The Variable

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Saskatchewan Mathematics Teachers' Society

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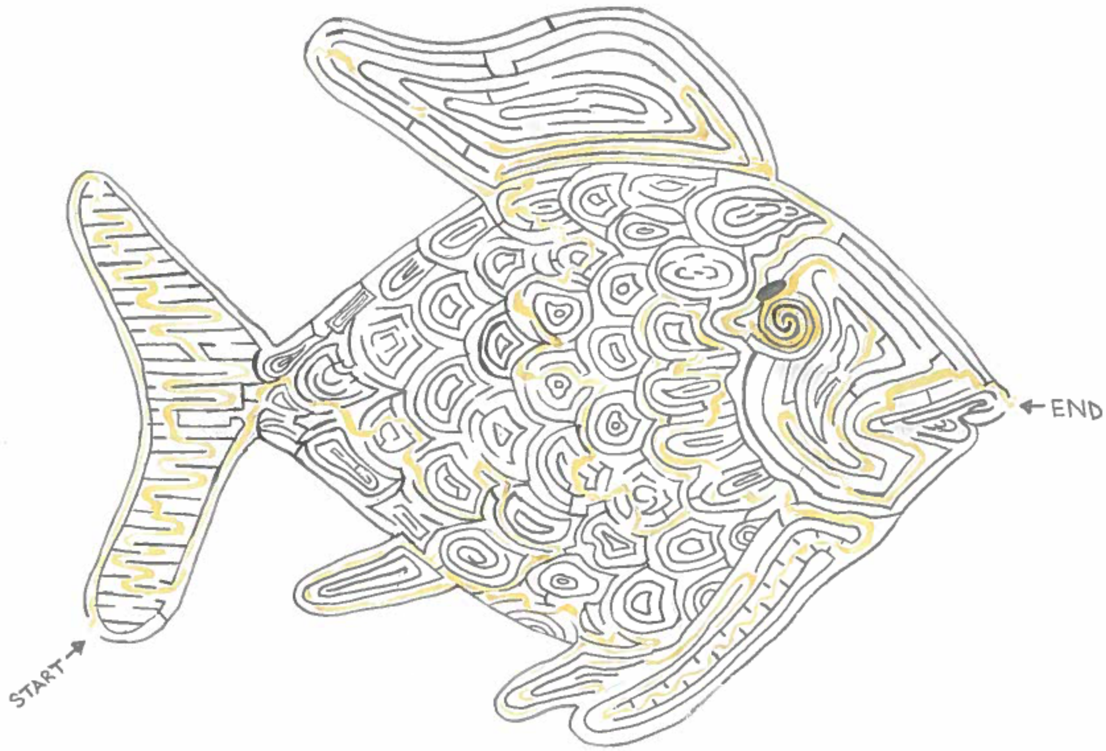

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Saskatchewan Mathematics Teachers' Society

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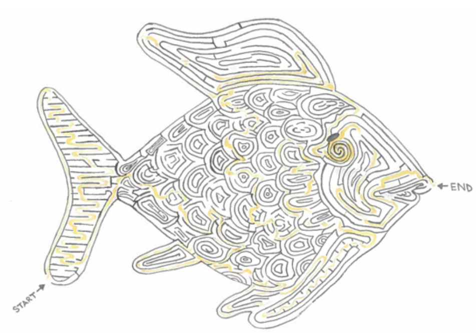


"This piece was created by one of my Grade 9 students as part of a design project, where students worked on spacing and placements of curves to create a maze within a picture from nature."

Sharon Harvey, Saskatoon Public Schools

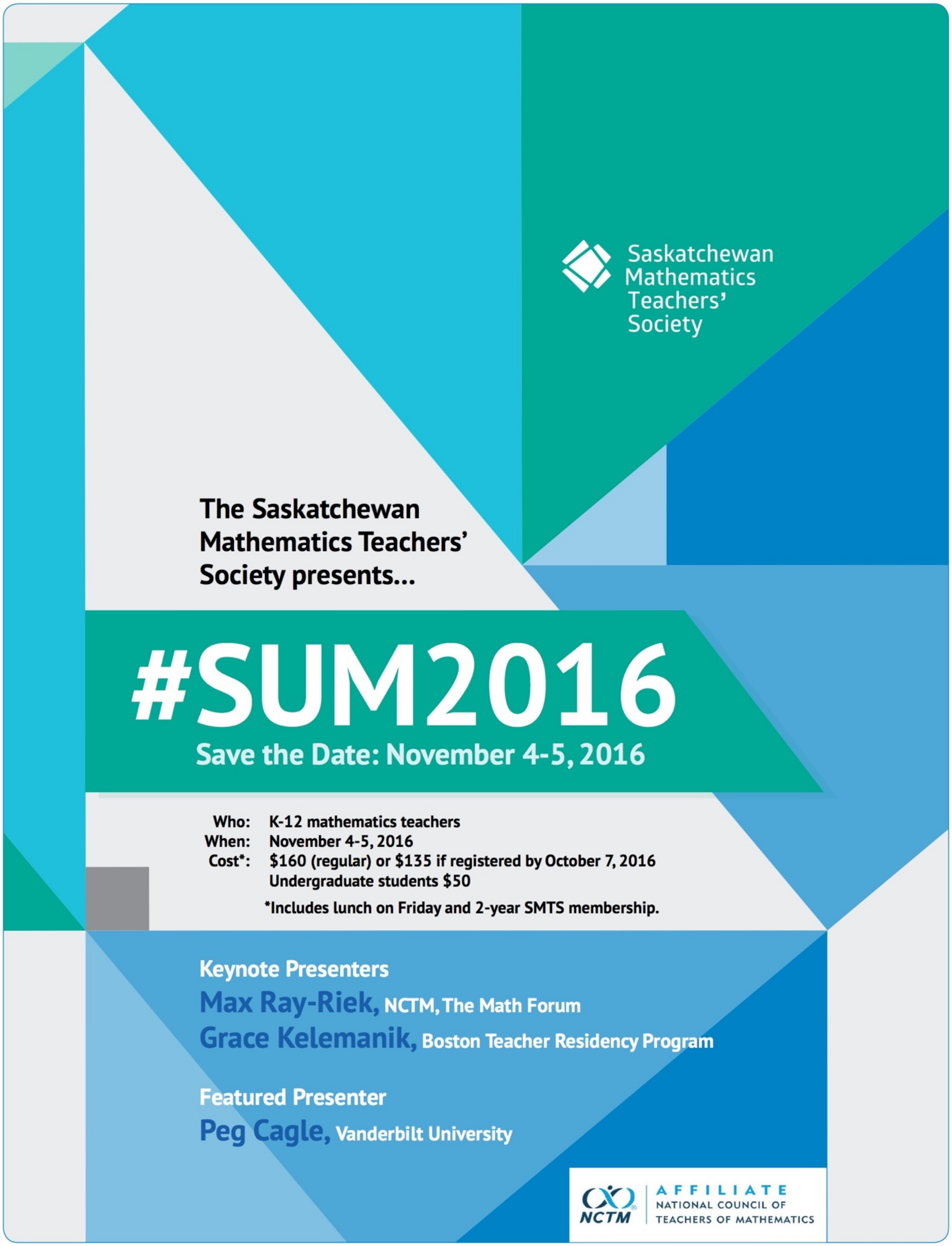
Notice to Readers

The views expressed in *The Variable* are those of the author(s), and not necessarily those of the Saskatchewan Mathematics Teachers' Society. In the publishing of any works herein, the editorial board has sought confirmation from all authors that personal quotes and examples have been included with the permission of those to whom they are attributable.

Notice to Contributors

The Variable welcomes a variety of submissions for consideration from all members of the mathematics education community in Canada and beyond, including classroom teachers, consultants, teacher educators, researchers, and students of all ages, although we encourage Saskatchewan teachers of mathematics as our main contributors. Submitted material is assessed for interest, presentation, and suitability for the target audience.

