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ABSTRACT

A workshop to develop a program for training primary school teachers was convened in 1969 by the Regional Centre for Education in Science and Mathematics (RECSAM) in Penang, Malaysia. Countries participating in the conference were Indonesia, Malaysia, Singapore, South Vietnam, Thailand, Phillipines, and Ceylon; consultants from the United States and Britain were also in attendance. The major outcome of the conference was a detailed description of a course designed to improve teachers' understanding of the new content and approach to teaching primary mathematics. The course was also intended to examine philosophical, pedagogical and methodological issues related to instruction, and to prepare key personnel from participating countries to organize programs in their home states. In addition to an outline of this course, this volume includes several working papers and documents related to the overall goals and projects of RECSAM. (SD)

Participating Members Countries

INDONESIA
MALAYSIA
SINGAPORE
SOUTH VIETNAM
THAILAND
PHILIPPINES

P5/SCMS/18

SE

REPORT

OF THE

PRIMARY MATHEMATICS PLANNING WORKSHOP

Convened by
the Project Office of the SEAMEC Regional Centre
for Education in Science and Mathematics,
Penang, Malaysia.

RECSAM Project Office,
c/o Malayan Teachers' College,
Penang, Malaysia.

June 30 - July 3, 1969
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"THE PRINCIPAL GOAL OF EDUCATION IS TO CREATE MEN WHO ARE CAPABLE OF DOING NEW THINGS, NOT SIMPLY OF REPEATING WHAT OTHER GENERATIONS HAVE DONE - MEN WHO ARE CREATIVE, INVENTIVE AND DISCOVERERS"

Jean Piaget
Swiss Psychologist

REPORT OF THE PRIMARY MATHEMATICS WORKSHOP

SUMMARY

This Workshop on Primary Mathematics is one of a series planned by RECSAM* to develop solid professional bases for future maths training courses. Because of time lags however between initial plans and eventual course implementation, and in the interest of insuring highest quality results, RECSAM plans to hold similar workshops on each course before it is given for the first time.

In the interests of standardising these workshop reports, the reader will find the format and some of the more generalised content of this report similar to the earlier report on the Primary Science Workshop (P5/SCMS/17). Since it was agreed at both workshops that joint planning and careful integration of both courses was necessary, this standardisation will be helpful.

This Workshop report supplements the earlier work presented in the Development Plan (See Supporting Professional Document-1) and reflects the up-to-date judgement and opinion of leading Primary Mathematics experts from each of the SEAMEC member countries and of outside consultants. It is considered to be a guide to RECSAM for its planning and to the Director of the Primary Maths Course to assist him in planning content, methods, and schedule. The philosophy of the Centre, corroborated by the members of this Workshop Group, provides that the Course Director, selected on the basis of his qualifications for the job, should be given wide latitude in how he plans and conduots his course. In particular, since the availability of certain needed specialists, e.g. content, evaluation, educational psychology, etc. is often unpredictable at an early date, the Course Director should not be held to a rigid schedule but should be given maximum flexibility in the final programming of the course.

It is RECSAM's responsibility, on the other hand, to ensure that the principles of operation of the Centre, as embodied in its Development Plan, are taken into account in all such course planning. For example, three key factors in such courses are:-

(1) When professionals from outside the region must be brought in to conduct new courses, regional experts should be assigned as counterparts to work closely with them, with the ultimate intent of making the transition to Regionally conducted programmes.

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* A brief description of RECSAM is included in Appendix F for new readers.

(2) Participants at each course will be expected to take definitive action relative to national maths programmes when they return to their home countries. They should, in effect, amplify the Centre's activities through well planned national activities (courses, seminars, lectures, workshops, etc.), thus accomplishing the "multiplier effect" principle noted in the Development Plan. Provision has been made for this part of the effort by the establishment of National Co-ordinating Committees in each member country. These committees will be responsible for recommending selection of participants, for modifications of courses based on feedback and evaluation information from participants, and for plans for subsequent national efforts.

(3) The critical problem of teacher/student communication and its consequent effect on teaching effectiveness is also being given considerable attention. This problem is present because very few course instructors have experience in teaching in all or even in a few of the SEAMEC member countries. Different national development policies and objectives, cultures, and educational systems; different terminology, even for such simple things as grade levels; and different student English language capability means that each new instructor is faced with an extremely complex communications problems. Evidence to date on short courses and seminars held at RECSAM indicates that an orientation guide on such problems is needed for future Centre instructors, in addition to the professional guides developed through the workshops. Action is underway at RECSAM to develop such a guide. In addition, are being worked out with the Regional English Language Centre in Singapore to deal specifically with the Language capability problem.

(4) Close coordination with other courses where feasible - In this case as already noted in close integration of primary maths and science was recommended in the Development Plan and strongly backed by members of this Workshop. Details on how this integration will be planned are described subsequently.

RECSAM extends its appreciation to all the SEAMEC country delegates and other talented participants for making this Workshop a success. In particular, Dr. Geoffrey Mathews, Organiser, Nuffield Junior Mathematics Project, U.K. and Dr. Howard F. Foncannon of the American Association for Advancement of Science, Washington D.C. contributed significiently.

BACKGROUND

The professional training programme and each specific course of RECSAM, directed at training key teacher-leaders in science and mathematics in the Elementary and Secondary Schools of the SEAMEC countries was developed (beginning in July, 1979) through the following steps:

(1) formation of a Scientific Task Force comprised of key science/maths experts, one from each member country.

(2) a series of seminars; generally of about three or four days duration, held in each SEAMEC Member Country in the summer of 1967. These seminars had the primary objective of identifying National biology, chemistry, elementary science, physics and mathematics education problems and needs that could best be solved on a regional basis. Since over five hundred participants took part in the six seminars held, results are believed to truly represent the needs of the countries as then existed.

(3) a subsequent Regional Seminar at RECSAM in Penang, where subject area specialists (5 from each country) met to outline a preliminary plan of training and research activities for the Centre.

(4) subsequent Task Force Meetings to refine and amplify the projects recommended and to propose priorities.

(5) final review, modification and abstracting of the projects (some similar ones were consolidated) by RECSAM to insure a common framework of reference, to determine budgets, and to insure that the operating principles of the Centre were met in all projects.

(6) each project was then incorporated into the Centre Development Plan* and is described in detail therein. Verbatim reprints of the abstracts of Primary Math Course TCM-1 and Primary Math Research Project RCM-1 which will eventually provide inputs to the former follows:

* Part I of the Development Plan contains a one page standardised abstract of each Project. Part II of the Development Plan contained the detailed project plan as finally developed. A copy of the latter is included as Supporting Professional Document- I.

ORIGINAL PROJECT PROPOSAL ABSTRACT (from Development Plan)

I. CODE AND TITLE:

TCM-1 Modern Mathematics Teaching and Evaluation for Primary Schools.

II. DEVELOPED ON THE BASIS OF PROPOSAL:

MT-1

III. OBJECTIVES AND BENEFITS:

A course designed to train for each of the member countries a cadre of persons qualified in modern primary-school mathematics methods and content who can serve as leaders in the introduction of new curricula to their countries' schools.

IV. DESCRIPTION:

Under the guidance of one or two consultant-teachers, the participants will analyse existing modern primary mathematics programmes, discuss and evaluate the long term content needs of the region, including timing of introduction of new elements, study and practise modern teaching methods, and study and practice appropriate evaluation mechanisms.

V. PARTICIPANTS:

Four to six key lecturers in elementary methematics or other supervisors and leaders in elementary mathematics programmes from each country, who will be in positions to play leading roles in the development and implementation of modern mathematics curricula for the primary schools of their countries.

VI. DURATION AND PHASING:

A six-month course, offered annually as needed by the region, with modification of later cycles as required by experience.

A month of pre-course preparation and a period of post-course evaluation is needed. If possible some co-ordination with course TCE-1 would benefit both groups. It would also be preferable to have participants in TCM-1 and TCM-2 together for at least two weeks in order to give them an indication of the articulation between Primary and Secondary Mathematics.

ORIGINAL PROJECT PROPOSAL ABSTRACT (from Development Plan)

I. CODE AND TITLE:

RCM-1 Curriculum and Evaluation Research in Primary Mathematics.

II. DEVELOPED ON THE BASIS OF PROPOSAL:

MR-1

III. OBJECTIVES AND BENEFITS:

This group will make studies of modern mathematics curricula for elementary schools and recommend to participating countries methods of instruction and content appropriate to the needs of the primary schools of the region. They will also stress the interrelationships among the various elements of mathematics and with science and other subjects (e.g. English, psychology)

IV. DESCRIPTION:

In general sessions, the participants will study syllabi and teaching methods based on research done in other parts of the world, will design investigations on the validity of the methods in this region, develop prototype teaching units and curricula for testing in their own countries, and make suggestions for the member countries in the trial use of these units. Emphasis will be on modern amd practical topics and methods.

V. PARTICIPANTS:

Two participants from each country with a knowledge of modern mathematics and experience in teaching, with an experienced oonsultant for initial stages.

VI. DURATION AND PHASING:

An initial period of six months in the Centre, which work is based on research already done in regional countries; an interim period for trial and modification in the home countries, followed by one or two additional group research-writing-omprovement periods at the Centre. Co-ordination with RCE-1 will be maintained.

OBJECTIVES OF WORKSHOP

The objectives of this workshop were:

(1) to invite a panel of experts, including at least one primary maths expert from each SEAMEC country, plus outside consultants, as available, to review the basic plan for Primary Maths Course TCM-1 (as abstracted in the previous section) from the standpoint of appropriateness, timeliness and professional adequacy.

(2) to amplify and expand the descriptions of the course (content, methodology of teaching and instructional aids) that were previously developed by the Regional Maths Task Force to the point where a document could be provided that would serve as a detailed guide to the future Course Director.

(3) to discuss any other points or problems relevant to the success of the programme and recommend specific courses of action. In particular to discuss the interrelationships of this course with the Primary Science Course TCE-1 and plan coordinated effort.

The professional documents resulting from this workshop session - namely those items believed of most help to RECSAM in its initial planning for the Course and to the Course Director - have been included in the body of this report, immediately following. The administrative details of the Workshop and its Proceedings, necessary to a complete understanding of the overall results, are included in the appendices. It is hoped that both the professional portion and the proceedings can serve as guides for future RECSAM workshops. Readers are invited to submit constructive suggestions for improvement of both parts of the report directly to the Project Office in Penang.

The following section, entitled "Major Results and Recommendations" covers the professional and budgetary suggestions of the workshop. Its format is similar to the original document on the course TCM-1 (Page - 5) but is considerably amplified.

MAJOR RESULTS AND RECOMMENDATIONS

INTRODUCTION

The SEAMEO Regional Centre for Education in Science and Mathematics (RECSAM) held a planning workshop on the teaching of Primary Mathematics in Penang, Malaysia - June 30 - July 3, 1969.

The RECSAM Programme Co-ordinator welcomed member country participants and consultants at the opening session*. He outlined the objectives of the workshop and the background information relevant to the proposed Primary Maths Course TCM-1 Modern Mathematics Teaching and Evaluation for Primary Schools, scheduled for early 1971. He also reviewed certain recommendations from the recently completed Primary Science Workshop (see report P5/SCMS/17) held in Manila, Philippines, details which should be considered. He then invited Mr. Chin Pin Seng, Acting Chairman, RECSAM Steering Committee to address the meeting and to chair the first plenary session. Mr. Chin and Mr. C. Ganasalingam then alternately chaired the plenary sessions. The initial session outlined workshop objectives and invited delegates from member countries to report on Maths projects and other curriculum development reforms in their own countries. These reports are included as Supporting Professional Document No. A - 2.

The specific work sessions were conducted in two separate groups to develop guidelines as to philosophy of approach, basic principles, the overall programme, including content and timing and other requirements. Discussion items and participants were:

1.	Scope of content of course	)Group I
2.	Methods	)Mr. Baharin Shamsudin
3.	Material theories	)Mr. Sena Ekriyagala
4.	Learning theories	)Mr. J. Vanniasingham
5.	Evaluation	)Mr. Tan Beng Theam
		)Mr. L.M. Fredericks
		)Mr. Wong Hee Sing
		)Mr. Hikmat
		)Mr. C. Ganasalingam
6.	Adaptation techniques	)Group II
7.	Teacher Training techniques	)Mr. E. Abracia
8.	Problems of Innovation	)Mrs. Chaweewan Mahatap
9.	Time duration	)Dr. Nguyen Kuy-Bong
10.	Financial consideration	)Mr. Chin Pin Seng
11.	Staffing	)Mr. Nasir Zain
		)Mr. H. Foncannon

The following pages present the detailed course plan and related recommendations as derived via the Workshop.

To make it simple for the reader, the format of the revised course is identical to the original abstract of TCM-1 as presented previously.

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* A list of participants is included in Appendix B

DESCRIPTION OF THE PRIMARY MATHEMATICS TRAINING COURSE (AS PROPOSED BY WORKSHOP)

I. CODE AND TITLE:

TCM-1 Modern Mathematics Teaching and Evaluation for Primary Schools.

II. DEVELOPED ON THE BASIS OF PROPOSAL:

MT-1 Teaching of New Mathemtics (Primary Level) refer Supporting Professional Document - 1 (P5/SCMS/TF/3)

III. AIMS AND OBJECTIVES:

- To improve participants' understanding of the "new" content and the "new" approach to teaching primary mathematics, with special emphasis on the continuity of mathematics through the study of its structure and theme.

- To make it possible for participants to examine carefully numerous new philosophical, pedagogical and methodological approaches including the nature of and the content in each of them; and to have some practice in efforts to adapt approaches and content to the conditions in their own countries as a basis for being qualified to help in making decisions as to what member countries would adopt, and to provide leadership in projects for the improvement of mathematics education.

- To train key personnel from member countries in the content and teaching of new mathematics at the primary level, so that on their return to their respective countries they can efficiently organise suitable national programmes.

IV. DESCRIPTION OF THE COURSE:

A. Orientation

The committee agreed that at the beginning of the course an orientation programme should be organised. Topics for consideration should include among other things the following:

- Familiarisation with local conditions.

- Participants to give a brief outline of the system of education in their own countries, with special reference to Mathematics, along with sample materials.

B. Mathematics Curriculum Content - Methodology and Psychological Implications

- A greater percentage of time should be devoted to practical work. This practical work should be supplemented with lectures and seminars.
- It is recommended that the course director should ensure that the participants of TCM-1 should be made fully acquainted with the primary maths programmes in and outside the SEAMES region.

C. Teacher Training Techniques

1 - Basic Principles

- The elementary teacher is expected to teach all subjects in one class, especially in the lower elementary grades.
- In-service education (or continuing education) is equally important as pre-service education.
- In-service programmes should be part of regular programmes of teacher training institutions.
- All teachers are expected to participate in regular in-service education.
- Continuing supplementary materials are to be provided by educational authorities to teachers as one aspect of continuing teacher education.
- Educational research should be part of activities of teacher training institutions.
- Encouragement of frequent, informal meetings of teachers.

2 - Suggested items to be incorporated in the RECSAM course;

- Each participant is requested to bring with them information on pre and in-service elementary teacher training in maths in hiw own country.
- Participants should be given early information of the date of the course by their Ministries of Education in order to get prepared.
- Use of TV in the teaching of Math., especially to orientate teachers, should be included in the course.
- Study of the latest trends in teaching modern maths from various countries in the world.
- Guidelines on how to conduct in-service courses at national and sub-national levels.
- Ways and means of getting teachers' evaluation on in-service programmes.
- Continuing communications with local teachers conducting new programs in schools.

3 - Implementation and Teacher Training:

This aspect of the course will be devoted to the problems of the implementation of new curricula and the associated problems of pre and in-service teacher training.

Implementation problems which will be considered are:

- Establishment of a receptive climate for the introduction of curricula change at the national and sub-national levels.
- Consideration of the rate at which curricular change can or should be introduced.
- The problems of pre and in-service teacher education, and the differences between the two.

Teacher training issues which will be considered are:

- Evaluation of pre and in-service training in primary maths teaching that have been carried on in the participating countries.
- Formulation of statements of what is desired in today's primary maths program in terms of professional training of teachers.
- Study and critique of available reports on success and failures of in-serive training activities in the different countries as the national, regional school district and school level.
- Formulation of implementable plans for pre and in-service training that may be used in the participant countries.

The totality of the above experience should be primarily geared to finding solutions to the recognised problems of the pre and in-service training of teachers for primary maths teaching, such as:

- Inadequate content background in science.
- Ignorance of modern teaching methods.
- Financial difficulties of teachers which prevents them from further training.
- Difficulties facing teachers who must try to study and teach at the same time.
- An instrument to evaluate teacher's is necessary.
- Inability to improvise equipment and materials.
- Inadequacy of the in-service training opportunities afforded to teachers.
- Non-availability of curriculum materials that reflect the more acceptable approaches to mathematics teaching.
- Fears of mathematics among teachers.

D. Problems of Curriculum Innovation

Consideration of the techniques and major problems associated with curriculum innovation and provision for development, review, and evaluation of sample lessons developed by participants. This course should be as much as possible be carried out by participants either in laboratory or workshop . Included will be discussions of, and practical work in:

- The philosophical basis for content selection and style of approach.
- The techniques for the preparation of written materials for teachers and/or students.
- The development of auxiliary materials, such as apparatus and visual, or audio aids, games and simulations.
- The implementation of curriculum, and the changes required, including necessity for appropriately trained teachers familiar with the philosophy and approach of the new materials.
- The problems presented by the opposition to change generally offered by traditionally oriented teachers.
- The fact that to be successful innovation required the sympathy and support of administrators, legislators, and of the public.
- The influence that the introduction of innovating techniques and materials in the teaching of mathematics and science has on the teaching of other subjects.
- The application of educational research (including psychological and social aspects to curriculum innovation.)

E. Special Issues.

Before coming for TCM-1 (course one) participants should study the existing mathematics curriculum in their respective countries so that they would be better equipped to raise special issues relating to their own countries.

F. Evaluation Techniques

Evaluation techniques, both classroom and curriculum should be dealt with. In addition, as a practical example, the participants should make an evaluation of TCM-1 (course one). It is suggested that the questionnaire for this evaluation be developed in workshop sessions.

G. It is recommended that RECSAM produce a handbook of TCM-1 (course one) for distribution to member countries and others interested. This handbook could also serve as a means of encouraging constructive critiosism and upgrading future courses.

V. PARTICIPANTS:

Four to six lectures in elementary maths or other leaders in elementary maths programmes from each country, who will be in positions to play leading roles in the development and implementation of modern mathematics curricula for primary schools of their countries.

Participants from the member countries should have the following qualifications:

- Proficiency in English.
- Teaching experience of normally 5 years or more.
- Knowledge of at least Secondary Mathematics.

VI. TIME DURATION AND STAFF:

It has been agreed that the suggestion made by the Primary Science Workshop for a 4-month course is acceptable.

For each course (Primary Maths, and Primary Science), there is a need for:

1 course director (be appointed by October 1969)

1 associate director from the region (be appointed by October, 1969)

2 full-time instructors from the region and

8 part-time consultants, or resource people.

These consultants and resource people will be available on short visits and their work will be devoted to special topics.

Full time instructors will be selected from member countries with a view to offering them possible permanent Centre appointments in the future in accordance with the Centre's philosophy of recruitment.

VII FINANCIAL CONSIDERATIONS:

(i)	for RECSAM participants:		
	Air travel from capitals cities to member countries to RECSAM:		
	18 x $160	$2880	
	Stipend for 18 weeks -		
	$25 week x 18	8100	$10,980
(ii)	Staffing		
	3 full time instructors from the region (including Associate Director)		
	travel 3 x $160	480	
	per diem 20 days $16/Day	1536	
	honoraria $900 x 3	2700	4,716
(iii)	Other operational expenses		
	Purchase of developed materials	1000	
	Purchase of books	500	
	Local transportation	300	
	Support Services laboratory technician	300	
	Purchase of supplies	300	2,400
(iv)	Contingencies	1000	1,000
			19,096

* It is expected that some of the costs for consultants will be met by US/AID, and UK/CREDO, etc.

SUPPORTING PROFESSIONAL DOCUMENTS

Page No.

SUPPORTING PROFESSIONAL DOCUMENTS

SUPPORTING PROFESSIONAL DOCUMENT - 1

P5/SCMS/TF/3

THIRD TASK FORCE MEETING
FINAL PROJECT PROPOSALS IN MATHEMATICS
for
THE REFINED DEVELOPMENT PLAN
of
THE SEAMEC REGIONAL CENTRE
for
EDUCATION IN SCIENCE AND MATHEMATICS

GROUP MEMBERS

Prof. Dang Ding Ang (Vietnam)	(Chairman)	Task Force Member
Dr. Ruth H.K. Wong (Malaysia)	(Consultant)	Faculty of Education, University of Malaya.
Dr. Geoffrey Matthews (United Kingdom)	(Consultant)	Nuffield Junior Maths Project.
Mr. Chan Kai Yau (Singapore)	(Support Member)	Ministry of Education, Singapore.
Mr. Lim Ewe Jin (Malaysia)	(Rapportuer)	Malayan Teachers' College, Penang.

Project Office,
SEAMEC Interim Office,
c/o Malayan Teachers' College,
Penang, Malaysia.

May 16, 1968.

SUPPORTING PROFESSIONAL DOCUMENT - 1 (cont'd)

THIRD TASK FORCE MEETING:

REPORT OF THE MATHEMATICS SUBJECT AREA GROUP

Discipline: Mathematics

Members:

1. Prof. Dang Dinh Ang (Vietnam) (Chairman)
2. Prof. Ruth Wong (Malaysia) (Consultant)
3. Dr. Geoffrey Matthews (U.K.) (Consultant)
4. Mr. Lim Ewe Jin (Malaysia) (Rapporteur)
5. Mr. Chan Kai Yau (Singapore)

Introduction:

Before going into the details of its recommendations the Mathematics Group felt that it was important to stress the following principles which should be borne in mind at every stage of planning and working of the Regional Centre - especially the planning stage.

While there is clamour all around us for change (a clamour which perhaps is the most loudly heard in our present meetings) the maths group felt that there should not be change for change's sake. However, when we do recommend a change it should be done with a clear knowledge and understanding of our countries' needs, objectives and priorities. Furthermore these needs, etc. should be evaluated before the details of our courses and projects are finalised. Towards this goal, perhaps the Regional Centre could run a preliminary course on evaluation whose participants could return to their own countries and evaluate in turn the needs etc. and existing programmes and eventually materials produced by the Centre.

The maths group also felt very strongly that there should be provision for the evaluation of the following in member countries when the Regional Centre is in operation:-

(a) the effectiveness and success of courses and projects run by the Regional Centre.

(b) the extent to which objectives of member countries are being achieved through courses and projects provided by the Regional Centre.

SUPPORTING PROFESSIONAL DOCUMENT - 1 (cont'd)

Finally, the greatest obstacle to the success of our Regional Centre may perhaps be the top-level policy makers of member countries. To surmount this it was proposed that a conversion or "winning-over" crusade be directed at these people. To this end it is imperative that a seminar be arranged for top-level policy makers in maths and science education, head teachers and senior teachers.

The following pages contain our amended version of P5/SCMS/TF/3.

SUPPORTING PROFESSIONAL DOCUMENT - 1 (cont'd)

(P5/SCMS/TF/3 - revised)

SUMMARY OF MATHEMATICS PROJECTS FOR THE REGIONAL CENTRE

The refined mathematics projects proposed for the Development Plan of the Regional Centre include the following.

I. Master Phasing Plan for Mathematical Projects.

II. Training Projects

M.T.1 Teaching of New Mathematics (Primary Level)

M.T.2 Teaching of New Mathematics (Secondary Level)

III. Research, Development and Evaluation Projects

M.R.1 Curriculum Research and Programme Evaluation (Primary Mathematics)

M.R. 2 Curriculum Research and Programme Evaluation (Secondary Mathematics)

IV. The appointmant of the Head of the Mathematics Department who is to supervise training and research.

MASTER PHASING PLAN FOR MATHEMATICAL PROJECTS

Programme Please refer to P5/SCMS/9	First Year Quarters				Second Year Quarters				Third Year Quarters				Fourth Year Quarters				Fifth Year Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Tr. Prog. M.T.1	P	P	C	C	P	C	C	C	P	C	C	C	P	C	C	C	P	C	C	C
Tr. Prog. M.T.2	P	P	C	C	P	C	C	C	P	C	C	C	P	C	C	C	P	C	C	C
Res. & Dev. R&D 1 & 2	S	S	E	E	E	E	E&R	E&R						E,	T,	T				
Sp. Services SS.1	P	P	P	M	M	M	M	M						M,	M,	M				

Code: P – – Planning & organisation for the programme.

C – – A training course of 3 months duration for a class of 24 to 30 participants. Food, lodging and laundry allowance to be altered from 36 (U.S.) per participants per month.

S – – Comparative study of mathematical syllabuses and methods in the various member countries and other advanced countries by a team of experts (one from each member country) under the Regional Director for Mathematics and formulation of an experimental syllabus.

E – – Trying out experimental syllabuses and texts in the model school at the Regional Centre and in selected schools in the member countries.

T – – Writing prototype textbooks for use in the region, based on earlier experiments.

M – – A single issue of a low cost Regional Mathematical Magazine. To start with it could be a wuarterly. From the third year onwards the aim should produce a monthly magazine or at least once in every two months.

R – – Meeting of experts (one from each member country) to evaluate the experimental syllabus and plan for the production of proto-type textbooks.

NOTE: This Master Phasing Plan is only an attempt to meet the request for as detailed a forecast of activities as possible. But it must be emphasised that it is highly tentative.

SUPPORTING PROFESSIONAL DOCUMENT - 1 (cont'd)

(P5/SCMS/TF/3 - revised)

WORK SHEET FOR WRITING OUT REFINEMENTS
PROJECTS/COURSES

FUNCTIONAL DIVISION: TRAINING

(a) CODE DESIGNATION AND NUMBER:

M.T.1 - Please refer to page 11 of Mathematics Report in P5/SCMS/9.

(b) TITLE:

Teaching of New Mathematics (Primary Level)

(c) AIMS AND OBJECTIVES:

1. To improve participants understanding of the "new" content and the "new" approach to teaching "primary" mathematics, with special emphasis on the continuity of mathematics through the study of its structure and theme.

2. To develop practical ideas for implementing "new maths" in primary schools of participating countries.

3. Training of Key personnel from member countries in the content and teaching of new mathematics at the primary level. After the course the participants are expected to go back to their respective countries and organise similar courses for other teachers in their countries.

(d) DESCRIPTION OF PROJECT/COURSE:

The above should aim at providing the participants with both the theoretical and practical knowledge in the modern content and method of Primary School Mathematics. The experiences gained in the following programmes and methods of teaching must be fully utilised:-

I. 1. The Nuffield Project
2. Minnesota School Mathematics & Science Project
3. Use of didactic materials such as Cuisenaire Rods, Dianes and Sterns apparatus etc.
4. Approaches to Maths, such as discovery.

II. To encourage discussion of the "new" content and approach among participants, especially concerning the value of participating countries and the way of adapting it to them.

SUPPORTING PROFESSIONAL DOCUMENT - 1 (cont'd)

(e) DETAILS OF PROJECT/COURSE

(i) CONTENT

1. Materials of the projects mentioned above to be studied critically against the needs of countries concerned.

2. Some education in the foundations of mathematics - including perhaps some idea of the relationship of set theory and numbers.

3. Seminars on the value of the above material.

4. Practical experience

(ii) DURATION

3 months at 30 Hours a week - times a year - including workshops, seminars and practical work.

(iii) SPECIAL COSTS

Please see programme T.1 for details.
U.S.$54,800/- per year.
Food, lodging & laundry costs should be altered from U.S.$2,700 to U.S.$100 x 3 x 75 = U.S. $22,500.

(iv) PHASING

1st 6 months of first year — Planning
next 6 ..... — 2 courses
From Second year onwards, the first 3 months of each year will be spent in planning and selection of participants and the next 9 months will be used for 3 courses each year.

(v) BENEFITS

1. Maths content and methods of teaching can be gradually and smoothly modernized in the whole region.

2. Eventually there would be greater uniformity in Mathematics instruction in the whole region.

3. Common training will lead to more regional co-operation in research in the field.

SUPPORTING PROFESSIONAL DOCUMENT - (cont'd)

(f) SPECIAL INSTRUCTIONAL/COURSE MATERIALS AND EQUIPMENT NEEDED:

(i) INSTRUCTIONAL/COURSE MATERIALS

Books and other learning materials — For cost please see programme MT. P5/SCMS/9

(ii) EQUIPMENT

A film projector
Films
Structural & other apparatus for teaching mathematics

For cost please see programme MT.1 P5/SCMS/9

(g) PARTICIPANTS:

(i) QUALIFICATIONS

Promising teachers and lecturers who have at least secondary school maths and have taught mathematics for 5 years and can be expected to go back to their countries and conduct similar courses to their own teachers.

Proficiency in English Language.

(ii) NUMBER

30 students per class.

(h) PROFESSIONAL STAFF:

Two lecturers with experience in the teaching of new mathematics at Primary Level - one short term and the other long term.

(i) SUPPORTING SERVICES AND CO-ORDINATION WITH OTHER FUNCTIONAL DIVISION:

(i) SUPPORTING SERVICES

(a) Administration Typing
Office boy
Clerk/Typist

(b) Technical or Laboratory Personnel
Workshop Assistant

Could be used for M.T.2 as well.

SUPPORTING PROFESSIONAL DOCUMENT - 1 (cont'd)

(ii) CO-ORDINATION

Regional Director for Mathematics working under the Chief Regional Director will be responsible for organising and co-ordinating all the mathematics programmes in Training, Research, Special Services and Information. He should also co-ordinate the research and training programmes at national levels.

(j) PLAN FOR EVALUATION:

After returning from the regional centre participants will participate in the conduct of similar training in their own countries and the carrying out of individual research programmes at national level. They will also submit periodic reports of evaluation to the regional centre for comparison and for further improving the programmes at the regional centre and in the member countries.

SUPPORTING PROFESSIONAL DOCUMENT - 1 (cont'd)

(P5/SCMS/TF/3 - revised)

WORKSHEET FOR WRITING OUT REFINEMENTS PROJECT/COURSES

FUNCTIONAL DIVISION: TRAINING

(a) CODE DESIGNATION AND NUMBER:

MT-2 Please refer to page 12 of Mathematics Report in P5/SCMS/9.

(b) TITLE:

Teaching of New Mathematics (Secondary Level)

(c) AIMS AND OBJECTIVES:

1. To improve participants understanding of the "new" content and the "new" approach to teaching "secondary" mathematics, with special emphasis on the continuity of mathematics through the study of its structure and theme.

2. To develop practical ideas for implementing "new maths" in primary schools of participating countries.

3. Training of Key personnel from member countries in the content and teaching of new mathematics at the primary level. After the course the participants are expected to go back to their respective countries and organise similar courses for other teachers in their own countries.

(d) DESCRIPTION OF PROJECT/COURSE:

The course should aim at providing the participants with both theoretical and practical knowledge in the modern content and method of Primary School Mathematics. The experiences gained in the following programmes and methods of teaching must be fully utilised:-

1. The School Mathematics Study Group (S.M.S.G.)
2. The Illinois Experimental Programme
3. The Southampton Mathematics Projects
4. The Scottish Mathematics Project
5. The Midlands, Mathematics Project etc.

SUPPORTING PROFESSIONAL DOCUMENT - 1 (cont'd)

(e) DETAILS OF PROJECT/COURSE:

(i) CONTENT

1. Materials of the projects mentioned above to be studied critically against the needs of countries concerned.

2. The integration of classical mathematics into modern mathematics.

3. Seminars on the value of the above material.

4. Practical experience.

(ii) DURATION

3 months at 30 hours a week.

(iii) SPECIAL COSTS

US$54,800 per year.

(iv) PHASING

1st 6 months of first year - - Planning
next 6 ..... - - 2 courses
From Second Year onwards the first 3 months of each year will be spent in planning and selection of participants and the next 9 months will be used for 3 courses each year.

(v) BENEFITS

1. Maths content and methods of teaching can be gradually and smoothly modernised in the whole region.

2. Eventually there would be greater uniformity in Mathematics instruction in the whole region.

3. Commom training will lead to more regional co-operation in research in the field.

(f) SPECIAL INSTRUCTIONAL/COURSE MATERIALS AND EQUIPMENT NEEDED:

(i) INSTRUCTIONAL/COURSE MATERIALS

Books and other learning materials) For cost please see Programme MT.2 P5/SCMS/9.

(ii) EQUIPMENT

A film projector
Films
Structural & other apparatus for teaching mathematics
) For cost please see Programme MT.2 P5/SCMS/9.

(g) PARTICIPANTS:

(i) QUALIFICATIONS

Practising teachers and lecturers who have at least a first degree in maths and have been exposed to modern maths and can be expected to go back to their countries and conduct similar courses to their own teachers.

Proficiency in English Language.

(ii) NUMBER

30 students per class.

(h) PROFESSIONAL STAFF:

Two lecturers with experience in the teaching of New Mathematics and familiar with secondary school mathematics, of whom one should be a long term lecturer and the other a short term lecturer. These persons may be drawn from school supervisors, lecturers in teacher training colleges and university professors.

(i) SUPPORTING SERVICES AND CO-ORDINATION WITH OTHER FUNCTIONAL DIVISIONS:

(i) SUPPORTING SERVICES

(a) Administrative Typing
Office boy
Clerk/Typist

(b) Technical or Laboratory Personnel-Workshop Assistant

) Could be used for M.T.1 as well.

(ii) CO-ORDINATION

Regional Director for Mathematics working under the Chief Regional Director will be responsible for organizing and co-ordinating all the mathematics programmes in Training, Research, Special Services and Information. He should also co-ordinate the research and training programmes at national levels.

(j) PLANS FOR EVALUATION:

After returning from the regional centre participants will participate in the conduct of similar training in their own countries and then carrying out of individual research programmes at national level. They will also submit periodic reports of evaluation to the regional centre for comparison and for further improving the programmes at the regional centre and in the member countries.

SUPPORTING PROFESSIONAL DOCUMENT - 1 (Cont'd)

P5/SCMS/TF/3 (Revised)

WORKSHEET FOR WRITING OUT REFINEMENTS
PROJECTS/COURSES

FUNCTIONAL DIVISION: RESEARCH DEVELOPMENT AND EVALUATION

(a) CODE DESIGNATION AND NUMBER:

M.R.1

(b) TITLE:

Curriculum Research and Programme Evaluation
(Primary Mathematics)

(c) AIMS AND OBJECTIVES:

(1) Comparative study of mathematics syllabuses and methods of teaching,

(2) Trying out experimental syllabuses and new methods of instruction.

(3) Making suitable recommendations on (1) and (2).

(d) DESCRIPTION OF PROJECT/COURSE:

(1) Participants to take part in workshop sessions to study collected syllabuses and to sample the teaching methods.

(2) Participants to draw up prototype syllabuses for experiments.

(3) Participants to conduct experiments separately in their own countries.

(4) Participants to evaluate these experiments as necessary and report to the Research Director for Mathematics at regular intervals.

(5) Participants will help in the writing of prototype texts.

(e) DETAILS OF PROJECT/COURSE:

(i) CONTENT

(1) Emphasis on modern mathematics.

(2) Emphasis on practical mathematics.

(ii) DURATION

6 months followed by 2 hours of individual experiments and then another 6 months of work together.

(iii) SPECIAL COSTS

U.S.$20,000/-

SUPPORTING PROFESSIONAL DOCUMENT - 1 (cont'd)

(iv) PHASING

Planning	6 months (1st year)	- in home country
team work	6 months (1st year)	- in Regional Centre
experiments	2 years	- in home country
team work	6 months (end of 3rd Yr)	- in Regional Centre
texts writing	2 years (4th & 5th)	- in home country

(v) BENEFITS

Prototype syllabuses and textbooks and useful and acceptable to all participating countries.

(f) SPECIAL INSTRUCTIONAL/COURSE MATHEMATICS AND EQUIPMENT NEEDED:

(i) INSTRUCTIONAL/COURSE MATERIALS

Teaching materials and syllabuses of all participating countries.

(ii) EQUIPMENT

Nil.

(g) PARTICIPANTS:

(i) QUALIFICATIONS

(1) Minimum of 5 years' teaching experience in the primary schools and/or secondary schools.
(2) Knowledge of modern mathematics
(3) Ability to do research work in Education and write teaching materials.
(4) Proficiency in English Language.

(ii) NUMBER

2 per country

(h) PROFESSIONAD STAFF:

(1) Research Director for mathematics who is also the head of the mathematics department.
(2) Research Assistant

(i) SUPPORTING SERVICES AND CO-ORDINATION WITH OTHER FUNCTIONAL DIVISION:

(i) SUPPORTING SERVICES

(a) Administration Typing Clerk/Typist

(b) Technical or Laboratory Personnel

Office boy.

(ii) CO-ORDINATION

Link up with Regional and National Mathematics Committees.

(j) PLAN FOR EVALUATION:

Seminars and feedback from participating countries.

SUPPORING PROFESSIONAL DOCUMENT - 1 (cont'd)

(P5/SCMS/TF/3 - revised)

WORKSHEET FOR WRITING OUT REFINEMENTS TO PROJECT/COURSES

FUNCTIONAL DIVISION: RESEARCH DEVELOPMENT AND EVALUATION

(a) CODE DESIGNATION AND NUMBER:

M.R.2

(b) TITLE:

Curriculum Research and Programme Evaluation (Secondary Mathematics)

(c) AIMS AND OBJECTIVES:

(1) Comparative study of mathematics syllabuses and methods of teaching.
(2) Trying out experimental syllabuses and new methods of instruction.
(3) Making suitable recommendations on (1) & (2)

(d) DESCRIPTION OF PROJECT/COURSE:

(1) Participants to take part in workshop sessions to study collected syllabuses and to sample the teaching methods.
(2) Participants to draw up prototype syllabuses for experiments.
(3) Participants to conduct experiments separately in their own countries.
(4) Participants to evaluate these experiments as necessary and report to the Research Director for Mathematics at regular intervals.
(5) Participants will help in the writing of prototype texts.

(e) DETAILS OF PROJECT/COURSE:

(i) CONTENT

(1) Emphasis on modern mathematics.
(2) Emphasis on practical mathematics.

(ii) DURATION

Same as in M.R.1

(iii) SPECIAL COSTS

Same as in M.R.1

SUPPORTING PROFESSIONAL DOCUMENT - 2 (cont'd)

(iv) PHASING

Same as in M.R.1

(i) BENEFITS

Same as in M.R.1

(f) SPECIAL INSTRUCTIONAL/COURSE MATERIALS AND EQUIPMENT NEEDED:

(i) INSTRUCTIONAL/COURSE MATERIALS

Same people as in M.R. 1

(ii) EQUIPMENT

Nil

(g) PARTICIPANTS:

(i) QUALIFICATIONS

(1) Minimum of 5 years' teaching experience in the secondary schools.
(2) Knowledge of modern mathematics.
(3) University graduate - mathematics as a major subject.
(4) Ability to do research work and write texts.
(5) Proficiency in English Language.

(ii) NUMBER

2 per country

(h) PROFESSIONAL STAFF:

Same as in M.R.1

(i) SUPPORTING SERVICES AND CO-ORDINATION WITH OTHER FUNCTIONAL DIVISIONS:

(i) SUPPORTING SERVICES

(a) Administration
Typing
(b) Technical or Laboratory Personnel

} Same as in M.R.1

(ii) CO-ORDINATION

Same people as in M.R.1

(j) PLAN FOR EVALUATION:

Same as in M.R.1

SUPPORTING PROFESSIONAL DOCUMENT - 2

SEAMEC MEMBER COUNTRIES MATHS STATUS REPORTS

Participants from different countries were requested to give an account of the present status of Primary Mathematics in schools and also in planning that has been done to introduce "new ideas" in teaching.

INDONESIA:
(Mr. R. Hikmat)

Teachers in mathematics are aware of the modern ideas, but still we do not have the chance to run a pilot project. Even teachers who are familiar with modern mathematics do not introduce them in schools. Within the 5-year plan in 1969, the operation will be like this: The experts in modern mathematics and those teachers will get feedback on facts from school officials who are expert experienced teachers and administrators. They will discuss the various problems we face and to have some conclusions and a concept on mathematics, and basing on this concept we will try to have manuals and guides. Within 5 years we hope to have those guides ready and then in 1974 to introduce them to all schools in Indonesia. Even in the Teachers' Training Colleges and Universities this has not been introduced yet, although we have experts who have studied abroad and obtained modern ideas from U.S.A., Australia, Germany, Japan and so on. Each year the Task Force Members of the Study Group will meet together and discuss what problems we are facing. These group members are a mixture of junior high school teachers, senior high school teachers and university lecturers as well as administrators. At the present time the lower grades, i.e. 1st, 2nd & 3rd grades, we are using as medium of instructions and mother tongues and then starting in 3rd grade we use Indonesian Language and therefore before we start the modern ideas of mathematics, we have to face first the problems of languages.

Exposure of participants to modern approaches, content and techniques of mathematics teaching, should be done with sensitivity for the appropriatness to the region of the materials examined and to the problems and limitations with which participants must deal in their own countries.

SUPPORTING PROFESSIONAL DOCUMENT - 2(cont'd)

MALAYSIA

(Encha Baharin Shamsuddin)

The Ministry of Education is planning a project called "Special Project In Primary Maths and Science" this year. The objective is to upgrade the teaching standard of Maths and Science in the rural schools. The method is by providing Instruction Sheets or Guide Sheets to the schools concerned. In the production of the guide sheets attempts are made to introduce new concepts and new approaches. Key personnel will involve in workshops and in turn conduct workshops on how to use the guide sheets. Implementation on a small scale will commence at beginning of 1970.

The new mathematics is included in the syllabus of the Teacher Training College (in Penang) and it has been discussed either at Miss Biggs' workshops (as well as workshops and in-services courses held by the Federal Inspectorate) or at talks about the various projects that are being carried out in foreign countries.

Our reason for not adopting or changing to the so called new or modern mathematics hurriedly is because we have not yet got over some of the major aspects of teaching the subject such as teaching attitudes and teaching methods of teachers.

Then there are also the problems of getting suitable key personnel who can conduct in-service courses successfully in exposing not only the content but also the teaching technique of the modern mathematics.

As far as secondary mathematics is concerned, the Malaysian Ministry of Education is starting a pilot scheme involving 25 schools in 1970 to introduce a Modern Mathematics Syllabus in the first three years of the secondary school.

SUPPORTING PROFESSIONAL DOCUMENT - 2 (cont'd)

PHILIPPINES
(Mr. Efrain E. Abracia)

The Mathematics improvement programme in the Philippines started informally, that is, as enrichment programme done by a few teachers who had some understanding, in 1962. This enrichment programme continued until 1965, with an increase in the number of participating teachers each year.

By the end of the school year 1964-1965, a clamour for curriculum guides in the new maths for the elementary school caused the holding of the 1st elementary maths curriculum development workshop in the summer of 1965. The original Grades I - IV guides were tried out by selected teachers whose feedback reports gave directions to the revision work that was done on the guides in the summer of 1966. This second curriculum workshop also produced the Grades V and VI guides in elementary mathematics. These were tried out in the schools where the Grades I - IV guides were first used. Using the feedback reports from the teachers, these guides were revised in 1968 and the revised guides are now being disseminated to all schools. Each curriculum workshop was participated in by science and maths supervisors, math teachers and maths Peace Corps volunteers.

Relative to the training of teachers, in-service education programmes in the school divisions are being carried on, and the approach which we are encouraging is the formation of study groups (teachers on one grade at a time) which meet regularly until they have satisfactorily studied elementary mathematics for the grade and have become well acquainted with the teachers' guide in elementary maths for their grade. Another approach that is very acceptable is the 5-6 week elementary maths institutes conducted in the school divisions utilising the services of Peace Corps volunteers in maths.

On the other hand, the BPS is trying to influence teacher-training institutions towards updating the mathematics preparation programmes of prospective teachers.

The above discussions point out that the Philippines is using a three-pronged approach to the improvement of the mathematics instructional offering in the public elementary schools.

SUPPORTING PROFESSIONAL DOCUMENT - 2 (cont'd)

SINGAPORE
(Mr. Wong Hoe Sing)

Pre-Service and In-Service courses in both new methods of mathematics teaching and content are being conducted in the Teachers Training College.

The new teaching approach is being tried out in some schools at the lower primary level.

Pupils of one secondary school will be sitting for the Cambridge Oversea School Certificate Mathematics Syllabus C examination this year.

THAILAND
(Mrs. Chaweewan Mahatap)

We start improving maths programme in 1966 by holding in-service programme for maths supervisors and maths head section teachers of public schools in Bangkok and Dhonburi project, orienting them of new contents and method of Primary School Maths. After that supervisors and teachers have been trying out some concepts in some certain grades. In 1968, the Department decided to have modern maths in all 30 public schools in Bangkok and Dhonburi for Kindergarten, grade I and grade II, after we worked hard on preparing materials such as lesson plans, teacher guides, work-book and conducted 3 in-service programmes for improving teaching maths. This year we organise and conduct courses for III grade and IV grade teachers for the next year programme. We expect the modern maths teaching can be gradually and smoothly modernised in the whole country within 1974 through VII grades. However at present, traditional books have been replaced by new ones only for 1st grade. Materials of the projects mentioned above would remain the same except course of study.

VIETNAM
(Mr. Nguyen Quy Bong)

Modern mathematics is not new to many of us in Asian countries. Unfortunately due to present unusual situation in Vietnam where the war is going on, modern maths is being thought of rather than taught. Nevertheless, since 1962, we have achieved some improvements in the teaching of primary maths. Workshops have been organised in the Saigon In-Service Education Centre and all elementary teacher training institutions to up-to-date primary maths teaching in order to relate it to the real-life situation of children. In 1966, with the help of AID, 14,000,000 new text-books in primary school, including primary maths, were written, printed, and distributed to primary schools throughout the country.

SUPPORTING PROFESSIONAL DOCUMENT - 2 (cont'd)

VIETNAM

It is hoped that the RECSAM Institute, sponsored by SEAMEC, as well as experiences learned from other Asian member-countries, will provide Vietnam with new ideas and competent staff to start its modern maths teaching at the primary level.

CEYLON
(Mr. K.R. Ekiriyagala)

We stared to re-organise Primary School Maths about a year ago and have done something for primary schools on the advice of Dr. Matthews. We tried out various activities by getting one group of four doing something else. Gradually we were able to have about 6 groups doing 6 different activities in a class - this was in a pre-pilot school.

A team has been set up to write up some material for trial by primary teachers. Four units were sent out to about 5 schools. The teachers who tried out these units met us at a feedback session. We are happy to report that the teachers liked those units which we had written.

The writing team would go on in this manner building up several units of work. In the meantime a selected set of Teacher Training College lecturers are trying out some of the new ideas in Grades 3-5. They would send in their experiences to the writing team.

We expect to devote about 4 to 5 years of work of this nature before we decide on a new maths curriculum for the primary schools.

At present only Arithmetic is being taught up to grade 5.
(Grade I children are 5 year old)

The Grades 6-10 project was started in 1961. At the moment the new curriculum is ready and is used in all schools, up to Grade 8. The grades 9 and 10 guides are being prepared. By the end of 1972 all grades (6-10) would be doing the new curriculum and hope to change the School Certificate Examination Paper in Mathematics to meet the new curriculum.

SUPPORTING PROFESSIONAL DOCUMENT - 3

Working Paper No. 1

A Suggested Plan for Administration of Concurrent Projects TCE-1 and TCM-1

by Mr. H.F. Foncannon - Consultant

The chart illustrates a means by which several gains can be made by joint planning of courses TCE-1 (Elementary school Science). It is based on the fact that many of the elements in both courses are similar, and that economies of time and staff can be achieved through combination of the two groups of participants. A greater advantage is that this procedure will help to impress upon the participants that elementary school science and mathematics are not descrete subjects but are closely related in may ways.

Following are comments on the numbered sectors of the chart:

I - Orientation

Much, if not all, of the Orientation part of the programme will be more effective if it is carried out jointly. For example, an important topic will be the exchange of information about current practices and problems in the various countries of the region. Many of these problems and practices are common for science and mathematics in the individual countries, and much will be gained by discussing them together.

II - IV - Special Lectures and Discussions

Most of the special lectures and discussions will be conducted separately for the participants in the two groups, since they generally will apply specifically to either science or mathematics. For the most part, these discussions will follow lectures or demonstrations by consultants from outside the region who will be available for only a short time. An example might be a lecturer from U.K., provided by CREDO, who might present information on elementary school mathematics developments in that country. Another might be a specialist on evaluation of U.S. elementary science curricula, loaned for a week by the US/AID - India Science Education Program. Discussions of new curricula, not dealt with in III and V would be held during this time.

SUPPORTING PROFESSIONAL DOCUMENT - 3 (cont'd)

Working Paper No. 1

III - V - Practical Work - Curriculum and Teaching Materials

This activity would be the "core" of both courses and would be carried out primarily in the laboratory, the shop, and the demonstration school. It probably would occupy one-half of each day, e.g. science in the forenoon and mathematics in the afternoon. Under the close supervision of the Course Director and the regional instructors, participants would actually be engaged in (1) the adaptation of sample units from U.S. or U.K., other curricula and (2) the development of experimental teaching units (including equipment) de novo. Concentration would be on two or three leading U.S. or U.K. curricula. The purpose of this sector of the course is to give the participants solid and through experience in the techniques of adaptation and development of instructional materials, including the design and fabrication of teaching aids. Included will be production of film strips, film loops, overlays, etc. An objective is to provide a broad background of technical expertise for the participants so that they can give effective leadership to projects for the development or adaptation of curricular and instructional materials in their own countries.

IV - Joint Seminars will consit of combined discussions of topics of common interest to participants of both courses, continuing throughout the duration of the project. They will be led, as appropriate, by the Course Directors, the instructors or by consultants, both from within and from outside the region. Examples are: (1) modern developments in learning theory as they apply to elementary school science and maths, (2) special problems in curricular innovation, e.g. attitudes of faculty, administrators, and the general public, (3) comparison of basic objectives of science and maths teaching at the elementary school level, e.g. for facts or basic skills only, for the mastery of science or maths "concepts", or for the development of proficiency in intellectual "processes." The principal purpose of this series of seminars will be to broaden the perspectives of the participants in their views of the place and function of elementary school science and mathematics as a part of education as a whole beyond the day-to-day classroom experience.

SUPPORTING PROFESSIONAL DOCUMENT - 3 (cont'd)

Working Paper No. 1

4 months

I - Orientation Mathematics and Science	II - Mathematics Special lectures and discussions (outside consultants)
	III - Practical Work Curriculum and Teaching Materials
	IV - Joint Sessions (i) Psychological & Philosophical Topics (ii) Training of teachers (pre-service and in-service) (iii) Evaluation
	V - Science Practical Work Curriculum & Teaching Materials
	VI - Science Special lectures & discussions (outside consultants)

SUPPORTING PROFESSIONAL DOCUMENT - 4

Working Paper No. 2

Some Suggestions on Planning the Course

(by Dr. G. Matthews - Consultant)

1. The course to be planned for 3 months or four months instead of 6 months, courses of 6 weeks duration also been found to be effective.

2. There should be time spent on evaluation and comparison of projects. Quite a lot can be achieved if the participants did some reading beforehand and also after the course.

3. The course should be integrated as far as possible with the Primary Science Course e.g. in areas of psychology.

4. The background of participants should also be considered and whatever the background was, it is preferable to start by doing something and with a minimum of lectures.

   As a possibility experience gained in Ceylon where they started in the individual check-ups and work their way up to small groups and classes, in between discussing rationale and psychology and then discuss how to plan first of all a unit of work and then a complete course.

5. Regarding staffing - it would be no good planning a detailed superb course and having no one to run it.

SUPPORTING PROFESSIONAL DOCUMENT - 4 (cont'd)

Working Paper No. 2

Suggestions on the Teaching of Moder Mathematics
by Dr. G. Matthews - Consultant

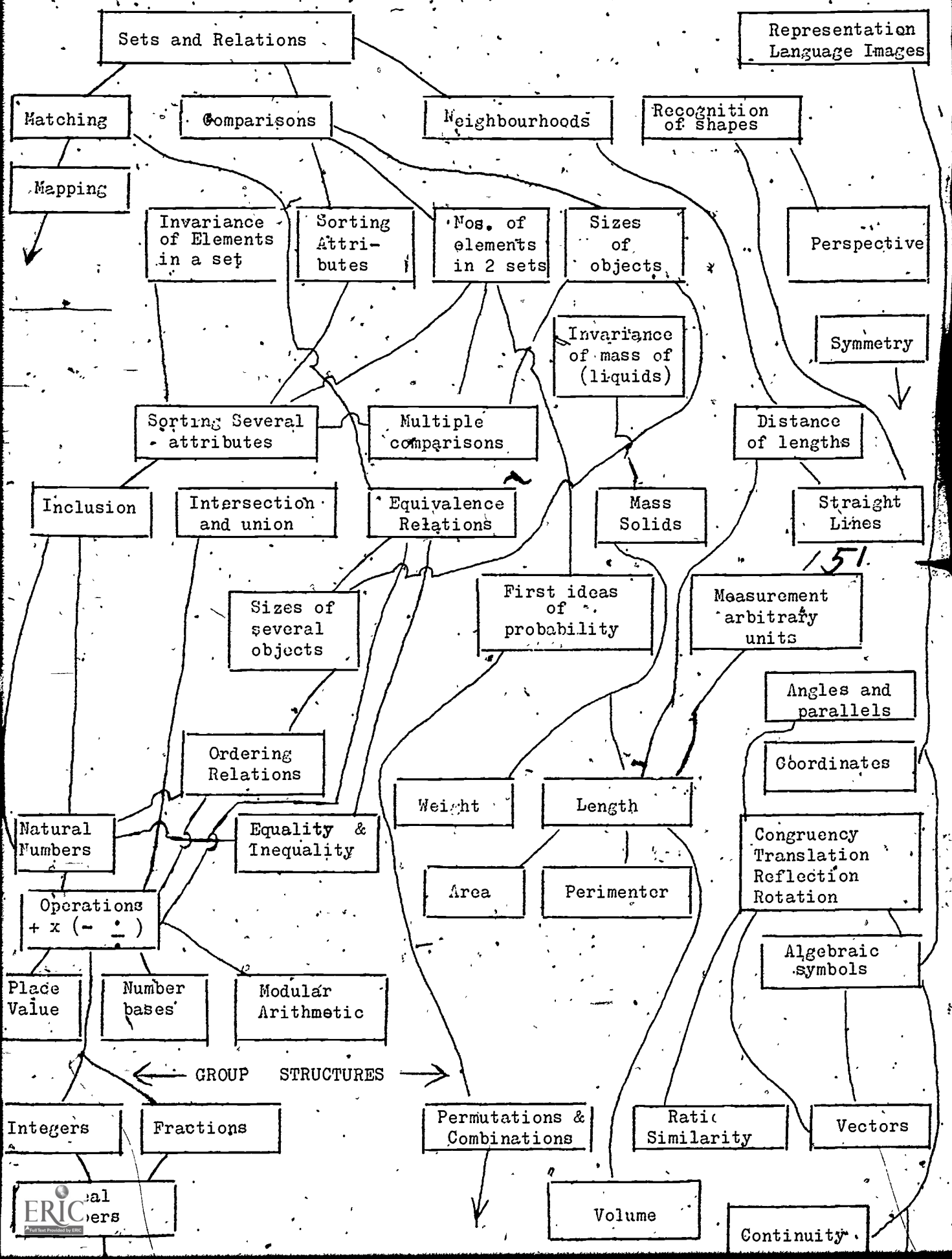
Reform is needed in both content and method. It is recognised that Ministries will be reluctant to change syllabus and exams quickly and rightly so, as the new techniques must be tested. A very limited amount can be done in simply taking the existing syllabus and making it more attractive by exposing the children to more practical work. But fundamentaly the fault of of the 'old' is that it goes at the wrong speed and in the wrong order (apart from being partially obsolete); the understanding of the children takes second place to a tradition followed by age rather than reason. It is therefore absolutely vital to make the participants aware that content and method must go hand-in-hand, and a very gradual take-over must be made in both at the same time. The object of the course is to imbue the participants with a missionary spirit so that they will return to their countries willing and able to influence both teacher training and curriculum development slowly but surely in the direction of progress and sanity.

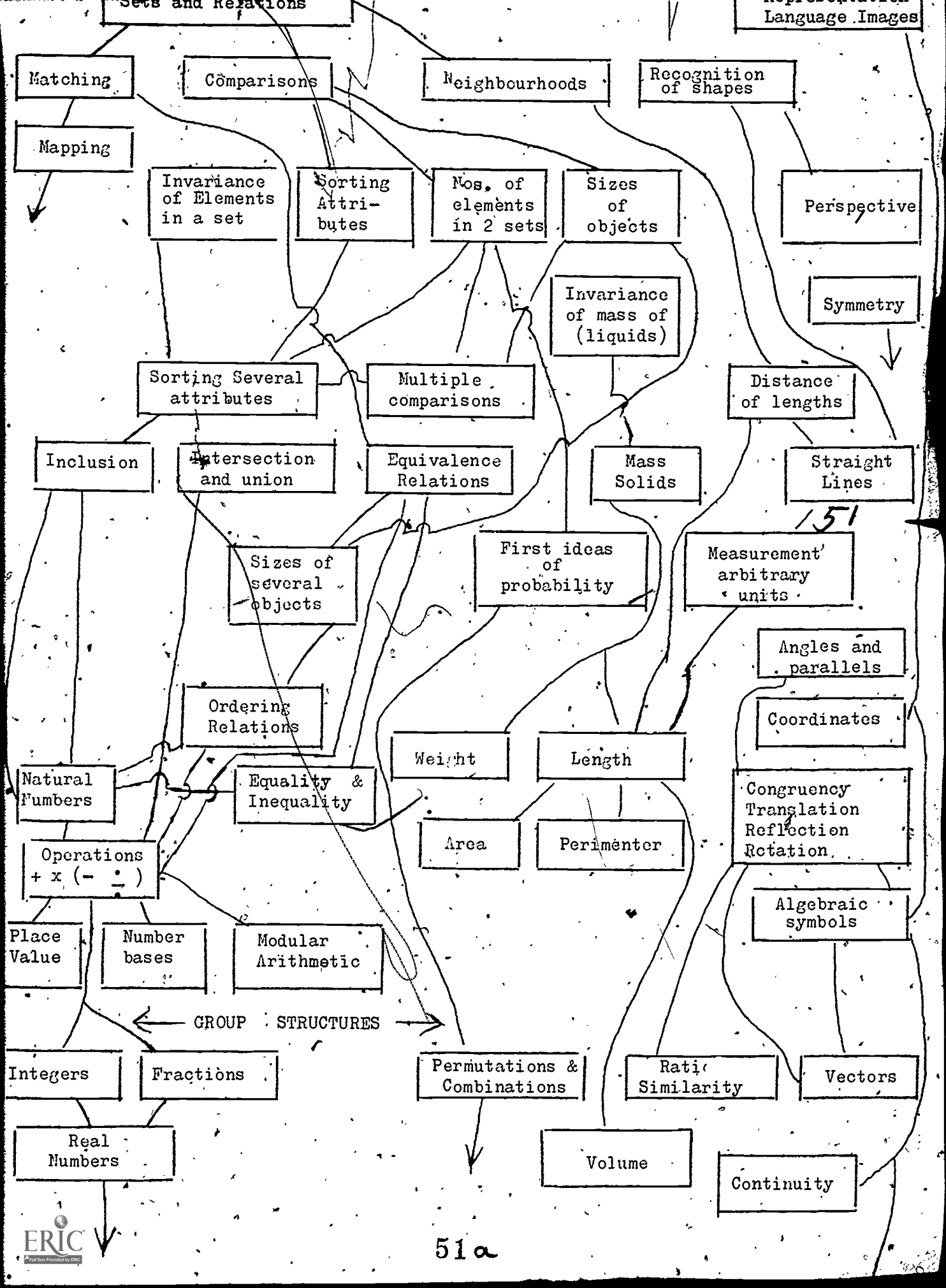
The chart on page 42 is an attempt to classify and partially order the various concepts acquired by the children on their way to the understanding of number and spatial relations.

It is based not only on experimental work done by the Nuffield Project in determining a suitable mathematics course for children from five to three, but also in psychological research work carried out in connection with the theory of knowledge by Piagets school in Geneva.

The chart is only a guide and requires careful interpretation, but the idea it represents could well form a basis for progression in the course. For example, the participants might start by "check-ups" on individual children in a particular concept and then discuss and have lectures on how this fits into the general framework. In this way, the participants would themselves learn unobtrusively about mathematical topics such as equivalence relations and isometrics.

FLOW CHART OF MATHEMATICAL CONCEPTS ACQUIRED BY PRIMARY CHILDREN; Nuffield Project




Sets and Relations
Language Images
Matching
Comparisons
Neighbourhoods
Recognition of Shapes
Mapping
Invariance of Elements in a set
Sorting Attri-butes
Nos. of elements in 2 sets
Sizes of objects
Perspective
Invariance of mass of (liquids)
Symmetry
Sorting Several attributes
Multiple comparisons
Distance of lengths
Inclusion
Intersection and union
Equivalence Relations
Mass Solids
Straight Lines
151
Sizes of several objects
First ideas of probability
Measurement arbitrary units
Angles and parallels
Ordering Relations
Coordinates
Weight
Length
Natural Numbers
Equality & Inequality
Congruency Translation Reflection Rotation
Area
Perimenter
Operations + x (- :)
Algebraic symbols
Place Value
Number bases
Modular Arithmetic
GROUP STRUCTURES
Integers
Fractions
Permutations & Combinations
Rati Similarity
Vectors
Real Numbers
Volume
Continuity

SUPPORTING PROFESSIONAL DOCUMENT - 5

Working Paper No. 3

PRIMARY MATHEMATICS PLANNING WORKSHOP

WORKING PAPER FOR DISCUSSION - prepared by Miss E.E. Biggs,
Department of Education and Science,
London,
member of RECSAM International Advisory Council.

Based on my ten years' of experience of teacher training courses in Mathematics, the following points have been found to be rather important:-

1. We have found it advisable to concentrate on change of teaching methods before change of content. The shift to active learning, i.e. to provide children with opportunities to investigate mathematical situations and problems rather than to instruct them is a difficult one for teachers, even in traditional arithmetic.

   Gradually we have introduced new ideas, as teachers gained confidence in the new classroom situation in which children are working in groups whenever as new topic (in mathematics or science) is introduced.

2. The most successful courses have provided teachers with opportunities to try experiments in the classroom during the courses. The pattern one week - one week in classroom i.e. alternate course work and classroom work has been successful as this enables teachers to experiment, to bring back pupils' work for discussion and to replan the work.

3. Before teachers gain confidence in this way of working they need extensive experience of learning mathematics by discovery themselves. Our courses have always provided such opportunities (see the latest course papers which I attach).

4. Teachers also need opportunities to plan work with their colleagues. For this reason the mathematics courses we alwyas cover the age range 5 to 16. Subsequently we give teachers opportunities to work with those who teach similar age ranges but it is important that they first appreciate the development of a mathematical topic over a wide age range. In this way we help our teachers to make their own scheme of work.

SUPPORTING PROFESSIONAL DOCUMENT - 5 (cont'd)

Working Paper No. 3

SUGGESTED COURSE BASED ON TCM-1 AND TCM-2

MIDDLE SCHOOL MATHEMATICS

A suggestion as to content

The establishment of middle schools may solve some of the problems of primary school mathematics on the one hand and may help to extend good classroom practice to older pupils on the other hand. There is no doubt that learning mathematics by investigation, the initial stage whenever a new topic is introduced, gives pupils an intense and sometimes lasting interest in the subject as well as an understanding of concepts.

I have used the term investigation because this has a wider connotation than practical work. This includes looking for patterns and relations in very varied situation. Awareness of the mathematical potential of the natural and man-made environment, and the ability to generalise and abstract, are most important achievements for the pupil. But we must not forget that the skills are still important. On the whole teachers required more help with the skills than in any other field.

Before I conside content let me make several important points. These concern the nature of investigation. There is a good deal of misunderstanding about practical work.

1. It does not mean running about with a measuring tape or trundle wheel "measuring" a room over and over again at various stages of the pupil's life.

2. Practical work of this nature is time-consuming and the teacher needs to have a very clear mathematical purpose for every activity undertaken.

3. Moreover, one piece of practical work can often be the starting point for a variety of mathematical ideas, provided the teacher has the mathematical imagination to appreciate this.

4. Certain ideas are so important that pupils need to meet them over and over again, each time at a more demanding level and in a different context. Normally one discovery is not enough. This means that, within a flexible framework which allows pupils to make their own investigations and to pursue their own ideas, we need to structure the mathematics we want them to learn. This implies that we need to have many ideas available and also that we need to know our subject matter. This does not mean, of course, that we should know the answer to every question our pupils ask. This would rob the work of its spontaneity and "of the particular relationship established between teacher and child when investigating a common problem to which neither knows the answer." (Prof. D. Hawkins)

SUPPORTING PROFESSIONAL DOCUMENT - 5 (cont'd)

Working Paper No. 3

5. All this implied the need to staff every middle school (and large primary schools for that matter) with at least one teacher with a interest and knowledge of mathematics, e.g. teacher who took mathematics as a main subject at a college of education or one who took a supplementary course later.

Content

Here is my summary.

1. Arithmetic (this should not be dealt with in isolation)

Much of the work at present covered in primary schools has a bearing on arithmetic although teachers do not always realise this. The period 8-10 years is usually the time when a child meets problems which involve increasingly complicated written calculations. This is the stage when he will come across problems which require techniques of long multiplication and long division for efficient solution. But he must have sufficient oral number knowledge before he is required to do written calculations of this nature. His first methods will normally involve repeated addition or subtraction. Teachers' questions will help him to refine these methods. His number knowledge should include:-

1. Number up to 10:

$5 + 3 = 8$, $3 + 5 = 8$, $8 - 5 = 3$, $8 - 3 = 5$. Extended to 20:

$9 + 6 = 15$, $6 + 9 = 15$, $15 - 6 = 9$, $15 - 9 = 6$

The addition facts imply $a + b = b + a$ and this should be explicit and operational.

"10" facts i.e. patterns such as $10 + 5 = 15$, $5 + 10 = 15$, $10 + 7 = 17$, $7 + 10 = 17$ etc.

"Number line" facts.

$9 + 7 = 16$, $19 + 7 = 26$, etc. $87 + 9 = 96$,

$96 - 9 = 87$, $86 - 9 = 77$ etc.

$96 - 7 = 89$, $86 - 7 = 79$ etc.

Children can discover these facts from a number line but the facts should be learnt.

SUPPORTING PROFESSIONAL DOCUMENT - 5 (cont'd)

Working Paper No. 3

Multiplication facts

7 x 6 = 6 x 7 = 42. This implied a x b = b x a and as before this should be operational.

9 x 10 = 90, 10 x 9 = 90, 17 x 10 = 10 x 17 = 170 etc. These facts are particularly important when it comes to long multiplication and long division. The question should frequently be asked: Why does these products end in zero? (The response should be because there are no units, these are all tens.)

Multiplication and Division Tables

It is a great advantage for children to know these except for some children who find it such a labour to learn the entire number facts they are put off mathematics for ever! In this event it is far better to let them make a complete multiplication table and use it for those facts they do not know. Nevertheless there are various ways in which we can help children to learn the tables. For example taking a ceiling such as 24 and learning all number facts (plus and minus as well as multiplication and division from 1 - 24, then raising the ceiling to 36 etc. has been found useful by many teachers). Knowledge of long multiplication and long division implied a knowledge of:-

1. The commutative laws;
2. The associative laws (e.g. 2 + 13 + 8 = 2 + 8 + 13 = 23)
3. The distributive law (e.g. 57 x 29 = 57 x 20 + 57 x 9)

These laws should be made explicit at this stage.

Long multiplication

Consider the example: how many tiles are there in a classroom with 37 tiles one way and 36 the other way?

		Recorded (1)		Recorded (2)	
	10 10 10 7	360	10 times	36	
Second		360	10 times	37	
effort 36	360 360 360	360	10 times	1080	30 times
		252	7 times	252	7 times
		1332	37 times	1332	

7 x 36 = 7 x 30 + 7 x 6

SUPPORTING PROFESSIONAL DOCUMENT - 5 (cont'd)

Working Paper No. 3

First effort

30 x 30 = 900, 7 x 6 = 42, total 942. The picture showed that this was wrong (but this can lead to an efficient solution)
A diagram will show this.

Second effort

The room was then divided into 3 strips of 10 and a strip of 7. This was eventually recorded by the children themselves in the traditional way. Variety of method: are to be encouraged but every child should have one efficient method and should practise this.

Division

A man weighs 300 lbs. How many stones and pounds is this?

First method	lb.	
	300	
	140	10 stones
	160	
	140	10 stones
	20	
	14	1 stone
	6 lb.	21 stones

Second method	300	
	280	
	20	20 stones
	14	1 stone
	6 lb	21 stones

Practice is essential. From time to time teachers need to give a piece of practice and to ask the pupils to write a problem (story sum) to fit the practice to see if the pupils understand when to use the operation.

Notation

The use of Dienes's multi-base arithmetic blocks gives the best instruction if it is desired to introduce this topic at 7 or 8 years. Otherwise the binary system can be introduced using kitchen weights or structural material between the ages of 8 - 10 years. The pattern is easily recognised. Practice with the abacus using different bases (perhaps playing a dice game) will give 2 or 3 children the experience they need. May children profit from practice in the 4 operations using bases other than 10. Normally this is given at the age of 9 or 10. This practice should make notation explicit, especially when children realise the need to invent new symbols for base 12 etc. The notation should emerge at this stage.

10000	1000	100	10	1
10^4	10^3	10^2	?	?

SUPPORTING PROFESSIONAL DOCUMENT - 5 (cont'd)

Working Paper No. 3

Extension of number system

An idea of decimals will be given in the lower junior stage with our new money system.

FRACTIONS

$\frac{1}{2}$s, $\frac{1}{4}$s, and $\frac{3}{4}$s will still be needed in everyday life. Fractions will first be met as rational numbers when the question is asked: Does the commutative law apply to division? Similarly negative numbers will first arise when a negative number line is introduced. (This might first be introduced with its numbers in a different colours. from numbers on the positive number line). The question of negative numbers often arises when graphs are drawn e.g. graphs of the miltiplication tables or the squares when children ask, "what happens next?" . The "application" of the commutative law to subtraction also leads to the introduction of negative numbers.

3. Measuring

need for equal units, standard units in length, weight (and density), time (and rate), volume, area.

The relation between one unit and another. Estimation and approximation appropriate to the situation. The idea of "betweeness."

Metric measures will need to be introduced side by side with imperia measures (little conversion if any will be necessary). Because of the difficulty of some of the measures, a lengthy period with arbitrary units at infant and lower junior stage will be very helpful. Certain important topics will arise at different levels: e.g. the circumference/diameter relationship of a circle. Various integrating topics are common to all aspects of measurement.

Comparison (subtraction and division)

Inequalities and ordering. Equivalence

Approximation

Conservation

Operations

Ratio and proportion.

Relations

SUPPORTING PROFESSIONAL DOCUMENT - 5 (cont'd)

Working Paper No. 3

Limits

Sets (but only if this topic can be followed through)

4. Statistics and probability

Statistics

These subjects have already been introduced into primary schools and graphical representation of various kinds is now common. Not enough attention has been paid to the ordering of information. This may well be because this topic does not receive due attention in the earlier stages (for example PIAGET seriation). Children soon begin to look for opportunities of ordering once they have had experience of this. (For example, order containers in as many ways as you can). From 10 - 12 or so pupils will order information, group it and also appreciate the effect of taking a larger and large sample (e.g. the weights of children in one age group in all schools in Nottingham. The children were able to recognise the pattern which emerged). Older pupils (possibly 11 - 13) will be able to find the relationships between 2 variables, e.g. using a cattergram of height and reach in answer to the question "Are you a square?"

A knowledge of the mean and mode and the relevance of each. (This may be introduced through measurement, e.g. Find the length of your average pace). For some pupils a cumulative graph will have interest and relevance, e.g. How many of this sample have weights less than 50 kg.? What is the median value?

Probability

Experiences such as coin tossing, drawing cards from a pack, spinning a toy, throwing 1 die, 2 dice, etc., leading to ideas of "expected" frequency. (Operation tables in the four operations are useful and can be associated with these experiements).

SUPPORTING PROFESSIONAL DOCUMENT - 5 (cont'd)

Working Paper No. 3

SHAPES

Conservation, Symmetry and Congruence, Similarity (Transformation Geometry)

In children's experience, three dimensional shapes precede two dimensional shapes. Children distract their knowledge of two dimensional shapes from handling three dimensional shapes in the first instance.

1. Knowledge of the properties of cubes, cuboids, cylinders, cones, balls (now spheres?), pyramids.

   Also square, rectangle, circle, ellipse, triangle, using three dimensional shapes to link three and two dimensions. (An acid test of whether a child understands squares is to give him a number of idential squares and ask him to build the largest square he can manage with these. A similar exercise can be given with cubes).

2. Properties of cubes made from identical unit cubes. Sequences such as perimeter and area of one face, volume, total skin area, skin area/volume relationship. The term (and those preceding and succeeding the term) is useful for those who are able to give this. Graphs can be made from these.

   (i) using unit cubes

   (ii) using a continuous graph

   This often encourages children to look for the different patterns in the number sequences.

   (Applications: biology, geography, physics (bridges and girders)).

3. Regular two dimensional shapes and their properties. Triangle (angle sum) squares, pentagons, hexagons, octagon etc. Tessellations using triangles to discover parallel properties as well as the angle sum properties). Tessellations with identical irregular triangles and Quadrilaterals.

SUPPORTING PROFESSIONAL DOCUMENT - 5 (cont'd)

Working Paper No. 3

Reasons for standard unit in area.

4. Properties of the quadrilaterals through paper folding, paper cutting, geoboards.

5. Transformations: translation, reflection, rotation.

6. Symmetrical polygons. Relationships such as angle at centre/side, (constant product), interior angle/side, exterior angle/side.

7. Rigidity of framework using meccano strips. Relationships of the sequence of polygons (number of sides, number of struts, number of triangles, angle sum, interior angle). Algebraic relationships.

8. Conservation of perimeter. Investigation of area of any shape, regular polygons, rectangles, triangles etc. Diagrams algebraic relationships, graphs. Sets of triangles with constant perimeter also make an interesting problem. Reverse problem, conservation of area relationship in perimeter. This can be done using identical unit squares, pupils to make their own rules. Finally a set of rectangles with contant area can be studied, cut out and "patterned" graphed etc.

Relationships graphs.

This work can be linked with operation tables of addition and multiplication for the numbers 1 to 10 (for example) Co-ordinates. These may be introduced through activities such as birthday day and month of all the pupils in the class, height and reach measures for every pupil in the class. Or a younger stage the salient points on a pupil's treasure island can be drawn on squared paper and the positions defined with compass directions and distances.

Proportion

1. Direct proportion, Pupils from about the age of 11 should be able to recognise these examples of direct proportion at a glance and to know immediately what the graph will look like. For example the multiplication tables, perimeter/edge relationships for a square, the circumference/diameter relationship for a circle.

SUPPORTING PROFESSIONAL DOCUMENT - 5 (cont(d)

Working Paper No. 3

Ready reckoner graphs e.g. prices at petrol pumps, air and rail fares.

Prices of individual articles and materials bought in bulk can be compared with conversion graphs e.g. the number of kilometre, travelled per litre of petrol.

Inverse Proportion

e.g. rectangles of constant area
the operation table for multiplication
angle at centre of regular polygon/number of sides, exterior angle/number of sides, angle between two hinged mirrors and number of images (plus object) seen. The graph of inverse proportion should also be recognised at sight. Able pupils sould be interested to make a three dimensional graph having the dimensions of cuboids, (volume e.g. 64 squares).

Other Functions

Graph of square and of cubes

Question "What happens next" could be an introduction to negative integers. Children who compare the graph of squares with the areagraph of rectangles with constant perimeter sometimes ask where the other half of the graph of the square is, especially if they have seen the similarity of the number pattern. This can sometimes be an introduction to the multiplication of negative integers.

Inequalities (see Section on Statistics) leading on to Liner Programming

Gradients can be introduced from the multiplication tables. Simple vectors. Limits. These will arise in a number of the examples already mentioned e.g. if the width of rectangles with constant area is repeatedly halved pupils often say that the rectangle becomes as thin as a piece of tracing paper but will never disappear altogether.

SUPPORTING PROFESSIONAL DOCUMENT - 5 (cont'd)

Working Paper No. 3

Ideas of: Similarity (three dimensions and two dimensions) should now be explicit, applications, surveying and trigonometry.

The language of sets can be used. This particularly applicable in graphical work and is very helpful when talking of the intersection of two graphs. But teachers should not attempt this unless they feel confident to do so.

A few able children may be interested in groups which could easily arise in a number of examples already mentioned.

I foresee an exciting future for middle schools given one leader teacher with mathematical imagination in each school. Team teaching might help to extend such methods and ideas.

SUPPORTING PROFESSIONAL DOCUMENT - 6

Working Paper No. 4

EXPERIMENTAL MATERIAL FOR PRIMARY SCHOOLS IN CEYLON

Presented By

K. R. Ekiriyagala

Do your children understand number?

Here is an experiment that we tried out on a large number of children in Grades 1 - 5 year olds and 2 in Ceylon Schools..

The Experiment

Nine beads are placed on the table in a row. The child is given about 12 counters and is asked to place on the table as many counters as there are beads. (The work number is not used at all). Most children do this by placing a counter in front of each bead as in Figure 1.

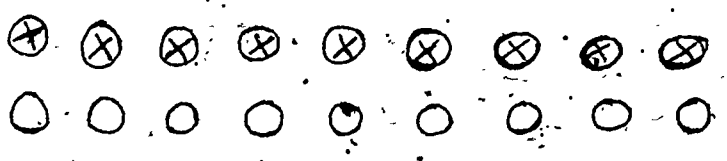


Figure 1

The child is asked again whether there are as many counters as there are beads so that any doubts can be cleared. Then while the child is looking on the counters are spread out as in Figure 2.

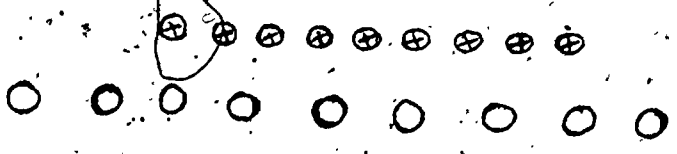


Figure 2

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

Working Paper No. 4

The child is now asked whether still there are as many counters as beads.

The next step is to collect all the counters together as in Figure 3 and ask the same question.

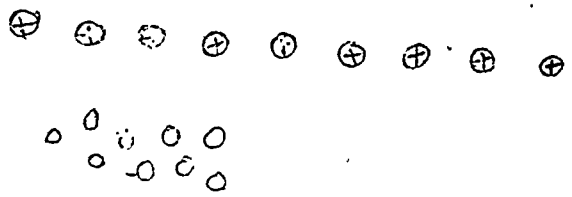


Figure 3

Results

In the course of the experiment we found the following results.

A. There were a few children who could not place the discs (as many as there were beads) on the table. Some of these children just filled in the whole length of the row of beads as in Figure 4.

Figure 4

B. Most of the children were able to place the disc as in Figure 1. And then they were sure that there were as many discs as there were beads. But the moment the arrangement was changed to Figure 2 they said that there were more discs. When the arrangement in Figure 3 was made (while the child was looking on) the an answer was that there were more beads.

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

Working Paper No. 4

C. Of the children who were able to place the discs as in Figure 1, there were a few who were quite sure that in the arrangements 1, 2, 3 there were always as many discs as beads. In fact some of them looked at me as if I were an idiot asking silly questions!

*Strange as it may seem, there were children of both Grade 1 and Grade 2 in all the three categories A, B, C above.

Some Points to Ponder on

Obviously the children in these three categories A, B and C were at different levels in their ideas of number.

Group A

These children do not seem to have any idea of number. They were guided only by the length of the row of beads and they thought that to have as many discs as beads the lengths of the two rows should be equal. They had no idea that for each bead they should place one counter only. Mathematically we say that they have no idea of one to one correspondence. Without this basic idea no number concepts can be built in the minds of these children.

Group B

These children have the basic idea of one to one correspondence. But they are still a long way from the idea of number. The fact that when the counters were spread out they say that there are more counters means that they are not aware that in whatever formation a set of objects is placed the number of objects remain constant. Mathematically we call this property the "invariance of a set."

Group C

These children are certainly well on their way to understanding number, since both the "1 - 1 correspondence" and the "invariance of a set" properties are well developed in their minds.

Now comes up the big question. Are we fair by these children if we try to teach them the "number facts" at one and the same time? And are we fair by a child when we say "Oh, he is very bad at number!"

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

Working Paper No. 4

The foregoing pages have been written with the hope that you would try this experiment on the children of your class. The experiment should be done with individual children as and when time is available in the course of a working day. It is not essential that you use beads and counters for this purpose. Any material that is somewhat attractive to children can be used. e.g. plastic spoons, pebbles, cotton reels, popsicle sticks, dolls match boxes, old torch cells, soda bottle stoppers, various kinds of seeds, flowers, cup and saucers etc. In doing this experiment you must make sure of three things.

1. Give the child more articles than in the row that you have laid out.

2. Do not use the word "number" when talking to the child.

3. Use seven to nine articles in a row so that counting the objects will not be easy.

Once you have done this in your class and if you have found that you have children of all groups in your class (and I am sure you will find it so) would it be fair to teach the same thing to all the children at one and the same time?

Here are a few suggestions as to how you could organise your teaching to include all these groups. At the beginning it may seem very difficult but really it is not so. I have done it myself (without any previous experience in Primary Schools) during the last month in a school in Colombo.

Select four children who fall into Group A. Set them up in a corner of the class and give them a "junk box" to play with. The junk box should contain all kinds of things such as the match boxes, cigarette boxes, cotton reels, torch cells, various types of seeds, pebbles, plastic spoons, and if available building blocks, plastic toys, soda bottle tops etc.

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

For a couple of days, for about an hour each day, let them just play about with this junk box, while you do your normal work with the other children. (Occasionally you may have to settle a small dispute among the four). On the second or third day ask these children to arrange the things neatly into groups (do not suggest to them what the groups should be). Get them to group these in different ways (according to the material they are made of, according to size, according to shape, according to colour etc.) You may be able to give them a writing lesson along with this e.g. they can write the name of the object they like most. They can even be asked to draw the things that they like most.

After a day or two of this you make sure that there are some sets which have the same number of objects - e.g. four torch cells, four match boxes, six plastic spoons, six nuts, etc. and other sets with different numbers of objects. Then you can suggest that they try to match up the torch cells and the match boxes (they could even place the cells in the trays of the boxes) or the spoons and nuts etc. They may like to draw these sets together. They can be encouraged to say "there are as many torch cells as there are match boxes" etc. It may even be possible to get them to write this (provided you write it out for them first). In this way you could get them to develop on their own, the idea of 1 - 1 correspondence, while they are playing with actual object.

Gradually you can lead them on to realise that there are as many match boxes as torch cells no matter how they are arranged.

It may take you a couple of weeks before you can achieve any results. But the results obtained would be lasting and rewarding - the children will not forget because they have learnt all this by actual experience while playing.

Also you would have done some reading, writing and drawing as well.

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

Working Paper No. 4

EXPERIMENTAL MATERIAL FOR PRIMARY SCHOOLS IN CEYLON

PATTERN PRINTING

Material Needed: Paper
Paint mixed in water
Banana stems, Calladium stems, Canna stems, Bandakka (Occra) pod.

Teaching Outcomes: alternate, odd, even
symmetry, pattern
mixing colours
translation
congruence

Have you seen that a Bandakka (Occra) pod cut transversally gives a beautiful picture of a flower. Similarly banana stems, calladium stems cut transversally give beautiful units for pattern printing. See Fig. 1.

Figure 1.

Cut about 6 or 8 pieces (each about 3 inches long). Mix some paint - say 3 colours red, yellow, blue - in three containers. A few sheets of paper complete the apparatus needed.

Organise a group of four children in one corner of the class. About three desks placed together would be ideal working conditions. On the other hand if the floor is swept well the children may like to work on the floor. Give the children the apparatus. Show them how a print can be made by dipping the end and printing on the paper.

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

Working Paper No. 4

At this stage it is best if you do not make any kind of pattern. Let the children play with this for some time. Perhaps in 10 or 15 minutes they would have printed on several sheets of paper. They may have produced some patterns. Certainly they would have made a mass of the paint and the place they worked in. This is one of the many good features of this activity. Gradually the children will begin to realise that their patterns would not look beautiful if they make a total mess of everything. Also they would notice that when colours are mixed other colours are obtained - they will ultimately end up with a muddy greenish brown. Let the children play about in this way for about 30 minutes or even longer if they like to.

On the second day you may try to get some pattern out of their work. You can fold a sheet of paper in two, open it out again and print something like the shapes in Figure 2 on one half of the paper.

Figure 2

You can then ask the children to complete the pattern on the other half of the paper. Figure 3 shows some patterns that were done by some Grade I children in a Colombo School.

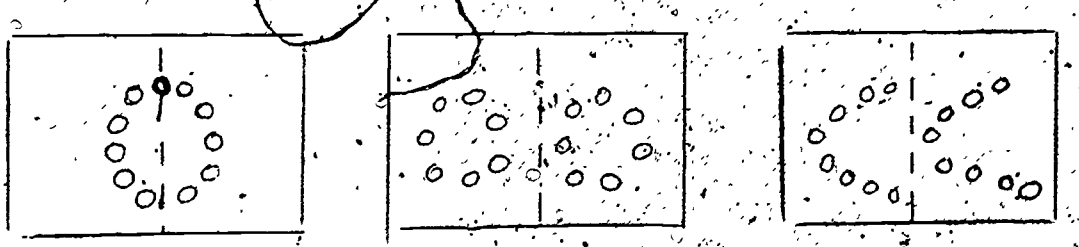


Figure 3

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

Working Paper No. 4

In this way you would be building up concepts of symmetry in the children's minds (symmetry forms an important aspect of mathematics)) all through an enjoyable activity.

You can also get children to form letters. Here are some letters printed by Grade I children.

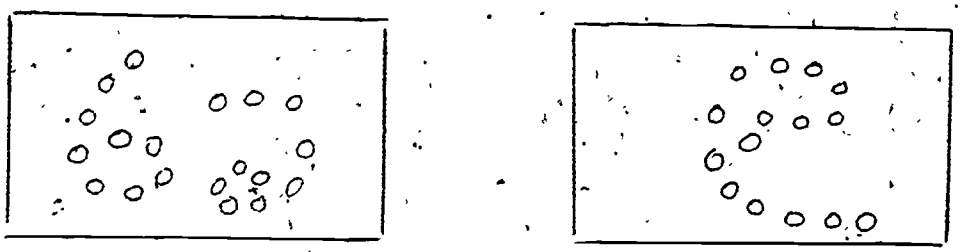


Figure 4

You can then direct the children to alternate their blocks and paints to produce patterns such as the following.

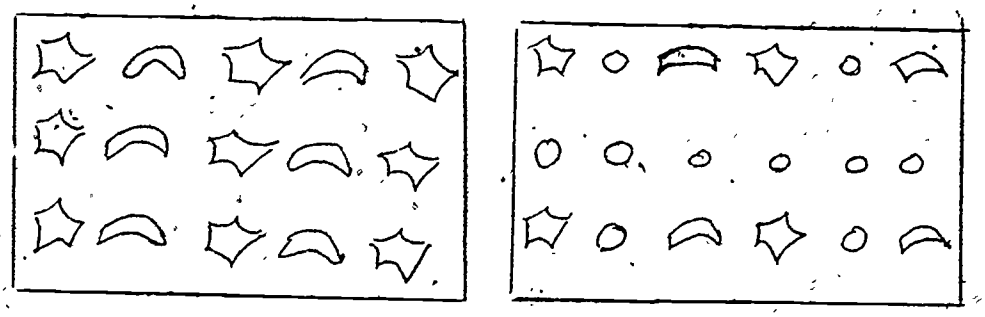


Figure 5

One thing you would notice and be reconcited to is the fact that these little children will not be able to achieve perfection (from the adult viewpoint) in their patterns. You should be happy if you get patterns as in Figure 5.

One difficulty you would encounter is that once you have started this in your class all the children will want to do it and do it everyday. It may be possible to set apart about 20 minutes a day for this type of work in class.

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

Working Paper No. 4

Check-Ups

devised by Piaget's Institute in conjunction with the Nuffield Primary Maths. Project

When doing the check-ups themselves it is very important to see to the following items:-

1. The child should be told that he is going to play some games.
2. The child should be put at ease as soon as possible. Try to talk to him about his name, family, where he lives, what he likes to eat, what games he likes to play etc. before getting on to the check-ups.
3. During the check-ups themselves you must overcome your temptation to prompt the child. You must maintain a "poker face" at all times.
4. Your voice and general attitude should be friendly - as informal as possible - to get the best out of the child.
5. At no stage must he realise that you are "testing" him.
6. At the first signs of fatigue you should allow the child to go.
7. Each check-up should not last more than 10-15 minutes.

1. One to one correspondence

Material: Pencils & pencil sharpeners (15 of each)
Match boxes and pebbles (do)
Bottles and stoppers (do)
etc.
(two sets of objects)

Procedure: Place 7 (8 or 9) match boxes in a row on the table. Give about 12 pebbles (more than the number of match boxes laid out) to the child. Ask him to place "as many pebbles as there are match boxes" on the table.
DO NOT USE THE WORD "NUMBER"

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

Working Paper No. 4

Check-Ups

If the child is able to do this proceed as follows:-

While the child is looking on spread out the pebbles as in Fig. 1. Now ask him

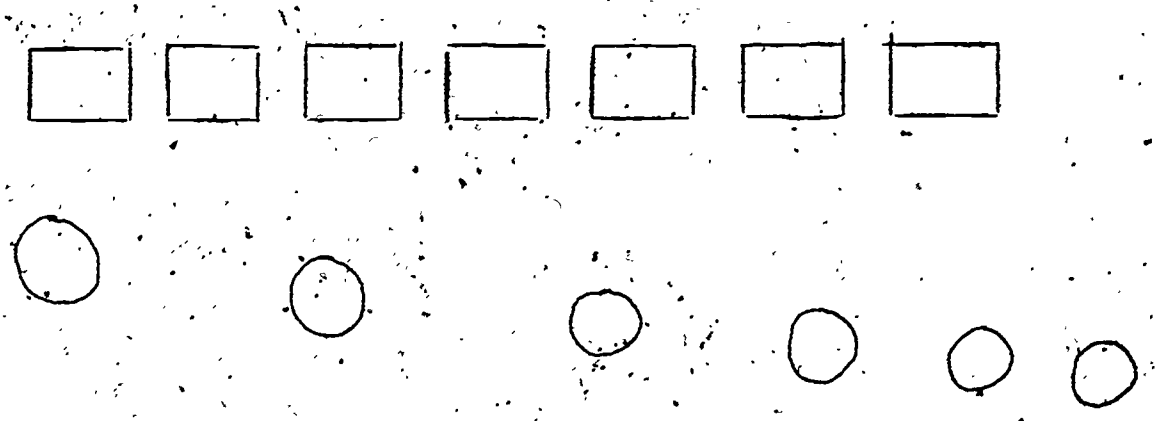


Figure 1

if there are "still as many pebbles as match boxes."
If the answer is "yes", ask him how he would explain it, say to a smaller child. If the answer is "no" put the pebbles back into the first order and repeat the question.

Next collect all the pebbles as in Fig. 2

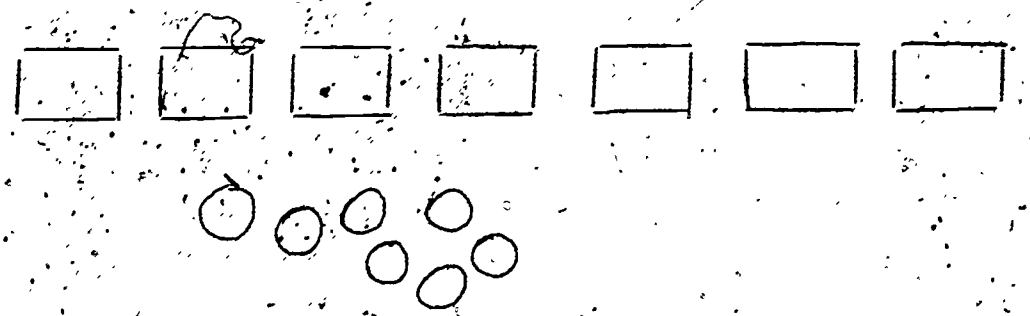


Figure 2

and ask the child if these are "as many pebbles as match boxes." Repeat what was done earlier according to the answers.

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

Working Paper No. 4

2. Sorting

Material:

4 large blue squares	(side 5 cm)
3 large red squares	(side 5 cm)
3 small blue-squares	(side 3 cm)
4 small red squares	(side 3 cm)
4 large blue circles	(d = 5 cm)
3 large red circles	(d = 5 cm)
2 small blue circles	(d = 3 cm)
3 small red circles	(d = 3 cm)

Procedure: Give the circles and the squares to the child and ask him to look at them, touch them etc. for about a minute or two.

Place two blank sheets of paper on the table so that they are apart. Ask the child to make two piles with the circles and squares, one pile on each paper.

(The child may just separate the objects arbitrarily)

If so ask him to mix up the things again and then to make two piles so that one pile would be "different" from the other.

AT NO STAGE SHOULD YOU CUE THE CHILD BY USING THE WORDS "COLOUR", "SHAPE", "SIZE."

If the child is able to do this - suppose he uses the colour attribute - ask him to mix up these things again and try to form two piles which are different from each other and also different from the earlier sorting.

Repeat for third attribute.

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

Working Paper No. 4

You may cue a child who is unable to do any serting by placing say:-

large red square	small red circle

This gives him a choice of all three attributes. If he is still unable to do this try

large red square	small red circle

This gives him a choice of 2 attributes. If he is still unable to proceed try

large red square	small red circle

which gives him only the on attribute "colour."

3. Ordering - (a) Concrete

Material: Paper cut-outs of 7 men of different heights. The differences in the heights should not be regular.

Paper cut-outs of 7 umbrellas, again differing in size, to go with the 7 men.

Procedure: First give the men to the child and ask him what they look like. Now ask him to arrange these men on the table. DO NOT USE THE WORD "SIZE" or "ORDER." If the child is unable to do this cue him by saying that when they stand they should be able to see over the heads of the others.- i.e. no man blocks the view of the other men when they all look in one direction.

Once the child has done this give him the umbrellas and ask him what they are. Then ask him to give the umbrellas to the men so that they suit the men properly. DO NOT USE WORDS LIKE "BIG" "SMALL."

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

Working Paper No. 4

(b) Abstract

Material: About 12 to 15 strips of cardboard, $\frac{1}{4}$ of an inch broad, and of different lengths from 1" to 6 or 7 inches. The differences in the length should not be regular.

Procedure: Give the child about 10 strips of cardboard and ask him to place them on the table so that they look "nice." If he does not put them in order suggest that he makes a staircase (flight of steps) with the strips.
DO NOT USE THE WORDS "ORDER" "SIZE" "ACCORDING TO LENGTH" ETC.

If the child is able to do this give him the other strips one at a time and ask him to place these also in the correct positions.

4. Inclusion

Material: 8 flowers of one kind and 2 or 3 of another kind.

2 kinds of vegetables in the same ration as above.

2 kinds of fruits in the same ratio as above.

Procedure: Get the child to handle, smell etc. the flowers (fruits or vegetables as this case may be). Ask him what he would call "all of them" (flowers). Show him one kind of flower and ask him to name the kind. Ask him to name the other kind of flower. Repeat this somewhat as follow:-

"These are roses, these are orchids. Are all these flowers." The child would say yes. Now ask him "Are there more roses or flowers?" If he says there are more roses try the following.

SUPPORTING PROFESSIONAL DOCUMENT - 6 (cont'd)

Working Paper No. 4

(a) "First I give all the flowers to you and take them back. Then I give all the roses to your friend and take them back. Who would have got more?" "Are there more roses or flowers?"

(b) "If we go to a flower garden and pluck all the roses will there be any flowers left?" "If we go to the same garden and pluck all the flowers will there be any flowers left? "Are there more roses or flowers?"

K. R. Ekiriyagala

(Ceylon)
1.7.1969.

SUPPORTING PROFESSIONAL DOCUMENT - 7

Working Paper No. 5

Some Reactions and Observations to the Preliminary Report of the Primary Mathematics Planning Workshop

SEAMEC Regional Centre for
Education in Science and Mathematics
Penang, Malaysia

By

Dr. Jerry P. Becker*
Rutgers University

June, 1969.

*Dr. Becker unfortunately was unable to attend the Primary Maths Workshop; however he visited RECSAM subsequently and kindly volunteered to submit comments on the draft report. They are contained here verbatim.

SUPPORTING PROFESSIONAL DOCUMENT - 7 (cont'd)

Working Paper No. 5

Overview

The following comments and observations* are based on discussions during a professional visit to the SEAMEC Regional Centre for Education in Science and Mathematics (Penang, Malaysia) July 7 - 8, 1969 and on a reading of the Report of the Primary Mathematics Planning Workshop (June 30-July 3, 1969).

I find the Report to contain many very interesting and valuable suggestions and ideas for upgrading mathematics education in Indonesia, Malaysia, Singapore, South Vietnam, Thailand and Philippines.

* Pages: , , are cross-referenced to the appropriate title and paragraph of the "Description of Primary Mathematics Training Course" starting on page

SUPPORTING PROFESSIONAL DOCUMENT - 7 (cont'd)

Working Paper No. 5

Part III: Aims and Objectives

I would emphasise and highlight the need to examine the content and spirit of contemporary mathematics. This will involve teaching mathematical content to workshop participants and exposing them to various new pedagogical techniques.

Part IV: Description of the Course

I would recommend that the outlines referencing the system of education in each of the cooperating countries be presented in written format. This gives participants something to read and study and take with them.

I would also emphasise the value in having participants bring exhibits (teaching aids, models, books, etc.) to the Workshop. These exhibits can then be displayed for a period of time, long enough so that participants can examine and study them and get ideas for what they could do when they return home after the Workshop.

Part IV. F : Evaluation Techniques - TCM.1 (Course One)

With respect to the evaluation, I would hope that some information could be collected relating to the attitudes of participants. For example, if participants do not already have positive attitudes towards contemporary mathematics and teaching when they arrive for the Workshop, they should have when they leave.

Part V : Participants

It would be highly desirable if participants have both a good proficiency in English and at least a Secondary level background in Mathematics. In fact, these are probably essential. Teaching experience is also desirable, but many years of experience is probably not a necessary pre-requisite. Curriculum development and In-Service institute work are two things that could be dealt with during the Workshop.

SUPPORTING PROFESSIONAL DOCUMENT - 7 (cont'd)

Working Paper No. 5

Part IV- C :Teacher Training Techniques

Para. 2 - I would make a stronger statement. In-Service education is, in fact, essential to upgrading mathematics education. There simply are large members of teachers that can be reached only through such institutes.

Para. 7 - I believe countries should be encouraged to establish strong national organisations of mathematics teachers (elementary and secondary). One of the big problems in upgrading mathematics education is good communications. A national organisations with which local and/or regional organisations could affiliate is one sound approach to tackling the communications problem. A natural consequence of such groups or organisations is the eventual publication of a journal(s) for members.

With respect to Teacher Training, I think the approach of bringing teacher-leaders together from the various countries for intensive workshops or institutes is a very good one. I would further emphasise that participants should realise they are expected to return to their sites to initiate the same kinds of activities.

It is also important that the SEAMEC Regional Centre provide a person who will maintain contact with these people after they have returned to their sites. This person should offer encouragement and help them in their work. I know from experience that demonstration of continued interest in the work of participants is very important.

It also seems important to have an easily accessible high quality library or resources centre. Such a centre should have the latest in films, books, teachers manuals, teaching aids, etc., from which teachers and leaders in mathematics education can glean ideas. Also, the more indigenous materials in the Centre, the better.

There should also be other kinds of follow-up activities such as (a) bring participants back for another conference or workshop (b) local, regional, national, or multi-national conferences aimed at identifying problems in mathematics education and possible approaches to solving these problems. What I am referring to, really, is a need to generate a recognition for the need for reform in mathematics education in the various countries and then to building up momentum for effecting change and then maintaining that momentum.

SUPPORTING PROFESSIONAL DOCUMENT - 7 (cont'd)

Working Paper No. 5

Part IV: Time Duration and Staff

Another possible approach would be to conduct two 2-month workshops for the same set of participants, perhaps six months apart. The strength of this approach is to maintain contact with Workshop participants and involve them and maintain contact with them over a longer period of time.

Other observations

I believe many teaching materials should be available to participants during the workshop. The workshop will probably incorporate formal lectures on appropriate mathematical content. These lectures should be delivered by people who can, by their own teaching, demonstrate good techniques in pedagogy and the spirit of contemporary mathematics and teaching.

Ample time should be scheduled for discussions and laboratory work, in which workshop participants are actively involved in doing the things teachers should be doing when they teach.

I would like to see workshop participants give classroom demonstrations of teaching to other participants. Or, perhaps, have a class of elementary students to whom the "new" mathematics is taught by a teacher using the latest techniques. Participants could observe such classes and get first-hand knowledge of how they (and the people they later work with) could proceed with the new ideas in the classroom.

I would also like to see participant-organised symposia conducted during the Workshop. Here would be an opportunity for participants to express their views in a highly professional way about some of the prominent issues in mathematics education. Such symposia could be chaired by prominent educators from the participating countries.

I would also like to have participants working on individual (or group) projects aimed, perhaps, at the development of indigenous teaching materials. Perhaps collectively, participants could develop a Teachers Guide for use in teaching the major mathematical concepts presented in elementary school. Other activities could also be organised, such as developing mathematics achievement tests.

APPENDICES

APPENDICES

APPENDIX A P5/SCMS/18

PROCEEDINGS OF THE PRIMARY MATHEMATICS WORKSHOP

30TH JUNE - 3RD JULY, 1969

RECSAM - PENANG, MALAYSIA

1. Mr. C. Ganasalingam, Programme Co-ordinator of RECSAM and Co-Chairman of the Primary Maths Planning Workshop, welcomed the participants at its first meeting held at the Library Conference Room, Malayan Teachers' College, Penang. He outlined the objectives of the planning workshop session and the background information of the proposed course, TCM-1 - Modern Mathematics Teaching & Evaluation for Primary Schools, scheduled for January, 1971 and some of the recommendations of the Primary Science Planning Workshop which was held in Manila, June 24th, 1969, which could be considered at this meeting for inclusion in the proposed course. The participants were then introduced to the Conference.

He then invited Mr. Chin Pin Seng, Acting Chairman, Steering Committee, RECSAM to address the meeting and to chair the first plenary session. Mr. Chin in his welcome address to the participants remarked that this was the first time that all participants arrived on time to attend the workshop session which augered well for the future.

The plenary sessions would be chaired alternately by Mr. Chin Pin Seng and Mr. C. Ganasalingam.

Dr. Geoffrey Matthews and Mr. Howard F. Foncannon made some suggestions on what to include in and 'how to conduct' the proposed courses. (Supporting Document 3 & 4)

2. Election of Secretary and Rapporteur

Mr. Wong Hee Sing of Singapore and Mr. Hikmat of Indonesia were elected Secretary and Rapporteur respectively.

3. Working Papers

Reference materials, documents and working papers for the background information and discussion were distributed to the participants.

4. Delegates from member countries gave accounts on projects and attempts towards curriculum reforms in primary mathematics in their own countries respectively. (See Supporting Document - 2)

5. Work Sessions

The meeting arrived at some agreement on how to plan the course. The participants divided themselves into two groups in order to recommend guidelines in respect of the philosophy, the basic principles, the form and programme and requirements of the proposed course. (Details of the recommendations are given in Page 8 of the report).

6. Adoption of Report

The report as drafted was adopted.

APPENDIC - B

PRIMARY MATHEMATICS WORKSHOP
Penang, Malaysia.
June 30 - July 3, 1969

PARTICIPANTS

Indonesia:

Mr. R. Hikmat
Secretary
Educational Research and Development,
Djalan Dipati Ukur 65,
Bandung.

Malaysia:

Mr. Baharin Shamsuddin
Ministry of Education,
Kuala Lumpur.

Mr. Chin Pin Seng
(Acting Chairman - Steering Committee RECSAM)
c/o Technical Teachers College,
Kuala Lumpur.

Mr. C. Ganasalingam
(Programme Co-ordinator RECSAM)
c/o Malayan Teachers' College,
Penang.

Mr. T.B. Slattery
(Contultant - RECSAM)
c/o Malayan Teachers' College,
Penang.

Mr. J.B. Vinniasingham
Federal Inspector of School,
Jalan Maxwell,
Kuala Lumpur.

Mr. Nasir Zain
Day Training College,
Penang.

Mr. Cheah Tat Huat
Malayan Teachers' College,
Penang.

Mr. Tan Beng Theam
Malayan Teachers' College,
Penang.

APPENDIX - B (cont'd)

Malaysia:	Mr.L.M. Fredericks Malayan Teachers' College, Penang.
	Mr. Lim Ewe Jin Malayan Teachers' College, Penang.
	Dr. G. Converse Malayan Teachers' College, Penang.
	Mr. Chong Thin Huat Malayan Teachers' College, Penang.
	Mr. Mohd. Dhamis Malayan Teachers' College, Penang.
Philippines:	Mr. Efrain E. Abracia Science Education Section, Bureau of Public Schools, Manila.
Singapore:	Mr. Wong Hee Sing Teachers' Training College, Singapore.
Thailand:	Mrs. Chaweewan Mahatap Supervisory Unit, Elementary & Adults Education, Ministry of Education, Bangkok.
Vietnam:	Dr. Nguyen Quy Bong Prof. of Education, Technical Teachers College, 280 Thanh Thai, Saigon.
Ceylon:	Mr. K.R. Ekiriyagala Maths Curriculum Development Project, Ceylon Technical College, 56/3 Mirihana Road, Nugegota, Ceylon.
	Mr. Chandrasena Hettiaratchy Science Curriculum Development Project, Ministry of Education, Malay Street, Ceylon.

APPENDIX - B (cont'd)

AAAS:

Mr. Howard F. Foncannon
Consultant,
1500 Massachussette Avenue,
N.W.
Washington D.C. 2005,
U.S.A.

U.K.:

Dr. Geoffrey Matthews
Consultant,
Prof. of Mathematics,
Education Centre for Science Education,
Chelsea College of Education &
Technology,
Bridges Place,
Fulham,
London, S.W.6.

Peace Corps/Malaysia:

Dr. Richard F.P. Salinger
Associate Director,
Peace Corps,
Malaysia.

U.S.A./Princeton University:

Mr. Khh Tsu Koon
Princeton University,
New Jersey,
U.S.A.

APPENDIX -C

WELCOME ADDRESS BY MR. CHIN PIN SENG,
ACTING CHAIRMAN, STEERING COMMITTEE
RECSAM
30th June 1969.

Lady & Gentlemen,

It gives me great pleasure, on behalf of the Steering Committee, RECSAM to add my welcome to that extended to you by Mr. C. Ganasalingam, the Programme Co-ordinator of RECSAM on the commencement of the planning session of Modern Mathematics Teaching and Evaluation for Primary Schools, today at the Conference Room of the Malayan Teachers' College Library.

It is gratifying indeed to mention that this was the first time that all the participants and observers from within and consultants and advisers outside the region ever arrived on time for any session convened by RECSAM. In the past due to circumstances beyond control full attendance at RECSAM's meetings or courses always eluded us and we had not hoped to see you all at today's session.

Much progress has been achieved by advanced and developing countries in science curriculum reforms for secondary schools in the last fifteen years. Attention has been focussed on the improvement of elementary science teaching in recent years. As learning is a continuous process right from birth no learning at secondary level can be really effective without curriculum reforms in elementary schools.

It seems to me that the main aim of mathematics teaching today is to enrich the mathematical experience of the young child through open-ended activities and to develop his ways of thinking on relationships of things, numbers and classification of objects, etc.

It is difficult to define Modern Mathematics. It means more than just the mere acquisition of computional skills in arithmetic. Arithmetical computation cannot be separated from other mathematical activities such as number relationships. Modern mathematics is not just a list of new topics like set theory but it is associated with the vast array of things and events that are worth thinking about in a mathematical way.

Mathematics is the creation of the human mind and because of its flexibility it can be designed to do any job. Computer mathematics is an example.

APPENDIX -C (cont'd)

Children are also creative creatures in their own mathematical way. Their young creative minds could be nurtured through mathematical experience and activity of a wide range. The traditional method of teaching should give way to the new method of learning based on an informal treatment of topics in order to develop in a child a flexible set of procedures for handling situations involving numbers, space, etc.

I would like to record my appreciation and thanks to the Principal of the Malayan Teachers' College, Penang for his kindness in lending us the Library Conference Room for today's session and for placing the facilities of the college at the disposal of RECSAM in order to ensure that all participants have a pleasant working environment. His prompt co-operation has contributed to the success of RECSAM programmes to a large extent.

I would like to offer my thanks and congratulations to the Department of Education of the Republic of Philippines and the participants at the Primary Science Workshop held in Manila last week for the comprehensive report on the Modern Science Teaching and Evaluation for Elementary Schools, which was produced in record time as a document to be tabled for discussion at the present session because primary mathematics and science courses to be launched next year at RECSAM have much in common in respect of learning processes and philosophy.

I hope all of you will find your brief stay in Penang pleasant and enjoyable as this island is well-known for its friendliness and scenic beauty.

CPS/HJN.

APPENDIX - D

A brief description of the major functions of the SEAMEC Regional Centre for Education in Science and Mathematics*

During the interim of Centre operation -- the Training and Special Services function will necessarily be carried on in parallel with (and perhaps somewhat independently from) the Research Function. As a Regional data base on local resources and materials, teaching techniques and instructional materials, etc. is established and evaluation programs conducted, the Research Group, in concert with Training, would begin to establish new guidelines and revise subject area content for the training activities of the Centre. The research function would then (quite properly) lead the other Centre functions in terms of providing relevant inputs (other than pure subject area content) to them. This function would also work with Training to set up general evaluation guidelines plus more specific course evaluation programs and to devise methods to obtain feedback on course effectiveness.**

Major Functions of Research and Development

- Research into Guidelines for establishing National and Regional Science Education policies.
- Technical awareness of Regional Scientific Research and Development programs.
- Advisory role - adaptation of scientific educational Research and Development information to serve Regional needs.
- Support and consultation in establishment of National Science Centres and National Scientific Research and Development policies.
- Long Range programs to provide guidance for Regional Science Education policies and Guidelines for future co-operative Research and Development programs.

* Excerpt from Final Development Plan for the SEAMES Regional Centre for Education in Science and Mathematics Part I - Operation Plan, November 1, 1968.

**Two kinds of evaluation are hence involved; 1) Evaluation of syllabi as to content, relevance of examination, etc, and 2) Evaluation of the effectiveness of Centre projects in general.

APPENDIX D (cont'd)

- Seminars and courses in methodology of Research and Development and Evaluation (co-ordinated with Training Division).

- Development of principles of evaluation, specific evaluation, specific evaluation of the Centre's Training programmes, instructional aids, and assistance in planning future pilot projects.

- Keeping up to date with new technological aids to education and continually appraising their appropriateness for application to Regional problems:

  These includes: educational television, teaching machines, programmed and computerised instruction, future use of computers for research and development, for administration, for storage, retrieval and distribution of information, and for student testing (as currently being done by Malaysia.)

- Research into Instructional Design, (translation of relevant scientific knowledge into instructional practices), curricula development and evaluation techniques.

- Research in co-operation with Special Services into equipment and instructional materials needed to supplement new syllabi, including such specifics as:

  a. - to develop apparatus and equipment for science and mathematics teaching and to advise on improvisation and construction of teaching materials from locally available resources within the region.

  b. - to test and evaluate the suitability and effective use of such prototype equipment and provide manuals and teachers' guides with the assistance of the Research and Development Division.

  c. - to disseminate information on the suitability and use of such locally produced equipment to schools and education authorities and other interested parties.

  d. - work with Special Services to construct suitable prototype science kits to match syllabi for multiple experiment for use in rural schools.

  e. - