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#### Fall/Winter 2020

## **President's Message**

Welcome to the 2020 Mathematics Teachers Assocition (MTA) conference newsletter, albeit not the conference itself. While the pandemic prevents us from meeting in person this year, your MTA executive are pleased to provide you with the articles and resources assembled here that include practical information for math teachers at every grade level. Special thanks to Erick Lee for his work in coordinating this information.

Thank you also to my MTA Executive colleagues -Anne, David, Erick, Jennifer, Kim, Maureen, and Joe - for their commitment and work year round to promote mathematics education in Nova Scotia. Planning for your 2021 MTA conference is already in the works.

# Message du président

Bienvenue à l'infolettre de la conférence 2020 de l'association des professeurs des mathématiques (MTA). Alors que la pandémie nous empêche de se rencontrer en personne cette année, le Comité Exécutif de la MTA est heureux de vous offrir un ensemble d'articles et de ressources qui présente des informations pratiques pour les professeurs de mathématiques de tous les niveaux. Je tiens à remercier, en particulier, Erick Lee pour avoir assemblé ces informations.

Merci également à mes collègues et membres du Comité Exécutif - Anne, David, Erick, Jennifer, Kim, Maureen et Joe - pour leurs implications et engagements tout au long de l'année pour promouvoir l'enseignement des mathématiques en Nouvelle-

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### **President's Message**

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To all Nova Scotia educators, thank you for the outstanding work you are doing for your students during these most challenging of times. You continue to set high standards for your students – standards that you meet and model every day.

I wish you all the very best for the 2020-2021 school year.

Zeno MacDonald President Mathematics Teachers Association Écosse. La planification de la conférence MTA 2021 est déjà en plein cours.

À tous les éducateurs et éducatrices de la Nouvelle-Écosse, merci pour le travail exceptionnel que vous faites pour vos élèves durant ces temps difficiles. Vous continuez à établir des normes élevées pour vos étudiants - des normes que vous respectez et que vous démontrez chaque jour.

Je vous souhaite le meilleur pour l'année scolaire 2020-2021.

Zeno MacDonald Président Mathematics Teachers Association



# NOVA SCOTIA MATHEMATICS TEACHER ASSOCIATION

# Math in the News and Around the Web



**Nova Scotia Homework Hub** — The homework hub is a place where students can get free one-on-one live virtual tutoring from licensed Nova Scotia educators. This year, the homework hub is open to all Nova Scotia math students in grades 7 through 12. Tutoring happens Sunday to Thursday from 5:30pm to 9:30pm.

In addition to the live tutoring, students can also access a variety of helpful resources. There are tutorial videos, practice questions and vocabulary flash cards. Students can also access the electronic version of their textbook (if one exists) for their course. Students and teachers can access the homework hub by looking for the Homework Hub icon on their gnspes.ca landing page. Check out this <u>short video</u> <u>from EECD about the features of Homework Hub</u>.

Virtual Professional Development Opportunities — Here are some virtual professional development opportunities coming up:

 <u>NCTM Virtual Conference, Nov. 11-14</u>. Over 200 presentations (70+ live and 130 OnDemand) designed to engage, inspire, and expand your professional development. Member registration \$175, non-member \$249.



- <u>CMC-South Annual Mathematics Conference, Nov. 6-8</u>. 50+ live and interactive webinars. 180+ prerecorded workshops-on-demand accessed *anytime until January 1, 2021*. \$90 registration fee
- <u>Make Math Moments Virtual Summit, Nov. 7-8</u>. Free registration, 25+ live and pre-recorded sessions.

**Technology in the Classroom**— The 2019-2020 school year was a challenging time for educators in Nova Scotia. Teachers had to figure out how to connect with their students and provide educational opportunities for their students remotely. Many teachers learned new skills and acquired knowledge on how to use a wide range of online and physical tools. We'd like to support teachers to continue this learning by providing a

number of teachers around the province with a pen tablet. Fill out the google form below to tell us how you would use a pen tablet in your classroom to support student learning and achievement. We'll select several teachers, distributed equitably among Nova Scotia regional centres of education, and send you a free tablet!

MTA Technology Assistance Google Form: https://forms.gle/wCTE2TVhHsmDn6AG6



# Math in the News and Around the Web

Math at Home from the Mathematics Learning Center - <u>Math at Home</u> is a website hosting a variety of mathematics activities designed to engage students in deep mathematical thinking as they work in blended and virtual learning environments. These games and activities are targeted to pre-primary through grade 5 students. The resources are free with no student, parent, or educator registration or login required. The example <u>activity below</u>, is from the list of grade 2 activities.

What do you notice? What do you wonder? What comes next?



Show or tell what the next few pictures look like. Describe how you know.

**Data Talks from Jo Boaler** — Jo Boaler has put together a web page to share information and resources about <u>Data Talks</u>. If you are familiar with a number talk, you probably have a good idea of how this math routine works. Data talks are short 5-10 minute classroom discussions to help students develop data literacy. Students are shown a data visual and asked what they notice or what interests them about the visual. Dr. Boaler says that, "Data talks are intended to pique students' curiosity and encourage question asking, and to help them understand and "read" the data-filled world in which they live."

In the <u>data visualization at right</u>, students are asked, "What do you notice?", "What do you wonder?" and "What is going on in this data visualization?"



**Centre for Education in Mathematics and Computing (CEMC) Problem Set Generator**— CEMC is probably best known for the mathematics and computing contests that it offers at a variety of grade levels throughout the year. CEMC also provides student courseware, including videos and practice problems for a number of courses with outcomes mapped to the Nova Scotia outcomes. You can also find an archive of past contests and solutions hosted on the CEMC website. Many teachers use these old contests for mathematical enrichment. A recent feature added to CEMC's website is the ability to mine this archive to create problem sets focused on specific topics or outcomes. This allows a more focused enrichment activity by exploring the outcomes you're working on in class to a deeper level. The problem set generator can be found at <a href="https://cemc2.math.uwaterloo.ca/contest/PSG/school/index.php">https://cemc2.math.uwaterloo.ca/contest/PSG/school/index.php</a>.

