THE CANADIAN MATHEMATICS EDUCATION STUDY GROUP

31ST ANNUAL MEETING

JUNE 8 TO 12, 2007

UNIVERSITY OF NEW BRUNSWICK

ANNOUNCEMENT AND REGISTRATION FORM

Welcome to the University of New Brunswick, Fredericton, host of the 31st Annual CMESG Conference. The conference will open with registration at 3:00 p.m. on Friday, June 8 and close at 12:30 p.m. on Tuesday, June 12.

The university is located downtown Fredericton in the St. John River valley. To locate the University and its various components visit http://www.unb.ca/welcome/maps/unb_fredericton.pdf.

CMESG activities will take place in Tilley Hall (9 Macaulay Lane – number 63 on the campus map) and the Dunn, Kidd and Tibbits (DKT) complex (42 MacKay Drive, numbers 38, 33 and 62 on the map).

WELCOME AND REGISTRATION

On Friday, registration (3:00 - 6:00 p.m.) and BBQ dinner will take place in the DKT complex. The CMESG Opening (at 7:00 p.m.) and the first plenary session (at 7:45 p.m.) will take place in Tilley Hall, room 303. The opening reception (at 8:45 p.m.) will take place in the DKT Main Lounge.

HOW TO GET TO THE UNIVERSITY OF NEW BRUNSWICK'S FREDERICTON CAMPUS

From the Fredericton International Airport: a cab ride to the University will cost approximately $25.
By car, from the west on the TransCanada Highway: Merge onto Hwy-8 at exit 280, on the left toward Fredericton/Miramichi. Take the Regent Street exit toward downtown, and then turn right on Beaverbrook St (at the bottom of the hill). The university gate is at the first lights.
By car, from the east on the TransCanada Highway: Merge onto Hwy 7 at exit 294. Take the Regent Street exit toward downtown, and then turn right on Beaverbrook St (at the bottom of the hill). The university gate is at the first lights.

ACCOMMODATION

If you have chosen to reside on the University campus during the conference, you will stay in the DKT Complex (42 MacKay Drive). If you are checking in outside of the registration time (Friday 3:00 – 6:00 p.m.) you will need to go to the UNB Hotel Front Desk, located in the Residence Administration Building at 20 Bailey Drive (number 54 on the map). You can choose to stay in a single room for $31/night or a double room for $23.50 per person per night. Rates include parking, high-speed internet access and phone with free local calls. Please specify your room type preference when making your reservation. If you would like to share a double room and need help to find a roommate, please let us know and we will try to assist you. Reservations can be made by calling 1.506.453.4800 or e-mailing unbhotel@unb.ca. Please

note we also have a limited number of suites available, next door to DKT, in the New Residence. A 3-bedroom suite has a double bed in each bedroom, a furnished living room, a kitchen with stove, fridge, microwave and dishwasher and a washroom. The price for a full suite is $109 per night. Make your reservation early if you prefer this option.

PARKING

If you are staying on campus and have a vehicle with you, temporary passes are available for free when you check-in. If you are staying off-campus and need a temporary pass, please pick one up at registration (Friday 3:00 – 6:00 p.m.)

MEALS

Besides breakfasts and the dinner on Sunday, all meals will be taken together. Indicate on your registration form how many breakfast tickets you will require. Breakfasts are buffet style and in McConnell Hall (number 44 on the map). Lunches and Saturday dinner will be served in the DKT dining hall. Sunday dinner will be in town wherever one chooses to go; we will regroup for dessert at the Charlotte Street Arts Centre (732 Charlotte Street). The Celtic group Brollachan will lead our entertainment. For Monday's dinner, we will walk to The Blue Door restaurant (100 Regent Street).

EMERGENCY

The phone number to the UNB Hotel Front Desk in the Residence Administration Building is 1.506.453.4800. The phone number for UNB Security is 1.506.453.4830. In the DKT complex there are several live-in staff and their phone numbers will be posted in the hallways and on the list of emergency numbers in your bedroom.