Please submit articles by email to thevariable@smts.ca in Microsoft Word format. Articles should be limited to 3000 words or less; authors should also include a photo and a short biographical statement of 75 words or less. Accepted contributions are subject to revision. Editors reserve the right to edit manuscripts for clarity, brevity, grammar, and style.



Saskatchewan Mathematics Teachers' Society
The Saskatchewan Mathematics Teachers' Society presents...
#SUM2016
Save the Date: November 4-5, 2016
Who: K-12 mathematics teachers
When: November 4-5, 2016
Cost*: $160 (regular) or $135 if registered by October 7, 2016
Undergraduate students $50
*Includes lunch on Friday and 2-year SMTS membership.
Keynote Presenters
Max Ray-Riek, NCTM, The Math Forum
Grace Kelemanik, Boston Teacher Residency Program
Featured Presenter
Peg Cagle, Vanderbilt University
NCTM
AFFILIATE
NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Guest Editorial

Summer time!

We have made it halfway through. Only three more weeks until we finally get a break from summer!

Wait.

Did I really just write that? And, maybe even worse—did I really mean it?!?!

I did! Don't get me wrong—I enjoy summer immensely. I like camping, hiking, and hammocking my days away, but I also miss students. I miss watching them learn. I miss problem solving with them. And I miss them laughing at all my bad jokes.

This fall holds new and exciting things for me. (Well, I suppose that's true for all of us!) I will be joining a new staff at a new building. This is a first in my career—I have taught in the same building since I interned there many years ago. I can't wait to create a new learning space for my students and for me. I've spent time thinking about what I will put on the walls, on the shelves, on the boards. What is helpful, and what's just visual noise?

Last month I had a chance to attend Twitter Math Camp in Minneapolis, Minnesota (you will be able to read all about my experience in the next edition of *The Variable*). Among the many sessions I attended, I spent a great morning session with Max Ray-Reik—who will be a keynote speaker at SUM this fall—discussing what mathematical play is, and when play becomes mathematical. As teachers, do we guide it, or will students get there on their own?

As I reflect on the discussions at Twitter Math Camp and look forward to the fall, this publication couldn't have crossed my email at a more perfect time. In this issue, you and I are going to find awesome ideas for setting up our classrooms, some exciting problems to introduce on your first days back, as well as some new ideas for engaging children in mathematical play.

So I'm grabbing my iPod and heading to the hammock to dream of fall and fresh faces.

Happy summer!

Sharon Harvey

Problems to Ponder

Welcome to this month's edition of Problems to Ponder! Pose them in your classroom as a challenge, or try them out yourself. Have an interesting solution? Send it to thevariable@smts.ca for publication in a future issue of The Variable!

The sixth cent [1]

You toss a fair coin 6 times, and I toss a fair coin 5 times. What is the probability that you get more heads than I do?

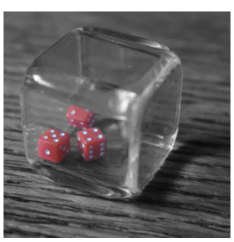
Dueling dice [2]

Consider the following four dice and the numbers on their faces:

- Red: 0, 1, 7, 8, 8, 9
- Blue: 5, 5, 6, 6, 7, 7
- Green: 1, 2, 3, 9, 10, 11
- Black: 3, 4, 4, 5, 11, 12

The dice are used to play the following game for two people. Player 1 chooses a die, then player 2 chooses a die. Then, each player rolls their die. The player with the highest number showing gets a point. The first player to 7 points wins the game. If you are Player 1, which die should you choose? If you are Player 2, which die should you choose?

Two too many dice [3]



Suppose you have a clear, sealed cube containing three smaller, indistinguishable six-sided dice. How can you use this three-in-one die to simulate a single, six-sided die? (Bonus: How can you use the three-in-one die to simulate *two* six-sided dice?)

Sources

[1]*Adapted from* Barbeau, E. J., Klamkin, M. S., & Moser, W. O. J. (1995). *Five hundred mathematical challenges.* USA: The Mathematical Association of America.

[2]*Adapted from Duelling dice.* (n.d.). Retrieved from Mathematics Centre website: http://mathematicscentre.com/taskcentre/046dueld.htm

[3]*Adapted from* Parker, M. [standupmaths]. (2016, April 12). *The three indistinguishable dice puzzle.* Retrieved from https://youtu.be/xHh0ui5mi_E

Problems to Ponder, May Edition: Solutions

Edward Doolittle

"I'm giving solutions to the June edition problems before solutions to the May edition problems, because some of the June edition results are used to solve May edition problems." [Look for Dr. Doolittle's solutions to the June edition problems in last month's issue of *The Variable*! –Ed.]

The theme for this month's solutions is the transformation of one problem into another, to show that solving one problem can lead to the solution to another, seemingly unrelated problem.

Magic Decimals

In a magic square, the sums of the numbers in the rows, columns and diagonals are all equal. Use a 4x4 grid to make a magic square for these numbers: 0.1, 0.2, 0.3, 0.4, … 1.4, 1.5, 1.6.

Strangely enough, to solve this problem, we're going to go back to the last set of solutions and one of the new problems that I gave. In the solution to "Why has 6 afraid of 7?", I asked you to find an arrangement of 16 face cards into a 4x4 square such that each row contains all four face values and all four suits, and each column contains all four face values and all four suits. I said that you didn't have to make each diagonal follow this rule, but of course I wanted you to be ambitious and try to find an answer in which the diagonals contain all four face values and all four suits as well.

The following narrative or storyline works for this problem. (See https://en.wikipedia.org/wiki/Graeco-Latin_square for an outline.) We first put any four cards that work in the top row. To be specific, let's suppose they are the Ace of Spades (AS), King of Hearts (KH), Queen of Diamonds (QD), and Jack of Clubs (JC), with the face values in decreasing order and the suits in reverse alphabetical order. Any other four cards would work (but then the instructions below would have to change). We have the following arrangement:

A♠	K♥	Q♦	J♣
1	2	3	4

I've labelled some of the unfilled positions with numbers so that I can refer to them easily. We know that the cards in positions 1 and 2 can't be aces and can't be spades because of the ace of spades in the first column and in the diagonal. However, the second row must contain an ace and a spade, so the ace and the spade have to be in positions 3 and 4. Since the ace of spades has already been used up, the card in position 3 is *either* an ace *or* a spade. Let's be ambitious and assume that it's an ace, and see where that gets us. (If you're really ambitious, you'll assume that it's a spade and then try to solve the problem on your own from there.)

The ace in position 3 cannot be a diamond (because of the column), a club (because of the diagonal), or a spade (because AS has been used already), so it must be AH:

A♠	K♥	Q♦	J♣
		A♥	
	1		2
	3		4

Now, the ace of clubs cannot go into positions 2 or 4 (club in the column) or into position 1 (ace in the diagonal), so it must go into position 3.

A♠	K♥	Q♦	J♣
		A♥	
	A♣		

The fourth ace's position is now completely determined:

A♠	K♥	Q♦	J♣
		A♥	1
	2		A♦
	A♣	3	

Now, let's put in the other spades. Because of the position of AS, the only places where we can put them are labelled 1, 2, 3 in the diagram above. Position 2 cannot be A, K (column) or J (diagonal), so it must be QS. Position 1 cannot be J or A (column), or Q (used), so it must be KS. Then JS goes into position 3.

A♠	K♥	Q♦	J♣
		A♥	K♠
	Q♠		A♦
	A♣	J♠	

Now we can complete the second, third, and fourth columns. In each case, there's only one face and one suit missing, so the choice is dictated:

A♠	K♥	Q♦	J♣
	J♦	A♥	K♠
	Q♠	K♣	A♦
	A♣	J♠	Q♥

And finally, we can complete the second, third, and fourth rows. In each case, there's only one face and one suit missing, so again, the choice is dictated:

A♠	K♥	Q♦	J♣
Q♣	J♦	A♥	K♠
J♥	Q♠	K♣	A♦
K♦	A♣	J♠	Q♥

You should check that each card is used exactly once; that each row contains each face value and each suit; that each column contains each face value and each suit; and that each diagonal contains each face value and each suit. So the resulting square is a solution to both our more ambitious problem and the original problem.

