

# 수학 교육에서 지역간 협력 및 국제 공동 연구의 필요성

최영한(한국과학기술원)

## 1. 머릿말

국제수학연맹(International Mathematical Union, 약칭 IMU)의 산하 조직인 수학교육 국제위원회(International Commission on Mathematical Instruction, 약칭 ICMI)는 많은 학술회의를 관장하고 있다. 그 중에 대표적인 것이 매 4년 마다 IMU가 주최하는 국제수학자대회(International Congress of Mathematicians, 약칭 ICM) 때 수학교육분과 발표를 주관하는 일과 독자적인 수학교육 국제회의(International Congress on Mathematical Education, 약칭 ICME)를 주최하는 일이다.

ICME는 ICM과 어긋나게 매 4년 마다 개최되며, 다음의 제 8차 ICME는 스페인의 세빌(Seville)에서 내년(1996) 7월 14~21일로 계획되어 있다.

또 ICMI는 위의 두 국제대회와는 별도로 수시로 지역회의를 개최하는 데 그 한 예가 작년(1994) 8월 15~20일 중국 상해에서 개최된 ICMI-China Regional Conference on Mathematics Education이었고, 또 한 예가 금년(1995) 4월 19~23일에 호주 멜보른에서 개최된 Regional Collaboration in Mathematics Education(수학교육에서 지역간 협력)이다.

지난 번 호주에서 개최된 ICMI 지역회의는 주제를 정하여 개최되었다는 점에서 다른 ICMI 주관 학술회의와는 좀 다른 점이 있다.

이 회의는 논문발표(Paper Session, Round Table Discussion, Poster Presentation, Video Presentation 등), 초청 강연(Keynote Address, Master Class 등), 워크숍, 실험실 견학(Internet Lab Operating, Telecom Research Laboratories) 등의 일상적인 학술 활동외에 14개의 공개 토론회(Forum)가 있었다.

이 14개의 공개 토론회의 주제는 수학교육에서의 지역간 협력에 관한 것으로 회의 진행 방식과 토론 방식이 독특하였다.

여기서 나온 제안(Proposition)을 중심으로 수학교육에서 지역간 협력 및 국제 공동 연구의 필요성에 대하여 이야기하고자 한다.

## 2. 호주 대회의 이모 저모

“수학 교육에서 지역간 협력”이라는 주제명으로 개최된 호주 대회는 오래전 부터 Alan Bishop 교수가 계획하여 왔으며, ICMI 한국 대표인 박한식 교수도 International Advisory Committee 와 International Programme Committee 에 들어 있다.

박한식 교수는 모두 14개의 Forum 중에서 “지역간 협력에서 수학교육센터의 역할과 임무”(Forum 3)의 사회를 맡았다.

한국에서는 박한식(한국교원대), 최영한(한국과학기술원), 류희찬(한국교원대), 강완(서울교육대), 김수환(한국교육개발원)의 다섯 사람이 참가하였으며 신현성(강원대) 교수는 프로그램에 발표자로 되어 있었으나 참가하지 않았다. 강완, 류희찬, 최영한은 실제로 연구 논문을 발표하였으며 제목은 다음과 같다.

Wan Kang (4. 20. (목), 16:45 - 17:30 Paper Session : Gifted Students) Map : “A Program for mathematically gifted students”

Hee Chan Lew (4. 21. (금), 13:30 - 15:00 Forum 8 : “The impact of technology on

mathematics education”) Some efforts for using computers in mathematics education : Korean perspective

(주 : 이 Forum은 Texas Instruments 에서 지원하였다.)

Young Han Choe (4. 22. (토), 16:00 - 17:30 Forum 13 : “Building bridges : the role of professional teachers’ associations”)

Mathematics teachers’ associations as centers for regional collaboration on mathematical education

전체적으로 일곱 분의 전체 강연(Keynote Address), 7개의 Workshop, 4개의 Master Class, 4편의 Video presentation, 4개의 Round Table Discussion과 83편의 논문 발표(Paper Session) 및 편수 미상의 Poster Session 이 있었다.

### 3. 공개 토론회의 제안

호주 대학의 꽃이라 할 수 있는 공개 토론회(Forum)는 모두 14개였는데 필자는 이 중 몇 개 밖에 참석할 수 없었다. 공개 토론회는 2~4명의 발표가 있고, 한 사람의 토론자(Discussant)와 한 사람의 사회(Chair)로 구성되어 있다. 사회는 Forum을 진행할 뿐만 아니라 마지막에 발표 내용과 토론을 요약하고 제안(Proposition)을 제시하였다.

14개의 Forum 중 13개 Forum의 제안을 번역없이 옮긴다.

**ICMI Regional Conference**  
**Monash University, Melbourne, Australia**  
**April 19 - 23 1995**  
**Recommendations from the Forums**

**A flexible future: Collaboration through distance education**

This forum recommends:

- that regional collaboration be used to explore ways in which full advantage can be taken of the new technologies which are revolutionising distance education to meet the demand for mathematics and mathematics education;
- that care should be taken that the globalisation of education resulting from the adoption of new technologies acknowledges the importance and contribution of different cultures in the process of education;
- that pro-active policies be developed for the provision of resources to ensure that the increasing reliance on the availability of technology to meet educational needs does not become a further barrier to access to education for disadvantaged groups and nations;
- that the issue of high quality education be addressed through the use of appropriate pedagogy which acknowledges the full range of educational needs (as opposed to training only), takes into account relevant research and makes use of appropriate evaluation techniques.

**Ethnomathematics and regional collaboration: Pitfalls and promises in the case of Papua New Guinea**

This forum recommends:

- that means be explored to help teachers identify the mathematics to be found in the cultures that their students come to school with;
- that materials, including textbooks, be produced giving examples of ethnomathematics;
- that an ethnomathematics centre be established whose main function would be to disseminate information on ethnomathematical issues and projects; the centre would serve as a "sounding board"; it would not have to be physically located anywhere but could be an association or group of people.

**Mathematics education centres: the roles and responsibilities in regional collaboration**

The following are not agreed recommendations but are suggestions for the possible roles that regional centres might play in the development of mathematics education;

*Teaching.* It is difficult to see how a regional centre would provide "low-level" teaching but it could provide conferences, high quality teaching materials for others to use particularly through high technology delivery systems. It could also act as a resource centre for state-of-the-art materials and systems.

*Research.* A centre might handle a research program which is supra-national and also serve to integrate and disseminate the findings of research.

*Policy Formation.* If funded in such a way as to be independent, a Centre could play a useful role in formulating mathematics education policy to assist in political decision making.

*Innovation.* A Centre should be seen as innovatory, injecting into the educational system, at all levels, ideas and material designed to enhance the quality of mathematics education.

