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Mathematical Instruction

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The International Commission on Mathematical Instruction

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INTERNATIONAL COMMISSION ON

MATHEMATICAL INSTRUCTION

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J.H. van LINT, Technische Hogeschool Eindhoven, Department of Mathematics and Computing Science, P.O. Box 513, 5600 MB Eindhoven, The Netherlands.

Andrei Ershov, Marshall Stone, Hassler Whitney

Since our last Bulletin was published the deaths have occurred of three outstanding mathematicians who had strong links with ICMI.

In December we learned of the death of Academician Andrei Ershov (USSR). Those who attended ICME 6 in August 1988 will recall the fine plenary address which Academician Ershov gave on 'Computerization and Mathematical Education'. Previously, Ershov, one of the USSR's leading authorities on informatics, had served on the programme committee for the first ICMI study, 'The influence of computers and informatics on mathematics and its teaching'. Unfortunately, illness prevented him from accepting our invitation to join the group which met in Kuwait (1986) in connection with the second study, 'School mathematics in the 1990's'. Andrei Ershov, then, had given much to mathematics education in his native USSR and elsewhere. We regret that we were to be denied further contributions, some of which were already planned.

The two other mathematicians, both from the USA, were former Presidents of ICMI and octagenarians. The names of Marshall Stone and Hassler Whitney will have a permanent place in the history of mathematics, for numerous theorems and innovations are associated with them.

Marshall Stone was President of ICMI from 1959-1962. These were very eventful years for mathematics education and Stone played an influential part: he was, for example, President of the famous Royaumont Seminar which led to OECD's New Thinking in School Mathematics. He continued to show an interest in mathematics education and, for example, gave the key-note talk at one of ICMI's first regional meetings, that held with the Japanese Society for Mathematics Education in Tokyo in 1974.

Hassler Whitney was a more recent President, 1979-82. In the last twenty years of his life he devoted much time to mathematics education and was a frequent attender at, and contributor to, our ICMEs: his work in mathematics education being particularly distinguished by the love and care which he showed for young children. His work within mathematics and mathematics education were indeed remarkable. Yet to know only that part of 'Hass' was to know only a little of a striking and altogether out-of-the-ordinary man. For there were many other Hass's: the mountaineer, the man who attempted his first marathon at the age of 77 (alas, he had to drop out with only a mile or so to go), the symphonist (for his first degree was in music, not mathematics), the international roller-skating judge, ...

We give thanks for all that he, Marshall Stone and Andrei Ershov contributed to mathematics education and to ICMI.

AGH

INTERNATIONAL PROGRAMME COMMITTEE

ICME 7 Quebec, 1992

The following have been appointed to membership of the IPC by the
ICMI Executive Committee:

David Wheeler (Chairman)
Concordia University,
7141 Sherbrooke St. West,
Montreal,
Quebec H4B 1R6,
CANADA.

C. Alsina,
Departamento de Matemáticas y Estadistica,
Escola Tecnica Superior D'Arquitectura de Barcelona,
Universidad Politecnica de Catalunya,
Diagonal 649,
Barcelona 28,
SPAIN.

W. Dörfler,
Universität für Bildungswissenschaften,
Institut für Mathematik,
Universitätsstrasse 65-67,
A-9010 Klagenfurt,
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Rosemary Fraser,
The Shell Centre for Mathematical Education,
University of Nottingham,
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Santiago de los Caballeros,
DOMINICAN REPUBLIC.

T. Nemetz,
Mathematical Institute of the Hungarian
  Academy of Science,
Budapest, V
Realtenoda 13/15,
1053 HUNGARY.

D.F. Robitaille,
Department of Mathematics & Science Education,
The University of British Columbia,
Faculty of Education,
2125 Mail Mall,
Vancouver, B.C.
CANADA V6T 1Z5.

Anna Sierpinska,
Institute of Math./Polish. Academy of Science,
00950, Warsaw PB 137.
POLAND.

The ICMI E.C. has also agreed to the co-option to the IPC
of

E. Muller,
Department of Mathematics,
Brock University,
St. Catherine's,
Ontario,
CANADA.

Roberta Mura,
Faculté des sciences
  de l'éducation,
Université Laval,
Quebec,
CANADA.

The current ICMI Secretary is an ex-officio member of the IPC.