We have solved last month's problem in a straightforward manner, but what does this have to do with May's problem about magic squares? Here's the transformation: Let J = 1, Q = 2, K = 3, A = 4, and for the suits, let C = 0, D = 4, H = 8, and S = 12. The total for AS = 4 + 12 = 16, and so on for each of the cards. Applying the transformation to the solution to the previous problem… we get a magic square!

16	11	6	1
2	5	12	15
9	14	3	8
7	4	13	10

Why does this work? Because any column contains each suit, the sum of the suits is always 0 + 4 + 8 + 12 = 24, and because the column contains each face value, the sum of the face values is 1 + 2 + 3 + 4 = 10, giving a total of 24 + 10 = 34 for each column. The same reasoning applies to the rows and the diagonals, so the solution to last month's problem gives us a magic square for free.

This still isn't the solution to the problem given, but I hope you can see the transformation required to take the above magic square into the answer: Divide each number by 10! We thus have

1.6	1.1	0.6	0.1
0.2	0.5	1.2	1.5
0.9	1.4	0.3	0.8
0.7	0.4	1.3	1.0

Now each row, column, and diagonal adds up to 3.4 instead of 34.

As an additional, related question, you should go back to the beginning of our card arrangement solution and take the alternative path, where the card in position 3 is a spade instead of an ace. After you go through all of the steps, you should obtain a different solution. The Wikipedia article to which I referred earlier states incorrectly that this second solution can't be derived from the first answer (the one we obtained in detail) by a permutation. See if you can find a permutation which takes the first solution to the second. As a consequence, all solutions to the card distribution problem can be found by permutations of the face values and suits and the additional transformation that takes the first solution to the second solution. It follows that there are 4! x 4! x 2 = 1152 solutions to the card problem.

An observation that you could make about the magic square we obtained is that many of the 2x2 sub-squares also add to the magic number 34, but not all of the 2x2 sub-squares have that property. Can you think of a way to improve our construction procedure so that more (or all) of the 2x2 sub-squares add up to 34?

Here is another, similar problem. Consider the following game: The numbers 1, 2, 3, 4, 5, 6, 7, 8, 9 are written on a piece of paper. I go first, and take one of the numbers for my own (I erase it from the common pool and write it on my own sheet of paper). You do the same on your turn. We continue, alternating turns. The first person to have three numbers with a sum of exactly 15 in their collection is the winner. Can you figure out an optimal strategy for the game? Does it matter who goes first?

Remainders

a) *What is the smallest positive integer that leaves a remainder of 1 when divided by 2, remainder of 2 when divided by 3, a remainder of 3 when divided by 4, and so on up to a remainder of 9 when divided by 10?*

For this problem, we make a simple, yet strange transformation that makes it almost trivial to solve. Instead of trying to find the smallest positive number with all the listed properties, we try to find the smallest (in absolute value) *negative* number. But for this to make sense, we need to think a little bit about what we mean when we divide with a remainder with negative numbers.

Consider the simple example 7 divided by 2. If we just divide as if by calculator, 7/2 = 3.5, we don't get division with remainder, so we need to express ourselves in a different manner without using the / symbol. Instead, we write the following equation: 7 = 2 x 3 + 1. In general, we have dividend = divisor x quotient + remainder.

Now what happens if we divide -7 by 2? We can just multiply the whole equation by -1 to get -7 = 2 x (-3) + (-1). That's a true statement, but it looks like we have a negative remainder, which isn't allowed in the kind of division with remainder that we're talking about. So we fix the division in the following manner, by adding 0 = 2 x (-1) + 2 x 1 to the equation: -7 = 2 x (-3) + 2 x (-1) + 2 x 1 + (-1). Then we apply the distributive law and do a little arithmetic to get -7 = 2 x (-4) + 1. This gives a positive remainder of 1 and a quotient -4, correct and slightly different from our incorrect answer above.

Now let's think about the smallest negative integer (in terms of absolute value), -1, and what happens when I divide it by 2, 3, 4, etc. We have the division equations

`-1 = 2 x -1 + 1` (quotient -1, remainder 1)
`-1 = 3 x -1 + 2` (quotient -1, remainder 2)
`-1 = 4 x -1 + 3` (quotient -1, remainder 3)
`-1 = 5 x -1 + 4` (etc.)

In other words, -1 is the answer to our problem! It gives a remainder of 1 when we divide by 2, a remainder of 2 when we divide by 3, and so on, up to a remainder of 9 when we divide by 10.

Now, how do we transform back to the original problem and find the smallest *positive* integer that has the required properties?

Notice that if we add any multiple of 2 to -1, the remainder upon division by 2 doesn't change, so for example -1 + 22 = 21 = 2 x 10 + 1. The quotient has changed, but the remainder hasn't. Similarly, if we add any multiple of 3 to -1, the remainder upon division by 3 doesn't change. And so on. So what we need to do is add to -1 the smallest number which is a multiple of 2, and a multiple of 3, and 4, and 5, and so on up to 10. In other words, we need to add to -1 the least common multiple (LCM) of 2, 3, …, 10. This seems like a long calculation, but it isn't so bad when we break it into chunks. LCM(2,3) = 6. LCM(2,3,4) = LCM(6,4) = 12. LCM(2,3,4,5) = LCM(12,5) = 60. LCM(2,…,6) = LCM(60,6) = 60. LCM(2,…,7) = LCM(60,7) = 420. LCM(2,…,8) = LCM(420,8) = 840. LCM(2,…,9) = LCM(840,9) = 2520. Finally, LCM(2,…,10) = LCM(2520,10) = 2520. (See http://oeis.org/A003418.)

So if we add -1 + 2520 = 2519, we get a number with all the divisibility properties that we need (you should check them!). It should also be the smallest positive number with those properties (I'll leave you to think about exactly why it's smallest).

b) *Dr. Theta wants to divide his class into equal groups. When he tries to divide his students into 5 groups, there are 2 students remaining without a group. He then tries to divide the students into 7 groups, but this leaves 3 students without a group. When he tries to divide the students into 9 groups, there are 4 students remaining. What is the smallest possible number of students in Dr. Theta's class?*

This doesn't work out quite so nicely as the previous example, so we're going to try a different kind of transformation, a transformation to geometry.

First, to simplify the problem, let's just consider the first two conditions: when we divide the number N of students in the class by 5 we get a remainder of 2, and when we divide the number N of students in the class by 7 we get a remainder of 3.

Let's systematically go through a few possibilities and see what kind of remainders we get. If we divide 0 by 5 we get a remainder of 0, and if we divide 0 by 7 we also get a remainder of 0, so we graph 0 at the point (0,0) on the (x,y)-plane:

```
y
6 |
5 |
4 |                 4
3 |              3
2 |           2
1 |        1
0 |  0
  +--------------
x    0  1  2  3  4
```

Similarly, we know where to graph 1, 2, 3, 4. However, the next number, 5, has remainder 0 when divided by 5 and remainder 5 when divided by 7, so it goes to position (x,y)=(0,5):

```
y
6 |     6
5 |  5
4 |                 4
3 |              3
2 |           2
1 |        1
0 |  0
  +--------------
x    0  1  2  3  4
```

The number 6 is placed to the upper right of 5. But the next number 7 has remainder 2 when divided by 5 and remainder 0 when divided by 7, so we pop down to the bottom and start working our way up from there:

```
y
6 |     6
5 |  5
4 |                 4
3 |              3
2 |           2     9
1 |        1     8
0 |  0        7
  +--------------
x    0  1  2  3  4
```

The next number, 10, has remainder 0 when divided by 5 and remainder 3 when divided by 7:

```
y
6 |     6    13
5 | 5    12
4 |   11        4
3 |10        3
2 |       2     9
1 |     1    8
0 | 0     7
  +-------------
x   0  1  2  3  4
```