*Technology.* Although implied in some of the roles outlined above, it is important to stress the importance a Centre might have in the evaluation and distribution of new developments in the use of computers and electronics in mathematics education.

*Collaboration.* The Centre would be an ideal forum for collaboration, especially with industry, commerce and government as well as with institutions in the education system.

**Future policies for higher mathematics education in the region**

Some countries in this region have made their policy to seek involvement in maths and maths ed development. Certain approaches are welcomed by these countries such as setting joint research projects and exchange programs both for faculties and students. Governments which could afford to should make policy to provide no-strings attached assistance and exchange to countries such as Vietnam and Indonesia which are seeking collaboration in the higher maths ed level. This policy will benefit the grounding countries both immediately and in long-term good relations. Evaluating this policy commercially will not be appropriate.

### **Future policies for school mathematics education in the region**

This forum recommends:

- that the curriculum should address first the needs and goals of the nation and culture in which it will be used;
- that curriculum sits in an international context and there is a need for collaboration on curriculum content and structure across national boundaries;
- that there is a tension between centrally determined curriculum and the recognition of the integrity and professionalism of teachers, and that we need to seek models of curriculum which support rather constrain teachers;
- that the mathematical knowledge and understanding of all teachers is acknowledged as important, and that mechanisms be established for sharing best practice with respect to supporting the mathematics learning of teachers.

### **The forgotten classroom: Mathematics education in the workplace**

This forum recommends:

- that industry trainers, TAFE teachers, school teachers and Higher Education staff seek viable, long-term ways of working together to design, implement and evaluate effective workplace-based training programs which meet the needs of individual workers, teams and organisations;
- that training programs recognise the importance of language and cultural factors in the design and implementation of any program aimed at improving mathematical knowledge, skills and attitudes of employees.

### **Business and industry's future mathematical needs**

This forum recommends:

- that there be genuine involvement of all stakeholders (teachers, academics, national peak professional associations such as associations of engineers, chemists, mathematicians etc) in the cooperative development of new mathematics curricula including in particular
  - curriculum statements
  - classroom activities involving investigations (eg. more importance given to data analysis and statistical methods);
- that there be effective and timely communication between professional bodies and schools regarding the educational resources available to schools sponsored by those bodies, such as
  - summer schools related to the profession
  - availability of members of those professions to visit schools
  - competitions.

### **The UNESCO Forum**

This Forum recommends that

- UNESCO should appoint a mathematics education specialist as soon as possible to replace Dr Ed Jacobson in its Education Sector in Paris;
- UNESCO should maintain a program of activities in mathematics education - similar to the program of the 1980s and early 1990s - in its Education Sector in Paris;
- delegates to this ICMI Conference on Regional Collaboration in Mathematics Education are encouraged to bring the above recommendations to the attention of their UNESCO National Commissions and ask for their support to have them accepted by UNESCO;
- ICMI should contact UNESCO officials and endeavour to ensure that, simultaneously with the "Mathematical Year 2000," mathematical literacy will be strongly emphasised by means of specific programs and activities in UNESCO's "Project 2000+," which aims to promote the development of scientific and technological literacy for all, in all parts of the world;
- UNESCO should allocate more funding for regional collaboration in mathematics education in South-East Asia.

### **Impact of technology on mathematics education**

This forum recommends:

an e-mail network on the issue of technology in mathematics be set up;  
the possibility of on-line professional development for teachers on the use of technology in mathematics education be more widely explored and made available to all. This would also provide opportunities for teachers in various countries to communicate and share ideas;  
priority should be given to providing all schools throughout the region with access to Internet to enable teachers to avail themselves of such services;  
curriculum development should have input from industry, mathematicians, mathematics educators, teachers, and other members of the community working co-operatively;  
mechanisms should be put into place to increase the awareness of teachers of what the computer industry already has to offer and for industry to obtain feedback from teachers of their needs.

### **Educational publishers' role in regional collaboration**

This forum recommends:

the promotion of collaborative networks to make mathematics education materials more accessible between countries by translating books, by publishing co-operatively and by importing and exporting materials;  
the encouragement of joint writing and materials production between consortia of countries using electronic communication systems with each country maintaining its own unique cultural and mathematical requirements;  
that the representatives attending the forum should continue to develop the links that had been established and that some firm project proposals for cooperative publishing and exchange of materials should be developed as soon as possible.

### **The role of ICMI in regional collaboration**

1. ICMI is recognised for, and encouraged to give further support to, regional collaborative activities in mathematics education by
  - (i) continuing its sponsorship of regional conferences and expanding its SOLIDARITY program to assist colleagues from developing countries and from indigenous population groups more generally to participate in these as well as other ICMEs
  - (ii) encouraging ICMI National Representatives to be more active in regional activities as well as in their own country
  - (iii) encouraging and supporting the establishing of autonomous regional committees, with an affiliation to ICMI, to help plan, develop and coordinate regional activities in mathematics education, and to provide a regional focus and identity in this field. Such communities could develop from relevant existing bodies. Priority should be given to regions with developing countries which do not necessarily belong to the IMU.
  - (iv) building linkages with established regional bodies in mathematics and mathematics education.
  - (v) encouraging an equitable distribution, world-wide, of locations for ICMI-sponsored activities, including ICMEs, study group meetings, special studies conferences and regional conferences.
2. As ICMI-affiliated regional committees develop and become effective, ICMI could add recognition to these by adapting the composition of its EC to include representatives from these committees.

### **Building bridges: The role of professional teachers associations**

This forum recommends:

- that a data base of contact persons for teacher associations concerned with mathematics education be established to support and promote regional collaboration;
- that teachers' professional associations work together to develop proposals which seek funding support for exchange visits and electronic forums on a regular basis;
- that teacher associations concerned with supporting and promoting mathematics education undertake reciprocal membership with a view to exchanging journals, newsletters and conference membership;
- that individual members in such associations be encouraged to participate in reciprocal membership arrangements;
- that opportunities be provided/created to encourage members to work together on similar issues or concerns, eg., classroom cultures, assessment, etc.;
- that contributions for newsletters be sought from members of mathematics teacher associations across the region;
- that existing associations work together to identify and support the development of similar groups in countries where there is no organisational or institutional support for mathematics education;
- at associations collaborate within regions to find effective ways of supporting and promoting mathematics education among primary/elementary school teachers who are typically involved with all subject areas.