ASSISTANCE TO GRADUATE STUDENTS

CMESG has limited funds available to support full time graduate students who wish to attend our annual meeting and who are not able to do so without additional financial support. For an application form please see our web site at http://cmesg.math.ca.

FOR NEWCOMERS

CMESG is not a typical academic conference, for it is not organized around presentations and audiences. Instead, it is a conference based on *conferring*.

Its main feature is the **working group**. Each working group will meet for three full mornings. You should select one of the four groups, based on the descriptions in this guide and the comments of the leaders on Friday evening. The task of the working group is to interact around a particular topic, with no prerequisite reading or experience and no post-conference obligations. Stay with the working group you select.

There are also two **plenary speakers**, who will each address the whole conference. However, unlike in other conferences, the audience will split into small discussion groups to develop questions for the speaker to address in a follow-up session.

Two other kinds of sessions provide more traditional forms of presentation: during the one-hour **topic session**, select one of two presenters, and during the two half-hour **new PhD sessions**, select one of the two or three presenters.

You will also note three half-hour **ad hoc sessions**: any conference member is welcome to sign up during the conference to lead an ad hoc session, and participants will select from as many options as are scheduled.

There is one last kind of session that many of us consider the most significant: **meals**! Sit with those you know, or sit with those you are getting to know – the meals are an integral part of the conferring that makes CMESG such a special conference.

PLENARY LECTURES

Lecture I Rafael Núñez
University of California, San Diego

Understanding abstraction in mathematics education: Meaning, Language, Gesture, and the Human Brain

Mathematics education deals with the teaching and learning of mathematical concepts. These concepts – which are human concepts – are highly imaginary (e.g. Euclidean point, complex numbers, transfinite cardinals) yet they are extremely precise and inferentially rich (e.g., theorems). Research in cognitive science – the multidisciplinary scientific study of the mind – has in the last two decades shown that human imagination is largely realized through everyday mechanisms, such as conceptual metaphor, analogy, and metonymy. In ordinary contexts (e.g., advertising, art, politics), however, these terms are often seen as mere figures of speech, and as such, as a simple matter of words. This is usually also what mathematics education takes metaphor and analogy to be. In contemporary cognitive science such terms designate phenomena about thought and cognition, not just language, and they have specific technical meanings (e.g., distinction between "metaphorical expressions" and "conceptual metaphors"). Moreover conceptual metaphor, analogy, and conceptual metonymy are seen as specific cases of "conceptual mappings", which also involve conceptual blends, fictive motion, and other mechanisms. Together, and often working in complicated networks, they are hypothesized to form the vast family of cognitive mechanisms that make human abstraction and imagination possible.

In this talk I will explore several issues regarding the study of these conceptual mappings (along with their inference-preserving properties) and their implications for research in mathematics education. In particular I will focus on methodological, experimental, and theoretical problems involving (a) the level at which the subject matter "metaphor" is defined, (b) the role of embodiment and bodily-grounded experience, (c) the nature of "selective projection" in conceptual mappings (especially metaphor and blending), and (d) the empirical investigation of these conceptual mappings via convergent methodologies such as real-time gesture production, priming psycho-linguistic experiments, and neuroimaging studies of metaphorical meaning via functional magnetic resonance (fMRI) in the brain.

Lecture II T. Christine Stevens
Saint Louis University

Mathematics Departments, New Faculty, and the Future of Collegiate Mathematics

Recent changes in the way mathematics is taught at colleges and universities in North America offer special opportunities to new mathematics faculty, but they can also pose special challenges for them. Having grown up with calculators and computers, new faculty are often eager to exploit the pedagogical potential of technology. Moreover, since they have very little experience with any method of teaching, they are sometimes more willing to try new ideas, such as cooperative learning, student projects, and using writing to teach mathematics. And when they decide to implement one of these new ideas, they often have more energy than we older faculty members do.

On the other hand, these pedagogical innovations can also pose special problems for new members of the faculty. With so many good ideas available, they may have difficulty selecting a focus for their efforts. Lacking much teaching experience, they may not be able to predict how students will react to a particular strategy, or how much of their own time it will consume. Finally, teaching is only one of their responsibilities as faculty members, and they cannot afford to neglect the other aspects of an academic career. They must establish and maintain an active research program, and they are also expected to serve on committees and advise students.

