



Pacific Institute *for the*  
Mathematical Sciences



**a place of mind**

**THE UNIVERSITY OF BRITISH COLUMBIA**

A photograph of a woman with grey hair and glasses, wearing a dark blue t-shirt, speaking and gesturing with her right hand. She is in front of a chalkboard with some faint writing. The image is partially covered by a blue diagonal overlay on the right side.

Outreach Program:  
Summer School for In-Service Teachers  
June 29 to July 24, 2015





The Pacific Institute for the Mathematical Sciences (PIMS) and the University of British Columbia (UBC) Department of Mathematics are dedicated to increasing public awareness of the importance of mathematics to the world around us. We consistently work towards creating the realization for young people that mathematics is a subject that opens doors to many diverse careers. While exciting careers in mathematics and science provide many opportunities, there is also a wide range of intriguing fields outside science that provide career opportunities for people that are well-prepared in this subject.

The UBC Mathematics Department, together with PIMS, organizes multiple outreach events and activities (workshops, contests, summer camps, public lectures, etc.) each year to enhance mathematical opportunities throughout British Columbia. As mathematical scientists we are very aware of the challenges faced by teachers and students in the dissemination and acquisition of mathematical knowledge. Our institutions are always happy to play a constructive role in finding ways to enhance opportunities for learners and educators, as it is our view that mathematical scientists should play a key role in this process. We are also keen on working in partnership with organizations and individuals that share similar views.

## Developing the Summer School

The reality is that many teachers, especially in elementary schools, do not have the necessary math knowledge or experience to feel comfortable teaching mathematics. Therefore, it is important to provide further teacher training.

To this end, we developed a summer school for in-service teachers and delivered the first session this summer. Twenty teachers attended, including teams of three teachers from each of six schools, as well as two teachers who teach remedial students in elementary and secondary schools. It was critical to have teacher teams of three per school so that teachers could further support each other as harbingers of positive change regarding the mathematical environment at their schools.

Teachers were recruited through email messages sent to school principals around the lower mainland. Eighty-seven applications were received and participants were selected according to their schools' needs and their personal statements for wanting to attend the summer school. The original plan included only 15 teachers per camp, but five more were added. Three of those teachers teach at the Aboriginal Focus School and we were able to cover their expense through Aboriginal-dedicated grants.

A team, formed by Malgorzata Dubiel (Senior Lecturer, Simon Fraser University Department of Mathematics), Ron Coleborn (President, the British Columbia Association of Math Teachers [BCMAT]), and Melania Alvarez (Education Coordinator for PIMS) assessed the applications and chose the participants.

Teachers came from the following schools:

- Sunnyside Elementary, Surrey
- Lord Kitchener Elementary, Vancouver
- Marlborough Elementary, Burnaby
- Aboriginal Focus School at Sir William Macdonald Elementary, Vancouver
- Kitchener Elementary, Burnaby
- École Cedardale, West Vancouver
- Pathways to Education Community (This is not a school, but a program to help increase the high school graduation rate.)

As teachers were coming from a variety of locations, we sought a venue with a central location. A room was kindly provided (free of charge) by the principal at Britannia Secondary School. The room was one that is usually used for math and as such, was a good fit for our purposes.



## Goals

The camp aimed to create a team of teachers at each participating school that could foster a cultural and academic shift with respect to the learning and enjoyment of mathematics by:

- increasing teachers' capability, confidence and attitude with regard to math
- educating teachers to strive for and expect success for all their students
- incorporating meta-cognition strategies so that teachers will understand their own learning processes for math, as well as that of their students
- making teachers the harbingers for institutional change by changing their attitude toward the teaching and learning of math at their schools, where they could develop with our support a variety of mathematical activities like:
  - Math clubs, Math Manias, and Math Fairs
  - sponsoring and supervising students participating in math contests
  - problem-solving sessions
  - math mentorship programs

