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Secretariat
Centre for Mathematics Education
University of Southampton
Southampton, SO9 5NH
England



The International Commission on Mathematical Instruction

BULLETIN NO. 25

DECEMBER 1988

**Editors: Keith Hirst and Geoffrey Howson
Centre for Mathematics Education
University of Southampton
Southampton, S09 5NH
England.**

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MATHEMATICAL INSTRUCTION
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**SIXTH INTERNATIONAL CONGRESS
ON MATHEMATICAL EDUCATION
BUDAPEST**

JULY 27 - AUGUST 3, 1988

Readers will be interested to learn that ICME 6, the best attended IMCE to date, had 2414 registered participants from 74 countries. These were accompanied by more than 500 additional visitors. The following countries were represented by more than 10 delegates: Australia (113), Belgium (13), Brazil (18), Bulgaria (61), Canada (47), Czechoslovakia (35), Denmark (11), Finland (26), France (112), FRG (75), GDR (11), Greece (17), Hungary (306), Israel (43), Italy (81), Ivory Coast (13), Japan (228), The Netherlands (65), New Zealand (12), Norway (21), Poland (28), Portugal (22), South Africa (25), Spain (80), Sweden (62), Switzerland (15), UK (274), USA (380), USSR (90).

The Proceedings of the Congress should be mailed to all participants early in 1989. Copies for libraries, etc. can be purchased from ICME Proceedings, Centre for Mathematics Education, University of Southampton, Southampton, SO9 5NH, England. The price is £25 including postage and packing. Alternatively, the Proceedings can be obtained, price US\$45, from ICME Proceedings, Mathematical Association of America, 1529 Eighteenth St., NW, Washington DC 20036, USA.

**ICMI STUDY
ON THE POPULARIZATION
OF MATHEMATICS**

This will take place in Leeds, England from 17-22 September, 1989. There will be an accompanying event mounted by a U.K. National Committee comprising, an exhibition, films, lectures, workshops, etc. Those wishing to attend should inform Professors Howson or Kahane of their particular field of interest. Papers should be submitted not later than 30 April, 1989.

REPORT FROM THE GENERAL ASSEMBLY

Minutes of the General Assembly of ICMI held on Tuesday, 26 July 1988 in Budapest, Hungary.

Present: J-P. Kahane (Chair), Lee P-Y, E. Lluís, A.G. Howson, H. Fujita, J. Kilpatrick, J.H. van Lint, M. Niss, (ICMI EC).

H. Whitney, Z. Semadini, H-G. Steiner (former ICMI President and Vice-Presidents).

National Representatives (or deputies) of Argentina, Australia, Austria, Belgium, Botswana, Brazil, Bulgaria, China (People's Republic), Costa Rica, Czechoslovakia, Denmark, Egypt, Federal Republic of Germany, Finland, German Democratic Republic, Hungary, Iran, Japan, Kuwait, Mexico, Netherlands, New Zealand, Nigeria, Norway, Poland, Portugal, South Africa, Spain, Sweden, Switzerland, UK, USA,

E. Jacobsen (UNESCO)

W. Dörfler and P. Neshor (PME), U. D'Ambrosio (ISGHPM), M. Barnes and L. Burton (IOWME)

Apologies were received from a number of National Representatives.

1. The President welcomed members to the Assembly.
2. The Secretary presented a report on financial matters. He explained how ICMI's funds had grown considerably in the last four years. We were most grateful to the IMU for its greatly increased support, to ICSU which had made increasingly valuable contributions to our work and to UNESCO which continued to give considerable assistance. Other aid had come from a variety of sources, for example, the French Government and the Royal Society had made grants for administrative purposes, IBM (Europe) and IBM (France) had made contributions to the studies and other 'hidden' but much appreciated contributions to these had come from the University of Strasbourg, the International Centre for the Mechanical Sciences (Udine) and various Kuwaiti institutions. The 'study series' books were now providing a small but welcome return in royalties and foreign rights.

During the period ICMI had spent money on, for example, the studies, on regional meetings, on assisting the educational activities of the African Mathematical Union, on the IPC for ICME 6, on the production and distribution of Bulletins and Study Proceedings, and on assisting educators to attend the Adelaide and Budapest Congresses.

The need for having a substantial balance which enabled ICMI to plan activities and to embark upon them whilst supplementary funds were being sought was stressed and was accepted by the Assembly.

