CMESG **GCEDM**

NEWSLETTER / BULLETIN

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The NEWSLETTER is a publication of the Canadian Mathematics Education Study Group

CMESG *is a group of mathematicians and mathematics educators who meet annually to discuss mathematics education issues at all levels of learning. The aims of the Study Group are:*

1) *to study the theories and practices of the teaching of mathematics*
2) *to promote research in mathematics education*
3) *to exchange ideas and information about all aspects of mathematics education in Canada*
4) *to disseminate the results of its work.*

Ce BULLETIN est une publication du Groupe canadien d'étude en didactique des mathématiques

Le ***GCEDM*** *est composé de personnes œuvrant en mathématiques et en didactique des mathématiques et qui se réunissent une fois par année pour étudier diverses questions relatives à l'enseignement des mathématiques à tous les niveaux. Les buts du Groupe sont les suivants:*

1) *susciter une réflexion critique sur la théorie et la pratique de l'enseignement des mathématiques*
2) *encourager la recherche en didactique des mathématiques*
3) *faciliter l'échange d'idées et d'information sur tous les aspects de l'éducation mathématique au Canada*
4) *faire connaître les résultats de ses travaux.*

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(in order of appearance / en ordre d'apparition)

PRESIDENT'S MESSAGE DU PRÉSIDENT

Elaine Simmt

For the first time after spending a number of years in administration, I had the fortune of teaching the University of Alberta's 4th year secondary mathematics majors. Many times over the term I invoked the lessons that I have learnt from my annual participation in CMESG. From lessons in proof and proving, early algebra, inquiry based teaching and learning, and using physical and conceptual objects for mathematical engagement, to thinking about the growing diversity in schools: the list of lessons that I have learnt and that came to me as I taught pre-service and in-service teachers are inspired by my CMESG colleagues. This year the CMESG program includes opportunities to think about the contemporary classroom, creativity in mathematics, connections to planet earth, cognition and curriculum. Each of these topics has immense potential to inform mathematics education in Canada.

It is my pleasure to announce that Peter Liljedahl, Simon Fraser University, was re-elected as a member of the executive. As well, Viktor Freiman, Université de Moncton, has been elected by acclamation as treasurer. Congratulations to both, and thanks to those who agreed to stand. Thank you to Dave Wagner, University of New Brunswick, and Laurent Theis, Université de Sherbrooke, for sitting on the nomination committee and looking after the annual election.

Please join us for our annual conference May 24 – 28, 2013 at Brock University in St. Catharines, Ontario. Chantal Buteau and Joyce Mgombelo have been working hard to prepare for our visit and have some wonderful plans for us while visiting the Niagara region.

Pour la première fois après plusieurs années en administration, j'ai eu la chance d'enseigner des mathématiques à l'université de l'Alberta pour des étudiants en fin de formation à l'enseignement des mathématiques. J'ai souvent pensé aux leçons tirées de ma participation annuelle à GCEDM. Les discussions sur la preuve et la démonstration, les débuts de l'algèbre, l'utilisation d'objets physiques et conceptuels pour susciter l'engagement mathématique, et la réflexion sur la diversité des écoles sont autant de leçons apprises qui me sont revenues. Cette année, le programme de GCEDM offre des possibilités de penser à la classe de mathématiques d'aujourd'hui par des réflexions sur la créativité des élèves, sur les mathématiques de la planète Terre, sur la cognition pour cerner le développement d'une pensée mathématiques et sur le curriculum. Chacun de ces sujets ont un grand potentiel à l'enseignement des mathématiques au Canada.

C'est avec plaisir que j'annonce que Peter Liljedahl, de Simon Fraser University, a été élu membre adjoint. De plus, Viktor Freiman, de l'université de Moncton, a été élu par acclamation au poste de trésorier. Félicitations, et nos remerciements à tous ceux qui ont accepté de se présenter. Je tiens à remercier Dave Wagner, de l'université du Nouveau-Brunswick, et Laurent Theis, de l'université de Sherbrooke, pour avoir présidé le comité de nomination et assuré le suivi de l'élection annuelle.

Nous vous invitons à nous joindre pour notre rencontre annuelle du 24 mai au 28 mai 2013 à l'université Brock, à St. Catharines, en Ontario. Chantal Buteau et Joyce Mgombelo ont travaillé très fort pour préparer cette visite et ont des plans merveilleux pour vous tout en vous faisant visiter la région de Niagara.

