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**The NEWSLETTER is a publication of the
Groupe canadien d'étude en didactique des mathématiques
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.

GCEDM est composé de mathématiciens et de didacticiens des mathématiques qui se réunissent une fois par année pour étudier diverses questions relatives à l'enseignement des mathématiques à tous les niveaux. Les objectifs du Group d'Étude sont les suivants:

- 1) faire l'étude de diverses théories et pratiques de l'enseignement des mathématiques
- 2) promouvoir la recherche sur l'enseignement des mathématiques
- 3) assurer des échanges d'idées et d'information sur tous les aspects de l'enseignement des mathématiques au Canada
- 4) assurer la diffusion des résultats de ses travaux.

**David Wheeler's Contribution
to
CMESG/GCEDM
Recognized When
Research Monograph Unveiled**

The GCEDM/CMESG monograph, *Current Research on the Teaching and Learning of Mathematics in Canada*, edited by Carolyn Kieran and Sandy Dawson, was unveiled at a reception the opening day of ICME, August 17th, 1992

GCEDM/CMESG President, Tom Kieran, made a special presentation of a bound edition of the monograph to David Wheeler, in recognition of the role David played in the founding of CMESG/GCEDM, and his many years of devoted service to the organization. In presenting this special edition to David, Tom noted:

'David, after many years of lamenting each year at the annual general meeting the fact that CMESG/GCEDM never published anything, it seems only fitting that we should present you with this one-of-a-kind, special issue of the our first ever publication, and in doing so, we honour you for being so very instrumental in the creation and continued success of CMESG/GCEDM.

Copies of the monograph were given to members of GCEDM/CMESG in attendance at the reception, and have since been mailed to all members. If you have not received your copy, please contact Lars Jansson.

PRESIDENT'S MESSAGE

Tom Kieren
University of Alberta

I want to mention a number of recent accomplishments of our organization and the Canadian Mathematics Education Community more generally, and in doing so, thank several persons who played key roles in this work. I will do so by name, but of course such persons are only representative of the many other individuals who also worked on the projects mentioned.

It seems fitting to start with ICME-7. For those of you who did not attend, you missed something. It was huge (well over three thousand participants) in size, and I think also a huge success. I certainly attended numerous stimulating sessions and talked mathematics and its learning and teaching with many persons whom I might not otherwise have met. *Many* of our members had a large hand in the arrangements for ICME-7. Our thanks especially go to Claude Gaulin, who has devoted the last many years to the idea and actuality of ICME-7, and also to Bernard Hodgson and Eric Muller who I witnessed working nearly non-stop during the conference itself. David Wheeler led the program committee which produced the high quality program which deserves our commendation. Carolyn Kieran worked very hard on the Canadian National Display, which was wonderful although hidden away and not visited as it should have been. Like the rest of ICME-7, it reminded me that there is *much* of interest happening in mathematics education in Canada. Finally, our own CMESG/GCEDM display should be acknowledged (and the work of honorary members, Sandra Dawson and Lenore Jansson, who spent several hours each at it).

If you attended our Annual General Meeting you witnessed the unveiling of our new publication on research in Canada. Again many of you worked to provide or locally gather information for it, but the main effort in making it the quality document that it is came from Carolyn Kieran and Sandy Dawson. Many thanks to them both for a document which I have already used many times as I was looking for names of persons doing work which interested me.

Many of our members are contributing to mathematics education efforts and are being recognized for this--new elected positions and awards are mentioned elsewhere for Pat Rogers, Peter Taylor, and Carolyn Kieran. In addition, the very large scale Third International Study of Mathematics and Science is centred in Canada under the direction of David Robitaille at UBC, and Tom Schroeder at that institution has been very active in the development and implementation of Teaching Standards of the National Council of Teachers of Mathematics.

As I noted earlier, these are only some of the many recent activities in mathematics education in Canada. To get a better and more personal picture of this activity, I hope you will consider participating in our Annual Meeting at York in Toronto in late May of next year. You will notice that I said participate in and not just attend our meeting. Our meetings centre around the activities of the participants, and are not passive occasions. I hope my notes above indicate that I think such quality activity is typical of Canadian mathematics education on an every day basis.

CMESG/GCEDM Members Honoured

Three members of GCEDM/CMESG have recently achieved honours in their fields, and we add our congratulations to them for the outstanding job they are doing for mathematics education around the world.

Carolyn Kieran, Université du Québec à Montréal, has been elected, for a three year term, President of the Psychology of Mathematics Education group (PME).

Pat Rogers, York University, has been appointed to the Georg Polya Lectureship of the MAA for 1992-1994.