It is vital that the IPC should benefit from input from National Representatives and others. In particular, David Wheeler has written:

The International Programme Committee (IPC) for ICME-7 will shortly begin its work by correspondence and will hold its first meeting in September 1989. At the meeting major decisions will be made about the structure of the scientific programme for ICME-7. The Committee is anxious to have input from National Representatives. If you have not already done so, please let me know your views and the views of other people in your country about the structure of ICME-7. Which features of the programme of ICME-6 should be retained, which should be modified, and what innovations should be considered for ICME-7? All feedback will be circulated to the members of the IPC and will be of great value to the Committee in its work. Your help is appreciated.

5 February 1989   A. G. Howson

NATIONAL SUBJECT ASSOCIATIONS

A list of National Mathematical Associations has now been compiled by Professor P Abrantes, A.P.M., Av. 24 de Julho, No. 134 – 4, 1300 Lisboa Portugal and Professor G. Becker, University of Bremen, Dept. of Mathematics – Infor.: FB 3 Postfach, 330 440 D – 2800 Bremen 33, Federal Republic of Germany, and this list can be obtained from them on request.

Thirty three associations are listed from Australia(3), Bangladesh, Belgium, Botswana, Brasil, Denmark, Egypt, Eire, Fiji (more information required), Finland (2), France, Germany (FRG), Greece, India (2), Jamaica, Netherlands, New Zealand (2), Philippines, Portugal, Spain (3), United Kingdom (2), USA (2), Zambia and Zimbabwe.

Clearly this list is incomplete. Will National Representatives please endeavour to make it more comprehensive.

PROCEEDINGS OF ICME 6 - ERRATUM

With a major production such as the Proceedings, the occasional error is bound to creep in. While we do not propose to report typographical errors, we are prepared to correct major errors of meaning or sense that have occurred during the editorial process. We have had the following reported to us:

p.138, line 16, "more" should be replaced by "less". This error completely distorts the sense of Mary Rouncefield's talk on Teaching Statistics through practical work.

We apologise to Mary Rouncefield for this error.

<div align="right">Ann & Keith Hirst (editors)</div>

PROCEEDINGS OF ICME 6

Copies of the Proceedings can be obtained from the ICMI Secretariat (£25 including postage and packing) or from the Mathematical Association of America, 1529 Eighteenth St., NW, Washington DC 20036, USA.

NATIONAL REPRESENTATIVES

AMENDMENTS

The correct spelling of Professor Zhuoqun's name

CHINA   Chinese Mathematical Society. Professor Wu Zhuoqun,
Jilin University, Chang Chun,
PEOPLE'S REPUBLIC OF CHINA.

The correct address of Professor C. Alsina.

SPAIN   Departamento de Matemáticas y Estadistica,
Escola Tecnica Superior D'Arquitectura de Barcelona,
Universidad Politecnica de Catalunya,
Diagonal 649,
Barcelona 28, SPAIN.

THE INTERNATIONAL GROUP FOR THE

PSYCHOLOGY OF MATHEMATICS EDUCATION

New Officers for 1988-90

President: Professor Nicolas Balacheff, IRPEACS, CNRS,
93 chemin des Mouilles, BP 167, F69131 Ecully Cedex,
France.

Secretary: Mr. David Pimm, Centre for Mathematics Education,
The Open University, Walton Hall, Milton Keynes,
MK7 6AA, England.

NEW JOURNALS

SUMA

We welcome a new mathematics education journal from Spain, published by the Federación de Sociedades de Profesores de Matemáticas. The journal is intended for school and college teachers, but students and pupils will certainly find things of interest. The contents of the first issue are:

Articles:
> What I have learned.
> Functions, symmetry and friezes.
> Some reflections on the mathematics in the work of
>   Jorge Luis Borges.
> Flexible polyhedra.

Ideas for the Class
> A lesson on probability in COU.
> "Donald in the land of mathemagics" - or the didactic use
>   of a film.
> Didactic possibilities of the black-faced cube.

Resources for the classroom:
> The tangram.
> The importance of resources in mathematics lessons.

Information:
> Containing a report on ICME-6, and on a travelling exhibition "Mathematical Horizons", together with book reviews and a report of the Andalucian regional olympiad.

It is planned to publish 3 issues per year. Subscription details can be obtained from: Revista SUMA, Apdo. de Correos 1017, 18080 Granada, Spain.