NOTICES / AVIS

Up-coming Conferences and Events

PME 38 and PME-NA 36 are coming to Vancouver! SFU and UBC will be hosting a dual meeting of PME and PME-NA on the UBC campus July 15-20, 2014. Plan now to attend. Watch http://www.pme38.com/ for updated information. Peter Liljedahl and Cynthis Nicol (co-chairs).

CMS 2013 Summer Meeting

The Canadian Mathematical Society's Summer Meeting is being hosted by Dalhousie University and Saint Mary's University in Halifax, Nova Scotia on June 4 - 7, 2013. This year's Mathematics Education session focuses on outreach and public perception of mathematics. The session is organized by John McLoughlin, and will be held on June 6. For more information, visit: http://math.ca/Events/summer13/

OAME Annual Conferences

OAME 2013: Think BIG will be held in Toronto, at Seneca College, on May 2 – 4, 2013. This year OAME is offering a special invitation for primary teachers to attend workshops designed to explore classroom-ready ideas that will help enhance primary math lessons and activities. Guest speakers include locals Cathy Bruce and Ruth Beatty, CBC's Bob McDonald, and international favourites Marian Small and Dan Meyer. For more information visit http://www.oame2013.ca/.

Preparations for *OAME 2014: CHAMPions 4 Change* are also well underway. It is scheduled for May 8-10, 2014 at Humber College, in Toronto. Keynote speakers include 2013 TED Prize winner Sugata Mitra, as well as Jo Boaler and Mawi Asgedom. This will be OAME's first "e-ver" e-conference with opportunities for delegates to attend selected sessions digitally. Please visit www.oame2014.ca for more details, or follow us on Twitter (@OAME2014). Paul Alves and Dwight Stead (co-chairs).

MEMBERS' ACTIVITIES / ACTIVITÉS DES MEMBERS

Maybe the SNARC is a Boojum after all!

Interactions Between Space, Time and Number: 20 Years of Research

College de France, February 26th, 2013

By Kevin Thomas

Approximately 150 people attended this single day seminar at College de France in Paris celebrating 20 years of research as marked by the 1993 publication of the seminal paper by Dehaene, Bossini & Giraux identifying the SNARC effect. The day included talks by some of the most distinguished researchers in numerical cognition and offered an opportunity to become acquainted with the latest research and issues in the field.

Stanislas Dehaene opened the event by outlining the findings of the 1993 paper on what has been dubbed the Spatial-Numerical Association of Response Codes (SNARC) effect, a play on the name of the fictional creature in Lewis Carol's poem *The Hunting of the Snark*. In this seminal research, adults were shown Arabic digits between 0 and 9 on a computer screen and asked to signal the parity of the number by pressing a key on their left using their left hand or a key on their right using their right hand. The important finding was that subjects responded more quickly to small numbers with their left hand and more quickly to large numbers with their right hand. This effect was replicated in a number of similar experiments and was interpreted as suggesting that we associate numbers with positions in space. In this case, subjects associated small numbers with the left side of space and large numbers with the right side of space.

The significance of the discovery of the SNARC effect was that it provided a possible psychological foundation for the link between spatial cognition and mathematical reasoning. Twenty years after the publication of the 1993 paper it has been cited over 900 times and has spawned an entire field of research, which was well represented at the conference. Highlights from other talks included:

- Martin Fischer and his suggestion for a broader conception of spatial numerical mappings to include a vertical (as well as horizontal) SNARC effect;
- Wim Fias's research which challenged the traditional view of SNARC as a consequence of a mental number line stored in long-term memory, suggesting instead a mapping between space and position in working memory;
- Giorgio Vallortigara's experiments with chicks that suggested a neurological basis for their preference to search for food towards the left rather than right;
- Andreas Nieder's research with monkeys which showed that individual neurons may be tuned to numerosities as high as 30, as well as to "greater than" or "less than".

One of the hot topics of discussion at the conference was the idea of a *logarithmic representation of the subjective number scale*. There was considerable debate on this issue, and before addressing some of this controversy I'll provide some brief context.

Humans are noted to perceive a variety of different stimuli on a logarithmic scale. Our ability to discriminate the brightness of light, for example, diminishes as light becomes brighter. One can express this phenomenon by saying that *the human subjective scale for the brightness of light is approximately logarithmic*. Research suggests that the human subjective number scale is, at least initially, also approximately logarithmic. For instance, preschool children typically discriminate between small numbers much better than large numbers – e.g. 75 and 80 would be perceived as being much closer to each other when marked on a number line than 5 and 10. A logarithmic curve seems to best fit the preschool children's line markings, whereas a linear curve becomes an increasingly good fit as children learn more about numbers in classes.