The pattern should be clear now. We add numbers to the picture in sequence, going up and to the right, until we bump into an edge of the rectangle. If we bump into the left edge, we jump over to the right side and continue. If we bump into the top edge, we jump down to the bottom side and continue. We can now completely fill in the picture:

```
y
6 |20  6 27 13 34
5 | 5 26 12 33 19
4 |25 11 32 18  4
3 |10 31 17  3 24
2 |30 16  2 23  9
1 |15  1 22  8 29
0 | 0 21  7 28 14
  +-------------
x   0  1  2  3  4
```

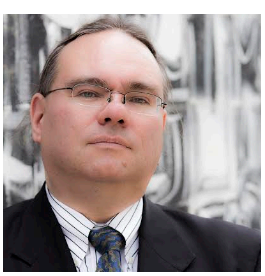
The question that started us on this process was to find the number N which gives remainder 2 when divided by 5 and remainder 3 when divided by 7. That is the number at point (2,3) on our picture. We can immediately see that the answer is 17. One more important point: The whole picture cycles with a cycle of 35 (the number 35 would be placed at the point (0,0) on the graph, and we would continue from there). So we can conclude that the number *N* of students in the class, when divided by 35, would give a remainder of 17.

So we have reduced our problem to that of finding a number *N* which gives a remainder of 4 when divided by 9 and a remainder of 17 when divided by 35. Guess what? We can do the same process again, plotting remainders when divided by 9 on the x-axis and remainders when divided by 35 on the y-axis:

```
 y
34 |               139 104  69  34
33 |           138 103  68  33
32 |       137 102  67  32
31 |   136 101  66  31
30 |135 100  65  30
29 | 99  64  29                     134
28 | 63  28                     133  98
27 | 27                     132  97  62
26 |                    131  96  61  26
25 |                130  95  60  25
24 |            129  94  59  24
23 |        128  93  58  23
22 |    127  92  57  22
21 |126  91  56  21
20 | 90  55  20                     125
19 | 54  19                     124  89
18 | 18                     123  88  53
17 |                157 122  87  52  17
16 |            156 121  86  51  16
15 |        155 120  85  50  15
14 |    154 119  84  49  14
13 |153 118  83  48  13
12 |117  82  47  12                     152
11 | 81  46  11                     151 116
10 | 45  10                     150 115  80
 9 |  9                     149 114  79  44
 8 |                148 113  78  43   8
 7 |            147 112  77  42   7
 6 |        146 111  76  41   6
 5 |    145 110  75  40   5
 4 |144 109  74  39   4
 3 |108  73  38   3                     143
 2 | 72  37   2                     142 107
 1 | 36   1                     141 106  71
 0 |  0                     140 105  70  35
   +-----------------------------------
 x    0   1   2   3   4   5   6   7   8
```

We can stop after filling in the number at position (4,17), which is 157. Therefore, 157 is the answer to our question. Let's double check: 157 = 5 x 31 + 2, so we have a remainder of 2 when dividing by 5; 157 = 7 x 22 + 3, so we have a remainder of 3 when dividing by 7; 157 = 9 x 17 + 4, so we have a remainder of 4 when dividing by 9.

Even though we could stop before completing the last table, it was still a lengthy process. So your final problem for this month is to figure out a pattern in row 17 that will allow you to complete just that row without doing the whole table. Your method should be applicable to other similar problems. As a check for your ideas, try to find the smallest number which gives remainder 3 when divided by 4, remainder 1 when divided by 5, and remainder 5 when divided by 7.



Edward Doolittle is Associate Professor of Mathematics at First Nations University of Canada. He is Mohawk from Six Nations in southern Ontario. He earned his PhD in pure mathematics at the University of Toronto in 1997. Among his many interests in mathematics are mathematical problem solving, applications of mathematics, and Indigenous mathematics and math education. He is also a champion pi-day debater at the University of Regina's annual pi day, taking the side of the other transcendental number, e.

Reflections

Reflections *is a monthly column for teachers, by teachers on topics of interest to mathematics educators: lesson plans, book/resource reviews, reflections on classroom experiences, and more. If you are interested in sharing your own ideas with mathematics educators in the province (and beyond), consider contributing to this column! Contact us at* thevariable@smts.ca.

Extreme Math Camp 2016

Amanda Culver

This month, twenty-five students from across Saskatoon decided to delay their summer holidays in order to engage in three days of mathematics enrichment at Extreme Math Camp 2016. Presenters from Saskatchewan and Ontario were brought together on July 4th-6th to offer new perspectives and new challenges to mathletes from Grades 7 to 10.

Peter O'Hara (left), Michael Minou (right)

Michael Miniou (Outreach Officer for the Centre for Mathematics Education and Computing at the University of Waterloo, Ontario) shared his angle on analytical geometry and demonstrated real-life applications of mathematics. String-drawing techniques introduced students to indirect proofs for conic sections.

Peter O'Hara (retired math teacher from London, Ontario) challenged students, presenters, volunteers, and teacher supervisors with a wide variety of pigeonhole and parity puzzles.

Dr. Gareth Griffith (retired mathematics professor from the University of Saskatchewan) gave students a historical account of Euler and Plato, two famous mathematicians, and their influence on modern-day topology, via storytelling.

Peter O'Hara working through a problem with a student

Andrew Kim and Daniel Zhou (senior students at Walter Murray Collegiate Institute and Centennial Collegiate, respectively) shared their understandings of number theory and engaged students in various problem-solving opportunities.

Stavros Stavrou (Outreach Officer at the University of Saskatchewan) provided students with a hands-on experience related to cryptography, building on knowledge from last year's Math Camp.

Throughout the three days, students were consistently challenged as they explored various aspects of mathematics from some of the best presenters our country has to offer. Team problem-solving activities and opportunities to play a variety of logic and geometrical games provided additional learning experiences. Special thanks goes out to two of Walter Murray's top math students, Yiwen Li and Rylan Smith, who helped make each day run smoothly, and to Saskatchewan Mathematics Teachers' Society, the Department of Math and Statistics at the University of Saskatchewan, and the Saskatoon Public School Board for providing funds to make the math camp possible.

Here's what some students had to say:

- "3 days isn't enough… We need a semester!"
- "I love how involved we were and the enthusiasm. Way more of a challenge than school (which I loved)."
- "I really enjoyed how enthusiastic all the speakers were. It was more fun than I thought it was going to be!"

We also captured the attention of the media! Read more about Extreme Math Camp 2016 at:

- The Saskatoon Homepage (http://www.saskatoonhomepage.ca/local-news/75139-students-learning-math-for-real-life-situations-at-math-camp);
- The Star Phoenix (http://thestarphoenix.com/news/local-news/kids-get-a-taste-of-new-problems-at-extreme-math-camp).

Be on the lookout for information about next year's Extreme Math Camp, to be held at the end of the 2016/2017 school year, in May 2017. Any inquiries can be made to Janet Christ or Amanda Culver (of Walter Murray Collegiate Institute, 306-683-7850) or Cam Milner (of Centennial Collegiate, 306-683-7950).

We hope to see your students there!

Amanda Culver has been a French and mathematics secondary teacher within the province of Saskatchewan for four years. She aims to make her classroom a safe and supportive space to be and to learn mathematics. Amanda's closet is full of math t-shirts, and she got a "pi" tattoo on Ultimate Pi Day. Needless to say, she loves math!

Spotlight on the Profession

In conversation with Dr. Rick Seaman

In this monthly column, we speak with a notable member of the Western Canadian mathematics education community about their work and their perspectives on the teaching and learning of mathematics. This month, we had the pleasure of speaking with Dr. Rick Seaman.

