The Alberta Science Teacher

Volume 34, Number 2 September 2015

Swimming Gummy Bear

Contents

Editor's Message

Welcome to another exciting school year filled with possibilities! This issue of *The Alberta Science Teacher* highlights the tremendous efforts of dedicated science teachers in Alberta who are making a difference for their colleagues and students. Specifically, the process of blueprinting assessments and the importance of setting goals are emphasized.

Are you thinking about attending the upcoming joint science and math conference? Well, let me tell you about a conference experience I will never forget. At the 2013 Science Council conference, I had the opportunity to meet Canadian Space Agency astronaut Jeremy Hansen. I was amazed by the many training stories he shared during his keynote presentation, but even more amazing was how he casually attended the daily conference sessions just like any other delegate. The presenters were surprised by and excited about his presence and his engaging questions. Jeremy is and always will be a learner. His stories about astronaut training on Earth illustrate the statement (often attributed to Albert Einstein) that "we still do not know one thousandth of one percent of what nature has revealed to us."

Do you have some great stories or resources to share? Have you attended a fantastic PD activity? Or have you been doing something creative, innovative or inspiring with your students? If you answered yes, then please share your experience with others by submitting an article for the next issue of *The Alberta Science Teacher.* Please send your contributions to ayres@shaw.ca or trinity.ayres@cssd.ab.ca.

Looking forward to the next issue!

Trinity Ayres

President's Message

On behalf of the Science Council, I would like to congratulate you on the successful completion of another school year. It is through the dedication and commitment of teachers like you that Alberta continues to have one of the best education systems in the world.

I would also like to let you know about upcoming Science Council events and activities.

This year our annual conference will be jointly hosted with the Mathematics Council, October 23–24 at the Fantasyland Hotel in Edmonton. We are pleased to bring you two world-class keynote speakers: retired Canadian astronaut Chris Hadfield and mathematician and author Steven Strogatz.

Space is filling up quickly (as I'm writing this, registration is already 40 per cent full), so register soon at https://event-wizard.com/GeeksUniteMathScience/0/welcome/ or use the QR code below.

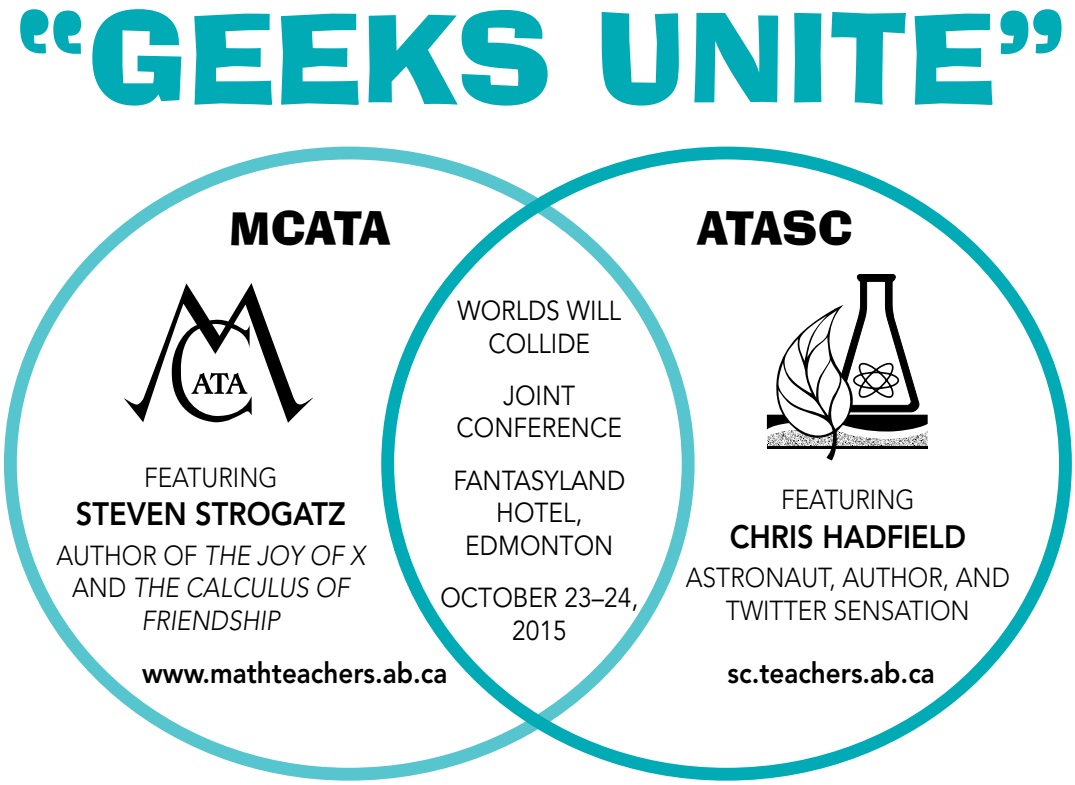
The Science Council executive is proposing some changes to our constitution. You should have already received a copy of the proposed changes in the mail. A copy has also been included with this issue of *The Alberta Science Teacher.*

