

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 oeuvrant 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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PRESIDENT'S MESSAGE DU PRÉSIDENT

Frédéric Gourdeau

Fredericton, nous voici!

Une autre année sur les chapeaux de roues, pour moi et pour plusieurs d'entre-nous. J'ai hâte de me retrouver à Fredericton, avec du temps pour réfléchir à l'enseignement et à l'apprentissage des mathématiques, avec des amis qui partagent cet intérêt. Le programme de notre rencontre, disponible sur notre site www.gcedm.math.ca, saura sûrement vous intéresser. Personnellement, je vais prendre part aux quatre groupes de travail simultanément... enfin, j'aimerais pouvoir le faire. Je me console en me disant que je n'ai pas à choisir entre nos conférenciers pléniers. John Grant McLoughlin, Dave Wagner et leur équipe nous attendent tous. Plusieurs d'entre-nous ne sont pas encore inscrits – ne manquez pas la rencontre, je suis certain qu'elle sera exceptionnelle. Je n'en dis pas plus – consultez le programme, inscrivez vous et c'est un rendez-vous!

L'Exécutif du GCEM

Dave Wagner a été élu à l'Exécutif, alors que notre trésorier, Doug Franks, a été réélu. Félicitations! Florence Glanfield et moi en sommes à la deuxième année de notre mandat, alors que Brent Davis continue comme membre désigné et que Walter Whiteley se joint à nous comme second membre désigné. Nos remerciements à France Caron et Leo Jonker qui quittent l'exécutif après y avoir fait du travail impeccable. Ça aura été un privilège et un grand plaisir de travailler avec eux.

Sherbrooke, 23 au 28 mai 2008

Que les critiques se taisent: on ne pourra pas nous accuser de vous informer à la dernière minute! Et on peut même vous dire que nos conférenciers pléniers seront Anne Watson et Ahmed Djebbar. La suite... dans quelques mois!

Fredericton, here we come

It's been, for me and for many of you, a busy year. I really look forward to our meeting in Fredericton, to another occasion to reflect on mathematics education, on teaching, on mathematics learning, and to be with many friends once again. The program, available on our website www.cmesg.math.ca, will certainly be of interest. I will personally attend the four working groups simultaneously... well, I wish I could. At least, I won't need to choose between the plenary presentations. Trust Dave Wagner, John Grant McLoughlin and their team to make it another unforgettable meeting. Many of you have not yet registered – don't miss it, it will be a great meeting. I won't say more – read the program, register and come!

The Executive

We are joined this year by Dave Wagner who has been elected to the Executive, while Doug Franks was re-elected as Treasurer. Congratulations! Florence Glanfield and I are on the second year of our mandate, while Brent Davis continues as co-opted member and Walter Whiteley joins us as the second co-opted member. Our thanks to France Caron and Leo Jonker who leave the executive after a job very well done. It has been a real pleasure to work with both of them.

Sherbrooke, May 23 – 28, 2008

We will not be accused of making those decisions at the last minute. And we can even tell you that Anne Watson and Ahmed Djebbar will be our two plenary speakers. More to come... in a few months!

MEMBERS' ACTIVITIES / ACTIVITES DES MEMBRES

Math Artist-in-Residence Project

submitted by Susan Gerofsky

Artist-in-Residence: George W. Hart, professor of computer science, SUNY Stony Brook
web site www.georgehart.com, project web site <http://www.georgehart.com/UBC/ubc.html>

Background to the project:

In May 2006, a call for proposals for artists-in-residence went out to the UBC Faculty of Education in connection with the Faculty's 50th Anniversary celebrations in 2007.