Thus, although taking one's first job as a full-time faculty member has never been easy, the current climate of change in undergraduate mathematics education makes it especially hard for a new Ph.D. to make the transition from being a graduate student to being a full-time member of a college or university mathematics department. To ease that transition, and to promote the improvement of collegiate mathematics education, the Mathematical Association of America established in 1994 a professional development program for new and recent Ph.D.s in the mathematical sciences, including pure and applied mathematics, statistics, operations research, and mathematics education. Called Project NExT (New Experiences in Teaching), it addresses all aspects of an academic career: improving the teaching and learning of mathematics, maintaining research and scholarship, and participating in professional activities. During the last thirteen years, Project NExT has helped over 900 new Ph.D.s to make the transition from being a graduate student to being a successful full-time faculty member. Many of the early participants in the program are now emerging as leaders on their own campuses and in the mathematical community at large.

I will reflect upon my experiences as director of Project NExT and their implications for new Ph.D.s entering the profession, for the mathematics departments that prepare and hire them, and for the future of collegiate mathematics education. Along the way, I will also share some of the things that I have learned from Project NExT that I use in my own classes.

WORKING GROUPS

Working Group A ***Outreach in mathematics – activities, engagement and reflection***
Leaders: Véronique Hussin & Eric Muller

As mathematics educators we have the opportunity to promote mathematics with students in our classroom, and also popularize mathematics outside the classroom, in other educational settings or with the general public.

In our classes we interact with a 'captive' audience, our students who, by choice or requirement, participate in the activities we provide for their learning of mathematics. What is the role of these activities in promoting mathematics, as would be demonstrated, for example, by a positive change in student attitude and engagement in mathematics? What are important components of such activities? What activities are particularly successful in getting students to reflect on their doing mathematics and for them to develop creativity in mathematics? What opportunities for promoting mathematics with our students are provided by technology?

In educational settings other than our own classes, and with the general public, what kinds of popularization activities are particularly successful in stimulating individuals to move beyond participation into reflection on mathematics? What components within such activities are more likely to motivate individuals to engage further in mathematics? What opportunities to popularize mathematics are provided by technology?

We anticipate covering areas that emanate from the work of previous Working Groups. Individuals who may be interested in joining this Working Group should read the report of the 1994 study on "Popularizing mathematics" (1) and of the 2001 study on "Where is the Mathematics?" (2). Participants of this Working Group are invited to bring samples of activities that they have used successfully to promote or popularize mathematics. This Working Group will function both in French and in English.

References from CMESG/GCEDM Proceedings:

1. "Popularizing Mathematics", 1994 Annual Meeting, pp. 53-80
2. "Where is the Mathematics?", 2001 Annual Meeting, pp. 53-57

Working Group B ***Geometry, space and technology: Challenges for teachers and students***
Leaders**:** Shelley Hunter, Donna Kotsopoulos, & Walter Whiteley

Children live and learn in the third dimension. Early school geometry tends to disconnect students from physically-based experiences, creating formidable challenges later on when students are required to reason in the third dimension. One contributing factor is that many teachers are inadequately prepared mathematically and pedagogically, to do and to teach geometry and thus are unable to support students in their learning of geometry in space. Consequently, geometry curriculum is increasingly marginalized (including in university curricula) despite the growing importance of spatial information and reasoning in many areas outside of mathematics (Hoyles, Foxman, & Küchemann, 2002).