### **Mathematicians Networking Forum**

1. National Centres for mathematics research and mathematics education to be encouraged.
2. Links between teachers and mathematicians to be actively pursued. While it is important to have research based centres (above) that enable research in mathematics to be encouraged, more broadly based centres where both mathematicians and mathematics educators could work together could support this.
3. The World Bank, UNESCO and other funding agents to be made aware of the equity implications of access to electronic mail etc and to be encouraged to fund developing countries to develop these resources so that they can collaborate on an international level with the speed and efficiency that is now common in developed countries

#### 4. 수학 교육 연구의 국제화

필자는 캐나다의 퀘벡에서 개최된 제 7차 ICME에 참가한 후 한국수학교육학회 창립 30주년 기념 특별 강연에서 수학 교육 연구의 국제화를 주장하였다(최영한(1992) 참조).

박한식(1992), 신현성(1992)도 ICME와 ICMI에 관련하여 수학 교육 연구의 국제적 협력 내지는 공동연구의 필요성에 대하여 강조하였다.

한 편 지난(1995년) 2월 17~18일 한국교원대학교에서 개최되었던 한국수학교육학회 주최 “수학 영재 교육에 관한 한국-러시아 합동 학술 세미나”에서 필자(1995)는 수학 영재 교육에 관한 연구에서도 국제적인 협력의 필요성을 밝혔다.

금년 호주 수학 교사 협의회(AAMT)와 호주 수학교육 연구회(MERGA)의 합동 연례회의의 안내와 “수학(교육)과 common sense”라는 학회의 안내, 내년 제 8차 ICME의 안내, 호주 수학교육 연구회지 Mathematics Education Research Journal의 구독 안내, 수학교육에 관한 논문의 Review지인 ZDM(Zentralblatt für Didaktik der Mathematik)에 관한 소개를 끝으로 이 글을 마칠까 한다.

### **MERGA 18**

Darwin (Australia), July 7-10, 1995

### **AAMT 15:**

### **Forging links and integrating resources**

Darwin (Australia), July 9-13, 1995

The 18th annual conference of the Mathematics Education Research Group of Australasia (MERGA) and the 15th annual conference of the Australasian Association of Mathematics Teachers (AAMT): Forging links and integrating resources (FLAIR) will take place at the Casuarina Campus of the Northern Territory University.

Keynote speakers will be Paul Cobb (Vanderbilt University Nashville), Catherina Vistro-Yu (Ateneo de Manila University), Alan Bishop (Monash University) and Michael J. Christie (Northern Territory University).

For further information please contact the conference organizers Ian Isaacs (phone 089-466158, fax 089-466151), Steve Flavel (fax 089-272421, email slavel@rodney.ma.swin.edu.au) or (regarding the submission of papers) Dr. Bill Atweh, Queensland University of Technology, Locked Bag 2, Red Hill, QLD 4059, Australia.

# CIEAEM 47

## Mathematics (education) and common sense: The challenge of social change and technological development

Berlin, July 23-29, 1995

### *Aims of the conference*

The central aim of the conference would be to review, analyse, and evaluate present models and theories of the mathematics curriculum and the teaching of mathematics – at all levels from school to university and professional training – in the light of fundamental social changes and technological developments. The conference should contribute to a systematisation and restructuring of the specialised research approaches in mathematics education and to the integrating of recent results from the related disciplines. To foster pluridisciplinary forms of cooperation the conference tries to apply various means for intensive communication of mathematicians, social scientist, psychologists, philosophers, computer scientists as well as pedagogues and teachers at all levels of the educational system.

The challenge of recent political changes determines one aspect of our conference in particular: the common sense about a basic and generalisable mathematical education for all has been more radically questioned by the transformation of the political and economical systems in Eastern Europe than with us. There is not only the need for redesigning the qualifications for future mathematicians, economists or engineers, but the increasing mathematisation throws into relief the demand for (re)defining mathematically based democratic competencies. How to create a new common sense?

### *Subthemes and questions*

Common sense is a local or cultural term to describe knowledge which refers to general reason, to intuition and an arrangement of social and cultural experiences common to most people. Common sense is also understood as a political term to describe socially agreed perceptions for common acting. The conference would explore the interrelation of different ideologies of mathematics, technology and education in the light of social and technological change. Of notable interest would be recent work on the influence of technology within mathematics, in the regulation of social practice, and on the purposes of mathematics education in a changing social and technological context.

### *Key-speakers*

Philip Davis (Brown University), Alan Bishop (Monash University), Juliana Szendrei (Teachers College Budapest), Rijkje Dekker (University of Amsterdam).

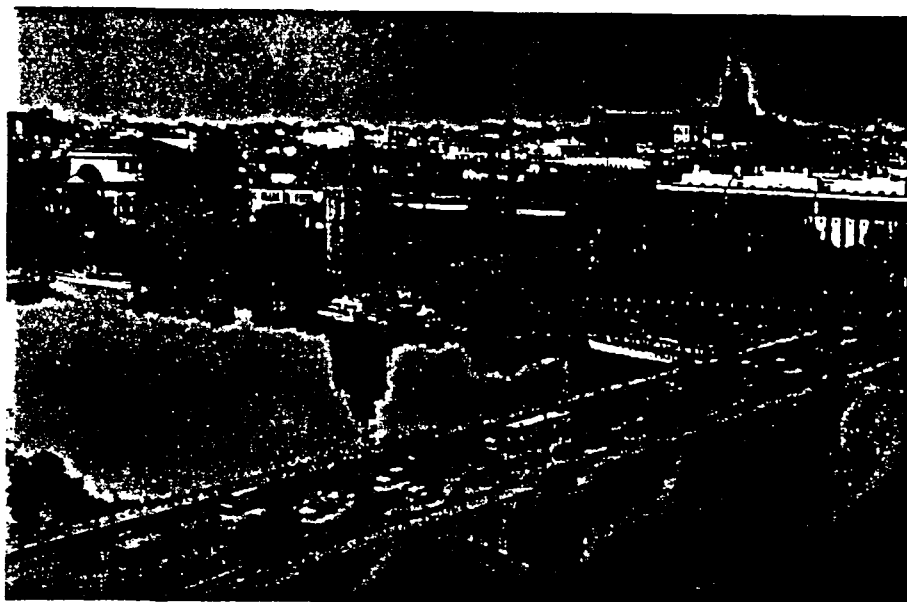
For further information please contact Prof. Dr. Christine Keitel, Freie Universität Berlin, FB 12, WE 2, Habelschwerdter Allee 45, D-14195 Berlin, phone 0049-30-8385975, fax 0049-30-8385972, email keitel@zedat.fu-berlin.de



First Announcement

ICME 8  
SEVILLA 1996

8<sup>TH</sup> INTERNATIONAL CONGRESS  
ON MATHEMATICAL EDUCATION  
July 14 - 21, 1996



The Spanish National Committee for ICME-8 on behalf of the International Commission on Mathematical Instruction (ICMI) and the Federación Española de Sociedades de Profesores de Matemáticas (FESPM), is pleased to announce that the Eighth International Congress on Mathematical Education will be held in the city of Seville, Spain, from July 14 to 21, 1996. Previous ICMEs were held in Lyon (France), Exeter (United Kingdom), Karlsruhe (Germany), Berkeley (U.S.A.), Adelaide (Australia), Budapest (Hungary) and Quebec (Canada), under the auspices of the ICMI, a Commission of the International Mathematical Union (IMU). The ICME-8 intends to continue this series of congresses with the objective of increasing the development of mathematical education in order to improve the learning and teaching of mathematics. We invite you to participate in ICME-8, the program of which will include a wide variety of scientific activities and an extensive cultural and social program for delegates and their companions, where you will have the opportunity to exchange views and discuss new ideas about the basics of mathematical education, in an international setting.