EDUCACIÓN MATHEMÁTICA

A group of Mexican mathematics educators representing a wide spectrum of institutions and professional organizations have jointed forces with Grupo Editorial Iberoamerica (Mexican branch of Wadsworth International) to publish three times a year a new journal "Educación Matemática" for mathematics teachers at all levels. The journal will be initiated in Mexico and is designed to cover eventually most Spanish speaking countries.

Complimentary copies of the first issue can be obtained by writing to:
> Elfriede Wenzelburger Guttenberger, Comité Editorial,
> Educación Matemática, Apartado Postal 5-076,
> México, D.F., C.P. 06500.

FORTHCOMING CONFERENCES

PME-13   (the 13th meeting of the International Group for the Psychology of Mathematics Education) will take place in Paris from **8-13 July 1989.** Details available from Gerard Vergnaud and Catherine Lavigne, PSYDEE, 46 Rue Saint Jacques, 75005, Paris, France.

PME-14   will take place in Oaxtepec (near Mexico City) from **14-21 July 1990.** Details available from Dr. Teresa N. de Mendicuti, Colegio Frances Pasteur, Homero y Schiller, Col. Polanco, Mexico.

CIEAEM-41(the 41st meeting of the International Commission for the Study and Improvement of Mathematics Teaching) will take place in Brussels from **23-29 July 1989** Details available from J. Vanhamme, Rue Firmin Martin, 2, B-1160, Brussels, Belgium.

ICOTS-3   (the 3rd International Conference on Teaching Statistics) will take place in Dunedin, New Zealand on **19-24 August 1990.** Details available from Mrs. A.S. Hawkins, Centre For Statistical Education, Institute of Education, University of London, 20 Bedford Way, London, WC1H OAL.

SEACME 5 South East Asia Conference on Mathematics Education 5) In Brunei, **early June, 1990.** Details Dr Ivo Duentsch, Department of Mathematics, Universiti Brunei Darussalam, Bandar Seri Begawan, Brunei.

ICMI Chinese Regional Meeting, Beijing, P.R. China, **3-6 September 1990,** Details from Professor Ding Er-Sheng, Beijing Normal University, Beijing, Peoples' Republic of China.

First Ibero-American Congress on Mathematics Education, Seville, Spain, **September 1990.** Details G. Sanchez-Vasquez, 41012, Sevilla, Calle Jucar 6, Spain.

GASAT 5 (International Conference of Gender and Science and Technology) will be held at the Technion-Israel Institute of Technology in Haifa, Israel, **17-22 September, 1989.** For Information write to the Secretariat of GASAT 5: c/o Atzeret Ltd., P.O. Box 3888, Jerusalem 91037, Israel.

CONFERENCES

1st INTERNATIONAL SYMPOSIUM IN MATHEMATICS EDUCATION

9 - 11 November 1988

(Organized by Maestría en Educación en Matemáticas de la Unidad de los Ciclos Profesional y de Posgrado del Colegio de Ciencias y Humanidades de la Universidad Nacional Autónoma de México)

Invited Speakers were: Dr.L.Ray Carry, (University of Texas Austin), Dr. Alfinio Flores, (Centro de Investigaciones Matemáticas, México), Dra. Teresa Rojano, (Sección de Matemática Educativa, Instituto Politécnico Nacional, México), Dr. Luis Radford, (Universidad de San Carlos, Guatemala), Dr. Patrick Scott, (University of New Mexico). Among the papers presented were "Proofs in mathematics: their function, teaching and learning in high-schools" (L. Radford); "The use of electronic spreadsheets in mathematics education" (P. Scott)

2nd INTERNATIONAL SYMPOSIUM IN MATHEMATICS EDUCATION

Tentative date: 23, 24, 25 October 1989

Main Topic: Curricular changes and related proposals for teaching strategies.

<u>Presentation</u>:

The activities of this Symposium will be centered on proposals for curricular changes in mathematics for the highschool level in several countries. The purpose of getting to know these proposals is to provoke a discussion among Mexican mathematics educators in order to initiate activities which might result in changes in the Mexican mathematics curricula and above all the teaching methodology.

<u>Address</u>: Dr. Elfriede Wenzelburger, Coordinadora de la Maestría en Educación en Matemáticas. Oficinas Administrativas 2 - ler. Piso. Av. Universidad 3000. México, D.F. Código Postal 04510.

EDUCATION IN COSTA RICA

CENADI – The National Centre for Didactics

The concept of a National Centre for Didactics was developed by Dr. Francisco Antonio Pacheco, prior to his becoming Minister of Education in 1988, as a response to a perceived deterioration in the quality of education. This manifested itself in three fundamental areas:

(i)   Defects and insufficiency in the plans for the education, training and up-dating of teachers.