Please remember that the Science Council is run by teachers for teachers. There are many opportunities to get involved, and we can always benefit from the increased participation of enthusiastic, science-loving volunteers. We anticipate several open executive positions this year. I hope you will consider joining our dynamic team.

I look forward to seeing you at the upcoming conference and throughout the school year!

Ian Doktor

Geeks Unite: Joint Mathematics Council and Science Council Conference



FINE PRINT: WE ANTICIPATE THAT THIS CONFERENCE WILL SELL OUT. REGISTER EARLY TO AVOID DISAPPOINTMENT. REGISTRATION LINKS ARE ON BOTH COUNCILS' WEBSITES.

Join the ATA's Mathematics Council and Science Council in celebrating their first joint conference, Geeks Unite, at the Fantasyland Hotel in Edmonton.

You can pick up your conference registration package at the registration desk from 6:00 PM to 9:00 PM on Thursday, October 22, and from 7:00 AM to 11:00 AM on Friday, October 23.

In your registration package, you will find your name tag. Please wear it at all times, as it ensures your entrance to your chosen sessions and to Chris Hadfield's keynote address. No reprinting of your name tag will be possible. Your registration also includes a ticket for Friday's buffet breakfast, lunch, and wine and cheese and for Saturday's buffet breakfast and lunch.

What:	2015 Science Council Conference
When:	October 23–24, 2015
Where:	Fantasyland Hotel, Edmonton
Who:	You, a famous astronaut and a few of your mutual friends
Why:	Outstanding math and science education PD in the Capital Region
How:	Go to https://event-wizard.com/GeeksUniteMathScience/0/welcome/

Conference Schedule

Thursday, October 22
6:00 PM–9:00 PM—Registration Only

Friday, October 23
9:00 AM–7:00 PM—Displays
7:00 AM–11:00 AM—Registration
7:45 AM–8:30 AM—Breakfast
8:30 AM–9:00 AM—Opening Remarks/Mathematics Awards
9:00 AM–10:15 AM—Keynote Speaker: Steven Strogatz
10:30 AM–11:45 AM—Session 1
11:45 AM–1:00 PM—Lunch
1:15 PM–2:15 PM—Session 2
2:30 PM–3:30 PM—Session 3
3:45 PM–4:45 PM—Mathematics AGM/Science AGM (Separate Rooms)
5:00 PM–7:00 PM—Wine and Cheese Social, Games Night to Follow

Saturday, October 24
9:00 AM–1:00 PM—Displays
7:45 AM–8:30 AM—Breakfast
8:30 AM–9:00 AM—Opening Remarks/Science Awards
9:15 AM–10:15 AM—Session 4
10:30 AM–11:30 AM—Session 5
11:30 AM—1:00 PM—Lunch
1:00 PM–2:00 PM—Keynote Speaker: Chris Hadfield

For more information and updates, visit www.mathteachers.ab.ca or www.sc.teachers.ab.ca.

Executive Contributions

If You Are Not Blueprinting Your Assessments, Read This

What began as a workshop to help teachers construct well-made tests has evolved to become a strategy that stimulates a profound mental shift in assessment practice. Many issues in education can be addressed with greater clarity once the blueprinting process has been learned.

There is a simple rule when it comes to reporting student achievement: teachers must report student achievement solely based on the outcomes in Alberta's program of studies. For example, a teacher cannot evaluate a student's proficiency at memorizing the genetic code in Science 9, because no such outcome exists in the program of studies. To ensure that all students are being taught and assessed on the same knowledge, skills and attitudes, teachers must refer to the program of studies to confirm that the programming and assessment practice meets the criteria. When teachers analyze the outcomes in the program of studies and design assessments in such a purposeful manner, there is a surprising shift in thinking that encompasses many aspects of teaching and learning.