This working group will explore geometry and spatial reasoning from multiple perspectives (with a focus on secondary and tertiary levels), for both content knowledge and pedagogical knowledge. Participants will engage in geometrical inquiry through key rich explorations, and collaborate with others in their domains of interest (i.e., teachers, mathematics college/professors, mathematics education researchers) to consider both the directions and tools for strengthening geometric and spatial reasoning for students. We encourage participants to bring along a favourite example, or illustrative challenge they have face

Resource pages for the working group are at: http://wiki.math.yorku.ca/index.php/CMESG

Working Group C ***The Design and Implementation of Learning Situations***
Leaders**:** Fernando Hitt, Anna McQuillan & Luis Radford

As she walked by Mr. Clark's classroom, Ms. Rochette, the principal of the school, saw Mr. Clark standing at the back of his class. He was watching his students, who were busy discussing a math problem in small groups. In one of the groups, two students were arguing about how to solve the problem but they could not reach an agreement; the third student was not sure about who was right. At lunch time, Ms. Rochette commented on what she saw, "The students seemed very interested." "Yes", replied Mr. Clark, "but there was a group that could not agree on how to solve the problem." "So what did you do?" asked the principal, "Did you explain to them how to solve it?" Another teacher interrupted, "Of course not! He can't!" Immediately, another teacher protested, "Of course he can!" and someone else vigorously added, "He must!"

Learning situations, which are the topic of this Working Group, involve designing classroom situations conducive to learning. As Mr. Clark's episode intimates – an episode that was witnessed by one of the leaders of this group when conducting classroom research – a learning situation goes beyond the choice of a good problem. But what is it exactly? What *is* and what *is not* a learning situation? How do we design and implement them?

We claim that the answer to these questions depends on the theoretical framework that is adopted. Different theoretical frameworks and epistemologies about learning and teaching lead to different answers, as suggested by the reported lunch episode.

The goals of our bilingual Working Group are to promote discussion about the characteristics of learning situations and their implementation from different theoretical frameworks. We also wish to explore some classifications of learning situations. To encourage discussion and reflection, we will share some clips and written material collected in the course of classroom research. We invite the participants to bring their material and vignettes to share with the group.

References

Gravemeijer K., Cobb P., Bowers J. & Whitenack. (2000). Symbolizing, Modeling and Instructional Design. In P. Cobb, E. Yackel, & K. McClain (Eds), *Symbolizing and communicating in mathematics classrooms* (pp. 225-273), Mahwah, NJ: Laurence Erlbaum.

Hitt F. (in press). Utilisation de calculatrices symboliques dans le cadre d'une méthode d'apprentissage collaboratif, de débat scientifique et d'auto-réflexion. In M. Baron, D. Guin et L. Trouche (Éditeurs), *Environnements informatisés pour l'éducation et la formation scientifique et technique : modèles, dispositifs et pratiques*. Éditorial Hermes.

Radford, L. (2006). Elements of a Cultural Theory of Objectification. *Revista Latinoamericana de Investigación en Matemática Educativa, Special Issue on Semiotics, Culture and Mathematical Thinking*, pp. 103-129. http://oldwebsite.laurentian.ca/educ/lradford/Objectification3Eng.pdf

Working Group D ***The multifaceted role of feedback in the teaching and learning of mathematics***

Leaders**:** Florence Glanfield & Jérôme Proulx

"Thanks, I just wanted some feedback."

How many times have we, as educators, heard that comment? At the 2004 CMESG annual meeting, Hewitt offered a topic session about the notion of feedback and provided the following context "I am teaching….I see/hear a student do something relating to mathematics….I make a choice about how to respond (which may involve the choice not to say or do anything)….What informs my decisions about how to respond? That nature of what is observed will be a factor, but what a student does is not the sole defining factor on the nature of the response….Our beliefs about teaching and learning mathematics partly informs the way in which we respond as teachers, to such situations. As we continue educating ourselves our awareness of pedagogical situations develops and we begin responding in different ways to how we used to respond. Through examining our responses to students we can begin to examine the awareness and beliefs which inform our decisions" (Hewitt, 2005, p. 105).

The notion/nature of "feedback" has varied throughout the years in reflections about mathematics education. Seen as a panacea in the behaviorist era, it has moved back and forth since then from being seen as a necessity, a taboo, an insignificant device, and many more. In this working group we will explore feedback from a variety of perspectives …meaning(s) of the word feedback, perspectives related to "feedback" in regard to theories of learning, relationship(s) between feedback and assessment (of, as, and for learning), and implication(s) for classroom practice and research about teaching mathematics.