The National Representative for Nigeria expressed thanks on behalf of those from developing countries who had been helped to attend the international study seminars and ICMEs. He hoped that more money would be made available for such work in the future.

3. The Secretary next presented a review of the activities of ICMI in the years 1984-88.

These included:

- (a) International studies on

The influence of computers and informatics on mathematics and its teaching (Strasbourg, 1985)
School Mathematics in the 1990s (Kuwait, 1986)
Mathematics as a Service Subject (Udine, 1987)

A study on 'Cognition and Mathematics Education' had been commissioned from the PME group.

The discussion document for the 'Popularization' study (Leeds, 1989), had now appeared.

- (b) Regional meetings had been held in

Singapore (SEAMS, 1987)
Dominican Republic (IACME, 1987)

- (c) The International Olympiad Site Committee had helped arrange annual olympiads and had now sites fixed for several years ahead.

- (d) A site for ICME 7, 1992 (Laval University, Quebec), had been agreed.

(e) ICMI sessions had been arranged at ICM 1986, Berkeley.

4. Reports were presented on the work of the three affiliated study groups.

Professor Nesher (PME) reported on the annual congresses which had been held since Adelaide. PME now had 600 members (individuals rather than national representatives) from 39 countries. She spoke of the activities of the working groups leading up to the production of the book on 'Cognition'.

Professor D'Ambrosio (ISGHPM) described how the group had mounted special sessions at ICM '86, at the '85 Congress on the History of Science and at a variety of NCTM and MAA meetings. The Newsletter now had a circulation of 2,500.

Professor Burton (IOWME) told of the eight years work which preceded the acceptance of IOWME as an affiliated study group. Unlike PME, IOWME presently works through a network of 18 national coordinators who are responsible, inter alia, for overseeing the distribution of the Newsletter, the publication of which, like that of IRHPM, was facilitated by assistance from UNESCO.

(The officers of the study groups were to change at the succeeding Congress.)

5. The assembly then heard of future plans and possible activities. These included a proposed study on assessment, regional meetings to be held in Brunei (SEAMS, 1990), Miami, USA (IACME, 1991) and, in conjunction with Chinese educators, a meeting in Beijing in September, 1990. The possibility of a joint study with ICSU-CTS on 'The scientific and mathematical education of teachers in elementary/primary schools' was mentioned.

The assembly then discussed other possible studies. Topics mentioned were:

The image of mathematics
Mathematics education in a time of diminishing resources
Cooperation between researchers in science and mathematics education.

6. Any other business

Items raised included:

- (a) the desirability or otherwise of always holding ICMEs in August. The case for a March/April ICME was argued since this would increase the number of possible sites. It was agreed to seek further responses from National Representatives on this suggestion.
- (b) the place of women in ICMI's committees and activities.
- (c) the need to carry out evaluations of ICMEs.
- (d) the standard of some of the short communications offered at ICME 6 and the desirability of these being refereed.
- (e) ways in which developing countries could be more involved in ICMI's work,
- (f) a call for the general existence of national sub-commissions and for emphasis to be placed on the rôle which these can play in ICMI's work.

In connection with (f), the National Representative for Belgium informed the meeting of a submission made to the EEC under the Erasmus program which, if successful, would allow National Representatives from EEC countries to meet together to discuss cooperation and the role of national sub-commissions.

7. The next General Assembly of ICMI will be held at Laval University, Quebec in 1992.

8 August 1988

AGH

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MATHEMATICS EDUCATION IN MALAWI

(This is an edited version of the Malawi National Presentation given at ICME-6 in Budapest by Myness Mkandawire of the Ministry of Education and Culture, Malawi)

THE STRUCTURE OF THE EDUCATION SYSTEM OF MALAWI

Since Independence there has been rapid growth of the whole education system of the country. This paper discusses how education, especially mathematics, has developed over the post-independence years. It gives an account of the measure of success which Malawi has achieved. It also gives aspects in which it has been less successful and singles out the problems which bedevil the teaching of Mathematics.

The formal education system of Malawi consists of eight years of primary education, four years of secondary education (two years of Junior/Secondary) and three to five years of higher education.

The administration of education in Malawi is centralised in the Ministry of Education and Culture. The Ministry is responsible for administration of public education institutions at all levels except the University of Malawi which has its own senate.

Primary Schools

Prior to the formal education in primary schools, some children attend nursery schools for 2 years. These schools are administered and manned by various local government councils and private bodies. The number of councils and organisations offering nursery schools is small but is rapidly increasing in all parts of the country.