With the support of my math education colleagues at UBC (Cynthia Nichol, Brent Davis and Ann Anderson), along with Melania Alvarez-Adem and Ivar Ekeland at PIMS (Pacific Institute of the Mathematical Science) and our dean's 50th Anniversary Fund, we raised just enough money to bring geometer, sculptor and computer scientist George Hart of SUNY Stony Brook to UBC for a week-long residency. George is a founding member of the Bridges conference group ("Mathematical connections in art, music and science" <<http://www.bridgesmathart.org/>>), and this project was also made feasible by the Bridges/ BIRS (Banff International Research Station) working group on innovations in mathematics education via the arts, which followed George Hart's residency in late January.

My aim in organizing this math/arts residency was to give a large number of student teachers, practicing teachers and school students a satisfying encounter in learning mathematics through art. I hoped that the shared experience of working with an established mathematical artist would help participants make a stronger connection between math and the arts as part of school curricular practice, and encourage teachers to pursue this connection further.

Project planning:

In planning the residency, George and I established guidelines that helped shape the project. George would design a mathematically accessible and interesting sculpture that could be constructed in middle and secondary school classrooms. We would invite school classes from the Vancouver region to come to UBC for half-day or full-day field trips and workshops. The students, assisted by UBC secondary math student teachers as well as George and me, would construct experimental prototypes for a final version of the sculpture that would be a permanent installation at the UBC Faculty of Education. An interpretive plaque hung near the sculpture would help viewers understand the finished sculpture's mathematical basis and would acknowledge the artist, school classes and volunteers who participated.

In the course of the week of workshops, George would work with the student teachers to write, illustrate and refine a set of instructions available to classroom teachers to use in constructing their own sculpture like the one we would be making. We wanted to have a "parent" sculpture on display at UBC and "offspring" sculptures in schools all around the Lower Mainland.

To make the sculpture project a practical one for school classrooms, it would have to be achievable over the course of one or two 70-minute class blocks. The materials would have to be cheap, easy to obtain and safe. For a long time, I was pushing to use compasses, plastic triangles or protractors from school geometry kits as the sculptural elements, but the high price of obtaining hundreds of these and the potentially dangerous accidents possible from falling compasses convinced me otherwise.

In the end, George's design used 150 CD's and 180 coloured nylon cable ties ("zap straps") to build a sculpture of a truncated icosahedron (eg.: the shape of a soccer-ball). Shiny-side-out CDs represented the vertices of the truncated icosahedron and dull-side-out CDs represented its edges. I found the cheapest suppliers of cable ties, new CDs and DVDs (we used both initially, and were pleased with their interesting colour differences). On the lookout for reusable materials, I contacted the campus radio station, which donated a huge bin of 2000 demo music CDs (many of them never opened, sadly for the bands who had sent them).

The workshops:

I advertised the geometric sculpture math workshop/ field trip in November and December through our provincial math teachers' listserv and through contacts in local school boards. In the end, we had over 300 students from seven schools who participated, along with their teachers and in many cases, parent volunteers.

About 20 secondary mathematics student teachers also participated throughout the week, at first as assistants and photographers, then as workshop leaders.

Each workshop took place in two phases. The first half of the workshop offered students ways to visualize, predict and understand the shape of the sculpture through drawing. This was an interesting way of using drawing as a modality for learning and knowing, a technique I have experimented with in an Islamic tiling project as well. For this phase of the workshop, participants were given large sheets of newsprint paper, pencils, and unit origami models of cubes and icosahedra built by my students in previous courses.



Students were first taught to draw a 3D cube using an unfamiliar corner-on perspective (by drawing a hexagon and joining alternate corners to the centre). Then they practiced truncating the cube in their drawing, lopping off corners to create triangular planes where the corners had been, and doubling the number of edges of the original square faces to create octagons. Using the pictures they had drawn, students were able to count the triangular and octagonal faces (as well as vertices and edges) of the truncated cube, and to see the logic that related these to the vertices and faces of the original cube. High school classes were guided to conjecture Euler's polyhedral theorem from their observations.