The task of blueprinting is simply a matter of looking at the learner outcomes in the program of studies and constructing an assessment tool, or a series of assessment tools, to measure student proficiency based on those outcomes. Good blueprinting practice considers the verbs in the outcomes and the cognitive level implied by the outcomes, and strives to use appropriate weightings to assess all outcomes with equity in mind.

The blueprinting process is cumbersome at first; therefore, many teachers prefer to omit it from their practice. Instead, they use approved resources (such as textbooks) to plan lessons and assessment. Unfortunately, external resources (such as tests provided by textbook publishers) do not always assess outcomes appropriately. The blueprinting workshops shed light on the degree to which these resources fit with the program of studies, and teachers are often surprised to learn that they have been teaching and assessing material absent from the program of studies or, conversely, that they have been missing content from the program of studies.

My workshops are full-day sessions in which I promise that at least one blueprinted assessment tool will be constructed by the end. Teachers typically find the task eye-opening, and many have remarked that it is the most relevant professional learning they have ever done.

The first step of blueprinting is to learn how to identify cognitive level (CL) in both outcomes and assessment tools. When teachers analyze the outcomes in the program of studies with CL in mind, it becomes apparent that the assessment must match the outcomes in CL, not just in topic. In the workshops, we focus on three cognitive levels: knowledge (K), comprehension/application (C/A) and high mental activities (HMA).

K-level outcomes ask students to identify, list, describe, classify and so on. These outcomes can be met by looking for information in a book or on

the Internet. These outcomes test student memory of basic facts.

C/A-level outcomes require students to comprehend concepts and apply their knowledge to new situations. For these outcomes, students must be able to interpret information to solve a new problem.

HMA-level outcomes assess students' ability to articulate their own original thoughts. They may be asked to justify, create, analyze or evaluate.

Teachers analyze outcomes in collaborative groups, and it is often a challenge to achieve consensus about the cognitive levels that are implied. The discussions allow teachers to unpack the outcomes and gain a greater understanding of what it is that students should be expected to do. This clarity is of great benefit to teachers.

Summative assessment tools are then created that focus specifically on the end—the outcomes. Whether these assessment tools are tests, discussions, debates or presentations, they must all perform the same task: to measure proficiency in the outcomes and nothing else. Teachers must show that the assessment tool measures student achievement related to the outcomes in the program of studies, and the blueprint template is ideal for this. Assessment tools that test knowledge, skills or attitudes outside those outcomes are never used as evidence for reporting student achievement.

For example, in Alberta's Science 7 program of studies, in the Structures and Forces unit, students must "interpret examples of variation in the design of structures that share a common function, and evaluate the effectiveness of the designs (e.g., compare and evaluate different forms of roofed structures, or different designs for communication towers)."[1] The CL of this outcome is HMA because students must interpret and evaluate. Therefore, an assessment of students' ability to identify the design of structures is inadequate to meet the criteria of this outcome. Similarly, the outcome stating that students must "identify points of failure and modes of failure in natural and built structures (e.g., potential failure of a tree under snow load, potential failure of an overloaded bridge)" has a CL of K. It would be inappropriate to assess this outcome for marks using a tool that measures a higher cognitive level.

Figure 1 shows how chapter tests from a textbook fit within the parameters of a blueprint. This blueprint shows the CLs for the seven outcomes in the Patterns and Relations strand of Mathematics 9. The shaded cells indicate CL. For example, outcome 1 is C/A, and outcome 2 has elements of all three CLs.

The questions from the chapter tests are analyzed to determine CL. For example, for outcome 1, question 13a of the chapter 7 test (7:13a) was a K-level question on that topic, and therefore inadequate for summative assessment. The blueprint also shows that weighting is uneven in that some outcomes are tested more often than others.

The serendipity of blueprinting is that teachers gain a clear vision of the end and, therefore, are better able to consider the means. For example, at one school we constructed a Grade 9 math test on the Patterns and Relations strand. The test was perfectly blueprinted in that every outcome was assessed at the appropriate CL and the outcomes were evenly weighted. No questions were easier or more difficult than what is indicated by the outcomes in the program of studies. We wrote the test afterward to discover that their students were not prepared to take a test with HMA-level questions. It became apparent that following the tasks outlined in the textbook was insufficient to meet the criteria outlined by the outcomes in the program of studies. The obvious next step was to ask questions about how to change teaching practice. At moments like this, introducing consultant expertise is most welcome. To put it succinctly, blueprinting has a profound impact on professional reflection, readiness to accept new ideas and the initiation of a change in practice with strong buy-in.