A child enters primary school at the age of 6 years. At the end of 8 years there is a national examination: the Primary School Leaving Certificate Examinations (PSLCE). Some of the successful candidates are selected for secondary education while others fall back to join the rest of the society in rural areas in order to earn a living.

Traditional Secondary Schools

The successful candidates at PSLCE are selected to Government (boarding or day) and Government grant-aided (missionary) secondary schools. The private secondary schools have their own admission procedures.

Distance Education Centres

An alternative to traditional secondary schooling is provided by the Malawi College of Distance Education, (MCDE). The college enrolls graduates of PSLCE who work in MCDE centres situated throughout the country.

In both systems, after 2 years a student writes Junior Certificate examination (JCE). The majority of the successful candidates go on to 2 more years of secondary education after which they write a Malawi School Certificate Examination (MSCE). The rest of the candidates either join various institutions for vocational training or they engage in commercial or self employment activities in the rural or urban areas.

Tertiary (Post Secondary)

Tertiary education is provided by either the University of Malawi, Primary Teachers' Colleges, Technical Colleges or High School.

University of Malawi

In the University of Malawi there is variation in the duration of various courses of study; it ranges from 3 years to 6 years. The awards of the University include Diplomas in Education, Agriculture, Business Studies, Engineering and Nursing. There are also degrees in Education, Liberal Arts, Natural Sciences, Social Sciences, Public Administration, Business Studies and Law. of late the University has started awarding Masters degrees in Education. In 1987 a masters programme in Agriculture was introduced. All masters programmes last for 2 years. The University of Malawi is the sole trainer of secondary school teachers in Malawi.

Only a few of the successful candidates at MCE can be considered for selection to any of the University Colleges.

Teacher Training Colleges

All primary school teachers are trained in Primary Teachers' Colleges. There are two types of courses and they last for 2 years. The first takes those who possess a Junior Certificate. Trainees for these courses come from both the traditional secondary schools and Distance Education Centres.

Technical (Vocational) Colleges

Technical Colleges cater for trainees who possess a minimum of Junior Certificate of Education. The courses include brickwork, carpentry, motor vehicle mechanics and secretarial work. The duration of the courses is 4 years but the secretarial courses last for less than 4 years.

High School

There are a few Malawians who do high school secondary education. The successful candidates take various professional courses abroad. The courses include Medicine, Architecture, Pharmacy, Forestry etc.

THE PLACE OF MATHEMATICS IN THE EDUCATION SYSTEM

Mathematics has established itself as an important subject in Malawi enjoying a high status. The teaching of primary mathematics aims at equipping the learner with skills to make him/her live a useful life. The Regulations and syllabus for Junior Secondary Mathematics (1982) of the Ministry of Education and Culture, emphasise the need for Mathematics in understanding other subjects; stimulating interest in further studies and developing abilities in reasoning and problem solving. These abilities are vital in everyday life. The Ministry ensures that the importance of mathematics pervades the curriculum of the whole education system as discussed below.

Primary Level

Only arithmetic is taught in primary schools and it is a compulsory subject because of its relevance and practicability in one's life in any environment. The arithmetic curriculum ranges from number work to simple accounts and book-keeping. To qualify for a PSLCE, a pupil must pass English and Arithmetic and any 2 other subjects. For selection to secondary education, a pupil must pass English and Arithmetic with a pass in any 4 subjects.

Secondary Level

Secondary school mathematics comprises Arithmetic (which includes elementary trigonometry), Algebra and Geometry. The three branches are taught and examined separately. Mathematics is a compulsory subject. Unlike in PSLCE, it is not a passing subject for both Junior Certificate and Malawi School Certificate Examinations. However a pass in Mathematics at JCE greatly influences selection to form 3. Selection to any University College requires a pass with a credit in mathematics and English. Clearly, entry, to Higher Education institutions is partly influenced by one's performance in Mathematics.

Primary Teachers' Training and Technical Colleges

Entry to Teachers' Training College requires a minimum qualification of a Junior Certificate with a pass in Mathematics in addition to a pass in English. During the course mathematics is compulsory and is taught as an academic subject and as Arithmetic methods. For Technical Colleges the minimum entry requirements include a pass in Junior Certificate Mathematics.