Rick Seaman is a retired professor of mathematics education at the University of Regina. Prior to completing his Ph.D. and beginning his 19 year teaching career at the University of Regina, Rick taught at the Regina Board of Education for 25 years, where he was instrumental in implementing the International Baccalaureate subsidiary and higher level mathematics programs at Campbell Collegiate. A year after defending his dissertation, Rick received the 1996 Wilfred R. Wees Doctoral Thesis Award from the Canadian College of Teachers.

Rick has also regularly volunteered his time coaching baseball and football, leading coaching clinics and coaching at levels ranging from youth teams to the Regina Red Sox and the University of Regina Rams. He held a variety of volunteer administrative positions, including serving as Commissioner of High School Hockey and President of the Regina Intercollegiate Football Coaches' Association. He has been recognized multiple times for his devotion and passion for coaching. In 1997, the Saskatchewan Roughriders recognized him for encouraging and supporting amateur football in the province of Saskatchewan. More recently, he was honoured as the 2014 Football Canada Gino Fracas Award recipient presented to the CIS Assistant Coach of the Year and was the Special Guest at the 63rd Annual Luther Invitational Basketball Tournament in 2015.

Part I: Questions, Dissertation, Forks…

Before going on to teach mathematics in high school, you obtained both a Bachelor's and a Master's degree in mathematics. What drew you to teaching at the high school level?

While I was a graduate student of mathematics at the University of Regina, I was on scholarship and teaching undergraduate mathematics classes. During the month of May, the year before I graduated with my Master of Arts degree in mathematics, I substitute taught high school mathematics at Martin Collegiate in Regina. During that month, I also volunteered to help coach the high school baseball team, and in the fall, the football team. After graduating the following spring, I was asked by a committee member to accompany him to the University of Alberta to work on a Ph.D. in mathematics. However, I chose to remain in Regina and obtain my Bachelor of Education After Degree at the University of Regina with a major in mathematics and a minor in physics. That fall, I began teaching mathematics in grades 8–12 at Campbell Collegiate in Regina.

Comment: Looking back, it is interesting how the last paragraph illustrates some of the forks we encounter in our journey down the road of life!

After twenty-five years of teaching mathematics in grades 8 through 12, you returned to university to earn a Doctorate in Curriculum and Instruction. Could you talk about the research that you did for your doctoral thesis (which would go on to win a National Doctoral Thesis Award in 1996), and why you decided to pursue a career in academia?

The award was a culmination of learning from students I had taught, mathematics education professors, colleagues throughout my career of teaching mathematics, and an academically strong cross-disciplinary dissertation committee chaired by supervisor Dr. Peter Hemingway of the Faculty of Education at the University of Regina.

Dissertation: "Effects of Understanding and Heuristics on Problem Solving in Mathematics"

Abstract: The study was designed to investigate the effect of an integrated approach to daily instruction in problem solving on problem understanding, problem representation and solution, and heuristics of students enrolled in a first-year university mathematics class. Two first year mathematics classes (one instructed and one comparison), participated in the 12-week study. The instructed group (n = 21) practised several cognitive strategies based on problem representation and solution and applied these cognitive strategies to three mathematical structures. Each class focused on the knowledge needed to represent and solve problems, but the comparison group (n = 28) approached representation less systematically. The instructed students' problem representations and solutions were assessed analytically by means of a structured worksheet. The instructed group was significantly better in their problem understanding, problem representation and solution, and use of heuristics than the comparison group. A transfer task was administered upon conclusion of the course and a maintenance task seven weeks after course completion. The instructed group showed transfer on relational and proportion isomorphic problems. The transfer task was maintained over time. Overall, the results supported an integrated approach to daily instruction in problem solving. Further research is suggested to expand this beginning knowledge base.

Another fork in the road: Upon graduation, my wife and I took about a month to accept an offer to be seconded from the Regina Board of Education to the Faculty of Education at the University of Regina to teach mathematics education. This led to another fork in the road two years later, when I needed to decide whether to apply for a full-time tenure track appointment at the assistant professor level in mathematics education in the Faculty. I applied, and my application was successful.

Comment: Former K-12 colleagues regularly ask me what it was like to be at the university, and my response is, "I enjoy what I am doing, but I miss where I have been."

During your career, you must have observed many changes in mathematics education in the province and in the country. Could you talk about how the teaching and learning of mathematics has evolved since the 1970s, when you began teaching? What do you know now that you wish you had known as a beginning teacher in the 1970s?

After you teach for a while, some ideas appear to be cyclic or repackaged (e.g., the discovery approach, the inquiry-based approach, and teaching with Three-Act Tasks). What I wish I had realized earlier in my career was the importance of taking more time to make a question "irresistible," as Dan Meyer put it in his video on "Real-World Math" (https://www.youtube.com/watch?v=jRMVjHjYB6w). It is also interesting to note that in graduate school, "What is your question?" is a familiar query that grad students often hear from others.

A counterexample to my cyclic conjecture: The New Math! ☺

Full disclosure: Today, I wished I had read the book *How To Solve It* written by Stanford professor George Polya after I purchased it for my undergraduate mathematics education class, even though I realized later in my career that one had to teach mathematics in the field for four or more years to gain a deeper appreciation as to what the author was writing about in that book. I later made up for not reading it as a student many times over. ☺

Recent and ongoing developments in pedagogy that I'm excited about: The advent of social media and its possibilities for gaining and sharing knowledge, collective intelligence, learning networks, authentic learning (Twitter), flipped classrooms, critiquing mathematical pedagogy (YouTube, Kahn Academy), blogging, WolframAlpha's impact on teaching mathematical content…

Quote: "The smartest person in the room, is the room." David Weinberger ☺

Pedagogic satisfaction: To give one example, when a student comes to you and says, "You know, I had a problem at home that I was trying to solve. It was just proportional!"

Pedagogic accomplishment: As a teacher, you know that you have met a lofty goal if students understand what you mean when you state at the beginning of class, "You're not going to learn anything new today." ;-)

Math anxiety is an issue among both children and adults that has only recently (relatively speaking) been receiving the attention it deserves. You've discussed the phenomenon in some of your own work[1,2]*. What do you think teachers of mathematics can do to reduce math anxiety among their students? Speaking more generally, why should mathematics teachers in particular be concerned about the affective domain of their teaching, and what is the difference between "teaching people" and "teaching content"?*

Regarding "teaching people," "teaching content," and the affective domain, initially I would direct the reader to the article: "Let's talk about our ideas" on pages 60–67 in the Special Edition of *vinculum* [Volume 4, Issues 1&2 – *Ed*.].

To be a bit more specific, I will attempt to illustrate the difference between "teaching people" and "teaching content" with an example. It is always interesting when you meet/hear from a student a number of years later to note what they remember from having you as their teacher/coach. Yes, they might mention the content they have learned, or that you wore sandals, but you will notice that there is more:

Student: "He (Mr. Seaman) is one of the five influential people who helped shape my life. He threw out challenges and encouraged his students in ways that were effective and meaningful. I "got" calculus in grade 12 because of him and it has laid the foundation for almost everything since." Campbell Reunion, July 2015

[1]Seaman, C., Corbin-Dwyer, S., & Nolan, K. (2001) Breaking the cycle: Only 1920 more years to equity. *Journal of Women and Minorities in Science and Engineering*, *23*(7), 19-34.

[2]Seaman, C., Nolan, K., & Corbin-Dwyer, S. (2001). 'It wasn't something I was a part of ': Women's experience of learning math and science. In *Proceedings of WestCAST 2001*, February 21st – 24th, University of Calgary, AB.

You have coached football, including the University of Regina Rams, for many years. Clearly, your passion for football carried over into your teaching – in one of your articles published in the most recent issue of vinculum*, you wrote about how you brought data from the field into the classroom to motivate discussions about data management. (In fact, this issue – which is dedicated to Dr. Seaman's work, is a treasure trove of interesting real-world applications of mathematics.) How else has your experience as a coach affected your teaching of mathematics at the university and/or the undergraduate level? Inversely, (how) has mathematics affected your coaching?*

I answered a similar question when honoured at the *8th Annual University of Regina Rams Alumni Night* last year. A question was directed to me on stage by an alumnus: "You have coached both offense and defense, which position would you prefer to coach in football after all these years?" My response was "I don't coach positions – I coach people."