Figure 2 shows a perfectly blueprinted assessment tool using questions selected from released materials from the Alberta provincial achievement

tests. It was designed to match the outcomes in the Patterns and Relations strand of Alberta's mathematics program of studies. In this case, all questions are at the CL implied by the outcomes, and the weighting of questions is appropriate for each outcome.

The workshops have evolved over time to consider more facets of assessment. For example, can blueprinting be used to better pinpoint where students have difficulty? Can self-assessment practices be incorporated to get students involved in unpacking the outcomes, appraising their own work and setting goals for improvement? Can adapted assessments be blueprinted to have lower CL sections that are formative and a summative section that follows the CL implied by the outcomes? Should we reconsider implementing mandatory final exams containing mostly K-level outcomes? Is it valid to report on student achievement based on behaviours that are not explicit in the outcomes, such as turning in work late, cheating or having an unexcused absence from class? Can we include the front matter of the program of studies in a blueprint to develop an assessment plan that incorporates skills and attitudes?

Figure 3 shows a self-assessment tool that uses a blueprint of a test on the Number strand of Mathematics 6 to help students analyze their performance and set goals for improvement.

Figure 1
Blueprint of a Textbook Resource

Program of Studies Outcome		Cognitive Level of Outcome/Task			Weight
Strand	Specific	K	C/A	HMA	
PAR	1	7:13a, 8:9a	6:5,6:7,7:13b, 7:13c, 8:9b	6:1, 6:8a	
PAR	2	6:2, 6:3, 6:4	6:6a, 6:6b		
PAR	3	6:8b	6:8c, 6:8d	8:2	
PAR	4	9:5, 9:6, 9:7, 9:8, 9:11b	9:1, 9:3, 9:4, 9:9a, 9:9b, 9:11b, 9:11c	9:2, 9:10, 9:11a	
PAR	5	5:1, 5:2, 5:3, 5:5, 5:6, 5:7, 5:8	5:11c, 5:11d, 7:4, 7:13c	5:11a, 5:11b	
PAR	6		5:4, 5:9, 5:10	7:11	
PAR	7	7:1, 8:1, 8:3, 8:4	7:2, 7:3, 7:5, 7:6, 7:7, 7:8, 7:9, 7:12, 8:5, 8:6, 8:7, 8:8abcd, 8:10b		

Figure 2
Blueprint of a Test Designed to Match Outcomes in the Program of Studies

Math 9 Patterns and Relation Unit Exam Blueprint

Program of Studies Outcome		Cognitive Level of Outcome/Task			Weight
Strand	Specific	K	C/A	HMA	
PAR	1		2013:mc21 2013:nr1		2
PAR	2	2013: MC38	2010 MC35,36	key PR pq 4	4
PAR	3		2010 MC:2 2013 mc 17		2
PAR	4		2010 MC:6, NR 8	2010 MC:8,29	4
PAR	5		2010mc23		1
PAR	6	(WR) taken from 2010 mc21	(WR) taken from 2010 mc21 2013 MC29		3
PAR	7	2013nr9	2013mc3, 39		3

Figure 3
Self-Assessment Tool for Students

Grade 6 Mathematics
Number Strand Analysis

Task
As we go over the test, **circle** the questions that you answered correctly.

Specific Outcome	Cognitive Level			Weight
	Knowledge	Comprehension /Application	Higher Mental Activity	
1. Demonstrate an understanding of place value, including numbers that are: • greater than one million	MC 12			1
1. Demonstrate an understanding of place value, including numbers that are: • less than one thousandth.	MC 1			1
2. Solve problems involving whole numbers and decimal numbers.		MC 4		1
3.Demonstrate an understanding of factors and multiples by: • determining multiples and factors of numbers less than 100		MC 2, MC 11		2
3.Demonstrate an understanding of factors and multiples by: • identifying prime and composite numbers	MC 3			1
3.Demonstrate an understanding of factors and multiples by: • solving problems using multiples and factors.		MC 2, MC 4		2
4.Relate improper fractions to mixed numbers and mixed numbers to improper fractions		MC 7		1
5. Demonstrate an understanding of ratio, concretely, pictorially and symbolically.		MC 6		1
6. Demonstrate an understanding of percent (limited to whole numbers), concretely, pictorially and symbolically.		MC 9		1
7. Demonstrate an understanding of integers, concretely, pictorially and symbolically.		MC 10		1
8.Demonstrate an understanding of **multiplication** of decimals (1-digit whole number multipliers).		NR 1		1
8.Demonstrate an understanding of **division** of decimals (1-digit natural number divisors).		NR 2		1
9. Explain and apply the order of operations, excluding exponents, with and without technology (limited to whole numbers).			MC 8	1