PROBLEMS FACING MALAWI

Malawi is facing several problems in her endeavour to achieve permanent functional numeracy and literacy in her nationals. These include curriculum development, high enrolment in schools, the nature of text books and equipment and the supply of teachers. The country also needs adequate manpower for its socio-economic development.

Curriculum Development - Primary and Secondary Schools

Both primary and secondary curricula have experienced problems over the years. These are discussed in relation to mathematics education in the country. To start with, reports from the field indicate that most teachers fail to cover the syllabuses for both primary and secondary mathematics. This may indicate the unnecessary length of the syllabus. Secondly, the curricula were adapted from those which were originally prepared for non-Malawian contexts. In the absence of regular curricula reviews there is a problem of ascertaining the relevance of these curricula to the socio-economic development of the country. Thirdly, among other things, examination results at PSLCE; JCE and MCE are a criterion for selection to higher levels of education. Teachers and pupils are conscious of the stiff competition for secondary and university education. The result is that teachers streamline their teaching towards sending as many pupils as possible to Secondary and University education. This has led to adopting teaching methods which have promoted rote learning at the expense of understanding, and development of mathematics concepts; as well as the practical application of the subject. Lastly, the Junior Certificate Mathematics covers topics which appear in the primary syllabus or in the Malawi School Mathematics. Therefore, there is a lot of duplication of subject content.

In addressing these problems, the Ministry in conjunction with Malawi Institute of Education (MIE), (responsible for Primary Teacher and Primary Curriculum Development) is revising the primary curriculum. Notwithstanding the substantial financial resources the review requires, it is hoped that the new curriculum will respond to the needs of those who move on to secondary education, as well as those for whom primary education is terminal and must engage in self employment activities.

Since last year (1987) a new syllabus committee has been formed in each subject for both JCE and MCE levels, replacing the two old syllabus committees. It is hoped that the new committee in mathematics will explore ways of reducing duplication of topics in the two syllabuses and effect a smooth transition from one syllabus to the other. In an attempt to resolve problems on the nature of examinations, the long term plan shows that the PSLCE will change its format in order to include examination of higher cognitive skills.

Curriculum Development - Post Secondary

The focus here is on secondary school mathematics teacher education. There are two major categories of teachers. Those that possess a diploma or degree in education and the others who obtained a general degree (B.Sc.). Both groups do a great deal of calculus at college but very little of secondary mathematics. This has posed problems because the expertise gained at college is under-utilised in secondary schools. To alleviate the situation, the Ministry is currently carrying a survey to establish and assess teachers' needs with a view to designing appropriate in-service training programmes.

Primary School Enrolments

Figure 1 shows enrolment by sex and by class for 1985/86 academic year. One striking feature is the wide base of standard I pupils. The diagram then narrows up to standard 7 which is the smallest group in the primary education. The change from standard I to standard 7 shows a drop-out rate of 31.2% to 6.2% respectively. The diagram then widens at standard 8. There are several factors contributing to this situation including inability for parents and guardians to pay school fees, the traditional demands on the children pertaining to religious beliefs and failure to value education. For first, their enrolment is smaller than boys in each class, especially in higher primary classes. This is probably due to early pregnancies/marriages. In addition, in some families, preference is given to a boy to proceed with education in times of insufficient school fees.

The second feature is the high repetition rate in each class, ranging from 2% in standard 4, 19% in standard 1 to 41% in standard 8. Primary schools have limited facilities such as number of classrooms and number of teachers. These have resulted into very big classes, ranging from 51 to 76. In some isolated cases classes go up to 100 pupils. In such situations effective teaching is low. The result is that most slow learners end up repeating various classes. The problem is more acute in standard 8, where out of 90,366 standard 8 pupils who sat for PSLCE in 1985/86, only 7,184 (about 8%) got selected to form one. Since there are limited facilities for vocational education and that most of the pupils are still young, they end up repeating standard 8 several times. This is why the proportion of repeaters in standard 8 is very high.

The Government is trying to reduce this problem by encouraging pupils to enrol with the MCDE. In 1985/86 there were 6,455 students enrolled with the college. This academic year the enrolment is about 9,000 showing an increase of over 250. In a related development the Government is increasing the capacity of some of the existing traditional secondary schools and also

converting some Distance Education Centres into normal secondary schools. This is with a view to enrolling 13% of the secondary school going age by 1996.