Coming back to the Paris seminar, two key issues arose regarding the logarithmic representation of the

subjective number scale. First, David Burr raised the possibility that the representation within the brain is not actually logarithmic. He argued that the compression of the number line is simply a consequence of regression towards the mean. The second issue was raised by Brian Butterworth in a very provocative final talk of the day. Butterworth argued against the view that, through education, the subjective scale changes from a logarithmic to a linear representation. Instead, he believes that a "learned equal-interval response grid" mediates the subjective representation to produce a linear line-marking response. In the final minute of Butterworth's talk, however, came the most stinging remarks: he suggested that the SNARC may not be an innate association, but rather a product of the fact that we "like to model numbers spatially". That is, spatial associations are useful, but not necessarily innate. In *The Hunting of the Snark* a Boojum is a special kind of Snark, and should you happen to catch one you vanish into thin air. Butterworth ended the day with the statement: "maybe the SNARC is a Boojum after all!"

Moving forward from the conference, researchers are motivated by Dehaene's closing question: "What are the implications of this research for mathematics education?" This was the question I found most pertinent and inviting. While the implications are not yet clear, it seems to me that this type of research offers the possibility of a scientific understanding of mathematical cognition, and as mathematics education researchers it's worth paying close attention. For those interested, all of the conference talks can be found via the "Seminars" link at: www.college-de-france.fr/site/en-stanislas-dehaene.

Past Proceedings, Contemporary Conversations

Over the last 36 years of the CMESG, the landscape of mathematics education in Canada has changed considerably. Nevertheless, one can see common themes, questions, and challenges that were pertinent then, and that continue to attract Canadian educators. To celebrate past CMESG conferences, and in anticipation of upcoming ones, it's interesting to look back at some of the issues that were engaging our community in its early years and to reflect on them in light of our contemporary conversations. Amongst the variety of themes at the this year's meeting is the role of technology in mathematics teaching and learning – a matter that was also on the minds of Bernard R. Hodgson and John Poland 30 years ago. Below is an excerpt from their article originally published in the CMESG / GCEDM Proceedings of the 1983 Annual Meeting, edited by Charles Verhille. For the full article, visit cmesg.ca.

Revamping the mathematics curriculum: the influence of computers

By Bernard R. Hodgson and John Poland

Almost every mathematics department in Canada has experienced a drop in the number of students graduating with a mathematics degree at the bachelor's level in many cases, to an unhealthy level. This phenomenon has occurred in many other countries too, and it is clear that the attractiveness of a career in our sister subject, computing, is a major factor. Computing is the new, challenging and prestigious frontier. But there are a number of key factors in this computer revolution that we feel will compel specific changes in undergraduate mathematics education. Let us spell out what we see as these key factors, the problems to which they give rise and scenarios of probable reactions and solutions.

Most important, in the next few years we can expect to see large numbers of freshmen in our mathematics classes with a substantial experience with microcomputers and their programming packages. Many provinces are committed to extensive distribution of these facilities to secondary schools and many students are eager to learn. At the undergraduate level we will see more disciplines using increasingly sophisticated computer techniques and backup mathematics. Of course, computer programs will continue to grow in their ability to do

arduous multi-precision calculations and carry out our standard numerical algorithms (like Simpson's rule or row reduction of matrices), as well as grow in the ability to do routine algebraic manipulations like techniques of indefinite integration or solving equations for specified variables). And the increasing ability of computer programs to carry out routine mathematics also comes with a growth of the new area of modern applied mathematics: mathematical computer science (from computational complexity and probabilistic algorithms to formal languages and cryptanalysis).

Does mathematics as we teach it now really address these changes? We feel that most of the undergraduate introductory mathematics courses in calculus, linear algebra and abstract algebra are presented in the classroom as though computers do not exist. How can we expect to be considered as teaching to our students when for example we present the traditional techniques of integration (e.g. partial fractions) and our students know that already there are packages to do these symbolic algebraic manipulations on the computer, and in any case computer programs exist to evaluate definite integrals without using anti-derivatives? This illustrates that some of the content of these courses needs to be deemphasized, especially as it relates to the actual passage to and evaluation of solutions that computers can obtain (c.f. P.J. Hilton in (CMESG 83)). But the more we use computers for these processes, the more we will need to emphasize checking and validation. The question is that thorny one of relevance. How relevant is our approach to the calculus or algebra? How relevant is the actual content of our courses? Are there other topics we should be introducing to the students? And how relevant does mathematics seem to them as a way of solving questions with which they are or expect to be concerned? What we wish most to share here is our feeling that the attitudes and expectations of the majority of our freshmen who have some interest in mathematics is and will continue to be for some time that the most challenging and meaningful problems have to do with computers. And this must be acknowledged in our methods of motivating our students, and students from other disciplines taking our courses.
…