Analyze your Data
1. What specific outcome did you do well on? Explain why.

_____

_____

2. What specific outcome do you need to work on? What were some possible reasons for your difficulties?

_____

Teachers may use formative assessments to assess outcomes outside the blueprint, but summative assessments must measure only the specific outcomes at the intended CL.

Workshops that provide time for teachers to analyze the program of studies are essential for the generation of creative ideas and for focused professional learning. Often teachers are able to determine that they need to learn more about how to develop proficiency in certain skills. For example, many outcomes in the program of studies call on students to interpret and evaluate. If teachers track student achievement by outcome, they may determine that they need support to improve their ability to develop students' skills in those verbs. Professional learning opportunities can then be designed to focus on ways to teach students to interpret and evaluate, and student achievement can then be improved by design.

Note

1. See https://education.alberta.ca/media/13335879/pos_science_7_9.pdf (accessed August 12, 2015).

Greg Wondga
Division III Director

EdCampYYC 2015

On May 15, more than 400 K–12 teachers gathered at Robert Thirsk High School, in Calgary, to discuss new and emerging education trends and their impact in the classroom. The Science Council was proud to be a sponsor of this innovative PD event.

In his session "The Shift Against Grades," Joe Bower furthered his theory that assessment should be based on a current measure of a student's understanding, not on an average of subjective measures. The atmosphere in the room was one of anxiety and curiosity. As a teacher-scientist, I understand these feelings. Joe encouraged participants to visit his blog (www.joebower.org) for further reading and links.

In a session entitled "Making Learning Visible in the Science Classroom," Kenzie Rushton showed participants how to effectively use pictures, videos and social media to fully develop student understanding and collaboration skills. As well, he shared procedures to enhance student metacognition in order to increase student success.

Last, several Robert Thirsk teachers shared their process of assessing competency skills in math class and how it has evolved. From a current 30 per cent weighting of the final mark, there is consideration to increase the weight to 50 per cent but to incorporate more of the mathematical process into competency assessment. As Alberta Education's high school redesign initiative moves forward, strategies for incorporating competencies into everyday teaching will change and be clarified.

Overall, participants in EdCampYYC 2015 came away with plenty of conversation and professional growth, and they were recharged to tackle the rest of the school year.

Leon Lau
Science—Division IV Director

Member Contributions

Bringing the Universe into My Classroom

I have always been an innately curious person, which is an attribute I consider vital to being a good science teacher. I've always wanted to know how things work and why. In my family, fishing, hunting, camping and all things outdoors were a way of life. All of this led to my path to becoming a biology teacher.

That path took a turn, and I became a junior high French immersion math and science teacher for most of my career. The first time I taught the then new Science 9 space unit was to a group of honours kids in Cold Lake. Cold Lake is where many CF-18 fighter pilots are trained, and we often paused as the windows rattled and the sky rumbled as the aircraft flew overhead. A day didn't go by when my students didn't challenge me with difficult questions about science, especially about space travel. Back then, social media and Wikipedia were in their infancy, so we did what any good researcher would do: we e-mailed NASA directly. Surprisingly, NASA not only e-mailed us back but also sent me resources I use to this day. The seed was planted.

My fondness for space grew exponentially the first time I read a "Good morning, Earth!" tweet from Commander Chris Hadfield (@Cmdr_ Hadfield) in the spring of 2013. He made space flight exciting and tangible and captured the minds and hearts of Canadians. He brought the International Space Station and all of its amazing experiments, Canadian robotics, and microgravity into our homes and schools and ignited the spark of all things space in my life.

I started to follow the Canadian Space Agency (CSA) on Twitter (@csa_asc) and discovered all that it offers for educators and students, including the Tomatosphere project, the National Film Board's Space School, and a variety of online resources and YouTube videos.