(ii)   A lack of stimulus for those who work in teaching.

(iii)   Neglect of teacher and pupil in the classroom.

In the process of setting up CENADI other needs came to light, including the need to take into account the participation of the family and the community in support of educational action.

The objectives of CENADI are to prepare teachers according to the needs of the education system, involving training, some of which is by correspondence; to develop national, regional and local mechanisms to organise, design, experiment with and produce resources for teachers and pupils; to plan, organize and coordinate institutional and inter-institutional efforts to help work of the teacher in the classroom; to promote the study of the processes of teaching and learning, and of ways to improve the quality of education.

Regional centres will be developed, located in Regional Education Authorities, and permeating to local level. The aims of CENADI have led to a concentration on three areas which will be promoted through the regional networks. They are analysis and guidance in the processes of teaching and learning, didactic resources, and professional development.

Another feature of CENADI is the mounting of short-term projects, which at present include

(i)   The development of Educational Centres and laboratories in support of regional units.

(ii)   Provision of self-training modules, particularly for specialist subject teachers.

(iii)   Mathematics by radio, with interactive methods.

(iv)   Radio surgeries to deal with teachers' queries and problems.

(v)   Presentation of outlines for classroom work.

(vi)   Production of workbooks for pupils.

(vii)   Specifications for manufacture of educational materials.

(viii) The transformation of school libraries into resource centres.

(ix)   Programmes for initial and in-service training.

(x)   Promulgation of information about CENADI, both nationally and internationally.

Two special projects, on education within the population and on environmental education are also being developed.

[This is an edited version by KEH, based on a translation from Spanish by George Hirst.   The original article, in Spanish, was produced by Mayela Palma Abarca, Rafael Angel Pérez, Elsa Sánchez Fuentes, Maria de los Angeles Vidaorreta, Maria Isabel Durán Zamora, Edith León Rodríguez.]

MATHEMATICS EDUCATION IN SPAIN*

1. PREFACE.

Spain is a modern European country where thirty nine million Spaniards are nowadays looking towards the future with hope based upon the democratic structure, and also with the wish to play a more important role in the world on the cultural, economical and political level.

In the present century some periods of great importance for education have been especially brilliant: the Free Educational Institution, the New European Schools, the School-Institutes, the Normal and Summer Schools are institutions which have been inspired by principles of active teaching, continuing education or high quality activity. In the field of mathematics Spain has welcomed the experiences of Maria Montessori, the development of Decroly methods, the ideas of Alexandre Galí on calculus, the exhibition on mathematical materials organized by Pere Puig Adam, the important influence of Julio Rey Pastor,... Unfortunately, people like Lluis A. Santaló or Emilio Lluis had to develop their important careers far away from their native country. In the last decade a change over to democracy has opened a new period for the educational system, and for mathematical activities in particular.

2. A PANORAMA OF THE EDUCATIONAL SYSTEM.

The present educational system in Spain originated in 1970. But the basic principles which regulate education today are expressed by Article 27 of the Spanish Constitution of 1978: the right to an education and academic freedom are recognised, basic (primary) education is compulsory and free of charge; the rights and duties of teachers, parents, students, centres and public authorities are stated under a general spirit of democratic freedom. Moreover the Spanish State has been structured into 17 Autonomous Communities; six autonomous communities (Catalonia, Basque Country, Galicia, Andalusia, Canary Islands and the Community of Valencia) have full authority on educational matters and the central government, through the Ministerio de Educación y Ciencia, deals with the administration and regulation in the other 11 communities, and with the framework of new educational structures, expediting and homologating academic and professional degrees, grants, scholarships, investments,... etc.

3. MATHEMATICS IN PRIMARY SCHOOLS.

During the 8 years of this compulsory period from 6 to 14, every year, 4 hours a week are devoted to mathematics (3 1/2 hours in some bilingual communities, 5 hours in many

private schools). For the Higher Cycle most of the teachers of mathematics are specialists in the science area and they all come from teacher training schools.

The main mathematical emphasis is put on numerical skills and basic introductions to measures, elementary geometry and functions. A small reference to probability, statistics and combinatorics is included.

