directions are as follows…

1. Go outside to the office and find a group to work with.

2. Pay close attention to the directions that your group leaders will give you – you will be walking to a tree, of someone's choice, to measure it's height.
3. HAVE FUN and embracing learning math outside!
4. I will be walking around if you have any further questions for me.
5. Please meet back under the office when you are finished.

ACTIVITY

Welcome back! I would love to hear how that activity made people feel.

Thank you for your patience, reliving your math student days, flying through my never resting brain with me, and for choosing to participate in my Capstone. I, Emily Denise Baronich, am an Environmental Mathematics Educator and I allow my students to understand that mathematics is the language of nature.

Self- Similarity by Tim Aaronson

When a twig looks like a branch
And a branch looks like a tree,
You're looking at a case
Of special symmetry.

If a branch look like a twig,
But just not very big,
You are looking at a tree
With self-similarity.

A natural pattern lies
In your veins and arteries
And the wings of butterflies,
Yes, self-similarity.

So when you find a tree
That's hiding in a branch,
And you find a branch
That's hiding in a twig,
Do a little jig
For self-similarity!

Again, Thank you.

References

Jardine, David. (1994) "On the ecologies of mathematical language and the rhythms of the earth." In Mathematics, Education and Philosophy: an International Perspective, ed. Paul Ernest, 109-123. London: Falmer

Appendix A: Step-By-Step Instructions Measuring Tree Height

Materials: *Clinometer, Meter Tape, Paper, Pen/pencil, Assistants, iPhone (calculator)*

Step 1: Pick a Tree : Pick a Tree to measure! You should be far enough away from your tree that you can see the top of it, and you need to (try) to be on level ground with the base of the object. *Place a volunteer **(Person A)** in a position there – this person will later use the clinometer to measure with.*

Step 2: Measure Angle: Have the volunteer measure the angle from their spot using the clinometer up to the top of the tree. Read the angle shown, and subtract from 90° to find your angle of vision from your eye to the top of the pole (it can be helpful here to have an assistant **(*Person B)*** to read the measurement while you look through the clinometer). Record your results on your paper.

Step 3: Measure Distance: Once you have your angle of vision, use your tape measure to find the distance from the spot ***Person A*** is standing to the base of the tree (***Person C and D*** would be useful here). We must know how far away you are to accurately calculate the height.

Step 4: Find Your Eye-height: The last piece of data you need to calculate the height of the tree is the height from the ground to your eye (your eye-height). Have ***Person B (or E)*** help you measure this using your tape measure.

Step 5: Fill in the Picture: All data should be filled in on the worksheet (for time purposes I am not worried about drawing this out)

Step 6: Solve for X: We can find x in this triangle (which represents the portion of the height from eye-level up) by using some basic trigonometry, specifically the tangent ratio of the triangle:

Use a calculator (iPhone tilted on it's side) to multiply these together and get a decimal value. An example of typing this would be:

1. Open calculator and turn iPhone on it's side.
2. Type angle value (example 35)
3. Then "tan"
4. Then multiply (x)
5. Then the distance (example 30 meters)
6. Out pops your x-value! (Round to the nearest tenth for these purposes and write down)

Step 7: Combine With Eye Height: To find the height of your object, add your x-value and your eye-height together to get your total tree's height!

You're all done!☺