This quote from University of Regina Rams head coach Frank McCrystal might also shed some light: "Rick has been a totally committed coach from the first day he stepped on the field. He combines teaching methodology with classroom instruction and on-field practicum. He's exceptionally prepared with a clear vision of what he intends to communicate."

As a teacher, I have always been concerned with pedagogic detail, whether in the classroom or on the field.

Part II: Keeping the Dust off the Dissertation and Furthering the Conversation

How has your research (e.g., in cognitive strategies) been applied in the field of mathematics education (and, perhaps, beyond)? Through what avenues did you share your research with others in the mathematics education community?

Post-Secondary Application

I have had the cognitive strategies adopted by instructors in classes from disciplines other than mathematics. For example, Dr. Marie Iwaniw from the Faculty of Engineering at the

University of Regina said the strategies have been useful for her students: "The students have developed problem-solving skills that they can apply to other mathematically-oriented material." She added, "They have told me the problem solving methods presented in the strategy have helped them," and "I see the evidence of this when I evaluate their work."

The following were opportunities to keep the dust off the dissertation and further my conversations with educators about its pedagogic implications:

Talking about connections. (2012). Presented at the 2012 Canadian Mathematics Summer Meeting, Regina, SK.

Nobody asked me but "Why not teach conics?" (2010). Invitation to present at Sciematics 2010, Regina, SK. [Regretfully declined]

Problem solving and metacognition. (2010). Presented at the Prince Albert Grand Council Numeracy Focus Group Meeting, Prince Albert, AB.

Using a thinking strategy as a vehicle between the space of the classroom, the space of students' mathematical thinking and our teaching. (2009). In *Proceedings of WestCAST 2009,* University of Victoria, BC.

Can I take these activities home to share? No one will believe it! (2008). In C. Kesten (Ed.), *Proceedings of WestCAST 2008,* Regina, SK.

Representation and conjecturing in mathematics. (2004). Presented at Sciematics 2004, 21st - 23rd October, Saskatoon, SK.

Real-world problems: A judgment call for middle school mathematics teachers. (2003). *Canadian Journal of Science, Mathematics and Technology Education, 3*(2), 275-279.

Making connections to facilitate deeper and lasting understanding in mathematics. (2002). Presented at the National Council of Teachers of Mathematics Canadian Regional Conference, Regina, SK.

'It wasn't something I was a part of ': Women's experience of learning math and science. (2001). With K. Nolan & S. Corbin-Dwyer in *Proceedings of WestCAST 2001*, University of Calgary, AB.

Effects of cognitive strategy instruction on students' attitudes and beliefs toward problem solving and mathematics. (2000). Presented at WestCAST 2000, University of Regina, SK.

Encouraging expert-like thinking in mathematics. (1999). In J. G. McLoughlin (Ed.), *Proceedings of the 23rd Annual Meeting of the Canadian Mathematics Education Study Group* (p. 126), St. Catharines, ON: Brock University.

Have I seen a problem like this before? (1998). Paper presented at Focus 98, Regina, SK.

Cognitive strategy instruction in undergraduate mathematics education. (1997). Paper presented at the Second Annual Conference on Research in Undergraduate Mathematics Education, Mt. Pleasant, MI.

Part III: The Journey to the Question

Earlier, you noted that "What is your question?" is a familiar query posed to graduate students. Would you say that your research was driven by one (or several) underlying question(s) about the teaching and learning of mathematics? If so, how did you come upon it?

How many times have you heard a teacher say to a student, "WHY DON'T YOU THINK?" I have always wondered what the response would be if the student went blink-blink, and responded by asking the teacher "What do you mean by think?" This question was the catalyst for my dissertation.

"How many times have you heard a teacher say to a student, "WHY DON'T YOU THINK?" I have always wondered what the response would be if the student went blink-blink, and responded by asking the teacher "What do you mean by think?"

Upon returning to the campus after internship, all mathematics interns are responsible for writing a reflection paper about their internship experiences as an assignment for their last mathematics education class. One of the memorable papers that I received was written by a mathematics education student from 'southern' Saskatchewan who interned in La Loche in 2007.

After reading and discussing this student's paper, I added the option of an Introduction to Cree, Dakota, Dene, other Indigenous language to the Indigenous Studies requirement of the Secondary BEd Program Mathematics Major at the University of Regina. Both of us also believed that this reflection paper should be published, but unfortunately, after many attempts we were unsuccessful.

A few years later, in 2010, I was invited to present to the Prince Albert Grand Council Numeracy Focus Group Meeting a session on "Problem Solving and Metacognition." Afterwards, while I was reflecting on the session, I came to the conclusion that something was missing.

Yet another year later, in the fall, two educators dropped by my office to ask the following question: "How would you teach mathematics to First Nation and Inuit male youth with mental health or addiction problems?" My response was, "I wouldn't!" Continuing the discussion, I learned that these youth came from both on and off the reserve, where some didn't attend school while others had variable academic success. This led to a conversation about a horizontal curriculum (the precedence of cultural instruction within the classroom), with mathematics permeating each subject area and the "Creation Story" (see, e.g., https://www.youtube.com/watch?v=Qn0zJ1QH2Zc) central to all teachings and experiences.

To give one example, one activity the youth were involved in was making their own hand drum. The youth learn the process from the sweat before the hunt for hides, and use this knowledge to make their own hand drum. When they have all made their own personal hand drum, they are shown how much mathematics was used to make the hand drum, its relevancy, and – more importantly – that they could do the mathematics involved! Embedded in the lessons are values such as trust.

Like everything else in life, when you look back, you see a journey that consciously or unconsciously leads to the "irresistible" question that becomes a catalyst for your research. In this case, the resulting research could benefit not only La Loche, but also other communities.

In wrapping up this interview, I would like to come back to one of your earlier statements, where you said (speaking about your transition to the Faculty of Education at the University of Regina after 25 years as a classroom teacher), "I enjoy what I am doing, but I miss where I have been." Does this still apply today? What do you miss about teaching at the high school or university level?

If I returned to teach at the high school level I would say the same thing, but the other way around. I am a teacher.

How do you carry on the work of teaching today, in your retirement?

I have interesting conversations with researchers and professionals about their work, or in general, about why we teach mathematics.

Thank you, Dr. Seaman, for this opportunity to discuss your work. We look forward to continuing the conversation in the future!

Ilona Vashchyshyn

Building on Mathematical Thinking Through Play!

Jennifer Brokofsky

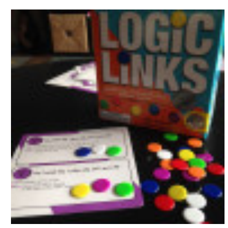
People of all ages love to play. Through play, conversations emerge, engagement increases, fun is had, and joy is sparked. These moments of play can also become powerful opportunities for learning. As a mathematics coordinator and as a mom, I am always looking for ways I can support mathematics learning though play. Time and time again, I have witnessed learners tackle complex thinking and problem-solving situations with persistence and joy while engaged in mathematical games. These same learners often shut down when faced with similar thinking situations that are presented in a traditional textbook question-and-answer format.

Games that support mathematical thinking can come in many forms. Some are games that you may already be familiar with, but never thought of as being mathematical. Some games may be new to you, offering unique ways to "play math."

Here are some of my current favorites.

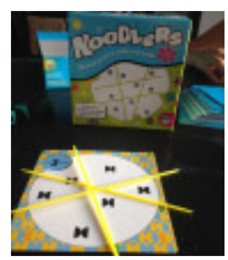
Games for Logical Reasoning and Spatial Sense – For Mathematicians of All Ages

Logic Links



A series of puzzles that really make you think. Each puzzle is comprised of a series of clues that are solved by arranging coloured chips in a certain order. This is a great game to develop logical thinking skills.