Secondary School Enrolments

Figs. 2 and 3 show enrolment for normal secondary schools and Distance Education Centres in 1985/86. The decrease from enrolment of 7,116 in form II to 5,337 in form IB was due to fewer places in form III than in form II. In fact most of normal secondary schools, form III had one class less than form II. It is gratifying to note that from this academic year (1987/88), the Government has introduced an extra class at form III level which will proceed to form IV (MCE level) in 1988/89. The enrolment in form V is likely to remain around 159 because there is only one institution offering High Secondary School education in the country.

One other problem is the low enrolment for girls at each level in the secondary education. The main factor here is their poor performance at PSLCE, JCE and MCE. This is mostly true in Science subjects. This is causing a nationwide concern, to the effect that the Research Unit of the Ministry of Education and Culture is considering conducting a survey to establish causes for girls' poor performance in science subjects. It goes without saying that the survey results will be an eye opener on where to start in dealing with the problem.

Primary School Textbooks and Equipment

Textbooks for the whole primary school curriculum are locally produced. The pupil-book ratio of about 1:1 indicates a healthy supply of these textbooks. The first problem with these arithmetic textbooks is failure to relate to the Malawian context. This is probably because they were an adaptation of textbooks originally written for non-Malawian context. Secondly, the textbooks are all written in English although the medium of instruction in standards 1 to 4 is in Chichewa (the National Language). Thirdly, the readability of these books is very low; as a result very few pupils can understand them without their teachers' help. The situation is aggravated by non-availability of supplementary learning materials.

The solution to some of these problems lies in the primary curriculum review mentioned earlier. The Ministry is training some Malawian Mathematics educators in writing primary arithmetic textbooks for the new curriculum. At the same time, the Ministry is seriously considering writing arithmetic textbooks for standards 1 to 4 in Chichewa. This move, it is hoped, will reduce the problems of learning mathematics concepts in a foreign language.

Secondary School Textbooks and Equipment

The situation in secondary schools is different. Most secondary schools do not have appropriate mathematics textbooks. As regards science equipment, most schools are unable to acquire the basic equipment. The main reason for this state of affairs in schools is budgetary constraints. The prices are so high that the Ministry can only order a few books and equipment every year. Here again, the textbooks used in schools are foreign to Malawi's context.

A positive step has been taken towards solving this problem. Since last year (1987) the Ministry is deploying the expertise of some Malawian mathematics educators to adapt a Zimbabwean mathematics course to suit Malawi Secondary Schools. However, even when these books become available in the shops, the funds to purchase them for schools will still be a limiting factor.

Teacher Demand and Supply Primary Schools

The demand for teachers in all districts in the country exceeds the supply of teachers. In addition, out of the 16040 teachers in the country (1985/86), 1715 were untrained; hence they were handicapped in teaching methods.

Further to the problem above some of these primary school teachers are not confident in teaching the subject.

The teaching profession is the last resort of the career option in many cases. Most of the able mathematics candidates must have gone to the University colleges or opted for more lucrative jobs. This means that the last group that goes for teaching is among the low achievers in mathematics.

The Government has from this academic year 1988/88, launched an in-service training programme for the untrained primary school teachers. The emphasis of the programme is on the methods rather than the academic content. The programme is targetted at all untrained teachers in the country. Parallel to this development, more training colleges are being constructed to increase the pre-service training enrolment.

Secondary Schools

For most of the subjects in the secondary school curriculum teacher supply exceeds teacher demand except for mathematics and Home Economics. For mathematics, the pre-service training programme does not produce enough mathematics teachers. According to the education statistics there were 29 students enrolled for B.Sc. and 24 for Diploma/B.Ed. But the enrolment for 1987/88 for the same group shows 17 B.Sc. and 20

B.Ed. confirming the statement above. Furthermore, very few old graduates majored in mathematics, and not all of them joined the teaching profession. The stability of the mathematics teachers in the profession is very unreliable because of the big demand for them in other organisations. In fact the Ministry's projection for mathematics teachers for 1991/92 shows a shortfall of 35.

The Government is regularly running in-service courses on methods for untrained secondary school teachers. Simultaneously, some diploma teachers are given an opportunity for a degree course in Education. As from 1988/89 academic year, the University will introduce a new B.Ed. programme. This programme is effectively phasing out diploma programmes in pre-service training for secondary school teachers. It is hoped that an all graduate secondary school teaching force will go a long way to enhancing the quality of secondary school education in Malawi.