# **In Memoriam**

In Memory of Preman Edwards - Preman Edwards passed <u>away on August</u> <u>21st, 2020</u>. He was an exceptional educator and a loving father. Preman taught mathematics and statistics for many years in HRCE schools and was active with the Black Educators Association Summer Camp. In recent years, he was the Executive Staff Officer Member Services at the Nova Scotia Teachers Union. His warm smile and positive personality will be greatly missed.



Below are notes from two of Preman's former students:

"Mr. Eddy not only cared about you as a student. He wanted you to be suc-

cessful and happy in life. With his mind, body, and soul, he looked out for so many different people the way they needed looking out for. His heart was always genuine and his smile always lit up the room. Mr. Eddy was special." - Gary Gray Jr.

"Math was always like Spanish to me until Grade 11 when I had Mr. Edwards as a teacher. He always made sure I understood what we were doing in class and that I could do it. I never had a teacher care so much about making sure I was successful in class like him. He made a class I never liked enjoyable." - Shawn A. Thomas, Auburn High class of 2009

## Announcements

**Congratulations** to the St Francis Xavier University Certificate in Elementary Mathematics Pedagogy Program South Shore Cohort who completed their program in Spring 2020: Jenna Bailey, Kelly Banks, Christina Bower, Sarah Haughn, Hilary Huskilson, Jennifer Langford, Kristen Lawlor, Dianna MacDonald, Lauren Nunn, Amanda Pashkoski, Monique Rossignol, Jacqueline Sanford, Julie Eliz Silmarie, Chera Smith, Jennifer Stead, Morgan Vale Wolf, Catherine Wamboldt, Lynn Wyatt-Reichheld.

**Congratulations** to the Saint Mary's University Certificate in Mathematical Sciences 2020 graduates: Richard Barry, Amanda Campbell, Tessa Crewe, Neil Fisher, Conor Fudge, Stephen Gardner, Janet Heppell, Amanda LeBlanc, Danielle Marchand, Michelle Salah Khattar, Amanda Welburn.

**Congratulations** to Brad Pemberton on his recent appointment as Mathematics Consultant with the Annapolis Valley Regional Centre for Education (AVRCE). Brad previously served as a Mentor/Coach and classroom teacher with AVRCE. He has served on the Provincial Mathematics Team for many years and is a regular presenter at the MTA Conference.

**Congratulations** to Cindy Ferguson, the new Coordinator of Mathematics for the Chignecto Central Regional Centre for Education (CCRCE). Cindy is taking over for Darlene MacKeen Hudson who recently retired. Darlene was a long serving member of the Provincial Mathematics Team. She was also a past MTA Executive member and was an integral part of the team during her tenure. **Best Wishes** on your future adventures Darlene!

**Congratulations** to Antoine Jarjoura who recently retired from his position as Mathematics Assessment Coordinator with EECD. Antoine previously served as a classroom teacher, Math/Science consultant with CSAP and French immersion Math/Science consultant with EECD. All the best in your retirement Antoine!

# News from Conseil scolaire acadien provincial

Cette année marque le 25<sup>e</sup> anniversaire du CSAP. Nous, au Conseil scolaire acadien provincial, croyons que l'intégration de pratiques d'enseignement gagnantes, spécifiques et uniformes en numératie est essentielle pour que les élèves développent leur plein potentiel. Nous croyons aussi que la participation active des enseignants et des élèves est au cœur des réussites. Le développement professionnel offert et l'accompagnement des enseignants permettent d'appuyer l'apprentissage d'habiletés en numératie.

Le développement professionnel et l'accompagnement des enseignants ont été deux éléments très importants durant la période de confinement. L'équipe mathématique du CSAP a reçu plusieurs demandes des enseignants pour des ressources et des outils numériques afin de leur permettre de mieux appuyer les élèves. Même s'il y existe un très grand nombre de ressources et d'outils, le défi était de savoir comment accéder à ces ressources et ces outils sans avoir accès à leur salle de classe. Pour traiter ce problème, l'équipe a créé un site web pour faciliter les accès aux ressources en numératie. Ici, ces derniers ont été organisés et entreposés sous différentes catégories pour permettre un accès plus facile pour nos enseignants. D'autres thèmes mathématiques qui se trouvent sur le site sont :

- documents d'appui à l'enseignement et à la planification en en fonction des RAS;
- les bonnes pratiques pédagogiques;
- l'utilisation du matériel de manipulation;



# Conseil scolaire acadien provincial

- des liens à des activités d'apprentissage intéressantes;
- des jeux mathématiques;
- des concours de mathématiques.

Ce site de numératie répond à plusieurs besoins des enseignants et nous espérons qu'il deviendra un premier point d'entrée pour rechercher et obtenir différents outils et ressources pour appuyer l'enseignement des mathématiques à tous les niveaux.

Même si l'année a commencé différemment, nous voulons prendre cette occasion pour féliciter tous les élèves et tous les enseignants pour leur flexibilité face aux nouvelles réalités. Sans vos efforts et votre collaboration, il sera impossible d'assurer la mise en œuvre d'une éducation de première qualité!



https://www.facebook.com/novascotiaMTA



By Dr. Evan Throop Robinson (<u>@Mathinmind</u>), Assistant professor, mathematics education at St. Francis Xavier University (StFX).

#### Moving from Hands-on to Online

The beginning of a new school year typically brings great excitement for students eager to re-connect with friends and for teachers eager to implement new learning acquired from summer learning and professional development. This fall is no exception with a return to in-class instruction and the possibilities for integrating technology in the classroom as a result of the shift to online learning last spring. Fortunately, there are many resources available to heighten learners' experiences in the mathematics classroom. These virtual manipulatives and interactive tools support students as they shift from concrete, hands-on materials toward a representational mode of thinking. They also provide an important scaffold for students as they explore new ways to show their mathematical thinking.

It is critical for students to have hands-on experiences in mathematics. NCSM also remind teachers that, "In order to develop every student's mathematical proficiency, leaders and teachers must systematically integrate the use of concrete and virtual manipulatives into classroom instruction at all grade levels" (NCSM, 2013). Dr. Kristopher J. Childs reiterates this when he states, "Every child should have their own set of manipulatives" (Childs, 2019) to explore and represent mathematical concepts for themselves. The following selected resources put these manipulatives into students' hands online to support their learning in the virtual classroom.