Peter Taylor, Queens University, has received the first Seaway Section of the MAA Outstanding Teaching Award.

A Tribute to Donald Coxeter

Tribute to H.S. M. Coxeter
on the occasion of
ICME-7
August 19, 1992
Québec City, Québec

A special event held in conjunction with ICME-7 was a dinner and film presentation in honour Professor H. S. M. Coxeter, noted Canadian mathematician. Both Professor Coxeter and his wife, Rien, were invited to Québec City for ICME-7. They were in attendance for the duration of the conference.

Many of Professor Coxeter's former students and colleagues had travelled to Québec City to be in attendance for the evening. Representatives of the ICME International Committee, the National ICME Committee (Bernard Hodgson), CMESG/GCEDM (Tom Kieren), and the Beatty Fund also attended. All had the pleasure of the company of the Coxeters at a dinner, sponsored in part by an anonymous donor. The dinner preceded a regularly scheduled ICME session during which a tribute was paid to Professor Coxeter by one of his former students, and longtime colleague, Dr. William Moser of McGill University. Following the tribute, there was a showing of films to which Coxeter had made significant contributions. Below is the text of Dr. Moser's tribute.

This is a VERY special day for me. I have the pleasure and honour of introducing Professor H.S.M. Coxeter. This is a special day for me even though I have had the pleasure of doing this before--at the M A A meeting in Toronto 1976; the Gauss Symposium 1977; the Coxeter Symposium 1979; the Coxeter 80th birthday 1987; and still other occasions. Moreover, I hope there will be occasions in the future when you will hear this once again.

Please note that I will be using the following designations interchangeably: Professor Harold Scott Macdonald Coxeter; Professor H.S.M. Coxeter; Professor Coxeter; Donald Coxeter; Coxeter; Donald; He.

At the age of 15, Donald Coxeter won a prize for an essay on the analogues of the regular solids in 4 and more dimensions. Three years later he completed the manuscript which became his first research publication: *The pure Archimedean polytopes in six and seven*

dimensions; it appeared in the Proceedings of the Cambridge Philosophical Society. It is therefore apparent that he has been a practising mathematician for 70 years!!

His most recent book, the second edition of *Regular Complex Polytopes*, is uniquely Coxeterian. This follows from the fact that the first edition was uniquely Coxeterian. No one else could have done it. The same can be said of much of his prolific research. This is one reason that he holds a special place in the world of mathematics. Another reason is that his works are so widely read. For example, his book, *Introduction to Geometry*, has been translated and published in German, Hungarian, Japanese, Polish, Spanish and Russian. He is the author of 200 research papers--more or less--approximately a dozen books--probably more like 20 taking into account revised and expanded editions--in a variety of fields. I don't know how many invited research-type lectures Professor Coxeter has given. I do know that 17 Ph.D. theses were completed under his supervision. Donald has made outstanding contributions to mathematical education by his innumerable popular lectures, especially at the secondary school level.

He has served as President the Canadian Mathematical Society, Vice-President of the Mathematical Association of American and President of the International Mathematical Congress in 1974.

Seven Honorary degrees have been conferred on him. Among them is the rarest type: an honorary degree from one's own university.

Those are some of the dry statistics of his impressive mathematical activity.

Of course Donald deserves most of the credit for his great accomplishments. Much credit, however, is also due to his wife, Rien, who, for almost 60 years, has watched over Donald with loving care. As we discovered at the dinner earlier this evening, tomorrow marks the 56th wedding anniversary of Rien and Donald. Our congratulations to both of you.

Coxeter devoted many years to the *Canadian Journal of Mathematics*. I recall that he did some of this work--editing, correcting, improving manuscripts--on his daily bus ride to the University of Toronto.

Even a minor editorial correction can prove to be important. For example, 4 years ago I sent one of my manuscripts to him. He responded with his usual kind words--and suggested several corrections among them to change:

m -ominoe to m -omino

I came across his letter last week, so I checked the published paper to see if I had made the change. I had. His letter had arrived in time for me to make the correction before the manuscript was sent off to the printer. I thought (last week) how fortunate I had been 4 years ago, considering the consequences of a similar mistake made recently by Dan Quayle, the Vice-President of the United States of America.

I pursued this *mistake* further. The problem I was describing was one of 50 that had been proposed in 1963 by my brother, Leo¹, in a mimeographed collection which he had titled *Poorly formulated unsolved problems in combinatorial geometry*. In my 1991 paper I explained that: "For each problem I will state the problem precisely as given by Leo." In the 1963 collection by Leo we see:

a m--ominoe which

So a better improvement would have been to insert (sic) after *ominoe* !