Conclusion

The six types of educational institutions in the education system are complementary in imparting to Malawians necessary knowledge and skills for the country's development and for personal social and economic advancement.

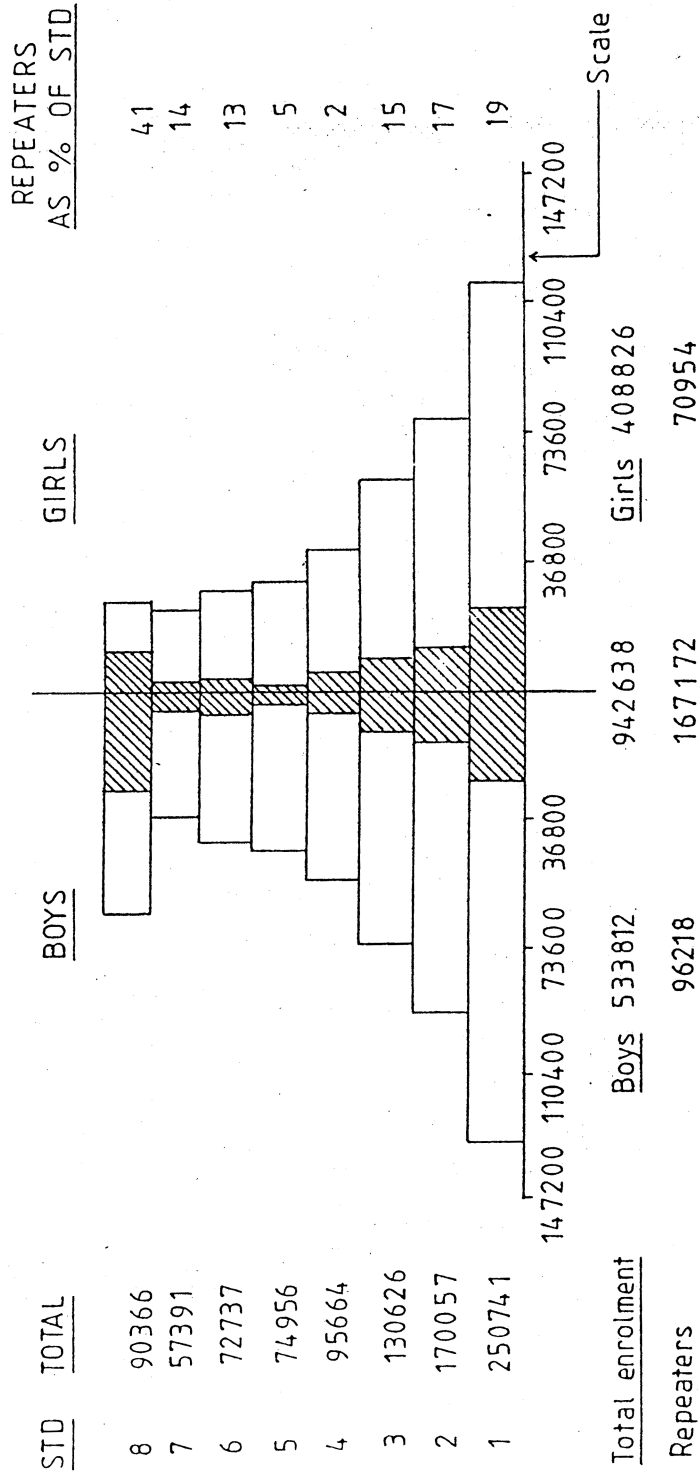
Mathematics features highly in the system. It enjoys high status in both primary and secondary curricula and influences selection to primary teachers' colleges and University colleges.

The country faces several problems in its attempt to promote mathematics education. The first is the relevance of the curriculum to the Malawian context. The second is high enrolment in schools causing big class sizes which lower effective teaching. The third is the quantity and quality of textbooks and equipment which deny the learner the necessary experience to develop concepts in mathematics. Finally, inadequate supply of trained teachers adversely influences the performance of students in mathematics.

In addressing these problems the Government has adopted several strategies. Firstly, it has allowed Malawian mathematics educators to be trained in the production of teaching and learning materials. Secondly, the enrolment in schools and MCDE centres is being increased. The number of teachers with appropriate qualifications and training is also being increased.

Figure 1

PRIMARY SCHOOL ENROLMENT 1985/86



Key



Repeaters as per
of enrolment

Figure 2

Secondary School enrolment by Form and by Sex in 1985/86.

