ISSN 1481-7799 **Spring/Summer 2021**

President's Message

The 2020-21 school year has proven to be another challenging one for Nova Scotia teachers. Yet, despite the uncertainty brought on by the pandemic, you, as proud Nova Scotia mathematics educators, have continued to make the needs of your students the priority. Each and every day, I am impressed by your outstanding work.

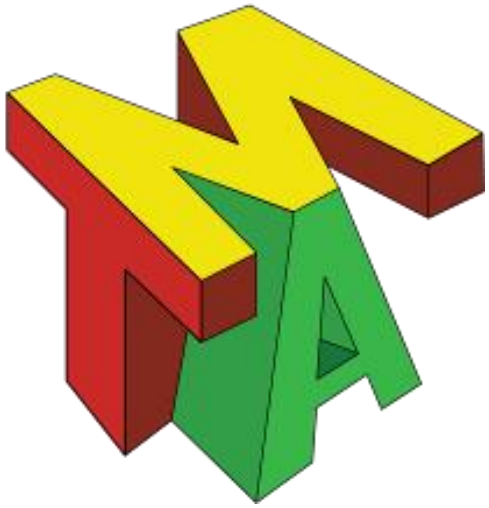
Though pandemic challenges continue, I am pleased to announce that the MTA will host a virtual conference in October. It will be very different from past conferences, but your MTA Executive are committed to developing sessions that will provide you with practical information that all teachers, regardless of the grade level, can put to immediate use. We value your input, so please advise us of any suggestions

Message du président

L'année scolaire 2020-2021 s'est révélée être une autre année difficile pour les enseignants de la Nouvelle-Écosse. Pourtant, malgré l'incertitude provoquée par la pandémie, vous, de fiers enseignants en mathématiques de la Nouvelle-Écosse, avez continué de faire des besoins de vos élèves une priorité. Chaque jour, je suis impressionné par votre travail exceptionnel.

Bien que les défis de la pandémie persistent, je suis heureux d'annoncer que la MTA accueillera une conférence virtuelle en octobre. Cette conférence sera très différente des précédentes. Ainsi, le comité Exécutif de la MTA s'engage à développer des sessions qui vous fourniront des informations pra-

In This Issue



President's Message

Continued from page 1...

that can make your conference a more rewarding experience for you. Also, please consider becoming a presenter. Conference session proposals can be submitted electronically using this Google Form.

In the interim, and on behalf of the MTA Executive, I wish you continued success as another school year draws to a close and a restful summer.

Stay Safe,
Zeno MacDonald
President
Mathematics Teachers Association

Know a new teacher? Because there was no MTA conference last year, they won't be on the newsletter mailing list. Please share this newsletter with your professional colleagues or anyone that you know who may be interested!

tiques que vous pourriez utiliser immédiatement, quel que soit le niveau scolaire. Nous apprécions vos contributions, alors veuillez nous informer de toute suggestion qui pourrait faire de votre conférence une expérience plus enrichissante. Veuillez également envisager de vous engager en tant que présentateur/présentatrice. Les propositions de sessions peuvent être soumises électroniquement à l'aide de ce formulaire Google.

En attendant, et au nom du comité Exécutif de la MTA, je vous souhaite un succès continu alors qu'une autre année scolaire tire à sa fin et un été reposant.

Soyez prudents,

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. Recently, the homework hub has been expanded to include all Nova Scotia math students in grades 4 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 short video from EECD about the features of Homework Hub.

Virtual Professional Development Opportunities — While the majority of in-person mathematics conferences have been cancelled this year, there are a number of exciting virtual professional learning opportunities. Here are a few:

- EECD Summer Learning Academy—The free EECD Summer Learning Academy 2021 (#SLA2021NS) will take place virtually from July 26-30.
- PCTM virtual conference—The Pennsylvania Council of Teachers of Mathematics (PCTM) virtual conference will be held August 5, 2021 with a theme of "Equity in Math". Dr. Kristopher Childs is the keynote speaker and there are many other features speakers. The cost is $30 US.
- LUMEN Online Professional Development videos —The Loughborough University Mathematics Education Network (LUMEN) has created and shared a number helpful videos to support teachers of mathematics in schools and colleges.

Spidrons! - What is a spidron you ask? A standard spidron consists of two alternating, adjoining sequences of equilateral and isosceles triangles. The name derives from the words 'spiral' and 'spider' along with the '-on' suffix from polygon. They were first created and named in 1979 by Dániel Erdély as a homework project. You can use them with students as an artistic opportunity to talk about similar figures and dilations… or just have fun with them. They are a fantastic intersection of mathematics and art. Erdély submitted a number of beautiful mathematical models for the 2007 Bridges Math Art exhibition.

You can investigate creating spidrons virtually using the Mathigon.org Polypad virtual tool set. Check out this page with instructions on how this can be created using Polypad.

Math in the News and Around the Web

Art Canada Institute Education Resources — The Art Canada Institute's education program is a national resource that offers primary and secondary school teachers thematically driven resources to facilitate the study of Canadian art through a wide range of subjects, from Decolonization to Urban Environments, and Astronomy to the Equations of Lines. They offer easy-to-use curriculum guides for teaching a broad variety of cross-curricular subjects, all through the inspiring lens of Canada's celebrated artists.

Each of the expert-authored guides follows national curriculum recommendations, and provides suggestions for class activities, individual and group assignments, and discussion topics. The latest mathematics resource from the Art Canada Institute is inspired by the work of Japanese Canadian artist Kazuo Nakamura (1926–2002), who was passionately interested in art and mathematics. Through a series of creative exercises, students can learn about perspective drawing, slope, and the equation of lines all through the inspiring lens of Nakamura's work.

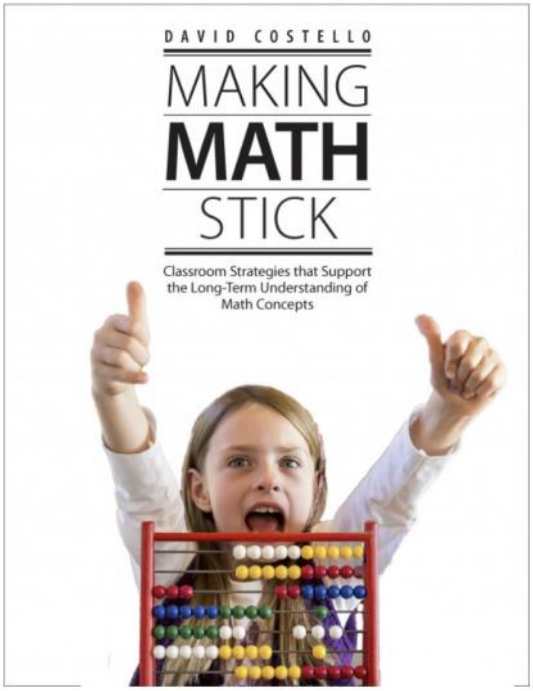
This guide can be accessed through their virtual library, in either English or French, for free: https://www.aci-iac.ca/education/teacher-resource-guides/perspective-drawing-slope-and-equations-of-lines-through-the-art-of-kazuo-nakamura/

If you would like the latest updates on resources and art-enriched curricular connections from the Art Canada Institute sent right to your inbox, you can sign up for their bi-monthly education newsletter here: https://aci-iac.us7.list-manage.com/subscribe?u=d66cf13dd51e3fd4a51f28a9e&id=3ca304295f

Book Giveaway - Making Math Stick is the latest book from educator and author David Costello. Pembroke Publishers has made this book is available to read online free for the rest of May. The book focuses on sustainable strategies that support the long-term understanding of math concepts. Just visit www.pembrokepublishers.com to take advantage of this offer.

You may also be interested in a recent online session with David Costello who shares practical ideas about math teaching and learning. You can view the webinar at https://youtu.be/XvOBbSrtybo.

BOOK GIVEAWAY!!! Pembroke Publishers has donated a copy of this book to be given away to a reader of this newsletter. If you would like to enter this draw, please complete this Google Form.



News from Conseil scolaire acadien provincial

Les membres des équipes du Conseil scolaire acadien provincial continuent à promouvoir l'intégration de pratiques gagnantes, spécifiques et uniformes en numératie afin de développer le plein potentiel de tous les élèves. Le développement professionnel offert et l'accompagnement des enseignants permettent d'appuyer l'apprentissage d'habiletés en numératie ce qui permet aux élèves de continuer leur cheminement en mathématiques.

Pendant cette année scolaire, plusieurs demandes d'enseignants ont été reçues pour accéder à des ressources, telles que, comment se servir de certains outils et comment travailler le matériel de manipulation avec les élèves dans les nouvelles contraintes. Pour traiter de ces demandes, l'équipe a ajouté de nouvelles ressources au site web pour la numératie pour appuyer l'enseignement des mathématiques. Plusieurs ressources et outils ont été organisés et entreposés sous différentes catégories pour permettre un accès plus facile aux enseignants. Une des nouveautés au site de numératie traite de la communication orale comme un outil d'apprentissage en mathématiques. Afin de développer les bonnes pratiques pédagogiques et les compétences en communication orale auprès des élèves, il s'y trouve un lien au site de la communication orale du CSAP et un document du langage mathématique de la maternelle à la 9e année. La communication orale permet aussi aux élèves de partager les processus qu'ils entreprennent en mathématiques, ce qui permet aux enseignants de vérifier la compréhension de leurs élèves tout en leur offrant des rétroactions efficaces. Pour accéder directement à cette page, veuillez s'il vous plaît cliquer ici.

Le CSAP a fourni des outils tels que la tablette Wacom à plusieurs enseignants de la 3e à la 12e année. Des sessions synchrones et asynchrones ont été offertes présentant leurs fonctions de base afin de promouvoir les bonnes pratiques pédagogiques dans l'enseignement hybride. Ce dernier est utile dans le contexte de cette année scolaire, mais sera un atout pour appuyer un enseignement de première qualité pour les années à venir. Un appui continu sera essentiel pour l'intégration de cet outil.

Nous reconnaissons et remercions le travail des membres de nos équipes (écoles, enseignants, équipe de numératie) pendant cette année scolaire atypique. Sans la contribution de ces derniers, la continuité des apprentissages de nos élèves sera difficile à envisager.

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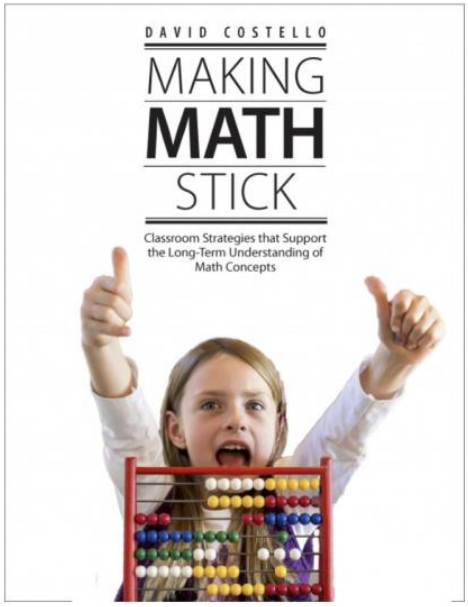
Making Math Stick: Strategies to Support Understanding and Recall of Concepts

By Dr. David Costello, author and professional learning facilitator who focuses on mathematics instruction and learning. A classroom teacher and administrator based in Prince Edward Island, David has supported teachers in many roles including as a numeracy interventionist, numeracy coach, numeracy leader, and curriculum consultant. A popular speaker at conferences, David has also instructed numerous university courses on curriculum, differentiation, mathematics, and literacy. David is committed to transforming math instruction and creating more meaningful learning experiences for teachers and students which he shared on his website CostelloMath.com.

This article is based on **Making Math Stick: Classroom strategies that Support the Long-Term Understanding of Math Concepts**. The two examples shared within this article are two of many found within the book.



Introduction

We have all experienced it: students learning math concepts only to forget them in the weeks and months to come. Students, regardless of grade levels, seem unable to apply previous learning to novel situations. Our way to approach this has always been to stop and re-teach math concepts. In some cases, this re-teaching resembles cramming, which doesn't work in the long run and uses up valuable class time. What we have here is a significant educational issue.

The issue of poor retention is creating problems as students move from grade to grade. You have probably heard fellow teachers complain about having to re-teach concepts supposedly taught in the previous grade because students say that they either forget the concept or don't remember working on it the year before. While we sometimes accept this as normal, perhaps we should pause and think about why failure to recall is becoming the norm.

Consider the following two comments shared by a teacher and student regarding the trend of students forgetting previous learning.

An Elementary Teacher Explains

"It is the same every year. Two weeks before the provincial exam, I will stop instructing new material and I review with my students. I want them to remember the concepts from the year and it takes me about two weeks to do this. I have tried shortening the time, but it can't be done. Many, if not all, the students forget lots of the stuff we did earlier in the year and I have to start from scratch. It really isn't so much review as it is cramming."

An Intermediate Student Explains

"I was shocked. Early in the year we worked on dividing fractions and I did very well on the test. I didn't get any questions wrong. But, when we had a midterm, I didn't do well with dividing fractions at all. I didn't study before the midterm because I didn't think I had to. I did great when we did them early in the year. But, on the midterm, I did all of the divisions wrong. I guess I didn't know how to divide fractions."

The above comments could be experienced by teachers and students at many grade levels and schools. What I will do in this short article is provide a rationale as to why this is happening and offer an approach that will address this discouraging trend. It is about working smarter, not harder.

Making Math Stick: Strategies to Support Understanding and Recall of Concepts

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Where We Are?

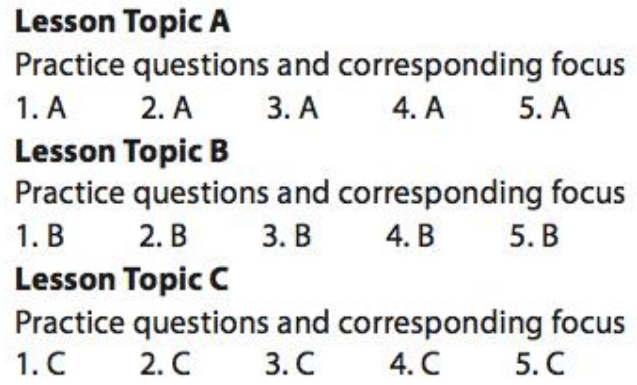
I would like to suggest that the way math is currently structured plays a role in the experiences documented by the teacher and student above. Consider the standard one-and-done organization of most math textbooks and year

(Source: Making Math Stick: Classroom Strategies that Support the Long-Term Understanding of Math Concepts)

plans. Concepts are isolated into units and then each unit is segmented into smaller lessons. This is a great plan if you want to support short-term performance.

Within the above visual, the teacher covers Topic A, moves on to Topic B, and then to Topic C. Such an approach to instruction and learning is practice based on units of study and can be referred to as blocked practice. The following visual illustrates how this blocked practice approach to instruction structures learning for students.

Notice that all practice questions relate directly to the focus of the lesson just taught. This one-and-done structure does a significant disservice to students. Removed from the equation is the requirement that students must select an appropriate strategy to apply to any given question or task. The processes inherent in strategy selection are critical to mathematical understanding and problem solving.



(Source: Making Math Stick: Classroom Strategies that Support the Long-Term Understanding of Math Concepts)

Solving a problem when the strategy is given is relatively easy. When the focus is on short-term performance, as the case of blocked practice, there is a removal of complexity for students.

When students only engage in blocked practice, they may experience something referred to as an illusion of mastery. Illusion of mastery is when students have an inaccurate depiction of their understanding (Agarwal & Bain, 2019; Brown, Roediger III, & McDaniel, 2014). In short, students think that they understand a concept when, in reality, they only have a limited or inaccurate depiction of it. If students only engage in blocked practice, the likelihood of an illusion of mastery increases as they don't have to think about the problem in terms of selecting a strategy.

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 http://mta.nstu.ca/

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Broadening Our View of Learning

Let us step back for a moment and think about how students learn. How would you define learning? When answering this, many will suggest that learning is the process of acquiring information and making connections between concepts. However, such a definition may be contributing to the experiences shared within the introduction of this article.

From the perspective of cognitive science, learning is the acquisition of knowledge and skills and having these readily available from memory to support future meaning-making opportunities. More specifically, there are three stages of learning: encoding, consolidation, and retrieval (Brown, Roediger III, & McDaniel, 2014). Encoding means getting knowledge into our heads; consolidation refers to assigning meaning to that knowledge, which gets it into our memory; and, retrieval means getting knowledge out of our heads.

When thinking about how to teach, it is important to consider all three stages of learning. Each of the stages is important and plays a considerable role in the learning process. Without all three stages, learning becomes far more challenging and not as effective.

Are we doing enough to address the retrieval aspect of learning? Each time a memory is retrieved, the student must think about it once again, re-construct it in terms of the previous knowledge and current experience, and then re-consolidate it. Through this process, the memory is strengthened. The brain organizes our memories more efficiently every time they are retrieved. By strengthening pathways to memories and increasing the retrieval cues, the brain naturally makes these memories more accessible. Therefore, it can be argued that retrieval is a more powerful learning activity than encoding (Agarwal & Bain, 2019; Brown, Roediger III, & McDaniel, 2014; Roediger III & Karpicke, 2018).

As stated earlier in the article, blocked practice tends to be the typical approach to review in many classrooms. While there are benefits in blocked practice, such as providing students opportunities to practice a concept; there are limitations. If we only engage in blocked practice, when will students have opportunities to retrieve previous learning? Knowing the importance of retrieval is one thing, but understanding how to approach it is another.

How to Retrieve?

When structuring opportunities for students to engage with the third stage of learning, retrieval, there are two structures that can be considered. First, is to space practice. Spacing refers to spreading retrieval opportunities over a period of time instead of squeezing them together (Agarwal & Bain, 2019; Brown, Roediger III, & McDaniel, 2014). When students return to content often, they interrupt the forgetting process before the initial memory gets completely lost. The difficulty experienced strengthens the memory by re-constructing and re-consolidating it while strengthening the pathways that lead to the memory.

Second, is to mix practice. Mixing refers to mixing up concepts so that consecutive problems cannot be solved by the same strategy (Agarwal & Bain, 2019; Brown, Roediger III, & McDaniel, 2014). When problem types come in random order, a student must first think about the problem and determine the necessary strategy before applying it. This addresses the issue of students not having to select an appropriate strategy that is inherent in blocked practice.

By spacing and mixing practice, the teacher introduces a desirable difficulty (Roediger III & Karpicke, 2006) and increases cognitive demand. Such an approach involving spacing and mixing practice is often referred to as mixed review in that teachers and students return to concepts throughout the year after they have been a focal point in a year plan.

Consider the following conceptual example that illustrates the difference between blocked practice and a spaced/mixed practice. In this visual, A, B, C, and D each represent a particular concept. Assume that all four concepts have

Making Math Stick: Strategies to Support Understanding and Recall of Concepts

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been introduced earlier in the year and that the practice sessions are an attempt to review the concept.

	Practice Session 1	Practice Session 2	Practice Session 3	Practice Session 4
Blocked Practice	AAAA	BBBB	CCCC	DDDD
Spaced and Mixed Practice	ABCD	BDCA	CBDA	DABC

Comparing the order of questions in blocked practice versus spaced and mixed practice

(Source: Making Math Stick: Classroom Strategies that Support the Long-Term Understanding of Math Concepts)

You will notice that in blocked practice, student will apply the same strategy to solve the problem. There is not significant cognitive demand placed on the student as the strategy becomes identifiable as students engage with the questions. It is the same process for each session – four questions addressing the same concept.

Now consider spaced and mixed practice. In each practice session, students will experience multiple concepts and will have to identify a different strategy for each question. There is considerable cognitive demand as not only do students have to apply the strategy, but they have to select one to apply.

Role of Metacognition

Before moving onto sharing examples of retrieval opportunities, I want to share the importance of metacognition. It is one thing to be teach from the perspective of our broadened definition of learning, but it is another to ensure students have an accurate depiction of their understanding. As stated earlier, there are too many instances of students having an illusion of mastery. To address this fallacy, it is important that students have an accurate depiction of their understanding. Metacognition is the ability to think about our thinking, and it is imperative to the learning process. Through metacognition, students can monitor their understanding and identify when their thinking comes 'off the tracks.'

While students have opportunities for self-assessment through ongoing retrieval practice, it is important for the teacher to provide students with feedback so that they can recognize whether their approaches to solving the task are correct or incorrect. Teacher feedback can support student metacognition as they navigate mathematical concepts. It can reinforce or correct their awareness of their learning, so that they can then take any necessary next steps.

In addition to teacher feedback, students can provide themselves with feedback when engaging in retrieval opportunities. An example of such feedback could be self-quizzing. Students would attempt to answer questions from memory and then check their understanding against a book or information source. A second example uses flashcards. Students would answer the question on the flashcard and then check their response against the answer on the back of the card.

The teacher doesn't have to be the sole provider of feedback and the feedback doesn't have to be immediate (but should occur within a reasonable amount of time). What is important is that students are provided opportunities to recognize if their response is correct. It is this recognition that will enable students to have an accurate depiction of their understanding – metacognition.

Example of Learning Strategy

The following learning strategy is an example of how to incorporate retrieval opportunities into the classroom for any grade level.

Compare and Contrast

Students must examine two concepts to distinguish similarities and differences. Such an approach assists the student in zeroing in on the foundational aspects of both concepts, thereby adding crucial layers of meaning to stu-

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dents' memories of the concepts. Through adding layers of meaning, students strengthen their learning because they are consolidating their memories each time they identify a foundational aspect.

There are multiple ways to encourage students to compare and contrast concepts.

- Students create or are provided Venn diagram which can be used to highlight the similarities and differences.
- Students create a list of similarities and differences.
- Students write descriptions of two concepts that focus on similarities and differences.
- In partners, students take turns identifying similarities and differences.

The following are suggested prompts to support students as they compare and contrast concepts:

- What do these concepts have in common?
- What differences are there between these concepts?
- What organizer could you make to determine how these concepts are similar and different?
- What criteria could you apply to decide if these two concepts are more alike than they are different?

Conclusion

Many classrooms are focused on short-term performance—such as answering questions correctly or doing well on a test—instead of learning. While short-term performance feels great, the material has not actually been learned if students are not retaining the information and applying it to future problems. Within a broadened definition of learning, importance is placed on encoding, consolidating, and retrieval. These three stages of learning support students in strengthening their understanding of a concept and their ability to recall and apply it in future problem solving opportunities.

The learning strategy shared in this article is but one of the many in my book Making Math Stick. Moving to this broadened definition of learning can be as little or big a step as the teacher wants to take. It can be as simple as introducing retrieval opportunities for students weekly in the form of a five-to-ten-minute review or providing students the opportunity to recall all they can about a concept. Or, it can be as significant as re-arranging your year plan to provide a spiraled curriculum for students. By approaching instruction from the perspective of learning consisting of three stages, students encounter desirable difficulties which support their development as independent learners. It is about making learning durable.

If you have any questions about approaching teaching from this broadened perspective of learning, please do not hesitate to reach me on Twitter at @dr_costello, via email at david@costellomath.com or on my newly created website at costellomath.com.

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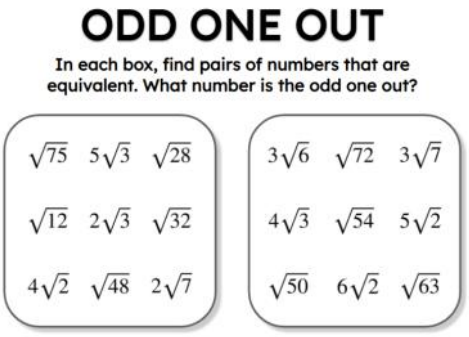
Odd One Out—Feedback with Self-Checking Routines

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

Self-checking activities are ones that include a way for students to see if they have answered practice questions correctly. When doing practice questions from a textbook, students can check their work by looking up the answers typically found in the back of the book. Seeing the answers however reduces the motivation to retry the problem. Ideally, self-checking activities will allow students to receive feedback on their work without revealing the exact answer.



Online formative assessment sites such as Quizizz.com and Kahoot.com offer students this type of immediate feedback. The online format however seems better suited to individual student work than to small group conversations.

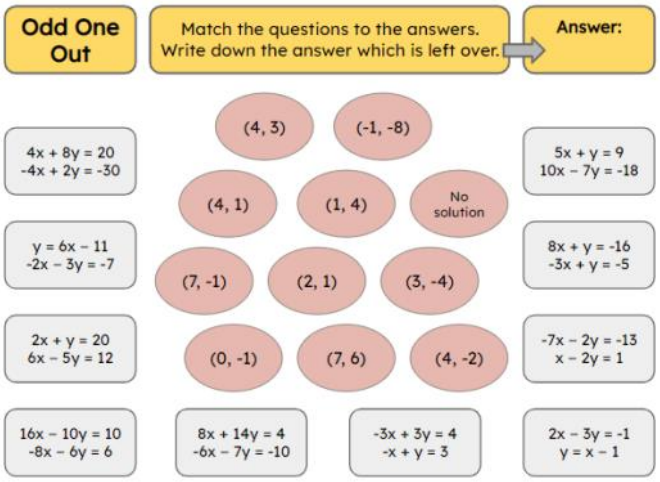
A self-checking activity that I've used recently is called "Odd One Out." Two different versions of this activity are shown at the bottom of this page. The example on the bottom left shows ten different systems of equations problems and a bank of eleven possible solutions. As students solve each problem, they will know it is correct if their solution is one of the possible answers in the centre. Once they finish all ten problems, the remaining solution is the "odd one out."

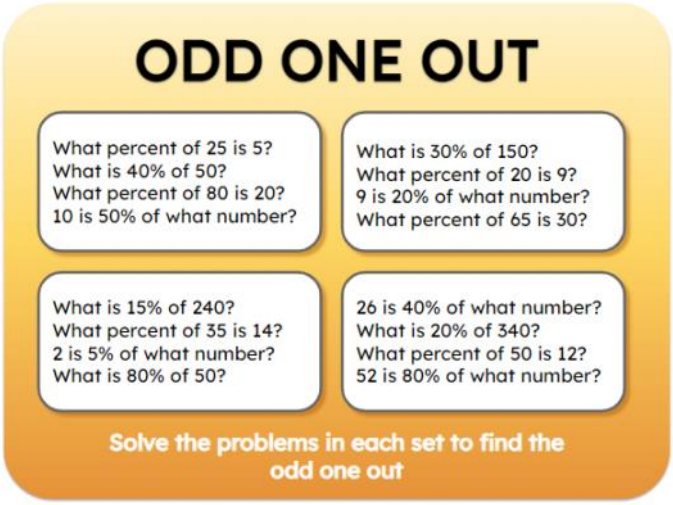
The example on the right side of the bottom of the page shows four sets of percentage problems to solve. All of the questions in each set have the same solution except for one. The goal is to identify the question with the "odd one out" solution.

Self-checking activities allow students to have immediate feedback on how they are doing. When these activities are completed in small groups, it gives students the opportunity for meaningful mathematics discussions. Students determine if they have the correct answers and if they don't, they can work together to determine where their mistake is. Because students can often find their own computational errors, these activities allow the teacher more time to support students with misconceptions and misunderstandings.

Craig Barton (@mrbartonmaths) highlighted Odd One Out activities in a "Maths Resource of the Week" in late 2016. He describes a few different varieties of this activity and also points to a variety of different examples of this resource.

Other favourite self-checking activities include Add 'Em Up, Scavenger Hunts, Row Games and Tarsia puzzles. Descriptions of these can be found at https://pbbmath.weebly.com/blog/self-checking-activities.



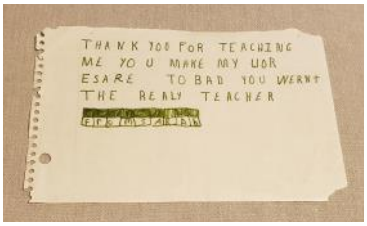


The Realy Teacher

By JoAnn Sandford (@joann_sandford), Junior High Mathematics Coach, Halifax Regional Centre for Education (HRCE).
Re-printed with permission from https://jsandfordmath.ca/2021/03/19/the-realy-teacher/

My mom was visiting this week and we got to reminisc-ing. A math teacher herself, we always have a lot to chat about. Today we were laughing about my first day as a "real" teacher. Well maybe not a real teacher – I was re-minded enough that first day that I was not, in fact, the real teacher. But it was my first day as a substitute – a paid gig. I was excited and nervous, but mainly excited. In for the day in a grade four class in my hometown of New Waterford, Nova Scotia. Grade 4's were scary. Younger than my comfort zone and probably super attached to their "real" teacher and their routines. I was going to mess it up. I was going to mess it up huge.

I was shown a bright, beautiful classroom with rows of tiny furniture. Excited. That's how I felt. This is what I want-ed: my own class to decorate and organize and breathe life into. Then I found the sub plan. It was a book. I could feel my pulse start to race…back to nervous. There was no time to read any of this. I saw the schedule, a list of spelling words, found a novel, and some math ques-tions. We would be fine? We would be fine. I took a few deep breaths and practiced my opening introduction and reviewed my expectations out loud to the empty desks. A throat cleared. A teacher from the neighboring room was there to show me where to collect my students from the line up out-side. She grinned as I turned a deep purple. "You'll do fine," she reassured me.



The day was a roller coaster of ups and downs. I used the wrong colour stars on the spelling chart and "ruined the whole thing" according to a little blond girl with curls. A few minutes before recess I tried to get the kiddos into their outside clothes and out to the playground only to discover that they needed easily five times the minutes I allotted to get ready. The bell rang to come in as we were making our way out. "Substitutes!" one little boy sighed rolling his eyes. Hilarious. I decided to take them out any-way and we had the playground to ourselves. "Best recess eva!" a few said. Back inside, the students couldn't agree on where the teacher left off in their read aloud book so I read one that I had brought, *Socks for Supper* by Jack Kent. We talked for a long time about the story and drew pictures until lunch time. Just when I thought I was win-ning them over the same know-it-all girl told me, "You were supposed to take us to the bathroom 15 minutes ago to wash our hands!" Yikes. Tough crowd.

The afternoon was better. The kids had music and gym and I went along with them as part of the class. They thought that was hilarious and awesome. I thought they were hilarious and awesome so of course I wanted to hang out with them. "You're better as a student", one of the kids said. I decided to take that as a compliment. The last class of the day was math. That seemed odd to me. I probably had that wrong. No – that was the schedule. A closer look revealed that the end of every day was math. Interesting. I told the kids that the best part of the day had finally arrived – math! They groaned. Some even looked nervous. Wow. Weren't these kids too young to have an opinion (never mind a negative one) about math? Apparently not. I powered through. I decided to ignore the lesson plan of drilling times tables and played a math game, had them guess my "Mystery Number" and then write as many questions as they could that had an answer of 5. We ended the day on a high note. Lots of sharing, happy faces, relaxed postures. "You are better at math than the other things", my biggest critic relented.

Learning from my earlier recess debacle I had those kids packed up and ready for the bus in record time. As they filed past me one quiet little girl shoved a note in my hands. It read, "Thank you for teaching me. You make my work easier. Too bad you weren't the realy teacher. From Sarah".
Yup – a pretty perfect day.

Adventures in Logic and Reasoning

Pennywise - A Simple Game with Coins

Pennywise is a game with simple rules that are easy to explain. It requires only a few coins to play. If coins are not available, numbered cards could also be used. It can be played and enjoyed by students at almost any grade level. A variety of mathematics outcomes can be address with this game including counting, addition and logical reasoning.

The Rules: Each player starts with an identical set of coins. One starting set might be 4 nickels, 3 dimes, 2 quarters and a loonie. Players take turns selecting a coin and playing it into the center. That player can then take back as many coins as they can, but the total must have a lower value that the coin they put in. For example if I put in a quarter, I could take out up to 4 nickels or 2 dimes or 2 nickels and 1 dime. The goal of the game is to not run out of coins. When one player is out of coins, the other player adds up the value of their coins and records that as their score. This game is available as a free print-and-play game. A copy of the rules and more information about the game including some variations is available at the following site: https://cheapass.com/free-games/pennywise/

This game is in the category of combinatorial games. A combinatorial game is one where there are two players who alternate taking turns and there are is no element of chance (e.g. rolling a die). A combinatorial game also is one in which both players have perfect information and there is always a winner (i.e. there is no way for players to tie). Other examples of combinatorial games are chess, checkers and dots-and-boxes.

Challenge students to develop a strategy for this game. Is it better to play first or second? It is better to start with your smaller coins or with your larger coins? Sometimes playing this game with just two or three coins for each player may help students discover a strategy by limiting the number of choices available.

Tinkering with Numbers—Persistence of a Number

In mathematics, the **persistence of a number** is the number of times one must apply a given operation to an integer before reaching a fixed point at which the operation no longer alters the number.

The multiplicative persistence of 39 is 3, because it takes three steps to reduce 39 to a single digit: 39 (3*9)→ 27 (2*7) → 14 (1*4) → 4. Also, 39 is the smallest number of multiplicative persistence 3.

There is only one number less than 100 that has a multiplicative persistence of 4. Can you find it? Can you find a number with a multiplicative persistence of 5?

The website Play With Your Math has a description of this puzzle along with a pdf that can be downloaded.

Another site to read about the persistence of a number is on the Math Pickle website. There is site hosts a video that students could watch to learn more about these special numbers.

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).

Name	Position	Contact
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 eplee@nstu.ca. We look forward to hearing from you!

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The opinions expressed are not necessarily those of the Editor, the NSTU, or the MTA.