Last week I took out the COXETER file in my office. There were many letters he had written to me in the past 30 years. There was great disorder in the file and I spent some time putting the letters in order. This binder contains some of the letters. I mention this to explain my earlier remark "I came across his letter last week."

I came across many of his letters last week.

For example there is a letter dated January 19, 1971 - in response to a letter I had written from London. I had mentioned that the famous

number-theorist, Lou Mordell, had invited me to lunch at the Atheneum Club. Donald wrote "I too saw Louis Mordell quite recently, when he come to the Ontario Mathematical Meeting in Toronto. I hope we can be as active as he when we are in our eighties!"

That's O.K. for you Donald.

The following year 1972 he wrote on July 20, from Washington, D.C. "It is hot as hell here in D.C." I'm happy that it's not snowing in Québec City today; this saves us from more Coxeterian invectives.

I enjoyed reading these letters again. I even picked up points that I had missed earlier. For example, there is a letter written October 15, 1982--complete on one side of the letterhead. There was a discoloration, but I made nothing of it at the time. Last week, while putting this letter into the binder, I noticed something I had missed 10 years ago. On the back side--in TINY script I saw--"Sorry, I spilt some sherry!"

Five years ago, on April 17, 1987, he wrote "We live a very quiet life." I found only 2 other instances of this sort of remark. But I found a hundred other letters--a typical one being a letter of April 29, 1983, in which he wrote "Rien and I are leaving on Sunday the 1st for 3 weeks in Europe. I give various lectures in Giessen, Erlangen, Beyruth, Darmstadt, Tübingen and Munich."

In a 1979 interview printed in the University of Toronto Graduate magazine, he said:"I'm someone who tries to find out mathematical truths--and I enjoy doing it."

That year, in his convocation address to the graduates of the University he said: "To you young graduates who are going out into the wide world to make your fortunes, I say, choose a career that you can really enjoy, even if it doesn't bring you material wealth. It is sad to see people doing jobs that bore them, just to make money. And try to influence your governments to make the world a happier place for everyone."

The penultimate sentence in my tribute is the ultimate sentence in his convocation address:

THE BEST I CAN WISH FOR EACH
OF YOU IS THAT YOU MAY HAVE AS
FULL AND HAPPY A LIFE AS I HAVE
HAD--AND AM STILL HAVING.

¹William Moser's late brother, Leo Moser, was a world-renowned number-theorist, who taught at the University of Alberta.

That was 13 years ago: I expect he would make the same wish today, and I would then say AMEN--and let's get on with the movie.

This tribute was followed by a showing of two films inspired by Coxeter's work, *Dihedral Kaleidoscope*, and *Platonic Solids*, the latter kindly made available by Professor Michele Emmer. Coxeter was actively involved in the preparation of *Dihedral Kaleidoscopes*, and he can be seen constructing the set-up for many of the film's sequences.

At the conclusion of the film presentation, and with the encouragement of a most appreciative audience, which gave the Coxeters a standing ovation, Professor Coxeter gave an impromptu presentation on some insights and thoughts of his recent work with Escher drawings.

The agility of mind and body so evident as he mounted the stage to give this short talk, testified to Coxeter's life-long passion for mathematics and its presentation in understandable ways. All in attendance would no doubt wish that he continues in this fashion for many years to come.

The above was prepared for the ICME-7 Proceedings, which will appear early next year, and is reprinted here with the permission of the editors.

NEWSBREAK:

There will be an informal session featuring Professor Coxeter the Sunday afternoon of the May '93 meeting of GCEDM/CMESG.

Member Reports

The editors of the Newsletter solicit reports on the activities of members of GCEDM/CMESG. This issue we have a research report from two of our colleagues at UQAM. Won't you take a few moments and drop us a page or so about your research, curriculum development, or teaching activities?

The development of spatial skills through the alternate use of analytical and operational activities

by

Richard Pallascio and Richard Allaire

Université du Québec à Montréal

Résumé: Over the last 10 years we have been dealing with research in the field of geometric spatial representation. We have created a matrix of development (Pallascio et al., 1992) that enable us to generate and classify activities in terms of intellectual operations and types of geometries. Our research also aims at the study of the influence of environment (Pallascio et al., 1990) on the spatial representation of people such as the Inuit. The latest results, described below, come from a study with 12- to 14- year-old students with respect to the generation of geometric shapes.

Two important facts have emerged from the general research on visualization. First, two types of mental images seem to exist: one pertains to the immediate intake of data (perception), while the other deals with the purely mental reconstruction of objects (representation). It is generally agreed that the first type of mental image involves the perception of 3-D objects only. With respect to 2-D images of 3-D objects, Bishop (1983) suggests that the mechanisms

are not the same as such images involve a type of representation which must be *processed* in some manner to be understood.