Among the general problems of the present structure we can mention the following: There is the tendency to abstract and formal-text-books presentation. Experimental-laboratory activities are avoided. Mechanical problem-solving exercises are more frequent than research activities. Computer science is being treated as a separate subject. Cultural richness such as the history of mathematics, or physical problems, like astronomy, are rarely dealt with. A presence of "modern mathematics style" is unfortunately still present but decreasing in influence.

4. MATHEMATICS IN SECONDARY SCHOOLS.

In the first year all students take 5 hours a week of Mathematics (1/6 of the school schedule) and then 4 hours a week in the second year (1/7 of the whole schedule). In the third year subject matter begins to diversify towards Science or Humanities. For the Science students 4 hours a week of Mathematics are offered, and the same situation applies to the pre-university course C.O.U. Some additional activities and complementary lectures (like problem- solving) are being organized.

The main mathematical topics are: numerical problems, an introduction to calculus, linear algebra linked to basic geometrical properties and some elements of probability and statistics. Let us point out some criticisms.

A large number of students with many different backgrounds and motivations go into the Secondary School but after these 3-4 years they either go to universities or they find a job.

Theoretically and officially the maths programmes represent the continuation of the previous ones. Actually some topics are on the air.

The methodology varies strongly from one centre to another.

There is the tendency to give a formal presentation of Mathematics. At present some progress is being made in this direction. Geometry has disappeared under the algebraic presentation. Probability and Statistics are considered but, in practice, many times are extremely reduced.

5. MATHEMATICS IN VOCATIONAL TRAINING.

Vocational training offers a range of 19 areas of study from the very beginning. A positive collaboration between vocational training centres and factories and companies is being developed to give students the opportunity to work in real places.

During the studies 2 hours per week courses on "useful" Mathematics are offered. At the first level (2 years) the programmes are oriented towards the specific area chosen by the student. At the second level (3 years) it is possible to follow introductions to Probability, Statistics, Computationn, Calculus and Analytic Geometry. Some peculiarities are:

Many students going into the vocational training actually decide to follow these studies not by a special "vocation" but as a result of unsuccessful results in their previous primary studies. Thus many students neither have a good mathematical background nor a positive

attitude towards maths in general. There is the tendency to give more formal mathematics than experimental mathematics. Geometry is normally absent.

6. MATHEMATICS IN UNIVERSITIES.

We may split our considerations into several parts, noting at the same time that due to the autonomy of these institutions clear differences among them arise naturally.

a) <u>The Faculties of Mathematical Studies</u>. At this moment many universities have a Mathematics Baccalaureate or "Licenciatura en Matemáticas". In five years a quite complete training on classical topics is offered by the Departments of Algebra, Analysis, Applied Mathematics, Geometry and Topology, Statistics and Operational Research. While some computer knowledge is being included, the Physics courses, Astronomy, Economics,... etc., have almost disappeared from the curricula.

The inclusion of courses on mathematical education during the studies of mathematics is rather the exception than the rule. There exists a Pedagogical Aptitude Course (C.A.P.) offered for those mathematicians who want to go into a teaching job in secondary schools. Research on mathematical education at the Ph.D. level has no tradition yet.

b) <u>Teachers Training Schools</u>. In each Spanish province there is, at least, a public Teachers Training School. All such schools are university colleges offering a 3 year preservice teacher training curriculum for the Primary School. A quite general maths course is required for all students at the freshman level. The other two year mathematical education courses are given to the "science" students. Special maths programmes are offered in other specialities such as kindergarden and special Education. The majority of students are female. A frequent discussion about this "mathematics education for teachers" consists of determining the percentage of basic maths which must be taught (and which methodology) and that of didactics of mathematics.

c) <u>Mathematics as a service subject</u>. Quite strong courses on mathematics are compulsory in most careers. As a general rule maths courses are taken during the first two years and they include algebra and linear systems, calculus of real functions and some elements of statistics. Many courses run for 1 year, 5 hours a week (3 hours of theory and 2 hours of problems). The level of specialization may vary greatly according to the careers. It should also be pointed out that didactic courses on mathematics are offered in the Pedagogical Studies. The main problems concerning these mathematical studies are: A large number of students which follow these courses do not seem to be extremely motivated for such studies. Courses tend as a rule to be quite general: that is to say they are not particularly related to the specific professions.

7. MATHEMATICAL ACTIVITIES.

a) <u>Societies, groups and centres</u>. Several societies and associations play a fundamental role in the generation of mathematical activities related to education (Asociación Matemática Española, Movimiento Cooperativo Escuela Popular, Real Sociedad Matemática Española, Sociedad Andaluza de Profesores de Matemáticas Thales, Sociedad Aragonesa de Matemáticas, Sociedad Canaria de Profesores de Matemáticas Isaac Newton, Sociedad Castellana de Matemáticas Puig Adam, Sociedad Castellonense de Matemáticas, Societat Catalana de Matemátiques).

Since the 70's the group-phenomenon has been appearing: Aleph, Almosta, Aresta, Azarquiel, Beta, Grup Zero, Grupo Cero, Matema, Periòdica Pura, Prop, Puig Adam,

Sigma, Vèrtex,... the activities of these groups have materialized in papers, teacher training courses, text-books, exhibitions...

In the university framework the I.C.E.'s (Educational Science Institutes) organize seminars, courses and publications.

The M.E.C. and other Autonomous Governments have founded 100 C.P.'s (Teacher Centres) in many provinces of Spain to promote educational activities involving teachers in the nearby area of the centre and to offer materials and resources.

b) <u>Conferences, workshops and courses</u>. In the attempt to promote new curricula, skills and ideas, conferences, workshops and teacher training courses play a fundamental role in communication.

In the last decade a large number of monographic meetings on Didactics of Mathematics have been organized periodically.

An event which had some impact was held in Madrid in 1984: "La enseñanza de la Matemática a debate" organized by Ministerio de Educación y Ciencia. Recently, the Thales Society (June, 1986) organized in Seville an   International Symposium on the new mathematical curricula in Spain and Europe and M. de Guzmán organized in the Real Academia de Ciencias (Madrid, 1987) an important workshop on "The need for research in Mathematical Education" which may become a point of reference for further research activities in the country.

Since 1914, summer schools for teachers have been organized in the period 1914-1924, 1930-1936 and since 1966 up to the present. These courses have had a great impact in the mathematical evolution of new ideas and curricula.

The Rosa Sensat Association in Barcelona has pioneered the organization of these schools as well as the I.E.P.S. (Instituto de Estudios Pedagógicos Somosaguas). Acción Educativa and Nuestra Escuela have followed similar ideas in the Madrid area.

In the last two years the academic authorities have planned to take several courses of action concerning the continuous education of teachers. Let us mention the following programmes promoted by the Subdirección General de Perfeccionamiento del Profesorado (M.E.C.):

* <u>Programmes for didactic up-to-date</u>: monographic workshops on Didactics of Mathematics and Sciences for teachers belonging to different places and levels, followed by practical experiences made in their original centres, ateliers and up-to-date scientific and pedagogical concepts.

* <u>Training animators for teachers centres</u>: seminars held in order to train people who may act as leader in the provincial teachers' centres.

* <u>Training trainers</u>: special intensive courses designed to prepare trainers which may generate, coordinate and promote mathematical activities.

Pioneer experiences have been organized by the Autonomous Government of Catalonia in the framework of continuous education (F.O.P.I.'s).

At the university level there exists permanent mathematical seminars organized by the (I.C.E.'s); the Courses for the Initiation on Mathematical Reseach of Jarandilla and Escorial's Workshops of the Asociación Matemática Española and at the Universidad Autónoma de Barcelona there exists a 2 years' Master course on "Mathematics and Experimental Science Education".

c) <u>Publications</u>. The number of publications on the mathematics education realm has grown extensively.

Some <u>journals on mathematical education</u> are: "Epsilon", "L'Escaire", "Gaceta Matemática", "Número", "Thales". These journals have in general regional diffusion mainly among the members of the societies. Concrete experiences, materials, problem solving sections and bibliographical information are included. Besides the journal "Enseñanza de las Ciencias" devotes about one forth of its pages to mathematics education.

Publications like "Apuntes de Educación", "Revista de Bachillerato", "Cuadernos de Pedagogía", "Infancia y Aprendizaje", "Bordón", "Revista de Educación de la Universidad de Granada", "Perspectiva Escolar", "Guix" often include special sections on mathematical topics.

There is a large offering of different series of mathematical text-books for all levels.

Most of the institutional proposals on math education are, of course, published by their publication services (New programmes, Atenea and Minerva programmes on Informatics; C.I.D.E. publications; the series of the I.C.E.'s; the "Documentos y Propuestas de Trabajo".