For example, one card asks the player to use only 1 blue chip, 1 green chip, and 1 white chip. Using those chips they need to arrange the three chips using only 2 clues. Clue 1: The blue chip and the green chip do not touch. Clue 2: the blue chip is directly on the left of the white chip.



Noodlers

This is a fantastic game for teaching spatial sense and problem solving. To play, you use a recommended number of sticks to separate each symbol on a given card into its own space.

Q-bitz Extreme

In this game, players each get their own Q-bitz Extreme board, 16 patterned cubes, and a Q-bitz card, then race to be the first to replicate the pattern and win the card.

Card Games

Quick confession… I love to play cards. It is a love that has been instilled in me by my parents and grandparents. Now, I am lucky enough to have my own kids picking up this love from my family. The joy for me comes not only from the games themselves, but from the memories of seeing four generations of my family sitting around a table, spending time together, engaged in conversation, and having fun.

My kids have three favorite games that they have been taught by their great-grandparents; they ask to play them every time we are all together. These games are great for the kids because they are easy to learn, and also allow them to use their ever-growing skills in mathematics.

Chase the Ace

To play this game, you need a standard set of cards and three counters per person (e.g., nickels, paperclips, buttons…). The dealer begins by dealing out one card to each player. Players then look at their card and determine whether they want to keep it or trade it. The object is to not be stuck with the lowest card (kings are high and aces are low). The player to the left of the dealer starts by either keeping their card or trading it with the person to their left. The player on the left must then hand over their card, unless they have a king. If they have a king, they are not required to trade and can flip the king face-up. If this happens, the original player must keep their card. The game continues around the table until every player has had a chance to determine if they want to keep or trade their card.

Once the play is back to the dealer, all players flip their cards face-up for all to see. The dealer, as the final player, can either keep the card they end up with or cut the deck. The card they cut becomes their card. The player with the lowest card places one of their counters into the pot. If more than one player has the lowest card, each player with the low card must place a counter into the pot. The cards are collected to be shuffled and dealt by the next player to the left of the dealer. In this way, the role of the dealer also goes around the table. Once a player loses all their counters they are out of the game. The winner is the last player to still have a counter.

The math in this simple game evolves with the player. Initially, young players may focus on identifying the relative value of the card you have (high or a low). Later, this game can be an engaging probability experiment which allows players to strategically reason through their choice to keep or trade a card.

Sticks – A Game of Sets and Runs

This is the current favorite around the table. All you need to play is a set of large Popsicle sticks (we bought ours from the Dollar Store) and a deck of cards. My mom actually made two sets: one that is more challenging, for the adults, and a junior version for the kids. This way, everyone can play together.

To play the game, you need two decks of cards and a set of sticks. The object of this game is to successfully accomplish the task on your stick before someone around the table goes out. The tasks involve getting "runs" (three or more cards of the same suit in sequence) and "sets" (three or more cards of equal value). Some examples of tasks are "1 run of 7 and 1 set," "1 run of hearts and 4 aces," and "2 sets of 4."

At the beginning of a round, each player randomly chooses a task stick. To go out, a player needs to get rid of all of their cards by laying out their own sets and runs, or by playing on the sets and runs of others. Each time a player accomplishes a task stated on their stick and turns it face up, they are able to get a new stick for the next round. The first person to earn seven sticks wins.

The math in this game also evolves with the player. Young players can focus on identifying cards that belong to sets or go together to form a run. Skills such as counting, identifying what is missing, and ordering are reinforced. Older players tend to focus more on probability by watching what opponents are playing and using that information to make strategic choices about what cards they should try to acquire to make sets and runs. In all cases players are thinking and problem solving.

Full rules can be found here; our list of Adult and Junior sticks can be found on my blog.

Uno

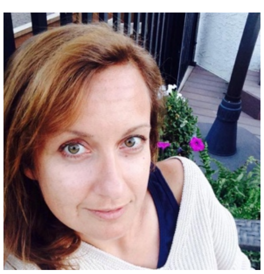
What can I say…we love this game. It's fun, it's easy, and there is nothing better that sticking a "Pick Up 4" to a loved one. (For those unfamiliar with UNO, the game is played using a deck of 108 cards in four-color suits, numbered from 0 through 9. The deck also includes "Skip" cards, "Draw Two" cards, "Reverse" cards, "Wild" cards, and "Wild Draw Four" cards. The object of UNO is to play all of the cards in your hand.) Playing the game can support the development of children's early math skills, including identifying numbers, basic counting, and matching.

> "If we can make joy, fun, and laughter as the goals of our playing time, the learning will follow."

For more games and resources, check out the links below:

- Games to Play with a Deck of Cards – This booklet was created by Math Coach's Corner (www.mathcoachscorner.com). It is a great collection of games that can be copied into a small booklet. I think this would make a great gift for families at a Math Night or at similar events.
- Acing Math – This 69 page booklet, created by the Positive Engagement Project (www.pepnonprofit.org), features games for Grade K though 6 students, all of which can be played with a standard deck of cards.

I hope the ideas shared give you some new ideas for ways to engage children in playing with their mathematics. If we can make joy, fun, and laughter as the goals of our playing time, the learning will follow.



Jennifer Brokofsky is the K-12 Coordinator of Mathematics for Saskatoon Public Schools. She is passionate about mathematics education, and believes in empowering students and teachers to feel ownership of, and become deeply engaged in their own learning. Her Masters work in Educational Technology and Design strongly influences her practice and her belief in the importance of technology as a tool to enhance and extend learning opportunities for all.

A New Classroom of Possibilities! The Environment as Third Teacher [1]

Anamaria Ralph

> *When teachers and parents find themselves in environments that are beautiful, soothing, full of wonder and discovery, they feel intrigued, respected, and eager to spend their days living and learning in this place. Aren't these the very feelings we want the children to have?*
>
> – Margie Carter, 2007, p. 25

> *There are three teachers of children; adults, other children, and their physical environment.*
>
> – Loris Malaguzzi

My teaching partner and I have spent quite some time planning and reflecting on the setup of our classroom environment. It's more than just decorating! Many factors played a part in creating an environment for children that acts as the third teacher.

You may be wondering what I mean by the environment acting as the "third teacher." According to Margie Carter,

> We must ask ourselves what values we want to communicate through our environments and how we want children to experience their time in our programs. What does this environment 'teach' those who are in it? How is it shaping the identity of those who spend long days there? (2007, p. 22)

This is where the reflecting piece came in for me. The following are a few factors that I felt were important to the design and setup of our Kindergarten classroom environment:

1. Flow in the room (allowing children to move freely between exploration areas, allowing for clear paths)

2. Accessibility of materials (supporting students' independence, self-sufficiency, and seeing themselves as capable learners)

3. Connecting home and classroom environment (creating softness; a safe, home-like feeling)

4. Starting with bare walls and being open to co-constructing the space with the children

5. Engagement with the natural world (connecting children with nature by using natural artifacts and taking part in experiences outdoors)

6. Creating an environment that fosters wonder, exploration, and curiosity (being intentional with the materials that are placed out for the children to interact with and explore)

7. Creating an environment that fosters respect for the materials used and for each other

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[1] A prior version of this article was published on August 30, 2014 on Anamaria's blog, *Wonders in Kindergarten* (http://wondersinkindergarten.blogspot.ca/). Reprinted with permission.

Without further ado, here are a few photos of our new classroom environment! But please note, it may change frequently based on the suggestions and needs of our students; as Gandini writes,

> In order to act as an educator for the child, the environment has to be flexible: it must undergo frequent modification by the children and the teachers in order to remain up-to-date and responsive to their needs to be protagonists in constructing their knowledge. (1998, p. 177)

Sand area

Light table area (various materials intentionally placed to explore light)

Writing area

Line provocation (exploring lines using different mediums, e.g. plasticine, crayons and paper, wire)

Art studio (mirror for sketching flowers, etc., adding another dimension)

Paint area (allowing for exploration using different-sized brushes and painting tools; clear containers to explore creating different colors)

A closer look at our arts studio (shelving unit to the left contains various recycled materials for creating)

Loose parts (recycled and natural materials for creating)

Discovery area

Construction (big blocks, recycled cardboard tubes, tree slabs)

Wonder Window (binoculars! I wonder what we'll see this year!