What is the basic perspective we should retain when considering [curricular] changes, what is our overall goal? The major recommendation of CUPM 81 was to capture the students' interest and lead them to develop both the ability for rigorous mathematical reasoning and the ability to generalize from the particular to the abstract. In this context it should be recalled that the Science Council study of mathematical sciences in Canada (COLEMAN 76) found “almost all mathematics professors allege that their highest ambition in undergraduate teaching is to convey not specific content but rather a way of thinking,” a way of thinking that even our colleagues in other disciplines consider important and wish their students to undergo when taking our courses. It is so easy when teaching specific content to forget that our subject matter, mathematics, is one of the greatest intellectual achievements of mankind… Can we offer our students courses in which the power of mathematics can be demonstrated in computer science and the value of the computer in mathematics can be appreciated in its proper role?
…

The authors go on to discuss ideas of what might contribute to “the fruitfulness of the interaction between mathematics and computer science, and the reasonable modifications we can attempt in our courses so our students have a deeper, wider and more meaningful education in mathematics” (p.110).

For a current look at similar issues, this year’s conference has in store: a Plenary Lecture by Bill Ralph *(Are we teaching Roman Numerals in a digital age?),* Working Groups by George Gadanidis and Phillipe Richard *(MOOCs and online mathematics teaching and learning), and* by Brent Davis and Kathy Kubota-Zarivnij *(Mathematics curriculum re-conceptualization), as well as a* Topic Session by Egan Chernoff *(Social media and mathematics education: whenever the twain shall meet).*

My thanks to PGL for the inspiration, and to the executive committee for permission to pillage and publish from past proceedings.

NEWS FROM THE EXECUTIVE / DES NOUVELLES DE L'EXÉCUTIF

Report of the Nominations / Elections Committee 2013

127 regular members were invited to participate in the election for the CMESG/GCEDM Executive. 47% of the regular members voted in the 2013 Elections.

Here are the results and the terms of office of our elected members:

Peter Liljedahl, member of the executive of CMESG/GCEDM, 2013-2015

Viktor Freiman (by acclamation), treasurer of CMESG/GCEDM, 2013-2015

Congratulations to the newly elected CMESG/GCEDM Executive members. Sincere thanks to those members who let their names stand for election. Our organization was very fortunate to have a strong list of nominees this year.

The members of the CMESG/GCEDM Nominations & Election Committee are David Wagner (dwagner@unb.ca) and Laurent Theis (Laurent.Theis@USherbrooke.ca).

Rapport du comité de nomination / sélection du GCEDM 2012

127 membres réguliers ont été invités à participer aux élections pour le comité exécutif du GCEDM/CMESG. 47% de nos membres réguliers ont marqué leur bulletin de vote.

Voici les résultats du scrutin et les mandats de nos membres élus:

Peter Liljedahl, membre du comité exécutif du GCEDM/CMESG, 2013-2015

Viktor Freiman (par acclamation), trésorier du GCEDM/CMESG, 2013-2015

Félicitations à nos membres élus. Nous remercions sincèrement tous ceux et celles qui ont bien voulu briguer les suffrages. Nous sommes très heureux de compter autant de membres qui veulent participer au sein de notre organisation.

Les membres du comité de nomination/sélection du GCEDM/CMESG sont David Wagner (dwagner@unb.ca) et Laurent Theis (Laurent.Theis@USherbrooke.ca).

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CMESG EXECUTIVE / L'EXÉCUTIF DU GCEDM

The members of the executive extend an invitation to you to contact us about any item of interest. If you have something you want to suggest, if you have a concern you wish to raise, if you want more information, etc., please let one of us know. In order to be of service to the membership, we need to be aware of what your interests are.

Les membres du Comité exécutif vous invitent à leur faire part de votre point de vue concernant n'importe quel aspect de la vie du GCEDM. Que ce soit pour transmettre suggestions ou commentaires, ou encore pour être mieux informé, n'hésitez pas à entrer en contact avec l'un d'entre nous. En nous faisant connaître vos intérêts, vous nous aidez à mieux vous servir.

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