In order to achieve a greater participation of teachers from developing countries and in the spirit of the ICMI Solidarity Fund, the ICME-8 Organisation will divert some of its income towards Grants. More detailed information about this point will be provided in the second announcement.

## PROGRAM OF THE CONGRESS

The ICME-8 includes a rich scientific program, which will cover the most important areas in mathematical education and will confront the crucial problems which will be of interest to the 3.500 to 4.000 participants we expect to welcome to this Congress.

Principal activities include plenary and ordinary Lectures, Working Groups, Topic Groups, Round Tables, Workshops, National Presentations, Short Presentations, Projects, Films and Special Exhibits. There will also be Exhibitions of textbooks, software and various teaching materials. The Study Groups of the ICMI will contribute to the program, presenting reports on their activities. Special meetings will also be arranged (ICMI Assembly, Associations, Magazines, etc.). Each participant will receive a copy of the Official Proceedings.

English and Spanish will be the official languages. French and Portuguese, being the languages of neighbouring countries, may be spoken and translated informally in the working groups, topic groups and study groups. However, it is anticipated that most sessions will be conducted in English. Some informations, services and translations will be available in other languages.

For proposals concerning the scientific program, please write to the Chair of the International Program Committee at the congress address.

### WORKING GROUPS

- WG1. Communication in the classroom.
- WG2. Forms of mathematical knowledge.
- WG3. Students' attitudes and motivation.
- WG4. Students' difficulties in learning mathematics.
- WG5. Teaching mixed-ability classes.
- WG6. Gender and mathematics.
- WG7. Mathematics for gifted students.
- WG8. Mathematics for students with special needs.
- WG9. Innovation in assessment.
- WG10. Languages and mathematics.
- WG11. A curriculum from scratch (zero-based).
- WG12. Curriculum changes in the primary school.
- WG13. Curriculum changes in the secondary school.
- WG14. Linking mathematics with other school subjects.
- WG15. The impact of technology on the mathematics curriculum.
- WG16. The role of technology in the mathematics classroom.
- WG17. Mathematics as a service subject at the tertiary level.
- WG18. Adults returning to mathematics education.
- WG19. Preparation and enhancement of teachers.
- WG20. Evaluation of teaching, centers and systems.
- WG21. The teaching of mathematics in different cultures.
- WG22. Mathematics, education, society and culture.
- WG23. Cooperation among countries and regions in mathematics education.
- WG24. Criteria for quality and relevance in mathematics education research.
- WG25. Didactics of mathematics as a scientific discipline.
- WG26. Connections between research and practice in mathematics education.

### TOPIC GROUPS

- TG1. Primary school mathematics.
- TG2. Secondary school mathematics.
- TG3. University mathematics.
- TG4. Distance learning of mathematics.
- TG5. Education for mathematics in the working place.
- TG6. Mathematics teaching from a constructivist point of view.
- TG7. The fostering of mathematical creativity.
- TG8. Proofs and proving: Why, when and how.
- TG9. Statistics and probability at the secondary level.
- TG10. Problem solving throughout the curriculum.
- TG11. The future of calculus.
- TG12. The future of geometry.
- TG13. The future of algebra and arithmetic.
- TG14. Infinite processes throughout the curriculum.
- TG15. Art and mathematics.
- TG16. History of mathematics and the teaching of mathematics.
- TG17. Mathematical modelling and applications.
- TG18. Roles of calculators in the classroom.
- TG19. Computer-based interactive learning.
- TG20. Technology for visual representation.
- TG21. Mathematics instruction based on manipulative materials.
- TG22. Mathematical games and puzzles.
- TG23. Future ways of publishing in mathematics education.
- TG24. Mathematics competitions.
- TG25. Mathematics clubs.
- TG26. International comparative investigations.



**REPLY CARD**

I am interested in attending the ICME-8. Please, send me the Second Announcement.

Prof.  Mr.

Dr.  Other  
 Mrs.  Ms.

Family Name	First Name
Address	
City	State
Zipcode	Country
E-mail	
	I expect to participate in:
	WG No. <input type="checkbox"/>
	TG No. <input type="checkbox"/>

**SEVILLE**

A city situated in the South of Spain, 80 kms from the Atlantic Ocean and traversed by the River Guadalquivir. Seville is the capital of Andalusia, has over 2000 years of history and is the origin of such universal myths as Don Juan, Figaro and Carmen. It was the birthplace of Roman Emperors such as Trajan and Hadrian and of famous painters such as Velázquez and Murillo.

Seville has one of the largest historic centres in Europe with remarkable ancient monuments: the Cathedral, the Giralda Tower, the Archive of the Indies, the Alcazar, etc.

The traditional charm of its streets, its hospitality and the gaiety of its inhabitants and its traditions, preserved over centuries, form part of the Seville of today, a modern city of great commercial and touristic activity and seat of the last Universal Exposition in 1992.

Despite its proximity to the sea, the climate of Seville is Mediterranean with a strong Continental slant, with a mean annual temperature of 18.8°C. At the time of the Congress the average temperature will be 27.1°C, the mean maximum being 35.5°C and minimum 18.6°C (with a relative humidity of 47%).

**ELECTRONIC INFORMATION VIA Mosaic**

From the 1st of March 1995, you will be able to consult Mosaic for ample information on all aspects of ICME-8 (program, committees, infrastructure, congress venue, services, etc.). This information will be up-dated periodically.

The URL will be: <http://icme8.us.es/ICME8.html>

**SECOND ANNOUNCEMENT**

The Second Announcement to be published in the second half of 1995, will contain full and detailed information about the scientific and social program of the Congress, together with registration and accommodation forms and submission of short presentations.

If you would like to receive this, please return the attached application form as soon as possible.