Many toy factories offer mathematical games and a few companies are specializing in teaching materials. Imported materials are also available.

d) <u>Mathematical olympiads</u>. The classical olympiad for pre- university students has been organized every year since 1963 by the Real Sociedad Matemática Española and has promoted and guided the Spanish participation in the International Olympiad since 1983 and in the Olimpiada Iberoamericana de Matemáticas since 1985.

The Thales Society has organized in Andalucia a special olympiad for 14 year old students. Similar contests are being organized now in several parts of the country, e.g. by the Puig Adam Society.

e) <u>Popularization of maths</u>. Main newspapers include a weekly section devoted to Education and another one to Science. Science magazines sometimes include expository math articles and, always, math games. The production of local school-newspaper has also been a fruitful experiment in many places, e.g., the 4-pages bulletin called O'Thales (J.A. Suárez, J. Núñez) including stories, news and problems.

Radios sometimes dedicate programmes concerning the social impact of maths education. S. Romero and J. Romero made an interesting series of radio programmes offered for school-audiences and including maths presented in story form and competitions on math abilities.

The international T.V. programmes about Maths have been broadcast by the Spanish T.V.'s but there is a lack of local production in this area (the programmes "Un Mundo Feliz" of M. de Guzmán were a first attempt).

Many educational local videos are now available both in Math and Informatics (Grupo Cero, Minerva, R. Pérez-Gómez,...).

A special interest has been devoted to math exhibitions in Summer Schools, maths meetings of societies and the Science Museums (e.g. "Weights and Measures" (C. Alsina-L. Marquet), "A brief trip to the Mathematical World" (C. Azcárate-C. Perelló), "Fascinating Symmetry" (C. Alsina-J.M. Fortuny) suported by the Caixa de Pensions Foundation, and the Grupo Cero's exhibits on Geometry in Valencia.

f) <u>Special activities</u>. Many interesting and unique mathematical experiments have been developed in the last decade. Examples are the "Encouters with Science" of the C.I.R.I.T. (Generalitat de Catalunya) devoted to "Statistics" (E. Bonet) or "Space Geometry" (C. Alsina, C. Burgués, J.M. Fortuny), the 5 days programme "Mathematics in Torrebonica" (C. Alsina et al.) where every week of the year a class-group (11-14) experiment a rich variety of math activities in fields and labs; the experiences on Astronomy (G. Azarquiel, G. Zero, Cadiz's workshop), Maps (Grup Zero), Traditional Measures (C. Alsina), Calculators (M.A. Canals, J.M. Yabar, J. Achón, R. Cemeli, G. Azarquiel), the role of History of Mathematics (S.E.H.C.) and many other alternative educational procedures.

8. THE WINDS OF THE NEAR FUTURE.

The winds of change are blowing very strongly for the educational system in general and for Mathematics in particular:

a) Compulsory education will be extended (6-16) and divided into two cycles (6-12 and 12-16). Secondary Schools may offer 5 different curricula for the period 16-19. Vocational Training studies will be much more specific and experimental. University education is being changed. New courses will be introduced.

b) New educational content, skills and attitudes are being established at all levels. In the case of Mathematics there is a tendency towards more concrete approaches, with less time being devoted to them, and several subjects, like geometry, are being restored. A lot of serious studies on curricular developements, pedagogical renovation and research results are being promoted and experimented with.

c) The new born Departments of Didactics of Mathematics have an important role to play in pre-service teacher training and in the development of post-grad courses, as well as in organizing doctoral studies on mathematics education for the first time in Spanish Universities. The pioneer efforts made in Bellaterra, Granada and Valencia are interesting. Nevertheless, the position of faculties of mathematical studies towards education research is disappointing.

d) A new journal SUMA may synthesize the efforts of many regional publications under the auspices of the Federación de Sociedades de Matemática, perhaps the germ of a Society of Mathematics Teachers.

e) Research on mathematical education is a promising field, attracting many contributions today. Many people are going to take Ph.D.'s in maths education.

f) Spain is an ideal focus for cultural events. In 1990 the Conferencia Iberoamericana de Educación Matemática will take place in Seville. In 1992, a large programme of scientific events may join forces with the important Olympic Games events in Barcelona, the Expo in Seville and the celebration of the 5th centenary of the discovery of America. Spain has already applied and will probably apply again in the future to be the location for the I.C.M.E.

To sum up, there is good reason to be optimistic about the immediate future. The winds of change may disperse the clouds. It is a well-known fact that Spain is a sunny country... Today is shining.

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NOTE