The cube and truncated cube were used as simpler examples of the process of drawing and truncating an icosahedron. Students were taught a way to draw an icosahedron starting with a regular pentagon, joining vertices to centre, and adding additional vertices and edges to represent the 3D figure. They found a number of ways to count the vertices, edges and faces of the icosahedron. Then, using the principles learned from truncating the cube, the students drew the truncated icosahedron. There were wonderful "aha!" moments when it suddenly became apparent that what they had drawn was a very accurate 3D picture of a soccer ball,

Finally, the participants substituted drawings of discs (the CDs) to replace each edge and each vertex of the truncated icosahedron. They were taught how to foreshorten the discs to give the impression of a 3D object on a 2D plane – not a trivial drawing task!

After a break, students began the second half of the workshop in which they built the actual sculpture. Working in groups, they produced "snakes" and then "rings" of 10 CDs joined together in a particular configuration using cable ties through their centres. George had already fastened an s-hook to the ceiling and tied five pieces of kite string together to hang the sculpture as it was built. Groups came up and added their rings of CDs, joining each ring to the next with an additional edge CD, until the bottom of the sphere-like shape was joined and the sculpture was complete.

The hanging sculpture took on an egglike shape because of its weight. One group wanted to experiment with spinning it to see if it would appear more spherical because of inertia – and it did! Two groups built variations on the original design. One group used three CDs for each edge rather than just one, so the structure was much bigger in diameter (and looked more egg-shaped). Another group built an elongated version that connected two truncated icosahedra into a "paramecium" shape. Connections were drawn between the shapes we were constructing and naturally-occurring biological and chemical forms.

Students, teachers and parents involved with the workshops were asked to complete a pre- and post-participation questionnaire about their attitudes towards mathematics, art and connections between the two. I have yet to formally analyze this set of data, but some of the positive comments arising from the workshop included the following:

"I used to think that art can be expressive but math is too constricting, Today I learned that math and art actually mix well."

"I used to think that math was an ugly thing. Today I learned that math and art can combine."

"I learned that art and math can be put together to make incredible things. Making sculptures takes concentration."

"I used to think math was boring, but now I think that math can be like art."

"Today I learned that geometry is fun, and simple shapes can build complex structures."



The experience was a positive one for the student teachers involved. In discussions after the workshops, student teachers in the group told me that they appreciated having extended contact with school classes of different ages (we had groups ranging from Grade 6 to Grade 12) and liked working closely with small groups of students. They gained confidence in their teaching skills as they led the workshops themselves, and found that they could vary the activities to suit the needs of the students and the time available. Several of the student teachers said that they would not have dared teach math through art before this, but now they felt confident to try this kind of project in their own classrooms.



Two of the student teachers used math/art projects in their practicum classrooms immediately following this experience, one replicating this sculpture project, the other working with a project on the geometry of design.

Public lecture:

Halfway through the week-long residency, George gave a free public lecture at a centrally-located high school in Vancouver at 4:30 PM – a time and place we chose for their convenience for teachers. Unfortunately, despite a fairly vigorous publicity campaign for the talk through the university and the provincial math teachers' listserv, only a small select group showed up on a dark, rainy Wednesday evening for George's talk. Those who did attend were treated to an incredible slide show and demonstration of George Hart's geometric sculptural techniques and the beautiful sculptures he has created, many of them with the participation of hundreds of volunteers in "barn-raising" sculpture assembly sessions. We videotaped and audiotaped the talk, and will podcast it soon so that others can have access to the lecture.

A permanent geometric sculpture display?

The final sculpture was hung in the Education Library in the Scarfe Building at UBC. It was built of new pale green CDs, and used red cable ties to mark out a symmetric Hamiltonian cycle on its surface. It looked beautiful, glinting in the sunlight and visible through several windows to passersby on campus. But unfortunately...

...as several months passed, the CDs began to crack under the strain of the extreme curvature under gravity. Once one CD had cracked, others followed. Two months after it had been hung, we took the sculpture down.