PLEASE RETURN TO:

**ICME - 8**  
**APARTADO DE CORREOS 4172**  
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**M E R G A**

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MATHEMATICS EDUCATION RESEARCH GROUP OF AUSTRALASIA

AIMS

The Mathematics Education Research Group of Australasia was established as a forum for mathematics educators to disseminate research information on the teaching and learning of mathematics.

The purposes of the Group include:

- \* promoting quality research in the learning and teaching of mathematics
- \* the dissemination to members of research results through regular publications and conferences
- \* seeking means of implementing research findings at all decision levels to the teaching of mathematics and to the preparation of teachers of mathematics
- \* liaising with other organisations with similar interests in mathematics education or educational research.

Membership is open to those who share and wish to promote the general aims of the Group.

**MEMBERSHIP**

There are two categories of membership: personal and library. Personal members receive:

- \* all issues of the *Mathematics Education Research Journal*  
(In 1995, Volume 7 will have 3 issues)
- \* the annual *Research Directory*
- \* regular newsletters on matters of topical interest
- \* reduced registration rates for the annual MERGA conference

Library members receive:

- \* all issues of the *Mathematics Education Research Journal*
- \* the annual *Research Directory*
- \* the *Proceedings* of the annual MERGA conference
- \* other occasional publications

Membership fees are payable at the beginning of each calendar year. To become a member of MERGA for 1995, please complete the form overleaf and return it with your subscription to:

Michael Mitchelmore  
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Macquarie University  
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AUSTRALIA

ENQUIRIES: Telephone (02) 805 8655, Fax (02) 805 8674.

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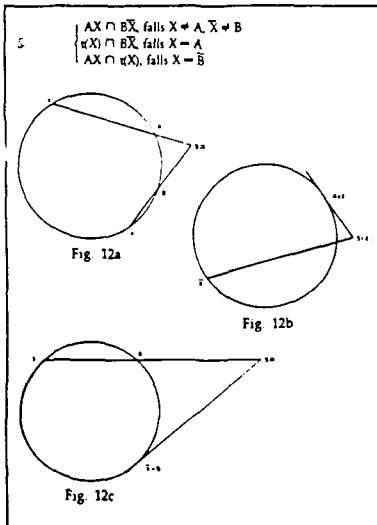
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# ZDM

Zentralblatt für Didaktik der Mathematik  
International Reviews on Mathematical Education

is an information and reference journal in mathematics education and computer science education from pre-school level to teacher training and adult education, published bimonthly. Each issue contains an articles and a documentation section.



From the articles section

The articles section provides book reviews, analyses, and information.

In the book reviews section important publications on the teaching of mathematics and computer science are reviewed in detail.

In the analyses section experts discuss central problems in the fields of mathematics and computer science education.

The information section gives surveys, literature reports, reports on international conferences, discusses teaching models and informs about future events.

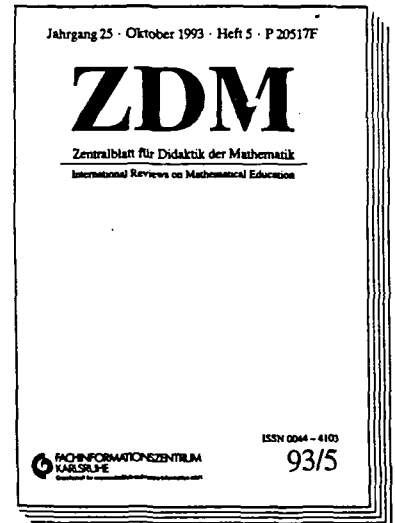
The main concern of ZDM is with documentation of current literature. Articles of more than 500 international journals and other serial publications are reviewed in ZDM. In addition to journal articles ZDM abstracts and indexes textbooks, audio-visual media, games, teaching aids, reports, curricula, dissertations and proceedings from the following fields:

- mathematics teaching from elementary school to university and adult education
- elementary mathematics and applications
- recreational mathematics and popular expositions of mathematics
- computer science education
- basic pedagogical and psychological issues for mathematics and science education.

Each issue contains about 700 literature references. Citations in ZDM provide bibliographic data and abstracts, mostly in English.

To facilitate pin-pointed retrieval of documents there are four indices

- author index
- subject index
- index of corporate entries
- index of journals



ZDM (ISSN 0044-4103)

### Subscription rates:

DM 290,- per year (volume)  
DM 50,- per issue

plus postage and handling; sample issues are available.

### Distribution office

Tel.: (+49) 7247/808-333

## Remarks on the structure of the documentation section

### Information sources

The documentation section of ZDM is a bimonthly abstract service in the field of mathematics education providing ready access to current publications on topics such as mathematics instruction from kindergarden to university level, basic pedagogical and psychological problems, as well as elementary mathematics and its applications. The information contained herein is extracted from all relevant documents published worldwide. This includes journal articles, textbooks, schoolbooks, audiovisual media, teaching aids, software, reports, dissertations, conference papers and syllabuses.

### Documentation

The documentation section of ZDM consists of two parts, the bibliographic section and the index section. The bibliographic part contains all necessary bibliographic data and content analysis elements of the abstracted documents. The bibliographical description of the documents is made in accordance with the international rules applied by the Fachinformationszentrum Karlsruhe. Subject description is done with the aid of an abstract, indexing on the basis of keywords and classification according to the ZDM classification (see "Subdivision of the documentation section of ZDM"). The resulting documentation units are combined into a machine-readable data base. From this the documentation section of ZDM is produced by computer. The "Example of a record" on the next page shows the bibliographic and content analysis elements of the literature analysed as they are represented in the documentation section. The resulting machine-readable data base MATHDI can also be searched by computer and is available for direct interaction by individuals through a computer terminal in their own facilities (for information about this see back cover).

### Subject arrangement

The documentation items, which are consecutively numbered within one issue (and volume), are ordered according to the ZDM classification. Every documentation item may have several notations of this classification scheme. Only the notation which characterizes the main aspect of the content is important for the subject arrangement of the documentation items within the issues. For the other relevant classification codes, the first record is referred to with the note "see also" and its number.

### Index section

The indexes facilitate retrieval of a certain document in the main part according to different criteria:

- R 1 author index
- R 2 subject index
- R 3 index of corporate entries
- R 4 index of journals.

The *author index* indicates the reference numbers of those documents where an author's name is given (also as co-author or cooperator).

The *subject index* gives only the German keywords characterizing the main aspect of the content of the documents. These keywords are controlled terms from the ZDM thesaurus or free descriptors. Following the subject index, there is a German-English vocabulary to help our English-speaking readers to find relevant documents.

The *index of corporate entries* lists all institutions which are either publishers of a document (e.g. of official documents, reports of organisations) or which are given as an author's address.