## The Curriculum

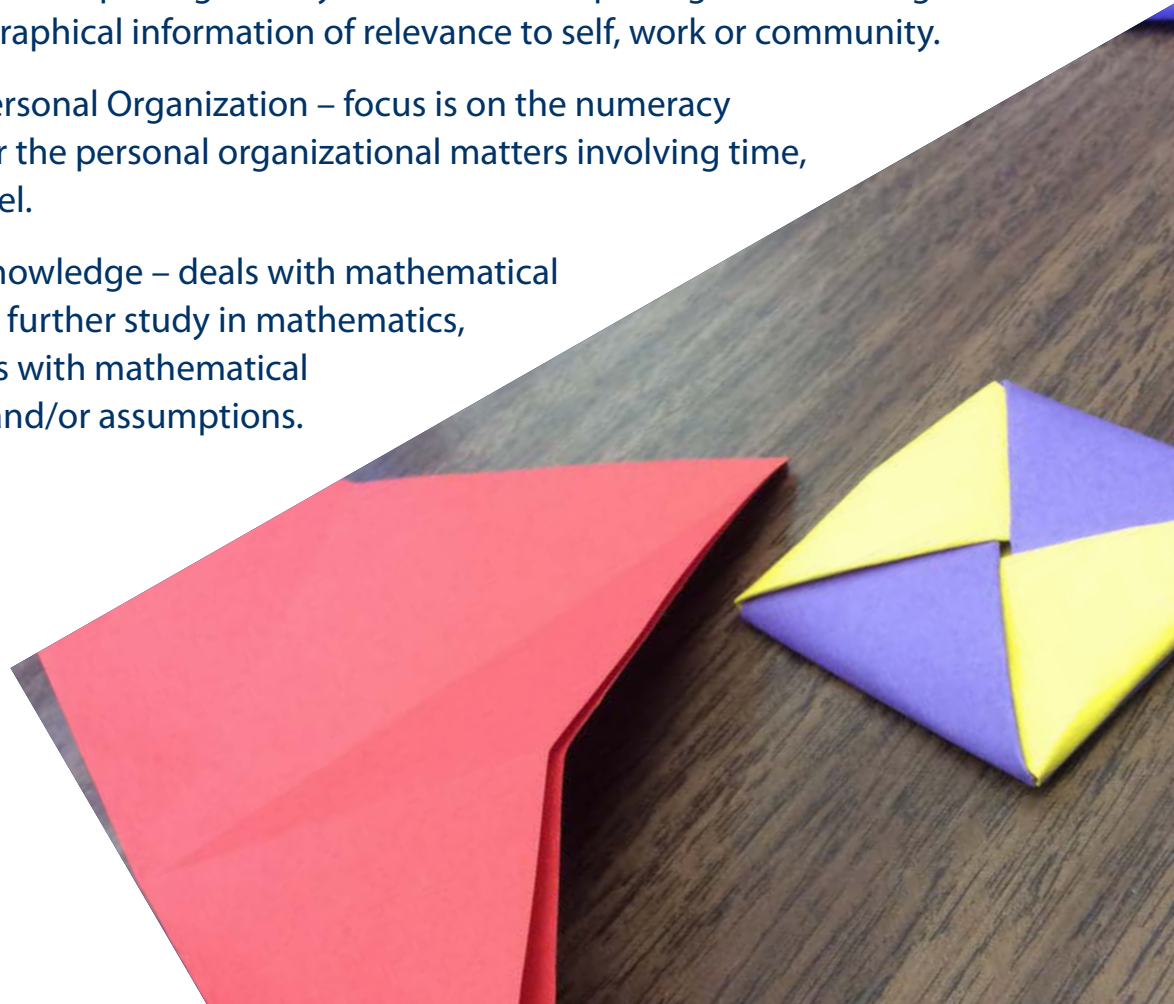
The training touched on the following:

- how to go from the concrete, to pictorial to abstract
- how to expose mathematics in the simplest and clearest way
- how to choose, and build word problems to teach a variety of mathematical ideas
- how to use a variety of algorithms and heuristics for problem solving

The program overview contained three main themes: geometry, numeracy and patterns, with a broad range of topics covered related to different grades.

With regard to numeracy we focused on four possible outcomes.

- Numeracy for Practical Purposes – addresses aspects of the physical world in regard to designing, making and measuring.
- Numeracy for the Interpreting Society – relates to interpreting and reflecting on numerical and graphical information of relevance to self, work or community.
- Numeracy for Personal Organization – focus is on the numeracy requirements for the personal organizational matters involving time, money, and travel.
- Numeracy for Knowledge – deals with mathematical skills needed for further study in mathematics, or other subjects with mathematical underpinnings and/or assumptions.