George Hart has gone back to the drawing board. At his home university, he is experimenting with heat-forming the CDs to the proper curvature before assembling the sculpture. He is building a sculpture with his students there, and will observe how durable it is after hanging for several months. Once the improved design is working well, he will fabricate a new sculpture, this time for more permanent display at UBC!

Explanation and Proof in Mathematics: Philosophical and Educational Perspectives

submitted by Gila Hanna

An international meeting on "Explanation and Proof in Mathematics: Philosophical and Educational Perspectives", took place 01 - 04 November 2006 at the Zentrum für Interdisziplinäre Studien (ZIS) of the Universität Duisburg-Essen, with the support of the Deutsche Forschungsgemeinschaft (DFG).

Organisers: Gila Hanna (Toronto), Hans Niels Jahnke (Essen) and Helmut Pulte (Bochum)

The organisers are presently editing a book of some 20 papers discussing issues pertaining to both mathematics education and the philosophy of mathematics. The book will be published by Springer in 2008.

Connecting Women in Mathematics Across Canada

submitted by Donna Kotsopoulos

The Canadian Mathematics Society Committee for Women in Mathematics, in cooperation with the Fields Institute, hosted the third *Connecting Women in Mathematics Across Canada* (CWIMAC) Conference from December 7 to 8, 2006, in Toronto. The purpose of this conference was to bring junior women (graduate students and postdoctoral fellows) and senior researchers in mathematical sciences at Canadian universities together to share research, offer mentorship, and discuss potential research directions/opportunities.

There were over 50 invited participants. Three of the 50 participants were from mathematics education. Junior researchers had the opportunity to present their research through either a paper or poster presentation. I was the only presenter from mathematics education. In addition to the research presentations, there were speakers and panel discussions. There was also a public talk by Siobhan Roberts, author of the recently published book about Donald Coxeter.

One noteworthy feature of this conference was the pairing of junior and senior researchers, for each conference day, in order to facilitate mentorship. The first day, I was paired with Dr. Cristina Stoica, from Wilfred Laurier University. On the second day, I was paired with Dr. Lisa Jeffrey, from University of Toronto. This was a terrific opportunity to learn about teaching, research, and career development from senior scholars.

Dr. Wendy MacCaull, from St. Francis Xavier University, gave a talk entitled, *Some New Opportunities for Mathematical Research*. Although Dr. MacCaull mentioned among possible collaborations, collaborations with other scientific communities in universities, collaborations with mathematics education was not mentioned. I did raise the possibility of collaborations with mathematics education during the discussion component of the talk. I sensed from the response of the participants, both during this talk and while interacting with participants over the course of the two days, that the possibility of collaborations with mathematics education had not been contemplated by many. The possibility for such collaborations seemed novel and welcome.

Overall the conference was a terrific opportunity. I commend and thank the organizing committee. My purpose in writing this short piece was to alert members of CMESG to the conference, but, more importantly to the fact that more work needs to be done to inform our colleagues in mathematics about our work in mathematics education, and the potential for collaborations. It would be terrific if, for future CWIMAC conferences, our presence as women in mathematics education, was $>$ than $n = 3$. More information on this conference can be found at <http://www.fields.utoronto.ca/programs/scientific/06-07/cwimac06/>.

Innovations in mathematics education via the arts

submitted by Stewart Craven and Susan Gerofsky

*In January this year, an international group of 29 mathematicians/artists/educators came together at the Banff International Research Station (BIRS) for a five-day collaborative working session on innovations in math education via the arts. Many of the participants had some connection with the **Bridges Conference: Mathematical Connections in Art, Music, and Science** <http://www.bridgesmathart.org/>. Three CMESG people were part of this working group (Stewart Craven, Susan Gerofsky and Bill Higginson).*