For example, concerning words, one can wonder about some of the roots of the word "feedback" in both of our official languages at the conference. It appears interesting to notice that the word "feedback" and its French translation "retroaction" possess very different roots and literal meanings. In effect, if we read the French word, it means something like "discussion of the previous actions" in the sense that it is retrospect on an action ("retro" – "action"). In English, "feedback" could be interpreted as "bringing food (again) to the event." These two have completely different meanings and intentions, so to say (if we read them naively or literally). In one case (French), it is mostly a reflective state on something that happened. In the other case (English), it could appear to be more active within the phenomena occurring.

Through the sharing of those many diverse perspectives, and concrete examples coming from participants' experiences, the working group will attempt at clarifying the notion of "feedback" and question its nature and importance in the teaching and learning of mathematics.

References

Hewitt, D. (2005). Feedback. In E. Simmt & B. Davis (Eds.) Proceedings of the Canadian Mathematics Education Study Group 2004 Annual Meeting. p. 105 – 110.

Western and Northern Canadian Protocol for Collaboration in Education. (2006). Rethinking classroom assessment with purpose in mind: Assessment for learning, assessment as learning, assessment of learning. http://www.wncp.ca/assessment/rethink.pdf

TOPIC SESSIONS

Topic Session A ***Communicating Excitement and Beauty of Mathematics***
Leader: Malgorzata Dubiel

Simon Fraser University has a long history of going out and trying to bring mathematics to as wide audience as possible. There were math activities in shopping malls in the 1990's, visits to schools, visits of students (and teachers) including recent cooperation with the Science World of BC. I will talk about my experiences with these events, from Math in The Malls to Math Camps and "A Taste of Pi", and share reflections on what is worth doing and how, and will gladly hear about the experiences and reflections of others.

Topic Session B ***Cabri 3D: an environment for creative mathematical design***
Leader: Kate Mackrell

Cabri 3D is a relatively new software which has great potential in the teaching and learning of both 2D and 3D geometry, in enhancing student ability to visualize, in modeling physical structures and motion and in developing new mathematics. Cabri 3D also provides an environment in which students can become creative designers using tools and solving problems that are almost entirely mathematical. This session will briefly illustrate some of Cabri 3D's possibilities and then focus on my work with grade 7 and 8 students in which I have attempted to create activities that will enable students to learn what they need to know in order to be able to use Cabri 3D effectively and to be aware of possibilities, but also encourage their own creative designing and problem-solving.

Topic Session C ***Design and experimentation of didactical situations in kindergarten and elementary school***
Leader: Jacinthe Giroux

In this session, we present two teaching experiments undertaken with kindergarten students (on 'number') and elementary level special education students (on 'multiplication'), and highlight the contribution of the Theory of Didactical Situations (Brousseau, 1986) in their design. In the process, we develop some of the key notions of this theory – namely, devolution, feedback from the milieu, and didactical variables. These notions are particularly useful for prompting dynamic interactions specific to the mathematical goal and for encouraging cognitive engagement and mathematical activity among young children and students with learning difficulties. In recounting our experiences, we question the rapport of the designed situations to the contingencies of the didactical interactions and examine, as an example, the case of atypical student approaches.

Topic Session D ***Mathematics educational neuroscience: origins, activities, and new opportunities***

Leader: Stephen Campbell

Mathematics educational neuroscience is poised as a thin edge of the wedge of an emerging and potentially foundational new area of educational research. I discuss some of the origins and rationale pertaining to this initiative, and show how educational neuroscience forms a natural bridging between cognitive neuroscience and educational psychology. I present an overview of activities and initiatives in this area that are particularly germane to mathematics education research. In so doing, I demonstrate recent results and discuss potential implications and new opportunities for mathematics education researchers.

NEW PHD SESSIONS

Jérôme Proulx ***(Enlarging) secondary-level mathematics teachers' mathematical knowledge: an investigation of professional development***

This doctoral dissertation reports on a professional development intervention aimed at enlarging the mathematical knowledge of six secondary mathematics teachers, who had (and recognized themselves as having) a strong orientation toward procedures and algorithms in mathematics. The program focused on offering opportunities to teachers to experience and explore school mathematics concepts, along different avenues from ones solely limited to procedures. The analysis of the sessions provides results concerning the learning opportunities that this approach created and offered teachers, both at the level of mathematical learning/understanding and of reflections about mathematics teaching.