## School Structure

Three hours per day for four weeks:

- Begin days with questions and discussion of previous day.
- Two activities per morning, with a break between.
- Homework: 30-60 minutes per day:
  - create a half-page lesson plan based on a topic covered that day (for a specific grade)
  - reflect on work and write down questions
  - other additional work as required (short readings, etc.)
- Teachers are encouraged to ask questions and provide comments immediately to ensure complete understanding of lessons and curriculum.
- Schedule (some changes occurred):

Week	Monday	Tuesday	Wednesday	Thursday	Friday
June 29 to July 3	<b>Introduction</b>	<b>Introduction</b>	<b>Holiday</b>	<b>Geometry</b>	<b>Geometry</b>
	Expectations General Overview	Creating lessons		introduction	Symmetry Galaxies Puzzle
	Handshake Problem				
July 13 to July 17	<b>Geometry</b>	<b>Geometry</b>	<b>Geometry</b>	<b>Numbers</b>	<b>Numbers</b>
	Paper craft: sum of angles is $180^\circ$ ; areas; triangles and parallelograms; binomial square	Susan's geometric construction	Origami: tetrahedron, cube, <a href="#">Sonobe module</a>	Movie: History of One Discussion	Place value activities, Roman numerals, etc. and discussion
				Math for K-2: further connections	Place value teaching: different models and examples
July 13 to July 17	<b>Numbers</b>	<b>Numbers</b>	<b>Numbers</b>	<b>Patterns</b>	<b>Patterns</b>
	$\times$ and $\div$ : a product is an area; MWW division; long division	Fractions	Bar Model –Algebra, other problem solving techniques	Geometric patterns: triangular numbers, square numbers, hexagonal numbers, Fibonacci, MWW 16	Geometric patterns: sand patterns
	Number properties, mental math, order of operations	Bar Model	Factoring: <a href="#">rectangles puzzle</a> , Locker Problem		
July 20 to 24	<b>Patterns</b>	<b>Patterns</b>	<b>Patterns</b>	<b>Consolidation</b>	<b>Consolidation</b>
	1,2,4: <a href="#">lazy caterer</a> , <a href="#">tribonacci</a> , <a href="#">partitioning L ego bricks</a> , divisors of $n!$ , MWW 11		Cellular automata; 1-D and Conway's Life	Susan's Puzzles	

## Measuring Success


The participants were not assessed with tests, but rather, an analysis of the lessons they prepared provided us with insight into how much they had learned and how they will use that new knowledge. Currently we are analyzing over 200 lessons prepared by the teachers, some of which will be uploaded to a website that will be linked to the new curriculum for other teachers to use and comment on.

We will also measure success by following the level of mathematical activity and academic success at the participants' schools by monitoring:

- the establishment and continuity of a math club,
- students' success based on grade 4 and grade 7 standardized tests
  - is math achievement improved at the school?
- how students are performing in math contests
- to what extent students participate in activities with a mathematical content

We are currently scheduling a variety of activities with three of the schools. We aim to extend this to teachers in all of the participating schools throughout the current academic year.

Given that the summer school ran during the teachers' summer vacation, they were each paid a \$1400 stipend for attending. They each received an additional \$200 in resources for mathematical books and pedagogical materials. We provided them with \$100 in resources and the additional \$100 was for them to spend at their own discretion according to the needs of their classes.



## Budget

Operational supplies & expense	\$1,353.50
Resources	\$2,395.22
Customs & freight	\$80.71
Salaries-staff	\$5,001.72
Employee benefits-Main	\$365.93
Employee benefits-insurance	\$35.01
Teachers' stipend	\$28,000.00
Final lunch	<u>\$370.42</u>
Total spent:	\$37600.79
Remaining resources stipend	<u>\$1700.00</u>
Total to be spent:	\$39300.79

\*\*As of September, 2015, there are 17 teachers who have not spent their additional \$100 in resources.\*\*

\$30,000 were covered by Dr. Satish Reddy's donation.

\$3,200 were covered by the Actuarial Foundation of Canada.

\$4,800 were covered by Aboriginal dedicated grants which PIMS has received.

The rest was covered by PIMS and the UBC Department of Mathematics.







## Teacher Testimonials

### Things you learned:

"As a new teacher it was helpful to see a best practice on how to/in what order to teach all of the important curricula."

"Getting the experience of learning with a concrete object first totally amazed me and fed a sense of beauty and wonder."

"I strengthened my skills in the areas of patterning and permutations and combinations. I feel much better equipped to teach these areas."

"I learned the importance of appreciating different learning styles and multiple ways to find a result."

"Different methods and perspectives on teaching math to expand our own ideas of what 'math' is."

"The importance of language – math as a language."

### How will the camp influence your teaching?

"I will be less reliant on pre-made materials."

"Greater confidence to facilitate discovery through play and to justify my methodology to parents or teachers."

"I'm more motivated than ever to provide exciting lessons for my class."

"Being able to include more hands on learning in my math class will be a priority now."

"I have learned so many different teaching strategies, ways of thinking, and that all strategies are valid... In the future, I plan on collaborating with other instructors to come up with ideas."

"It will allow me to spend time focusing more on the process in math as opposed to the outcome"

"To engage students and keep them excited about math..."



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