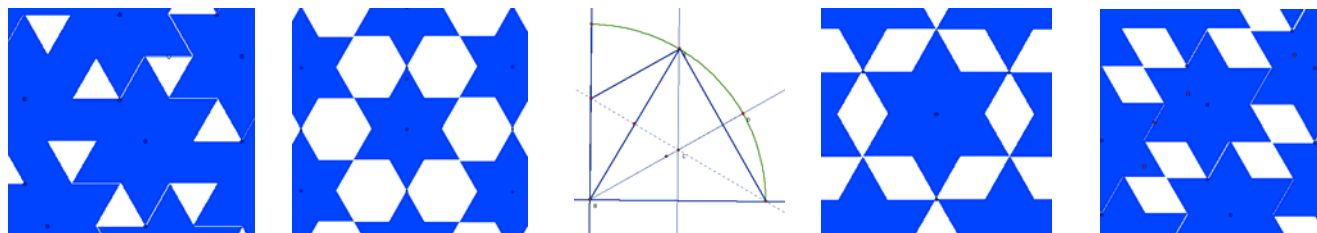
STEWART: In January of this year I was privileged to take part in a meeting of some of the most eclectic and interesting folks on the planet at the Banff International Research Station. This group comprised people who have a profound interest in connections between the Arts (defined very broadly) and the world of Mathematics. How was it that a person like myself could be part of this milieu? Although the majority of participants were

mathematicians, mathematics education professors, or artists I was a school mathematics teacher who had an interest in the motivational potential of using Arts' contexts to inspire children to do worthwhile mathematics.

It was the aim of the group to commit to creating some “products” – books, mobile museums, web/wiki sites, individual activities, ...– that could be used at various levels of education to teach mathematics within Arts' contexts. I was part of a small group that was attempting to tease out some activities that would be useful for teaching mathematics in elementary school. Early in the week I was captivated by a short activity that we all participated in where we folded circles and used scissors to create six and eight point stars. Upon returning to Toronto, I began to use this activity with children, teachers, professors, and school administrators. The basis of their exploration of the six-point star was based on two inquiries:

1. How is it that the folding generates a perfectly symmetric star?
2. In creating mosaics with groups of stars what kinds of patterns emerge and how can you describe them?

This investigation has begun to take off as one can see in these Geometer's Sketchpad drawings:



This could well be the beginning of a “Math/Art product” that would be of interest to elementary school teachers.

SUSAN: I was thrilled to find such a wide range of arts connections with mathematics represented at this workshop – connections including sculpture, textile arts, art history, poetry, computer graphics, beading and jewellery design, dance and music. I soon became a member of a small working group that was working with circular representations of musical rhythms as an embodied way of teaching a very wide range of mathematical concepts. We met as a small group every afternoon, walked down the snowy trail to Banff and spent a few hours working on laptops in a café, with occasional forays to the nearby dollar store to buy necessary supplies (spirographs, castanets and polyhedral models, mostly). Our collaborative paper is coming along well!

Working at the Banff Centre is a treat. Residents are provided with meals, accommodation, meeting space, a fitness centre, and contact with other artists and scholars in residence. Our math/arts group formed close ties with Aboriginal artists on a seven-week residency working on “the idea of North”. One of the artists gave a workshop to our group on traditional geometric transfer patterns for beading and quilling created by chewing birch bark. We were also welcomed to an evening of traditional stories and songs.

The manager of the Banff Centre let us know that the staff there aimed to give artists “no excuses” for not progressing with their art. I had a chance to experience this policy firsthand. I made a request to borrow six metre sticks for a workshop on the geometry of longsword locks in traditional English dance. The next morning, the manager appeared with six beautifully fabricated oak longswords made to my specs in the theatre carpentry workshop! The longsword workshop was a success.

Stewart, Bill and I were interested in making connections between CMESG and the Bridges Conference, since it seemed that many of the people in both groups shared similar interests and ideas about mathematics education. It would be interesting to build links among interested members of the two groups. Thanks to PIMS and BIRS and the workshop organizers for making this event possible.