Georges Touma ***An experimentation paradigm in the science laboratory for the identification and statistical optimisation of an algebraic model through visuo-graphical interaction***

This research deals with algebraic modelling of physical phenomena. We developed and validated a new method, Graphical- Statistical Regression (GSR), which allows for the adjustment of a mathematical model to a physical phenomenon. Additionally, this method allows its optimization. Furthermore, it helps to evaluate the standard error of prediction of the model and to provide scientific criteria to reject singular points. We demonstrated that secondary and high-school level students, by using this method, can complete the cycle of logical induction and deduction in experimental sciences not only by setting up an algebraic model, but also by giving a range of uncertainty of its fit to the data.

Dominic Voyer ***Factors intrinsic to the students or to wording and their influences on understanding and solving written arithmetic problems***

This thesis examines the representations that students assemble when solving written arithmetic problems. Two types of factors were considered: those intrinsic to the student (gender, mathematical ability and reading ability), and those linked to the wording of the problem (presence or absence of different types of information - essential, situational and explanatory). The aims of the research were,

first, to study the influence of these factors on students' understanding and, second, to analyze their effects on students' performances in solving written arithmetic problems. Different versions of written problems were given to 750 Grade 6 students (i.e., 11- and 12-year-olds) from 17 francophone schools in Quebec.

PANEL

What courses could or should mathematics departments offer to graduate programs in mathematics education?

Panelists: France Caron, Peter Liljedahl, Morris Orzech, Anna Sierpinska, Elaine Simmt

This theme allows for continued discussion (from last year's joint session with CMS and working group on secondary math teacher development) of the relationship between mathematics education and mathematics departments. Here, the focus will be on the graduate level in mathematics education. Of course, even the premise of offering such courses might be challenged.

CMESG 2007 - SCHEDULE

Friday 8 June	**Saturday** 9 June	**Sunday** 10 June	**Monday** 11 June	**Tuesday** 12 June
	9:30 – 11:00 Working Groups	9:00 – 11:00 Working Groups	9:00 – 11:00 Working Groups	9:00 – 10:00 Topic Sessions C and D
				10:00 – 11:00 Panel
	11:00 – 11:20 Coffee Break	11:00 – 11:20 Coffee Break	11:00 – 11:20 Coffee Break	11:00 – 11:30 Coffee Break
	11:20 – 12:30 Working Groups	11:20 – 12:30 Working Groups	11:20 – 12:30 Working Groups	11.30 – 12.30 Closing Session
	12:30 – 13:30 LUNCH	12:30 – 13:30 LUNCH	12:30 – 13:30 LUNCH	
	13:45-14:15 Small Group Discussion of Plenary 1	13:45 – 14:45 Plenary 2 T.C. Stevens	13:45-14:15 Small Group Discussion of Plenary 2	
	14:15-15:15 Discussion of plenary 1		14:15-15:15 Discussion of plenary 2	
15:00 – 18:00 REGISTRATION DKT Complex	15:15-15:45 Ad hoc sessions (1)	15:00 – 16:00 Topic Sessions A and B	15:15-15:45 Ad hoc sessions (3)	
	15:45 – 16:15 Break		15:45 – 16:15 Break	
	16:15 – 16:45 New PhDs (1)	16:00 – 20:00 Free time to explore Fredericton trails and have dinner in town	16:15 – 16:45 New PhDs (2)	
17:30 – 18:45 BBQ *DKT Complex*	17:00 – 17:30 Ad hoc sessions (2)		17:00 -18:15 Annual General Meeting	
19:00 – 19:45 CMESG Opening session	19:00 DINNER *DKT Residence*		19:30 DINNER *The Blue Door Restaurant*	
19:45-20:45 Plenary 1 R. Núñez		20:00 Desserts and CELTIC MUSIC at *Charlotte St Arts*		
20:45 RECEPTION *DKT Complex*				