Playdough provocation (What can you create? Using corks, buttons, pebbles, shells, beads)

Math area

Reading/quiet area

As in many of the other spaces, students will find many open ended materials and loose parts in the math area. Dice, wooden numbers, ten frames, dot plats, rulers, and wooden shapes are placed in the area to entice and motivate an engagement with these materials. The Learning Carpet, with its square grid, is used by the students in many ways: for example, to create number lines and patterns, to sort objects, or to create concrete graphs. Books that include math-related concepts are also placed in the area to further encourage exploration of emerging mathematical understandings.

Although these materials are housed in the math area, students are encouraged to freely use them in all areas of the classroom as needed in order to further support the learning of mathematics in an authentic way.

Of course, the physical environment is only one of the "teachers" in our classroom. In my next article, I will describe in more detail our holistic approach to teaching mathematics in our Kindergarten classroom. [*Don't miss Anamaria's article, "Teaching math holistically in our classroom," in the next issue of* The Variable*! – Ed.*]

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Anamaria Ralph is a Kindergarten teacher for the Toronto District School Board. She teaches at Maurice Cody Public School in Toronto, Ontario. She has taught Kindergarten for nine years and still regards each year as an exciting adventure where many wonders, explorations, and investigations take place. She is passionate about inquiry and play-based learning, and is greatly inspired by the Reggio approach to learning. She shares her students' learning with families and other educators on her classroom blog, www.wondersinkindergarten.blogspot.ca, and can also be reached on Twitter at @anamariaralph.

Intersections

In this monthly column, you'll find information about upcoming math (education)-related workshops, conferences, and other events that will take place in Saskatchewan and beyond. If travel is not an option at this time or if you prefer learning from the comfort of your own home, see the Online workshops and Continuous learning online sections. Some events fill up fast, so don't delay signing up!

For more information about a particular event or to register, follow the link provided below the description.

Within Saskatchewan

Conferences

SUM Conference
November 4th – 5th, Saskatoon, SK
Presented by the SMTS

Our own annual conference! Join us for two days packed with learning opportunities, featuring keynotes Max Ray-Riek and Grace Kelemanik and featured presenter Peg Cagle. This conference is for math educators teaching in K-12, and registration includes lunch on Friday and a two-year SMTS membership. See the poster on page 3 for more information, and keep checking the SMTS website (www.smts.ca) in the coming months for registration details.

Presenters: Are you interested in presenting at SUM 2016? The SMTS is now accepting proposals for one-hour sessions focused on improving the teaching and learning of mathematics. Presenters receive one complimentary registration (includes lunch and a 2-year membership). Head to www.smts.ca/sum-conference/sum-call-for-proposals/ to submit your proposal.

Workshops

Number Talks and Beyond: Building Math Communities Through Classroom Conversation
August 15th, Saskatoon, SK
$110 (early bird), $150 (standard)
Presented by the Saskatchewan Professional Development Unit

Classroom discussion is a powerful tool for supporting student communication, sense-making and mathematical understanding. Curating productive math talk communities requires teachers to plan for and recognize opportunities in the live action of teaching. Come experience a variety of classroom numeracy routines including number talks, counting circles, quick images and more. Take math conversations to the next level by strengthening your skills as a facilitator of classroom discourse and student thinking.

See https://www.stf.sk.ca/professional-resources/professional-growth/events-calendar/number-talks-and-beyond-building-math

Structures for Differentiating Mathematics – Part Two
August 17th, Saskatoon, SK
$110 (early bird), $150 (standard)
Presented by the Saskatchewan Professional Development Unit

The journey continues! This workshop is for educators who have already attended the structures for elementary or middle years workshops and would like to continue refining their differentiation practices. We will share our experiences using the Assess-Respond-Instruct Cycle and then work collaboratively to plan new units of study or revise and improve existing materials.

See https://www.stf.sk.ca/professional-resources/professional-growth/events-calendar/structures-differentiating-mathematics-%E2%80%93

Structures for Differentiating Middle Years Mathematics
September 26th, Regina, SK
$110 (early bird), $150 (standard)
Presented by the Saskatchewan Professional Development Unit

We know that assessing where students are at in mathematics is essential, but what do we do when we know what they don't know? What do we do when they DO know? Student understanding does not change unless there is an instructional response to an assessment. This workshop will introduce an Assess-Respond- Instruct Cycle in mathematics, as well as responsive stations as a classroom structure to meet individual student needs, without having to create a completely individualized mathematics program in your classroom.

See https://www.stf.sk.ca/professional-resources/professional-growth/events-calendar/structures-differentiating-middle-years-2

Beyond Saskatchewan

MCATA Fall Conference 2016: Opening Your Mathematical Mind
October 21-22, Canmore, AB
Presented by the Mathematics Council of the Alberta Teachers' Association

Come join the Mathematics Council of the Alberta Teachers' Association in celebrating their annual fall conference "Opening Your Mathematical Mind" at the Coast Canmore Hotel & Conference Centre, 511 Bow Valley Trail, Canmore, Alberta. Featuring Keynote Speakers Dr. Peter Liljedahl of Simon Fraser University and Dr. Ilana Horn of Vanderbilt University. See https://event-wizard.com/OpeningYourMathmind/0/welcome/

Online Workshops

Math Daily 3
July 31th–August 22nd or *August 28–September 24*
Presented by the Daily CAFÉ

Learn how to help your students achieve mathematics mastery through the Math Daily 3 structure, which comprises Math by Myself, Math with Someone, and Math Writing. Allison Behne covers the underlying brain research, teaching, and learning motivators; classroom design; how to create focused lessons that develop student independence; organizing student data; and differentiated math instruction. Daily CAFE online seminars combine guided instruction with additional resources you explore on your own, and are perfect for those who prefer short bursts of information combined with independent learning.

The seminar includes:

- online access to videos, articles, and downloadable materials
- access to an exclusive online discussion board with colleagues
- a certificate of attendance for 15 contact hours

See https://www.thedailycafe.com/workshops/10000

Continuous Learning Online

Education Week Math Webinars
Presented by Education Week

Once a month, Education Weekly has a webinar focusing on math. They also host their previous webinars on this site. Previous webinars include Formative Assessment, Dynamic vs. Static Assessment, Productive Struggling and Differentiation.

Past webinars: http://www.edweek.org/ew/webinars/math-webinars.html
Upcoming webinars:
http://www.edweek.org/ew/marketplace/webinars/webinars.html

Call for Contributions

Did you just deliver a great lesson? Or maybe it didn't go as planned, but you learned something new about the complexities of teaching and learning mathematics. Maybe you just read a book or attended a workshop that gave you great ideas for presenting a topic your students have always found difficult, or that changed your perspective about some aspect of teaching. **Why not share your ideas with other teachers in the province – and beyond?**

The Variable is looking for a wide variety of contributions from all members of the mathematics education community in Canada and beyond, including classroom teachers, consultants and coordinators, teacher educators, researchers, and students of all ages. Consider sharing a favorite lesson plan, a reflection, an essay, a book review, or any other article or other work of interest to mathematics teachers in Saskatchewan. If accepted for publication, your piece will be shared, as part of this periodical, with a wide audience of mathematics teachers, consultants, and researchers across the province, as well as posted on our website.

We are also looking for student contributions, whether in the form of artwork, stories, poems, interesting problem solutions, or articles. This is a great opportunity for students to share their work with an audience beyond that of their classroom and their school, and for teachers to recognize their students' efforts during their journey of learning mathematics.

All work will be published under a Creative Commons license. If you are interested in contributing your own or (with permission) your students' work, please contact us at thevariable@smts.ca.

We look forward to hearing from you!