I was delighted to learn that CSA representatives would be at the 2013 Science Council conference and that the keynote speaker would be Canadian astronaut Jeremy Hansen. If you were fortunate enough to be there, I am sure you will agree that his presentation was remarkable. He shared his background, his extensive fighter pilot and astronaut training, and the many advancements in Canada's space program. He told us of his training adventures, including learning geology in the Arctic and living in an immense system of caves for six days with five other astronauts from around the world. He shared his respect for educators and noted our role in supporting the next generation of Canadian astronauts. I was lucky enough to talk to him and CSA senior communications advisor Magalie Renaud about space education and to hear their unique point of view on the future of Canadians in space.

That experience resonated with me for the rest of the school year and influenced my pedagogy. Chris Hadfield once said that if you want something, you have to start living your life completely with that goal in mind. So, my students and my own two children became astronauts in training. How would the everyday things we do in life be different in microgravity? How can this scientific concept be applied to living in space or even on Mars?

Magalie asked me if I had applied online with the CSA to have an astronaut in my classroom as a

guest speaker. I was excited about the opportunity, and a Skype call with Jeremy was soon scheduled for less than five months later, on Earth Day.

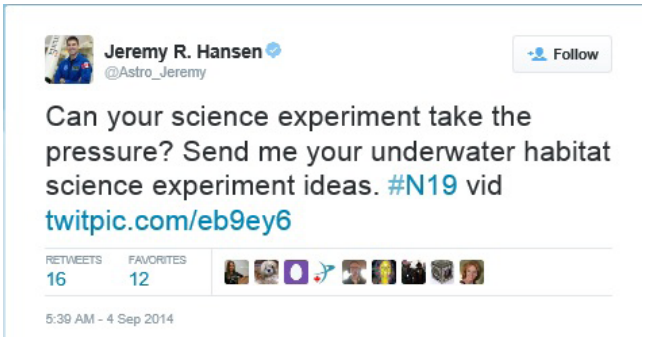
The much-anticipated event was nearly postponed after a computer problem was reported aboard the International Space Station. A contingency spacewalk was being planned for that week, and Jeremy had been named ground intravehicular (IV) officer, as the CSA informed me in an e-mail message:

> The role of the IV is to support the astronauts and help them with procedures while they are spacewalking outside of the station—a little bit like an orchestra conductor if you will. It's the first time that this kind of assignment is given to a Canadian astronaut—and a rookie nonetheless—and we feel that it's actually a strong statement of confidence in his skills.

Fortunately, we were able to Skype with Jeremy after all. The next day, we watched the spacewalk live on Ustream and cheered on our favourite Canadian astronaut. My students were genuinely excited to talk to Jeremy and to ask him their questions. He shared his inspirational story and his hope that children just like them would reach for the stars.

I continued to follow Jeremy (@Astro_Jeremy) and the CSA on Twitter and was able to learn so much about current space flight technologies, launch events and the insights of a variety of astronauts. Before the end of the school year, the CSA announced Jeremy's participation that September in NEEMO—NASA Extreme Environment Mission Operations. As the NASA website states, "NEEMO is a NASA mission that sends groups of astronauts, engineers and scientists to live in Aquarius, the world's only undersea research station, for up to three weeks at a time. The Aquarius habitat and its surroundings provide a convincing analog for space exploration."[1]

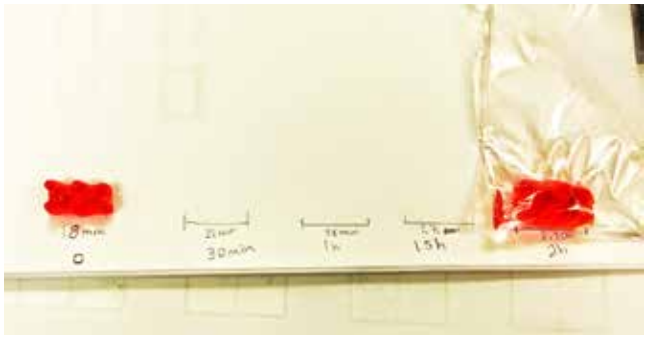
School had only been back for a week when Jeremy sent a challenge out to the public via Twitter:



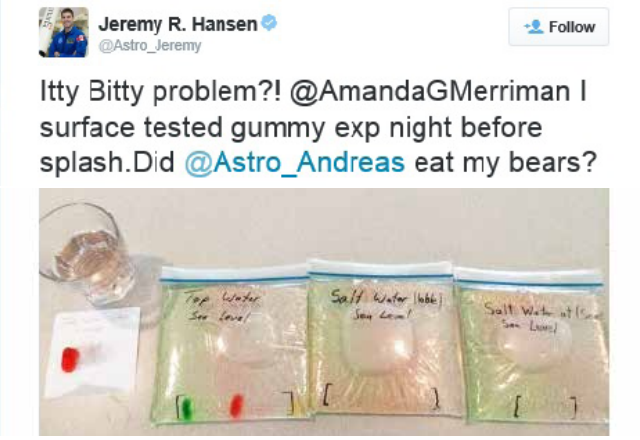
We were studying lab safety and the scientific method, so this was a perfect opportunity for real-world application. The previous year we had studied osmosis in plants, and I had shown my students how gummy bears expand when left in water overnight. We compared what happened in a variety of fluids, including tap water, salt water, vinegar, maple syrup and distilled water.

I had my students come up with a simplified version of that lab that could be done with a few simple resources aboard both Aquarius (19 metres below the ocean surface) and the International Space Station (up to 435 kilometres above Earth in orbit). Although Jeremy's challenge involved only Aquarius, it is always good to dream big.

We sent Jeremy our idea through a post on my blog.[2] We challenged him to see how big the gummy bears would grow within half a day at sea level and then aboard Aquarius, where the pressure is two and a half times greater. To keep it simple, we suggested putting a gummy bear in a clear resealable bag with water and taking regular measurements. Our hypothesis was that the rate of osmosis would be greater (faster) aboard Aquarius because of the difference in pressure (despite being regulated for those aboard). We also hypothesized that if the same experiment were to be done aboard the International Space Station, the rate of osmosis would be slower because of microgravity and the lack of pressure (again, despite being regulated for those aboard). We proposed that the applications of these observations are important, since we use these concepts when we look at agriculture, water purification and the needs of the human body in space. These are all vital to learning how to expand our reach into the universe.



Jeremy took on our challenge and tried our experiment in Key Largo, Florida, at sea level, before diving down to Aquarius. He put two gummy bears in tap water in a glass and two each in resealable bags of tap water, salt water and ocean water. He tweeted the following:

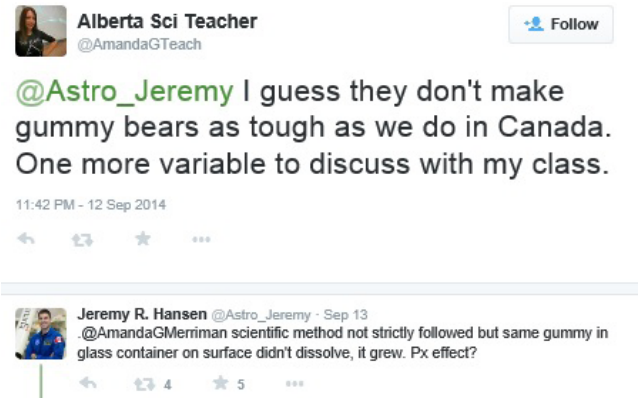


He included a photo of his experiment, with almost nothing left of his gummy bears except for one in the glass, and took the opportunity to tease fellow aquanaut/astronaut Andreas Mogensen. He added the following:

This sparked a Twitter conversation with people all over the world about possible experimental errors and related ideas. Some blamed rate of dispersion in a closed bag versus in open air, currents, Brownian motion, temperature and so on. Jeremy commented that the experiment initiated a great conversation with his NEEMO crewmates, as well.

A few days later, Jeremy tried the experiment again, aboard Aquarius. He tweeted the following:

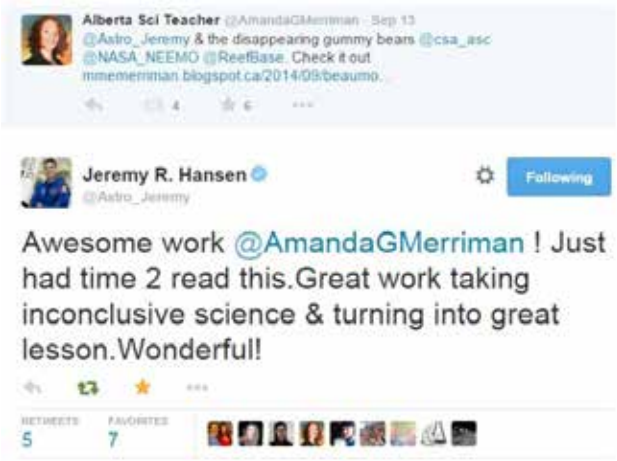
He included a photo of gummy bears in bowls of fresh and salt water, showing how they dissolved over time instead of expanding and absorbing water. Basically, our experiment was a bust. Jeremy and I exchanged the following tweets:



So, was our experiment a total failure? Absolutely not! I always tell kids that science is a process and that most of the time your results will be inconclusive but will lead to refining the experiment and coming up with a better plan. It is what you do with the apparent failure that matters. We had a great class discussion about how to modify the experiment and the many variables to control to make it better.

The following quotation (source unknown) is popular on the Internet: "Science: If you don't make mistakes, you're doing it wrong. If you don't correct those mistakes, you're doing it really wrong. If you can't accept that you're mistaken, you're not doing it at all."

This process has taught me a lot about the kind of teacher I strive to be. I want to guide, explore, inspire and help kids reach for their goals. I want to bring the universe into my classroom—and something as small as Twitter has allowed me to do just that.



My own goals of meeting Jeremy Hansen and having him as a guest speaker in my class have been achieved above and beyond my expectations. My new goals include having one of my students' experiments aboard the International Space Station for the Student Spaceflight Experiments Program, and maybe even Skyping live with Jeremy from space one day. It may be years before Jeremy and his colleague David Saint-Jacques get their turn in space, but one day it will happen and we will be here to cheer them on. If there is a lesson to be learned from my experiences over the past few years, it is that anything is possible if you live your life toward your goals and dedicate yourself to making them happen. So, my fellow teachers and science lovers, keep dreaming, working hard and inspiring your students to do the same, and someday you will maybe even change the world.

Notes

1. See https://www.nasa.gov/mission_pages/NEEMO/index.html (accessed August 13, 2015).

2. See http://mmemerriman.blogspot.ca/2014/09/neemo.html (accessed August 13, 2015).

Amanda Green

Proposed Constitution Changes

Your Science Council executive has proposed changes to the council's constitution. These changes will be discussed at the council's annual general meeting, to be held during the joint Mathematics Council and Science Council conference, on October 23. A vote by all eligible Science Council members on the adoption of these changes will follow. A copy of the proposed changes has been included with this issue of *The Alberta Science Teacher.*

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The Alberta Science Teacher is one of the official publications of the Science Council (SC) of the Alberta Teachers' Association. SC Bylaw 9.4 states: *The Alberta Science Teacher* shall reflect on the contributions and activities of Alberta science teachers in the classroom.

ISSN 0229-3099

Please address all correspondence to the editor, Trinity Ayres at trinity.ayres@cssd.ab.ca. All manuscripts should be submitted electronically in Microsoft Word format. Pictures or illustrations should be clearly labelled and placed where you want them to appear in the article. A caption and photo credit should accompany each photograph.

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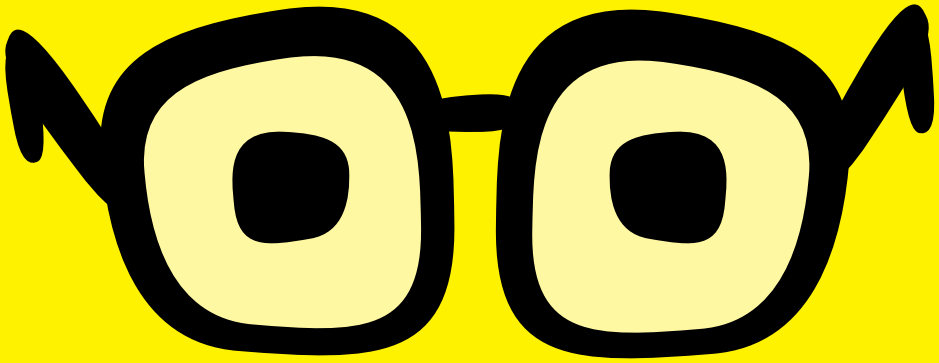

WORLDS WILL COLLIDE

Joint conference of the Mathematics Council of the ATA and the ATA Science Council