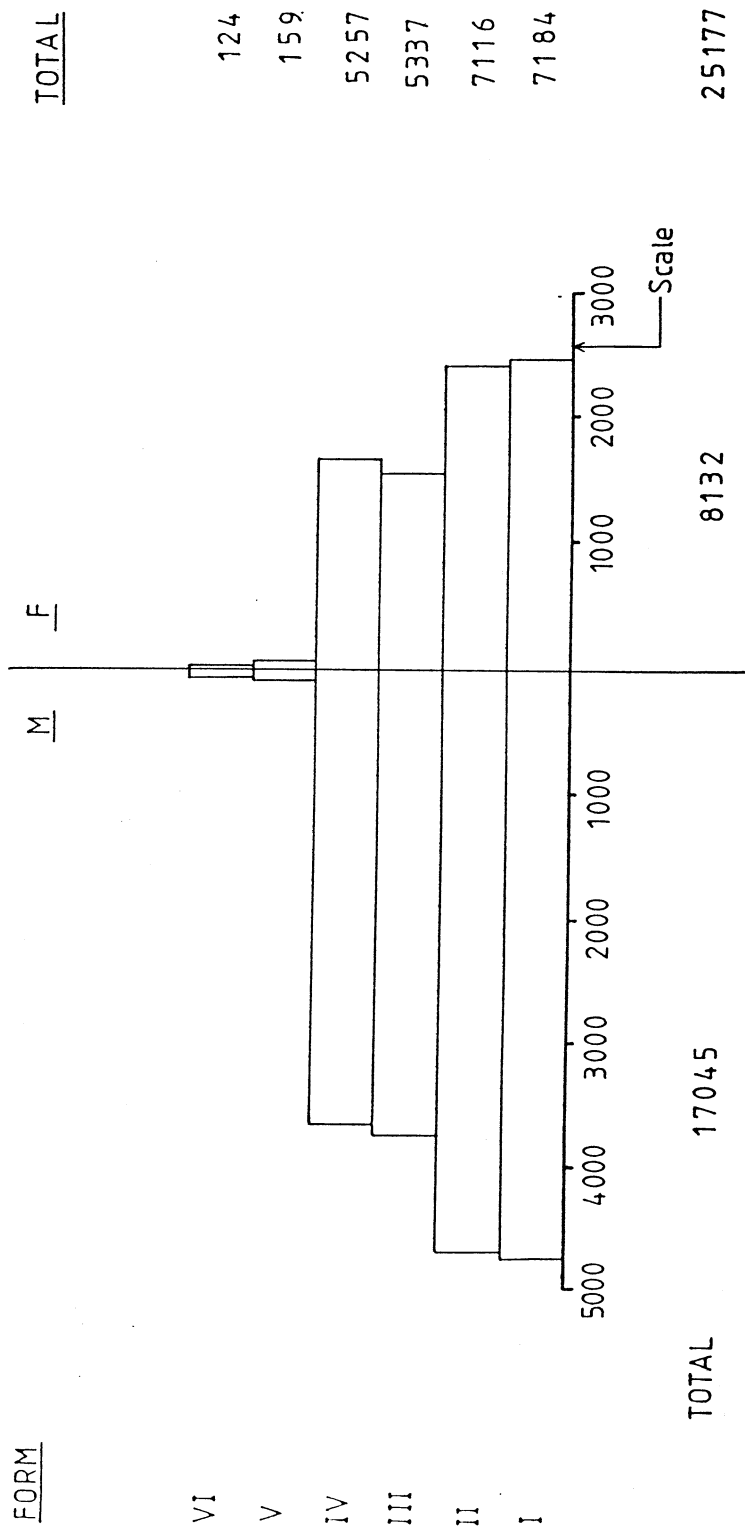
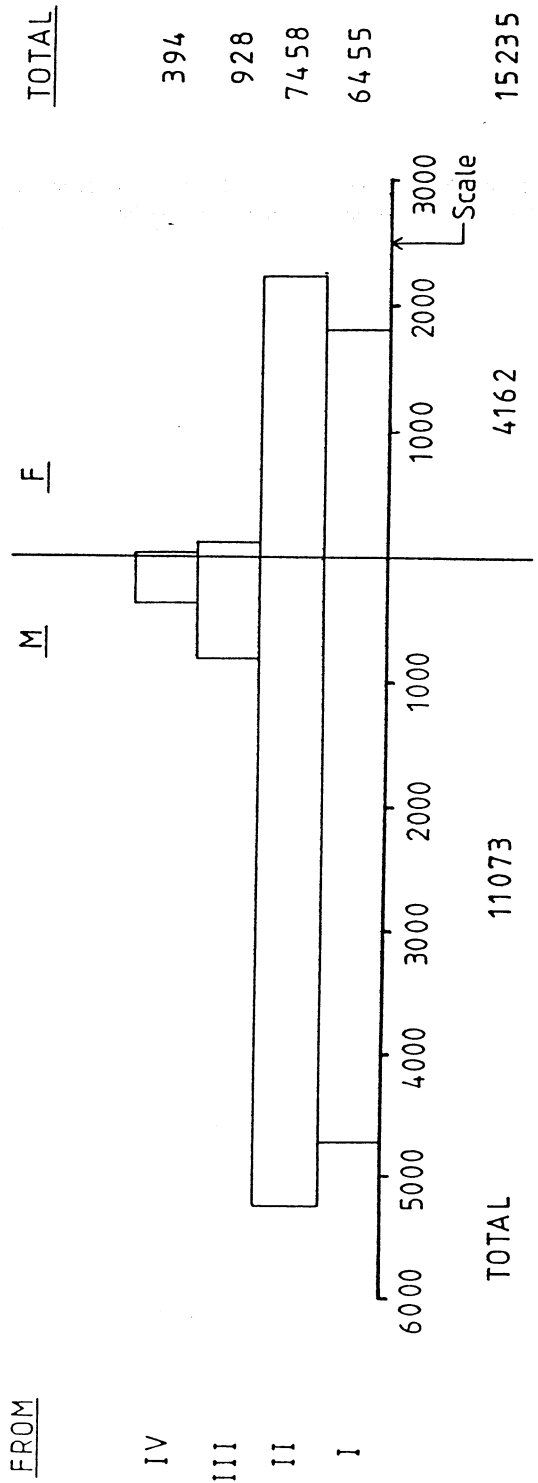


Figure 3

Malawi College of Distance Education by Form and by Sex in 1985/86



PUBLICATIONS RECEIVED

1. Neue Medien im Unterricht: Mathematik (New Media in Teaching: Mathematics)

Landesinstitut für Schule und Weiterbildung
ISBN 3-8165-1708-0 pp.128.

This book combines a discussion of criteria for the evaluation of computer software for use in teaching with a description of particular pieces of software, drawn from graph plotting, statistics, dynamic modelling, and algebra.

2. Teaching of Modern Engineering Mathematics
edited by Lennart Råde

Studentlitteratur, Chartwell Bratt Ltd 1988
ISBN 91-44-27621-4 and 0-86238-173-8

This is a report of the Fourth European Seminar in Engineering Education held in Gothenburg, Sweden in April 1987, organised by the Mathematics Working Group of the European Society for Engineering Education.

The report comprises invited papers, contributed papers and working group reports from a variety of authors.

Common themes in these articles are the importance of computers in relation to the teaching of mathematics, and the increasing occurrence of topics which at one time were not thought so important, including probability and statistics, numerical analysis and, most recently, various aspects of discrete mathematics.

The main emphases centre on discussions of content, and how it is delivered, in many cases allied to computer workshops. Issues concerned with the nature of the difficulties faced by Engineering students in learning mathematics are not directly addressed.

K. E. H.

TME - CONFERENCE

PROCEEDINGS AVAILABLE

The International Study Group "Theory of Mathematics Education (TME)" founded in 1984 at ICME 5 in Adelaide, Australia, has thus far held three international conferences. The proceedings of TME-1, a post-congress conference held in Adelaide in 1984, are available from: IDM, University of Bielefeld, P.B. 8640, D-48 Bielefeld, F.R. Germany (Prof. H.G. Steiner). The proceedings of the 1985-Bielefeld-conference TME-2: "Foundations and Methodology of the Discipline Mathematics Education (Didactics of Mathematics)" (ed. by H.G. Steiner and A. Vermadel) and of the 1988-Antwerp-conference TME-3: "Investigating and Bridging the Teaching-Learning Gap" (ed. by A. Vermandel and H.G. Steiner) are available from: Universitaire Instelling Antwerpen, Universiteitsplein 1, B-2610 Wilrijk, Belgium (Prof. A. Vermadel). The prices are resp.: US \$ 5; 10; 5 plus postage.

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