The *index of journals* indicates the issues of the journals evaluated for each ZDM issue. All bibliographic information as well as addresses can be found in the "ZDM Source Journal Index", available from Fachinformationszentrum Karlsruhe.

## Subject classification scheme of Zentralblatt für Didaktik der Mathematik (ZDM)

All subject categories are represented by a three digit notation consisting of one letter followed by two digits. The capital letter determines the various classes such as algebra, geometry or teaching material and instructional media. The first digit subdivides the classes into more special subclasses. The second digit permits the characterization of the field of education such as primary, secondary or vocational education. Thus the formal structure is determined by two hierarchical levels – the classes and the subclasses – presenting a system of ordering for all fields of didactics of mathematics, completed by the specification of the field of education. The full classification scheme of all classes and subclasses is following on the next pages. There are also the digits of the third position referring to the special field of education. For an overall view of the matter, a brief outline of the classification is given on the back cover.

### Other specifications

Anon.

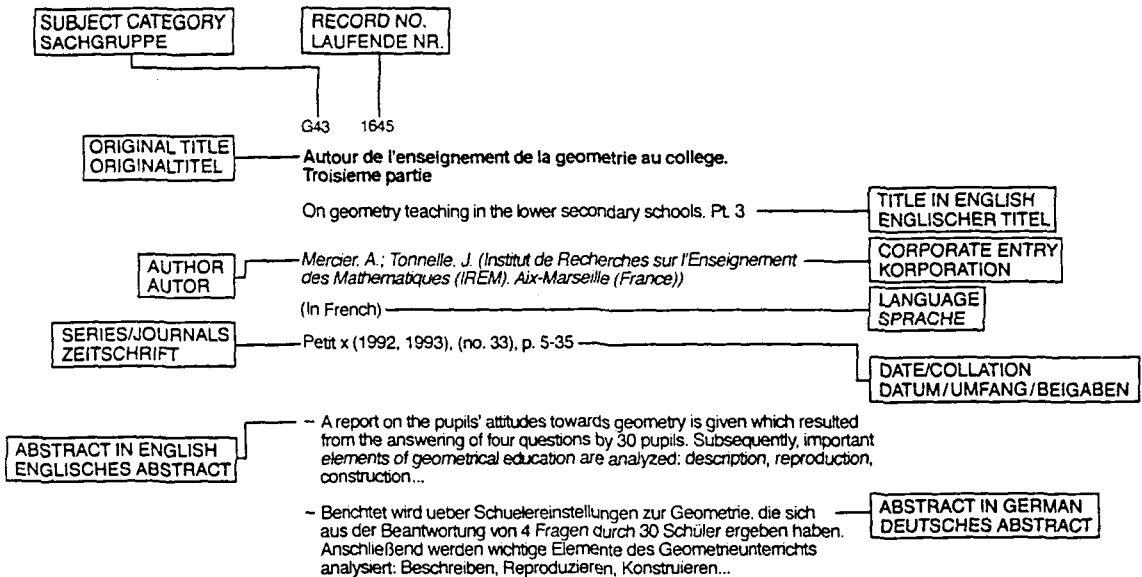
neither a personal author nor a valid corporate could be found [nd]

no date is given for the publication

In general the abstracts are done by the scientific staff of ZDM or by the abstractors mentioned under "Contributors of documentation section". Abstracts marked with a special sign have been provided for ZDM from other information centres. References are given, for example ERIC, OBIS PeF UK (Oborové Informační Středisko Pedagogické Fakulty University Karlovy, Praha). Other German institutions are abbreviated by LI, SB, HS, PZ or FS. ERIC citations of CURRENT INDEX TO JOURNALS IN EDUCATION (CJIE) are included by permission of the publisher, The Oryx Press, Phoenix, Arizona, USA.

## Beispiel einer Titelbeschreibung

## Example of a record



### Subdivision of the documentation section in ZDM (Subject Classification Scheme)

- A General
- A10 Comprehensive works on mathematics. Reference books, encyclopaedias and dictionaries
  - textbooks see U20
  - materials for repetition see U90
  - comprehensive works on special disciplines see each discipline
  - mathematical tables see U70
- A20 Recreational mathematics
  - educational games see U60
- A30 Biographies. History of mathematics and of mathematics teaching
  - innovations in education see D30
- A40 Sociological issues. Political education in the mathematics classroom. The profession of teaching. Careers in mathematics, labour market
  - sociological aspects of learning see C60
- A50 Bibliographies. Information and documentation
- A60 Proceedings. Conference reports
- A70 Theses and postdoctoral theses
- A80 Standards
- A90 Picture stories. Cartoons. Fiction. Games
  - recreational mathematics see A20
  - educational games see U60

- B Educational policy and educational system  
(Educational research, educational reforms, pilot projects, official documents, syllabuses)
  - B10 Educational research and planning
  - B20 General education
    - syllabuses see B70
  - B30 Vocational education
    - syllabuses see B70
  - B40 Higher education
  - B50 Teacher education (Teacher pre-service and in-service education)
  - B60 Out-of-school education. Adult and further education (Summer schools, working groups, student competitions. Private study)
  - B70 Syllabuses, curriculum guides, official documents
    - testing of syllabuses in pilot classes see D30
- C Psychology of mathematics education. Research in mathematics education. Social aspects
  - C10 Comprehensive works and surveys
  - C20 Affective aspects (Motivation, anxiety, interest, attitudes, feelings. Self concept. Attention. Affective development)
  - C30 Cognitive processes. Learning, learning theories (Thought processes, information processing, concept formation, problem solving, understanding. Learning. Memory. Perception. Cognitive development)
    - concept teaching see E40
    - teaching problem solving see D50
    - social learning see C60
    - learning with texts see C50
    - teaching-learning-processes see C70



- C40 Intelligence and aptitudes. Personality (Talent, intelligence, abilities and skills, creativity). Behaviour. Personality traits, personality development  
 → learning difficulties and student errors see D70  
 → achievement control see D60  
 → special education see C90
- C50 Language and verbal communication (Verbal classroom communication. Language acquisition. Verbal teacher-student-interaction. Communicative competence. Language difficulties, multilingualism. Teaching and learning mathematics in a second language. Learning with texts)  
 → mathematical language see E40  
 → readability of textbooks see U20
- C60 Sociological aspects of learning (Group dynamics. Interpersonal interaction. Social learning. Roles. Social, economic and cultural influences)  
 → teaching methods see D40  
 → mathematics and society see A40
- C70 Teaching-learning-processes. Evaluation of instruction (Relations between teaching-processes – e.g. teacher attitudes, teaching methods – and learning processes – e.g. student attitudes, achievement. Effective teaching)  
 → teacher-student interaction see also C50, C60  
 → learning see C30  
 → teaching methods see D40
- C80 Other psychological aspects (E.g.: test theory, neuropsychology, research methods in psychology)
- C90 Other educational aspects (E.g.: special education, vocational education, curriculum theory, andragogy)  
 → mathematics teaching see D  
 → educational media and media research see U10  
 → media education see U
- D Education and instruction in mathematics**
- D10 Comprehensive works and surveys on mathematics instruction in general and at different school levels and types. Comparative studies on mathematics education in different countries
- D20 Philosophical and theoretical contributions to mathematical didactics. Research methods. Theory of mathematics education  
 → history see A40  
 → learning theories see C30  
 → teaching-learning research see C70
- D30 Goals of mathematics teaching. Curriculum development (Mathematical formation. Formation of general abilities by mathematics instruction. Minimal competencies. Objectives and content of mathematics education, also with regard to cultural demands. Impacts of new technologies on mathematics instruction. Innovations and trends. Curriculum research. Curriculum evaluation. Interaction with other subjects)  
 → syllabuses and curricula see B70  
 → history of mathematics instruction see A30  
 → political education in the mathematics classroom see A40  
 → socialisation in mathematics instruction see C60
- D40 Teaching methods and classroom techniques. Lesson preparation. Educational principles (E.g.: classroom conversation, classroom organization, teaching approach, ability grouping)  
 → programmed instruction see U50  
 → interactions see C50, C60, C70  
 → evaluation of instruction see C70  
 → language in mathematics instruction see C50  
 → preparation for examinations see D60  
 → teacher resources for preparing lessons see U30  
 → interdisciplinary teaching see M10
- D50 Teaching problem solving and heuristic strategies (E.g.: methods of problem solving, classification of exercises, problem solving in the curriculum)  
 → psychological aspects of problem solving see C30  
 → see also test theory C80  
 → exercise problems and student competitions see U40
- D60 Achievement control and rating (Mathematics achievement. Assessing pupils performance. Control and measurement of knowledge, abilities and skills. Examinations, preparation for examinations)  
 → student errors see D70  
 → problem books see U40  
 → abilities as personality traits see C40
- D70 Diagnosis, analysis and remediation of learning difficulties and student errors  
 → special education see C90  
 → achievement control and rating see D60
- D80 Teaching units, draft lessons and master lessons
- E Foundations of mathematics**
- E10 Comprehensive works on the foundations of mathematics and their teaching. Methodology of mathematical research
- E20 Metamathematics. Philosophical aspects of mathematics. Epistemology  
 → history of mathematics see A30
- E30 Logic. Acquisition of logical verbal reasoning abilities in mathematics instruction  
 → Boolean algebra see H50
- E40 Language of mathematics. Formalization. Defining. Axiomatics and axiomatic methods. Acquisition of mathematical concepts  
 → psychological aspects of concept formation see C30  
 → verbal communication see C50  
 → number concept see F20  
 → mappings and functions see I20
- E50 Proof methods. Reasoning and proving in the mathematics classroom
- E60 Sets. Relations. Set theory  
 → mappings and functions see I20
- E70 Miscellaneous
- F Arithmetic. Number theory. Quantities**
- F10 Comprehensive works on arithmetic and the teaching of arithmetic
- F20 Prenumerical stage. Number concept, counting
- F30 Natural numbers and operations on natural numbers. Place value. Pencil and paper arithmetic, mental arithmetic  
 → estimates see N20  
 → representation of numbers (numerical mathematics) see N20
- F40 Integers. Rational numbers. Arithmetic operations on integers, fractions and decimals. Extensions of number domains
- F50 Real numbers, powers and roots. Arithmetic operations on real numbers, powers and roots. Complex numbers
- F60 Number theory
- F70 Measures and units (Quantity concept, operations with specified measures and units)  
 → areas, volumes see G30
- F80 Ratio and proportion. Rule of three. Percentages and calculation of interest. Mixture problems (E.g. proportional quantities, inversely proportional quantities)  
 → mathematics in vocational training see M20

- F90 Practical mathematics, real problem solving (E.g. real life problems)  
 → mathematical modelling and mathematical applications see M  
 → teaching problem solving see D50  
 → linguistic comprehension of word problems see C50
- G Geometry**
- G10 Comprehensive works on geometry and the teaching of geometry
- G20 Informal geometry (Spatial orientation. Basic geometrical shapes)  
 → prenumerical stage see F20
- G30 Areas and volumes (Lengths and areas, volumes and surface areas)  
 → quantities and units see also F70  
 → word problems see F90
- G40 Plane and solid geometry. Geometry in multidimensional spaces  
 → geometric transformations see G50
- G50 Transformation geometry (Isometries, similarity transformations)  
 Trigonometry, spherics
- G70 Analytic geometry. Vector algebra
- G80 Descriptive geometry  
 → technical drawing see M20  
 → cartography see M50
- G90 Miscellaneous (E.g.: convex sets, packings, coverings, tessellations, non-euclidean geometries, finite geometries)  
 → fractals see I90
- H Algebra**  
 → numerical methods in algebra see N30
- H10 Comprehensive works on algebra and the teaching of algebra
- H20 Elementary algebra (Variables, manipulation of expressions. Binomial theorem. Polynomials. Finite sums)  
 → theory of equations see H30
- H30 Theory of equations and inequalities  
 → variables, terms see H20
- H40 Operations. Groups, rings, fields  
 → computational rules see H20
- H50 Ordered algebraic structures. Lattices. Boolean algebra  
 → propositional logic see E30
- H60 Linear algebra. Multilinear algebra (Vector spaces, linear mappings, matrices, determinants, theory of equations)  
 → vector algebra see G70
- H70 Miscellaneous (E.g.: algebraic topology, algebraic geometry)
- I Analysis**  
 → numerical analysis see N40
- I10 Comprehensive works on calculus and the teaching of calculus
- I20 Mappings and functions. Elementary properties of functions. Special functions (Concept of function, representation of functions, graphs of functions. Functions of a real variable. Monotonicity, continuity, limits)  
 → sequences see I30  
 → polynomials see H20
- I30 Sequences, series, power series. Convergence, summability (Infinite products, integrals)
- I40 Differential calculus (E.g.: curve sketching, extremum problems)
- I50 Integral calculus. Measure theory (Integrals of different types. E.g. applications on bodies of revolution)
- I60 Functions of several variables. Differential geometry
- I70 Functional equations (Definition of functions. Differential equations, difference equations, integral equations)
- I80 Functions of a complex variable, conformal mappings  
 → complex numbers see F50
- I90 Miscellaneous (E.g.: functional analysis, set theoretical topology, catastrophe theory, non-standard analysis, fractals, chaos theory)
- K Combinatorics and graph theory. Statistics and probability**
- K10 Comprehensive works on stochastics and the teaching of stochastics
- K20 Combinatorics (Classical combinatorial theory, configurations, latin squares)  
 → tessellations and packings see G90
- K30 Graph theory  
 → discrete mathematics see N70  
 → finite geometries see G90
- K40 Descriptive statistics, statistical data handling, graphical methods of data representation, data analysis
- K50 Probability concept and probability theory
- K60 Probability distributions, stochastic processes, limit
- K70 Statistical inference (Methods, non-parametric methods, robustness, Bayesian approach, methodology and foundations)
- K80 Correlation and regression analysis. Multivariate statistics (Discrimination, cluster analysis, factor analysis)
- K90 Applied statistics (E.g.: simulation, decision theory, reliability, quality control)
- M Mathematical modelling, applications of mathematics**
- M10 Mathematization, its nature and its use in education. Interdisciplinarity. Comprehensive works on applications of mathematics  
 → probability and statistics see K  
 → numerical methods see N  
 → interactions with other subjects see D30
- M20 Mathematics in vocational training and career education  
 → see also F80, F90
- M30 Financial mathematics. Insurance mathematics
- M40 Operations research, economics  
 → mathematical programming see N60
- M50 Physics. Astronomy. Technology. Engineering. Computer science. Earth sciences
- M60 Biology. Chemistry. Medicine. Pharmacy
- M70 Behavioural sciences. Social sciences. Education
- M80 Arts. Music. Language. Architecture
- M90 Miscellaneous (E.g. sport)

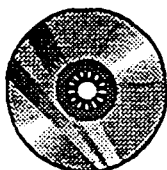
- N Numerical mathematics. Discrete mathematics. Mathematical software**
- N10 Comprehensive works on numerical mathematics and its instruction
- N20 Representation of numbers, rounding and estimation. Theory of errors and computation with approximate values. Conditioning
- N30 Numerical algebra (Iteration methods for the solution of nonlinear equations and systems of linear and nonlinear equations, numerical linear algebra)
- N40 Numerical analysis (Numerical solution of differential and integral equations, numerical integration and differentiation)  
→ interpolation and approximation see N50
- N50 Approximation, interpolation, extrapolation
- N60 Mathematical programming  
→ operations research see M40
- N70 Discrete mathematics (Finite methods in various mathematical fields, especially used as theoretical foundation in other disciplines)  
→ combinatorics see K20  
→ graph theory see K30  
→ finite geometries see G90  
→ difference equations see I70
- N80 Mathematical software. Collections of computer programs  
→ software for special disciplines see each discipline  
→ computer as a teaching medium see U70
- N90 Miscellaneous (E.g. experimental mathematics)

- U Educational material and media. Educational technology**
- U10 Comprehensive works on instructional materials, educational technology and media research
- U20 Textbooks. Analysis of textbooks, development and evaluation of textbooks. Textbook use in the classroom  
→ textbooks for special disciplines see each discipline  
→ learning with texts see also C50
- U30 Teacher manuals and planning aids (Teacher volumes, solutions, teaching aids)  
→ comments on syllabuses and edicts see B70  
→ lesson preparation see D40  
→ draft lessons and teaching units see D80
- U40 Problem books, student competitions, examination questions  
→ preparation for examinations and achievement control see D60  
→ teaching problem solving see D50
- U50 Programmed instruction, computer assisted instruction (CAI, intelligent tutor systems)
- U60 Manipulative materials and their use in the classroom (Visualizations, teaching aids, models, educational games, worksheets. Teaching in laboratories)  
→ games see also A90
- U70 Mathematical tables. Mathematical instruments, pocket calculators. Comments on their instructional use. Computer as a teaching medium  
→ mathematical software see N80  
→ collections of computer programs see N80
- U80 Audiovisual media and their use in instruction (Transparencies, films. Broadcasting and television)
- U90 Miscellaneous (Student publications, repetition materials. Mathematical expositions)  
→ reference books see A10

All notations are principally in three places and consist in the first position of a capital letter, in the second position of a digit for additional subdivision and in the third position of a digit to characterize the educational institution:

- 0 General, difficult to classify in the third position;  
--1 Kindergarten, Pre-school education;  
--2 1st to 4th year of school, primary education, elementary level;  
--3 4th to 10th year of school, secondary level, lower and middle secondary (all types of school);  
--4 11th to 13th year of school, upper secondary;  
--5 Universities, Colleges, Polytechnics;  
--6 Special schools;  
--7 Vocational schools;  
--8 Extra mural institutes, Colleges of Further Education, Correspondence schools, Popular education etc.;  
--9 Teacher training, teacher in-service training.

# CD-ROM MATHDI



## Citations of relevant literature in mathematics education on a disc

The Zentralblatt für Didaktik der Mathematik (ZDM, English subtitle: *International Reviews on Mathematical Education*) was founded in 1968 and is today the only abstracting and reviewing service in mathematics education. It covers the entire spectrum of mathematics education from preschool level to teacher training and adult education as well as elementary mathematics and its applications. ZDM contains references to worldwide literature from about 500 journals and serials, books, reports, conference contributions, software, and educational material.

### Subject Coverage:

- Teaching of mathematics from elementary school to university and adult education
- Research in mathematical didactics
- Elementary mathematics and applications
- Computer science education and information technology
- Basic pedagogical and psychological issues for education in mathematics and sciences



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The ZDM is now offered in three forms:

- the well known printed version
- MATHDI (MATHematical DIactics) database (online on STN International)
- the CD-ROM MATHDI.

This new CD-ROM, produced with the help of the STN Personal File System Software, offers you the following attractive features:

- reviews and bibliographic data from ZDM, from 1976 to 1994 (58,000 data in mathematical education)
- time-independent searching
- CD-ROM saves you the additional costs you might incur using other database systems e.g. telecommunications costs.

CD-ROM MATHDI costs DM 940.00.  
(For ZDM subscribers: DM 790.00)

Special price for individuals: DM 198.-  
(manual only available in form of postscript files on the CD-ROM)

For further information, please contact:

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Gerhard König  
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### CD-ROM MATHDI

Zentralblatt für Didaktik der Mathematik (1977-1994)

- Order for CD-ROM
- Subscription to ZDM from 1995 for DM 290,00 + 90<sup>DM</sup>
- CD ROM, special offer for individuals postage

참 고 문 헌

- 박 한식(1992). 제 7차 수학교육 국제회의와 관련하여, 한국수학교육학회지 시리즈 A 수학교육 31, no. 4, 1-10.
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