#### **Concreteness Fading**

Virtual manipulatives provide support for students who have experienced concrete materials to demonstrate their mathematical thinking and are ready to move explicitly and gradually to a more abstract representation. The benefits of concreteness fading are well-documented (Bruner, 1966; Fyfe, 2014). Significantly, virtual manipulatives help students establish memorable images that will assist them in the shift to the abstract or symbolic notation of mathematics.

My choices for virtual manipulatives and online activities include the following websites: Didax.com, GeoGebra.org, Mathies.ca, Mathigon.org, Mathsbot.com, Mathlearningcenter.org, Mathplayground.com, and ToyTheater.com. They are easy to access online at home or school for exploration, representation, modeling, reinforcement, and reasoning. Along with the sharing of student-created visuals through apps like Jamboard or screenshots and Flipgrid videos, the virtual manipulatives engage students in math talk with peers, teachers, parents and guardians as they play online games and explore concepts together. For a wide selection of problem solving activities for the lower and upper elementary mathematics classroom and for those activities included below visit <u>www.nrich.maths.org</u>.

#### What's the buzz?

After a description of each resource, I offer feedback from pre-service teachers at StFX along with comments from my own two teenagers at home. Their hands-on review of the websites prompted feedback in the form of benefits and challenges for teachers and students who might choose to develop a set of virtual manipulatives this fall.

#### Games of Chance

In my class, I make a selection of games of chance available to reinforce quantity sense, build logical reasoning and promote strategic thinking. With simple materials like *dot cubes, number cubes, and spinners,* students can interact with peers in short games of chance where often simple rules belie the inherent complexity of the game.

For example, in *Build My Number* students 'roll' multifaced number cubes or 'spin' uniquely designed spinners to generate random digits that they use to form numbers and represent place value. In *Dotty Six* (NRICH), students play a version of tic-tac-toe while building confidence in subitizing numbers.

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#### What's the buzz?

A strength of using online dot or number cubes and spinners is that the student can pick the number of sides needed for an activity from 4-sided to 20-sided. There are cool sound effects for each roll or spin and the application calculates the totals. This was also noted as a disadvantage as it takes away the student's use of mental math strategies to calculate after each roll or spin.

#### Didax.com



<u>Didax</u> provides very simple and straightforward manipulatives that are also very lifelike and easy to use. For example, the *Unifix cubes* were

the preferred choice by students as they were easy to click and drag on the screen to build towers. An activity like <u>A</u> <u>Bowl of Fruit (NRICH)</u> might make use of the Unifix cubes, for example, to represent the number of fruit in the bowl.

#### What's the buzz?

Instructions and activities for the virtual manipulatives are provided; however, there is no writing tool or pen included in the application. This is the only website included here with ads for commercial shopping embedded onscreen.

#### GeoGebra.org

GeoGebra, already wellknown to many secondary teachers, now offers an increasingly popular site for elementary teachers to use. Here you will find a variety of tools to visualize rational numbers or play with basic facts. A Square Tiles tool allows for creative geometric design as well as a way to represent spatial problems such as <u>Threeway Mix-up (NRICH)</u> using a selection of three different color tiles. Activities and visual representations are organized by level and topic and are great for mini-lessons or student-led explanations. Teachers may also access the GeoGebra Classroom and set up their own learning space for their students.

#### What's the buzz?

Students were impressed at the wide variety of activities and excellent tools available. A writing tool is usually included with the manipulatives. Teachers found it difficult at times to find the manipulative they were looking for and a suitable activity for their students. More time to familiarize themselves with this vast website would be helpful. A GeoGebra Classroom could offer an alternative to the Google Classroom for teachers who want to use the online tools directly.

#### Mathies.ca

Mathies were developed by the Ontario



Association of Mathematics Educators (OAME) for use in the classroom. Fully bilingual in English and French, they include many popular manipulatives such as open *Number Lines* that can be configured to suit students' needs and *Relational Rods* to show measured lengths for whole numbers, decimals or fractions. Students may use the rods easily to represent solutions to pattern problems such as <u>*Cui-*</u> *senaire Squares* (NRICH) or hops on the number line to visualize their operation sense as they explore number relationships. The flexible *Rekenrek* application shows these relationships clearly and transitions students to operation facts with simple click and drag motion.

#### What's the buzz?

Students appreciated the availability of Mathies across all devices and were excited to see them work wonderfully on phones. Short, how-to videos in English or French included with the applications provided familiarity and comfort to teachers along with the printable resources. Although connected to the Ontario curriculum outcomes, teachers found strong parallels in the NS curriculum. The writing tool and text box features allowed students and

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teachers an opportunity to annotate their work. Considerable choice of colour and sizing allowed for visual differentiation and customization to suit more students' needs. At present, some applications require flash player to run the games; however, after December, this will be removed to increase universal access for all.

#### Mathigon.org



Polypad, from Mathigon, offers rich content and visually appealing virtual magrams, Pentominoes and Origami. Drawing tools enable students to annotate

their work and teachers to comment directly on screen. As well, a variety of resources enrich students' appreciation of mathematics. For example, in a timeline of mathematics the story of mathematics comes alive with a diverse representation of mathematicians from across cultures and history.

#### What's the buzz?

Teachers found Mathigon most suitable for upper elementary and secondary students. While intuitive, the site provides minimal instructions for the manipulatives. Developed in the UK, Mathigon focuses on a UK curriculum with strong connections to the NS curriculum. The introduction to mathematicians and their significant contributions in mathematics history helps make cultural connections for learners and humanizes the content.

#### Mathsbot.com

Also from the UK, Mathsbot was developed by Jonathan Hall to meet the needs of teachers not only for virtual manipulatives but also for tools, questions, and lesson starters. A Domino application allows students to manipulate blocks to find solutions for *Domino Square* (NRICH) and Number Frames provides clear visualization of number relationships. An interactive and flexible Hundreds Square, *Geoboard* and *Bar Modeling* give students choice in how they may represent operation sense and spatial sense. The

Counting Stick provides a unique representation of number line work and helps students build quantity sense.

#### What's the buzz?

Teachers and students were impressed with the wide choice of manipulatives and the growing body of tools as new applications are frequently added. Popular Two-sided counters and Dienes blocks (also known as base-ten blocks) allow for flexibility and adaptability with an intuitive interface and a choice of backgrounds, colours, writing nipulatives including Pattern blocks, Tan- tools, and random generators to facilitate use. Teachers noted an additional Hundreds Chart from the UK, Splat Square (requires Flash), which offers interaction and great sound effects and demonstrates skip counting, pattern making, adding, and subtracting.

#### Mathlearningcenter.org

For tools to help students build quantity sense, the Math Learning Center is a rich site. The Ten Frames application helps stu-



dents with counting strategies and visualizing operations such as 'groups of' counters in multiplication. Unique resources like the Partial Product Finder and the Math Vocabulary Cards help students visualize quantity differently and develop mathematical discourse.

#### What's the buzz?

Teachers and students enjoyed these applications on all Apple and Chrome devices. The popular Geoboard is also available on IPhone making geometry tasks like Inside Triangles (NRICH) virtually possible. Teachers liked the sharing possibilities through Google Classroom with a simple link button. Writing and drawing tools as well as text boxes are available with each manipulative. Without much instruction, students need to know about the concrete manipulatives first before trying the virtual models.

#### Mathplayground.com

The Math Playground offers strong activities to build spatial sense with students. Tangrams and

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*Cube Perspectives*, for example, challenge students to manipulate two- and three-dimensional objects in a similar fashion to <u>Steve Wyborney's *Cube Conversations*</u> tasks.

#### What's the buzz?

Teachers and students find this site very fun and engaging. The activities, designed for play-based learning, are organized by grade level and topic. The essential skills and connections to Common Core Curriculum guide teachers in selecting appropriate activities. Sharing is encouraged through Google Classroom with quick connection to teachers' classrooms.

#### ToyTheater.com



The <u>Toy Theater</u> website offers a great choice of math games, activities, and virtual manipulatives for students and teachers. Clear instructions are given with suggested activi-

ties to explore the manipulative further. The *Make Ten Game*, for example, helps students develop mental skills in an engaging format while providing access to the *Number Line*, *Number Path*, *Number Frame*, *Rekenrek*, and *Counter* tools. A *Canadian Money* tool gives students access to appropriate coins and a variety of charts and mats help students visualize place value concepts.

#### What's the buzz?

Teachers found this site most suitable for the lower elementary classroom (Primary to Grade 3). Many activities met curriculum outcomes in these grades while some tools, for example the *Fraction/decimal/percentage strips*, could be useful in the upper elementary classroom. Students enjoyed the play-based learning approach although the timed games added stress to activities and caused more errors.

#### Hands-on Online

This was a brief overview of readily available, favorite resources and a few puzzles to get started using online resources for hands-on exploration. These selections help students transition easily from fully concrete experiences in the face-to-face mathematics classroom to visual representation and more abstract models of mathematical thinking in an online, virtual environment. With new ways of thinking about online learning emerging at a steady pace, teachers can feel confident in finding a place for these virtual manipulatives in whatever environment they work in, the physical or virtual classroom, or a blended version of the two.

Please share your online experiences using virtual manipulatives with the community of mathematics educators in NS. What are your favorites? What challenges have you faced? What are some a-ha moments for you and your students? You can find me on Twitter <u>@mathinmind</u>.

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# Flipping COVID—How my experiences with a flipped classroom and with remote learning are informing my teaching this year

By Carolyn Nickelo (<u>@CarolynNickelo</u>), Senior High Mathematics Teacher, Chignecto-Central Regional Centre for Education (CCRCE).

For my colleagues not familiar with the concept, a "Flipped Classroom" is one which flips or exchanges where students take notes and where they do practice. Content delivery happens outside of class time and face-to-face contact time is used for practice and discussion. Thinking about how often students in my Math courses would tell me that they stopped partway through their homework because they got "stuck" on a problem, I decided to give this instructional strategy a go in 2014. Since then I have used it in several different courses, including what I felt was a well-refined and fully flipped Calculus course. Which means that as I was listening to announcements in late March of this year about the fate of the school year, I thought that I would be ready for remote learning.

I can freely admit that I was wrong. Nothing could have prepared me for the experience that was remote teaching in Nova Scotia in the spring of 2020. Teaching without any face-to-face interaction is very, very different from a flipped classroom. But the intersection of two sets of experiences have taught me several valuable lessons for the 2020-21 school year and the rest of my career.

### Lesson #1 – Don't try to do it all yourself

These days it feels like I am just trying to survive from day to day. I believe that I am a good teacher and I know that I will always continue to grow as an educator – but the changes that have happened in our school communities as a result of public health concerns mean that this year is a radically different experience from anything I have ever known. In many ways, it is as though I am starting from scratch with one hand tied behind my back. Because of this, I am grateful that during the early days of COVID-19, I really took it to heart that perfectionism can be the enemy of good.

In my early days of offering content on the flipped classroom model, I felt that I had to create everything that I used from scratch and have it be 100% tailored to my plans. During remote learning, as I tried to offer meaningful and often differentiated content for three different courses (while also parenting a child who was seriously missing social interactions with her friends), I realized that I was putting too much of a burden on myself and this simply wasn't sustainable.

Sometimes, it makes a lot more sense to use something another colleague has made and shared so that I can spend more time with my daughter. Making an Instagram-worthy practice page doesn't help me as much as getting an extra half hour of sleep. During the days of lockdown and now in the return to face-to -face teaching, this has also spurred a lot of conversations with my perfectionist students about finding balance and being gentle with their expectations of themselves. It's a tough lesson to take to heart though – like my students, I need frequent reminders not to get bogged down by a desire to be perfect.

And so this year, I give myself fifteen minutes to reach out to colleagues and search the internet for the work of other fantastic teaching professionals before I turn to trying to make something that I feel I need for a lesson. I shudder to think how much more time I'd be spending on planning if I hadn't gotten into this habit. And it has actually had another unexpected benefit – in one of my classes where students

### Flipping COVID by Carolyn Nickelo

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have demonstrated strong self-management skills, for ble bites for students – in terms of the content, activilessons I will share links to two or three videos from different content creators all discussing the same topic, and more than half the class has expressed enjoyment of access to multiple explanations which often harmonize and help clarify ideas.

#### Lesson #2 – Go bite-sized

When I was younger and struggling with a significant challenge, my parents often used to remind me to "eat an elephant one bite at a time." I thought of this often during remote learning.

Prior to COVID, I would generally offer my Calculus students a single video to cover an entire lesson and my video lessons often ranged from eight to fourteen minutes. Since research into flipped classrooms suggested a minute of content per grade level, I had felt quite comfortable with this. But when more external stressors were heaped onto everyone involved in the process, when internet service was not always reliable, and when students had to try to fit in lessons around when they had a turn with a device - long lessons no longer made sense.

During remote learning, I generally tried to break down content into the smallest pieces possible so that it was easier for students to pick up where they had left off and to re-tread something that didn't make sense. What I discovered was that they found it far more appealing to have a larger number of small tasks than to have one or two larger tasks. Now that I am back in my classroom, I keep coming back to this idea in my planning.

My students and I are all adjusting to hours-long classes, so I am trying to break class down into managea-

ties and mental load. In all of the courses that I teach, I find myself using flipped lessons at times as a part of this sub-division of our time – especially when it is a lesson that I think students will benefit from being able to revisit and hear again as often as they like. Then I break those flipped lessons down to be short readings or video clips so that students can really zero in on what make sense and what they need to have clarified.

While it does make for a bit more planning (thank goodness I'm not creating everything myself!), as we switch from one task to the next the body language around the room lets me know that the changes are worth it. We are finding ways to make the longer classes work, and if a student gets overwhelmed, it is easier for them to tune back in when we make a transition. And as an added bonus, having content and practice broken down this way makes it easier for students to do targeted review and will hopefully offer me more flexibility in the future with shorter class sizes or a curriculum re-design.

### Lesson #3 – Students need to see each other struggle

One of the biggest advantages of a flipped classroom is how this approach naturally emphasizes the importance of practice as a part of the learning process. Year after year, the majority of my Calculus students would report doing at least twice as many practice problems as they had done under the traditional model in prior math courses. The sheer volume of practice played a big part of their successes. And being able to access support as they practiced was im-

### Flipping COVID by Carolyn Nickelo

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portant, too. But I realized in the spring of 2020 just how important it was for students to be able to literally see their peers also being challenged.

While many of my students kept in touch with classmates during the lockdown, they got the sanitized social media version of everyone else's experience. They didn't see the practice and effort that was put in before something became "easy". When they felt stuck, they could no longer just look around to seeing other puzzled faces and hands in the air and get the affirmation that feeling challenged was normal. As the weeks passed, many lost the ability to persist and rise to a challenge. Of course, there were a lot of factors at play, but I have thought a lot since then about how a social environment affects a student's perceptions of and reactions to difficult tasks.

Now that I am back in my classroom, I am spending time trying to normalize being challenged. My favourite check-in question as we transition from one task to another is "What did you find challenging about ... ?" and I find it rewarding to see how many students who choose to pass nodding their heads or looking relieved when a classmate mentions what they found hard. They need to know that they are not alone, that it is normal to find math difficult sometimes – and that they can make choices that will help ease that difficulty. More than ever before, I am actively encouraging and investing in a culture of resiliency and persistence so that my classroom can be a place where students will hopefully grow to believe in the value of productive struggle.

#### **Final Thoughts**

I remember speaking in front of a group of my teaching peers about my experiences offering Calculus on the flipped classroom model, and how someone raised a concern about teachers being replaced by computers. Having lived through remote learning, I can safely say that I will never again worry about this: teaching and learning rely on the human relationships.

Ultimately, relationships form the underlying theme of each of the lesson I've shared here. Whether it is your relationship with yourself and the grace to accept imperfections, your relationship with your students influencing how you adapt your lessons to the realities of this school year, or nurturing the relationships between students to help them better understand productive struggle – relationships are at the root of everything we do. In fairness, this is old news. But as we adapt to so many changes in our teaching practice this year, I think it is perhaps valuable to remember that there is still a lot that we can do to nurture and deepen the relationships that sustain and support us as teachers.

Carolyn is a regular presenter at the NS Math Teachers' Association Annual Conference and has been teaching mathematics in CCRCE for sixteen years, including using a Flipped Classroom model for the last five years.

# **Fraction Talks**

By Jordan Rappaport (@JRappaport27), Teacher/Math Coach, York Region District School Board (YRDSB) in Ontario & Lead Math Mentor, The Mentoree

My passion for mathematics education was sparked once I had kids of my own, leading to a profound interest in teaching for understanding and the development of student thinking and reasoning. This is framed around the role playful mathematics has in uncovering a sense of wonder, belief and beauty. As an educator, my work is predicated on the belief that all learners have mathematical experiences that need to be honoured, and using these experiences will help to leverage new learning opportunities for our students. Central to my teaching practice is the role problem solving plays in learning mathematics. By learning to solve problems and by learning through problem solving, students are given, and create, numerous opportunities to connect mathematical ideas and to develop conceptual understanding. Problem solving forms the basis of effective mathematics programs that place all students' experiences and queries at the centre. (2020, Ontario Math Curriculum, Grades 1-8).

But it's more than that. I believe we need to provide students with opportunities to solve meaningful problems that are accessible to all learners, and to engage with students in mathematics challenges that have multiple entry points, a low floor and a high ceiling. These problems lend themselves to natural differentiation where all students are able to access the problem at their level and experience success, they allow for varying facets of mathematics and give students meaningful and enjoyable contexts so they can make sense of, and mathematize their world.

For me, <u>Fraction Talks</u> have been a mainstay in my class as a means of engaging with students in meaningful mathematics conversations by providing them with opportunities meaningful opportunities to assess student thinking and to see the relationships between the visual parts of a whole to numerical fractions. The premise of Fraction Talks is built around meaningful conversations and collaboration between students, and between students and teachers. These two principles guide the types questions, hints and/or extensions teachers give, and support the delivery and facilitation of each activity. One common

structure is similar to a Number Talk. Students are provided with an image, often composed of a larger figure, such as a quadrilateral or triangle, with several smaller shapes embedded into the larger figure. A section or several sections are shaded or coloured, and the teacher asks, "What fraction is shaded?"



Students then develop an answer supported with reasoning. For the prompt from above, one student reasoned, "I split all the different shapes into fractions by seeing how many of that shape could make the full shape, and then making that number the denominator, so I saw that the shaded shape was a mixture of a 1/16 triangle and a 1/8 triangle, so I turned 1/8 into 2/16 and added the 1/16 to it to get 3/16."

Based on the direction and depth of the conversation, this routine often evolves into full lessons as they provide understanding; two guiding principles that frame my assessment practices. This is grounded in the belief that assessment should be framed through the lens of supporting learning through a developmental continuum/trajectory, and incorporating Fraction Talks as part of regular classroom routine supports this belief.

### Fraction Talks by Jordan Rappaport

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Being an educator is an incredibly rewarding and demanding career. These demands were compounded when we came to a complete halt, and pivoted to Emergency Distance Learning in what could best be described as an increasingly complex and evolving set of circumstances, not to mention balancing that with the inequities that exist for students and families. As we transitioned into Emergency Distance Learning, I very quickly learned that staying connected and feeling a sense of connection was the most important thing for students and families. As a parent myself, I realized that when crafting learning opportunities for students through a distance learning model, it wasn't just students I was planning for. I needed to strongly consider and be respectful of the various home dynamics and the manner in which families were and are able to navigate these challenging circumstances.

Many of us have found ourselves working under new and challenging constraints. For instance, students and families not having reliable internet access, difficulties for parents and caregivers navigating new or unfamiliar online platforms or students and families not having access to technology. In my context, this also meant balancing my commitment and responsibilities to families and students, while at the same time managing the learning and socialemotional well-being of my own children, ages 11, 9 and 4. I believe that under this model, whether synchronous, asynchronous or a blend of the two, now more than ever, learning experiences for students need to be framed so they are contextual, meaningful and impactful. Developing

learning experiences in this way will reduce the impact on families through their own ability to access the learning, which could be technology-based, their own experience and comfort, or a myriad of other scenarios to consider for families.

In a recent <u>article</u> addressing emergency remote math instruction, James Tanton states that as math educators, our role under an Emergency Distance Learning model is to invite students into mathematics conversations, no more, no less.

This continues to resonate with me as ongoing communication and collaboration between and with students and



families is always important, but never as important as we began teaching remotely. Using this as my guiding princi-



#### Nova Scotia Mathematics Teachers Association Website

Have you visited the NS MTA website recently? This is your source for information on the NS MTA conference, NCTM conferences and resources including math websites, enrichment, math contests and past issues of this newsletter. Check it out at <a href="http://mta.nstu.ca/">http://mta.nstu.ca/</a>

### Fraction Talks by Jordan Rappaport

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ple, I set out to craft a framework for mathematics learning grounded in solving meaningful problems, the big ideas and the development of student reasoning.

Supporting all students and families by intentionally selecting and sequencing problems, puzzles and challenges, where all students had points of entry and opportunities to experience success served as my driving force to invite all students into meaningful mathematics conversations. So it only seemed natural to continue using Fraction Talks as part of my teaching framework as we shifted to Emergency Distance Learning.

My approach continues to involve crafting learning experiences for students grounded in the principles of numbers and operations, patterns and relationships, and geometry and measurement. By teaching and learning mathematics through a relational approach, students are provided with opportunities to naturally uncover the relationships that exist between Fractions, Algebraic Reasoning, Proportional Reasoning and Spatial Reasoning.

As educators, our role is to inspire, guide and facilitate learning opportunities. This is conditional on building a nurturing environment where learners actively look for, and engage in finding multiple strategies for solving meaningful problems. This not only empowers students to explore alternatives and develops confident, cognitive mathematical risk takers, it invites students to think about mathematics, to take risks, and to persevere.

Using these pillars as my framework for sequencing learning, I scaffolded instruction through the use of weekly <u>Choice Boards</u> composed of activities, challenges, puzzles and tasks supporting the development of mathematical reasoning. Although these were implemented while teaching remotely, the structure and essence of the learning supports teaching face-to-face, through distance learning or through a hybrid model. In my context, remote teaching and learning was first done through an asynchronous model, which definitely provided for a unique set of challenges, particularly around keeping the conversations meaningful

and ongoing. While I drew from the research and work of mathematics educators, such as Peter Liljedahl, Sunil Singh, Kyle Pearce and Jon Orr, it was the structure of Fraction Talks that remained consistent as I planned for and scaffolded learning for students.

Every Friday, I would record <u>instructions</u> for students, with each activity as the backdrop to support the visual representations of each Choice Board. These would be uploaded onto our class online platform each Sunday leading into the week. I believe this helped to support parents and caregivers in planning out their week, and supported students in mapping out their learning for each week, as well as serving as means for students to ask questions before engaging in the work. From week to week, students were provided with an image, with a section or sections shaded. Or they would be provided with two images, such as the one below from <u>Carla Dawson</u>, and would be asked, "Which shape is 1/4 coloured in? How do you know?"

### Which shape is 1/4 coloured in? How do you know?



Students developed responses supported with reasoning, and often used a Google Form to share their thinking.

Or students were provided with a large figure made up of various quadrilaterals and triangles. Here the challenge was to determine what fraction of the shape appears to be shaded.

Students would often send a video of the mathematical work that led to their solution, which truly made their thinking come alive.

### Fraction Talks by Jordan Rappaport

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Or students were shown a star made up of several smaller triangles, and were asked, "How many triangles do you see in the star... how can you be sure?"



Sometimes these <u>conversations</u> didn't have any words at all, but they could be the most revealing in terms of student thinking and mathematical reasoning.

These would often evolve into really rich discussions online, where students began posing their own questions to problems they wanted to solve, for instance, "what is the fractional value of each triangle?"

As we enter into a new school year, the commitment of educators to students, families and each other will help us navigate through these challenging times. From these evolving set of circumstances come many opportunities to continue to be innovative and evolve our practice.

By teaching mathematics through a relational approach, we provide opportunities for students and families to have meaningful conversations that are ongoing and impactful, that uncover key mathematics principles, and support the development of reasoning through ongoing communication and dialogue. As so eloquently stated in his book Math Recess: Playful Learning in An Age of Disruption, Sunil Singh notes that "math and children need time and space; time for wondering and space for wondering." When we engage students in playful and meaningful mathematics supporting the development of reasoning, everyone has a seat at the table.



# **Measurement Esti-Mysteries**

By Erick Lee (@TheErickLee), 7-12 Mathematics Consultant, Halifax Regional Centre for Education (HRCE)

Esti-mysteries are a math routine created by Steve Wyborny (@SteveWyborney). He has shared many of examples of this routine <u>on his website</u>. An esti-mystery uses an image to invite students to make an estimate. After an initial estimate, clues appear which help students narrow down the possible set of answers and refine their estimates. Most of the esti-mysteries that Steve has created are aimed at elementary students and ask them to estimate a collection of discrete objects. This engaging routine can also be adapted and used with secondary students.

#### **Metric Measurement**

In Nova Scotia, measurement outcomes are included in all grade 10 math courses as well as Math at Work 12 and Math Essentials 12.

While brainstorming with a Math at Work 10 teacher, we decided that an esti-mystery might be an engaging way to get students to think about different units of measurement while at the same time giving them some benchmarks for a variety of different units.

The first esti-mystery we gave students was a basic one from Steve Wyborney where students estimate the number of objects in a clear glass. A good practice esti-mystery might be something like <u>"Return of the Erasers"</u>.



I created several esti-mysteries using Google slides. The first esti-mystery I created asks students to estimate the

length of a pencil. Since I'm using these with high school students, the types of clues that are given can include vocabulary terms that you might not use with younger students. It allows a place to include a review of some terms that they may not have heard in a while (e.g. prime and composite).



The second esti-mystery I created was for the weight of a bunch of bananas. In this activity, students try to guess the weight to the nearest hundredth of a kilogram.

These could easily be changed to create esti-mysteries for imperial units. Once you have one as a template, creating new esti-mysteries doesn't take much time. Just some inspiration and creativity to make up some clues. Here is a list of links to the esti-mysteries I've created:

- Length of a Pencil (centimeters)
- Weight of a Bunch of Bananas (kilograms)
- Length of a Bank of Lockers (meters)
- Weight of a Pumpkin (kilograms)

Andrew Stadel's <u>Estimation180</u> website is a great source of inspiration for these types of measurement esti-mysteries. For example, I used the image from Day 55, the capacity of a cylindrical vase, to quickly create an esti-mystery for capacity in litres.

I encourage you to give these a try with students in your own class. Better yet, create your own or challenge students to create them. I think you'll find that they are a worthwhile mathematics routine.

# **Fractions Can Be Fun?**

By JoAnn Sandford (@joann\_sandford), Junior High Mathematics Coach, Halifax Regional Centre for Education (HRCE).

A lot of people have strong feelings about fractions. As a passionate teacher determined to do the best possible job for her students, I had strong feelings about fractions too. Negative feelings. Dread. Despair. Exhaustion. Failure. When I could sense the fraction unit approaching in our yearly plan the nervous, negative feelings heightened and I would beat them down with renewed determination - I can do this! I am a problem solver! I will figure this out! Fractions can be fun! But somewhere, in that marathon of a unit, my best practices would break down. Students didn't come with the necessary prerequisites. I had too many levels in my class. I was running out of time. I would resort to repetitive practicing of procedures...the hallmark of the "I do, we do, you do" teacher. Steeped in unproductive beliefs and literally the worst, most desperate action that only an ill-informed educator (or one out of time, options, and ideas) would choose. There had to be a better way! I am proud to say that after a mere decade (or two, but who's counting?) I have found it. If you are that teacher that thought you finally had fractions figured out, only to be crushed by the complete lack of understanding shown by students on a summative assessment, read on! This article is for you!

The change in my practice came with good old fashioned reflection. This was not working. This was not the way. What did I really want my students to be able to do? Demonstrate the grade level outcomes - sure! But what else? As math teachers we have broader goals. We want students to have number sense; be flexible and efficient in their thinking and methods. We want students to be able to estimate and determine if an answer is reasonable. Can they prove their solutions and find errors of reasoning in the work of others? Can they solve interesting and novel problems and enjoy and take satisfaction in the process? We are trying to build mathematicians here - not rule followers!

So what is this magic formula? (Well it's not a formula). I have three things that I do.

1. Engage students in conversations with fraction squares. Oh wait...that's one thing!

My discovery grew out of my two great loves as a teacher of mathematics. Playing with math and listening to kids. By playing with math I'm talking about challenges, puzzles, games, manipulatives, patterns and artwork. And listening to kids? Well that's what you do when you are not looking for one specific answer. When you are listening, your goal is to understand. It's not just to acknowledge that correct response or a pause as you wait your turn to direct the conversation back to your pre-determined purpose. The moment I saw the connections, witnessed the passionate arguments, and reflected on the multiple entry points and proofs that were possible with fraction squares, they moved from the dessert, to the main course.

#### Here's how to start.

Break out the tangrams. Play. Make a cat. Make a hat. Here's a spot with lots of puzzles to try: https:// www.tangram-channel.com/. This is usually an area of math that showcases the strengths of a different group of students - let them savour it! Make a square. Talk about the pieces. If the square is one whole, how could we name the other pieces? How can we be sure? Don't show. Listen. Teach students how to listen by asking those that share some follow up or clarifying questions. Model how to build on someone's idea by naming the person and restating their contribution. Confirm with them that you shared their words as intended. Ask if anyone thought of it another way. Do not rush. Do some more puzzles. Play. Make a right triangle, a hexagon, a frog. Ask if different shapes can have the same fraction name? Why? How can we be sure? Hold the pieces. Line them up. Compare them. Let the students sit with the ideas. Talk about it. Write about it. Let it marinate. Talk about the relationships to other pieces. You'll see some magic start to happen. Students will say things like, "Half of a fourth is an eighth" and "two one eighths make one fourth". They'll do this without you. These will be their words. Their understanding. Stay

### Fractions Can Be Fun? By JoAnn Sandford

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out of their way - let them chat. Be less helpful.

Figure 1 shows a typical tangram square. You might ask students, "If the entire set of tangrams represents one





whole, name the pieces with fractions."

Sample student responses:

- "The piece labelled "a" is one fourth because it would take four pieces that size to cover the whole thing. It is one of four pieces that make one whole."
- "The piece labelled "b" is one eighth since 8 pieces that size would cover one whole - see!"
- "It's also one eighth because it is one half of one fourth see!"
- Can different shapes have the same fraction name? "Yes! see?"

Extend the traditional tangrams to include other fraction squares. My favourite pictures to examine next come from Fulton and Lombard's <u>Tangram Fractions</u>, part of their publication *Simply Great Explorations in Geometry*. My advice? Go slow. Discuss one a day or every other day as a warm-up leading up to your fraction unit. Maximize the discussions, the proving, the connections. Use prompts like, "Convince me that..." to put the focus on the proof

and away from finding the answer. Help students craft their arguments. Work on clear, precise language. (See Fig. 2)

Using the image in figure 2, students can name each piece



Figure 2: Ask Students to Wonder Aloud

and then discuss and prove things they notice. I might wonder out loud, "It looks like the sum of a, d, and e is equal to one half. Is it?" Or perhaps, "It looks like 2 b's and 2 c's are the same space as a, d, and e all together? How could be prove that with the fractions?" And another, "The sum of 2b's, a, e, and d look like a familiar fraction. What's the fraction? Can you prove that their sum is that fractional amount?

When your students beg for another one, and they will, go to <u>http://fractiontalks.com/</u>. Here you will find fractions squares as well as other shapes, and lessons, and connections. Some have colour and are primed for an obvious prompt. Others look like a super fun colouring sheet where students might be directed to colour to certain specifications or colour first and analyze later. I often copy a square into a paint program and fill it with colour to use as a low entry warmup where all students can engage with the picture at their own level while hearing and verifying the contributions of others. (See Fig. 3) Other great activi-

### Fractions Can Be Fun? By JoAnn Sandford

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ties that use fraction squares from fractiontalks.com include a clothesline activity created and described <u>here by</u> <u>Erick Lee</u>, and another I crafted called <u>Two Truths & A Lie</u> (Fraction Edition). (See example, Fig. 4)



Figure 3 - An image from fractiontalks.com

There will come a point when we start to formalize what we notice, and know to be true, with symbolic representations. This comes naturally. Instead of recording a student's idea in words that "this area is one eighth because one eighth is half of one fourth", I record that idea symbolically:  $\frac{1}{2} \pm \frac{2}{8}$  or  $\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$  or  $\frac{1}{8} \pm \frac{1}{8} = \frac{1}{4}$  I might ask which statement matches their thinking and why? We discuss what operations mean and how they are connected. Pure magic.

While some students may abandon pictures later when their symbolic representations become more automatic and efficient, I have noticed that the computational errors that I used to see so frequently are greatly diminished. Students are better at predicting reasonable solutions since they have a picture in their minds of what fractions look like and what happens when we operate with fractions.

The moral of this story is: Fractions CAN be fun! But please...make time. I start weeks before the official fraction unit. On a Friday afternoon we might play with tangrams as a reward class. Set it up as fun and prove that you are right! Then give small but regular doses. Maybe you look at the fraction square as a warm-up activity...maybe it's the cool down. Wrapping your mind around big, new ideas is not the work of a three week unit. Make time to play. Time to colour. Time to discuss and argue and prove and clarify. Spend less time talking and more time listening. When you start listening you might hear the things that I started hearing, and you don't want to miss these comments!

"I used to be afraid of fractions - but now I get it!"

"I wasn't good at math until this year!"

"I like when we can hold math in our hands - it helps it make sense."

"I like hearing the different ways people think about things."



"I just needed more time to think about it - now I can do it!"

"I couldn't figure out why multiplication could make the answer smaller but now I see it."

Isn't this why we all became teachers?

Fractions **ARE** fun. Knowing you can help students believe that too? Absolutely priceless.

# **Adventures in Logic and Reasoning**

# Star Battle Puzzles

These puzzles, also known as *Two Not Touch*, are similar to <u>Suguru puzzles</u> with very simple rules. Each row, column and bolded region must contain exactly two stars. The stars can't touch each other, not even diagonally. So when you place a star, you can eliminate all the squares that immediately surround it, and when you place the second star in a row, column, or bolded region you can eliminate all the remaining cells in that grouping as well. For a short tutorial on how to play, <u>visit Krazydad's tutorial</u>.

Try the two Star Battles puzzles below from the Krazydad.com website (<u>https://krazydad.com/twonottouch/</u>) or down-load the <u>Star Battles Go app for iOS</u>.





Star Battle Puzzles reprinted with permission from Jim Bumgardner.

# Split these numbers into two groups. Which number would you put where?



### Think about...

- What other numbers fit in each of your groups?
- What are some numbers that don't fit in either group?
- Can you find a different way to split the original numbers into two groups?
- What if there were three groups?

Source: mathsteachercircles.org.au

# Nova Scotia Math Teachers Association Executive

Below are the current members of the NS MTA Executive. The membership and the positions of the executive change each year at the Annual General Meeting held at the MTA Provincial Conference (The MTA provincial conference is on the fourth Friday in October of each year).



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Zeno MacDonald	President	zgmacdonald@nstu.ca
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# **Special Projects**

The MTA strives to give back to its membership by making funding available for special projects developed by classroom teachers. If you have an innovative math education project taking place in your classroom(s), MTA may be able to offer some financial assistance to help develop the project. Information on funding can be obtained by contacting any member of the Executive.

# **Call for Contributions**

We are better together. Mathematics Matters, the MTA newsletter, is looking for a variety of contributions from elementary and secondary teachers, math mentors and coaches, math support teachers and others who are interested in the teaching and learning of mathematics. Please consider sharing a favorite lesson or activity, a reflection or blog post, a book or technology review, or another work of interest to mathematics teachers in Nova Scotia and beyond. Sharing your ideas and reflections with other teachers is a great way to contribute to a vibrant and dynamic community of mathematics educators in our province.

If you are interested in contributing, please contact me at <u>eplee@nstu.ca</u>. We look forward to hearing from you!

The MTA Newsletter is published by the NSTU for the Mathematics Teachers Association, Erick Lee, Editor. The opinions expressed are not necessarily those of the Editor, the NSTU, or the MTA.