The second point of agreement is that the formal aspect of representations would seem to be a function of learning; more precisely, access to higher levels of logical organization remains a function of the learning situations in which a person is immersed. Even though there currently seems to be widespread acceptance of the hypothesis that such access is not strictly due to biological maturation but rather to the stimulation of the mental operations that trigger it, there are nevertheless differing views on the nature of such operations. We have defined the nature of these intellectual operations from a geometric point of view (Mongeau et al., 1991; Pallascio et al., 1992).

After identifying early adolescence as a period which is conducive to the natural development of spatial-representation skills (Mongeau, 1989), we endeavored

to gain a better understanding of the respective roles of intellectual operations and the various types of spatial representation in a person's development of visualization. In order to do so, we conducted interviews with two 12-year-old students, a boy and a girl, and two 14-year-old girls. These interviews consisted of five hours of 3-D geometrical activities that were record and analyzed afterwards.

Our exploratory research, which is likely to provide a basis for the development of an effective didactic intervention model, enabled us to answer certain questions that we had posed previously: What should be the role of tactile activities in the creation or generation of spatial representations? What role should topological and projective figures play in the activities used? Which operation(s) could gradually lead to the emergence of deductive reasoning? Should the analysis of spatial relationships be encouraged among younger students? Which operations are the most effective in facilitating the development of visualization skills.

References

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- Bishop, A. J. (1983). Spatial abilities and mathematics thinking. In Proc. of ICME-IV, pp. 176-178. Boston: Birkhäuser.
- Mongeau, P. (1989). Analyse et évaluation géométrique et psychologique de la représentation spatiale et de son développement. 3rd cycle thesis, Université de Montréal.

Avis de modifications à la constitution Notice of Constitutional Amendment

A la suite de sa réunion en septembre, le comité exécutif propose les amendements suivants à la constitution afin de rendre le vocabulaire et le genre plus consistants d'un paragraphe à l'autre.

IL EST PROPOSÉ QUE:

Dans l'article 5, item 1.7, régissant l'élection du comité exécutif, les termes

un président, deux vice-présidents et secrétaire-trésorier

soient remplacés par:

un-e président-e, deux vice-président-e-s, et un-e secrétaire-trésorier-ère.

Dans l'item 1.7 régissant l'élection du comité exécutif, la phrase:

les fonctions de président et de secrétaire-trésorier

soit remplacée par:

les fonctions de président-e et de secrétaire-trésorier-ère.

At its meeting in September the Executive reviewed the Constitution. In order to make the language both consistent from one section to the next and gender neutral, the following amendments are proposed.

BE IT RESOLVED THAT:

In Article 5, and in item 1.7 of Procedures Governing the Election of the Executive Committee, the terms

chairman and vice-chairman

be replaced by the terms

President and Vice-President

In guideline 1 on Article 3, that the sentence

A person will be termed "member of the Study Group" if s/he (a) is a present or past holder of a position in mathematics or mathematics education in Canada, and (b) has paid the required annual dues.

be changed to read:

To be called a "member of the Study Group" a person must (a) be a present or past holder of a position in mathematics or mathematics education in Canada, and (b) have paid the required annual dues.

Appel pour des candidatures

C'est difficile à croire, mais Tom Kieren et Lars Jansson se sont déjà dévoués au delà de six ans au comité exécutif et ne seront plus éligibles au sein du prochain comité.

Sandy Dawson et Bernard Vanbrugghe sont des membres cooptés et leurs mandats supplémentaires d'un an arrivent également à échéance. Le nouveau comité exécutif cooptera deux nouveaux membres pour les remplacer après l'élection de mai prochain.

Carolyn Kieran et Pat Rogers continueront à siéger au prochain comité exécutif.

Le comité exécutif a donc mis sur pied un comité de nomination composé de Lesley Lee et David Wheeler pour recevoir vos suggestions en fait de candidats. Pour faire connaître vos suggestions, contactez l'une ou l'autre de ces deux personnes à l'adresse électronique ci-jointe.

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Avis de convocation, réunion annuelle de 1993

Il est déjà temps de penser à la réunion annuelle du groupe qui aura lieu du:

28 mai au 1er juin
à York Université
Toronto, Ontario

L'organisatrice local est Pat Rogers.

Le comité exécutif s'est recontré les 18, 19 et 20 septembre au chalet de Tom Kieren à Canmore et a développé le programme de cette recontre.