A CMESG/GCEDM First-Timer Reflects on Calgary 2006

submitted by Egan J. Chernoff

As the saying goes, 'you never forget your first time'. That is exactly how I feel about my experiences in Calgary last year. Although I will always remember CMESG/GCEDM 2006 as the first Mathematics Education conference I ever attended, the conference will also be remembered for a whole host of reasons. More specifically, I will never forget two comments made that week: one of which I heard, the other of which I made. Since they have had such a lasting impression on me, I felt it appropriate to share them with the group of people responsible for me experiencing them. What follows is a brief account of the first few hours, of the first day, of my first conference.

Given my naïveté, I was unaware of how many activities were on day one of the conference. Nevertheless, I decided to experience them all. As such, I attended the joint session between the CMS/SMC and CMESG/GCEDM that was held downtown. The presentation came to an interesting conclusion, which prompted me to ask a question (my first conference question ever). At this point, something weird happened: I am unsure if it was audible for others in the audience, but I became so nervous while asking the question that there was an unexpected inflection in my voice! This made me worried, were these nerves going to arise every time I spoke within a full room this week? In spite of this, there was no time to worry because I had to hop on the *Ctrain* (the wrong *Ctrain* at first!) and make my way back for registration and dinner.

It was at dinner that I heard one of the two memorable utterances from the conference. I was fortunate enough to have Gary Flewelling sit down next to me at dinner. Like everyone else I met at the conference, he was extremely cordial and we soon were engaged in a conversation. Given my limited conference experience at the time, I was interested in asking people what they thought of the CMESG/GCEDM. When I asked him what was so special about this particular conference, he paused and then eloquently replied, "You fly home without a plane."

After dinner I was off to the CMESG/GCEDM opening. This opening is where I would experience my second indelible utterance from the conference and oddly enough, it came from me. As the opening began, I started to recall the events of earlier in the day and my nerves started to well up again. I was getting worried, would the inflection in my voice return when I spoke to the fullest of rooms? I soon found myself starting to count down how many people there were left to introduce before it was my turn. Fortunately, I (somewhat) still had my wits about me and started to notice a pattern while conducting my countdown.

As people went around the room introducing themselves, certain individuals proudly (and rightly so) made the point of saying that they were in attendance for the first ever CMESG/GCEDM conference in 1977. For some reason this struck a cord with me. Eventually it came to my turn. My introduction was succinct: "*Egan Chernoff: Simon Fraser University: And I was born...in 1977.*" It was a spur of the moment reaction and to this day I do not know why I said it. I suspect it has to do with some sort of connection between thoughts of: firsts, conferences, attending, and the year 1977. Nevertheless, I could not be more grateful that I said what I did. The uproarious response I received put my nerves at ease for the remainder of the conference.

There is an old saying in show business, 'leave on a high note'. I had definitely experienced my high note, but I could not leave after the first day of the conference! Unsurprisingly, I was able to experience a number of other high notes during the conference thanks to the many interesting people I met. In part, I was able to meet these people because my remark from the opening session soon became an icebreaker. In fact, as I passed people in the hallways, or back and forth from the dorms, some of them would say, "Hey: you're that guy born in 1977." Moreover, some prominent academics used my remark at the opening as an opportunity to come and introduce themselves to me!

I was fortunate to have such a great icebreaker for my first conference ever. However, upon comparison with other conferences I have attended over the past year, I have come to the realization my icebreaker was unnecessary. The first conference I ever attended would have been exactly the same for me and I still would have met all those people, even without my icebreaker. After all: It was CMESG/GCEDM!

There were so many great experiences during the remainder of the conference, that even though two of my most memorable moments occurred on the first day, when it was all over I was still able to (as Gary so prophetically put) fly home without a plane!

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CMESG EXECUTIVE / L'EXÉCUTIF DU GCEDM 2006-2007

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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