Les orateurs invités sont Jere Confrey (*Constructivisme social et mathématiques*) et George Joseph (*Qu'est-ce que la racine carrée? Une étude comparative de la formation du concept dans différentes traditions mathématiques*).

Les cinq groupes de travail prévus ainsi que les responsables sont actuellement:

La formation initiale des enseignants(es) pour la création de communautés mathématiques dans leurs classes (LaDonna MacRae et Tom Schroeder)

Nouvelles tendances en mesure et évaluation (David Robitaille)

La différence entre garçons et filles dans l'enseignement et l'apprentissage des mathématique (Lesley Lee)

Recherche sur l'enseignement et l'apprentissage des mathématiques sous-graduées (Joan Ferrini-Mundy et Joel Hillel)

Mathématiques, technologie et résultats socio-culturels (Lars Jansson et Geoff Roulet)

Les personnes qui ont déjà accepté de traiter de sujets spéciaux sont: Richard Allaire, Olive Chapman, Lynda Colgan, Israel Kleiner, Michel Lyons, Richard Pallascio, Bernard Vanbrugghe, and Eric Wood.

Cette année à la session de clôture nous aurons un débat avec Tom Kieren et Ed Barbeau.

Call for Nominations

It is difficult to believe, but it is true! Tom Kieren and Lars Jansson have very ably served the Executive for over six years now, and hence this year brings to an end their eligibility to continue on the Executive.

Sandy Dawson and Bernard Vanbrugghe are coopted members, and their extended one year terms will be completed as well. The Executive will coopt members to replace them after the election next May.

Continuing members of the Executive are Carolyn Kieran and Pat Rogers.

The Executive has therefore struck a Nominating Committee composed of Lesley Lee and David Wheeler, who seek your input as to candidates for the Executive. Please contact either Lesley or David at

their respective addresses (email or snailmail) to submit your nominations.

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Notice of 1993

Annual Meeting

It is time once again for colleagues to begin thinking about attending the annual meeting next May. The dates and location are as follows:

May 28th - June 1st
York University
Toronto, Ontario

Local organizer is Pat Rogers.

The Executive Committee met September 18th-20th at Tom Kieren's mountain hideaway in Canmore, and developed the Program for the meeting.

The guest lecturers are Jere Confrey (*Social Constructivism and mathematics*) and George Joseph (*What is square root? A comparative study of concept formation in different mathematical traditions*).

The five planned working groups and their discussion leaders, as of press time, are:

Educating preservice teachers for creating mathematical communities in their classrooms (LaDonna MacRae and Tom Schroeder)

New trends in assessment and evaluation (David Robitaille)

Gender issues in teaching and learning mathematics (Lesley Lee)

Research in undergraduate teaching and learning of mathematics (Joan Ferrini-Mundy and Joel Hillel)

Computers in the classroom: Mathematical and social implications (Lars Jansson and Geoff Roulet)

Individuals who have already agreed to give topic groups include:

Richard Allaire, Olive Chapman, Lynda Colgan, Israel Kleiner, Michel Lyons, Richard Pallascio, Bernard Vanbrugghe, and Eric Wood.

A new feature at the gathering this year will be a session closing debate between Tom Kieren and Ed Barbeau.

Professional Meetings in 1993/1994

1993

71st National Council of Teachers of Mathematics [NCTM], Research Pre-Session, March 29-30th, Seattle, WA. The conference itself runs from March 31-April 3.

American Educational Research Association [AERA], April 12-16th, Atlanta, GA.

GCEDM/CMESG Annual Meeting, May 28-June 1, York University, Toronto.

Canadian Mathematical Society [CMS] / Société Mathématique du Canada., June 12-14.

Canadian Society for the Study of Education [CSSE], The Learned Societies. June 10-13, Ottawa, Ontario.

Psychology of Mathematics Education [PME], July 18-23, Tsukuba, Japan.

North American Group for the Psychology of Mathematics Education [PMENA], October 17-20th, Asilomar Conference Centre, Pacific Grove, CA

1994

72nd National Council of Teachers of Mathematics [NCTM], Research Pre-Session, April 11-12, Indianapolis, IN. The conference itself runs from April 13-16.

American Educational Research Association [AERA], April 4-8, New Orleans, LA.

GCEDM/CMESG Annual Meeting, May 27-May 31, (Dates tentative, location TBA).

Psychology of Mathematics Education [PME], July 30-August 3, Lisbon, Portugal.

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**LOOK FOR GCEDM/CMESG MEMBERSHIP FORMS
AND ANNUAL CONFERENCE REGISTRATION MATERIALS
IN THE SPRING 1993 NEWSLETTER**

See you in Toronto next May
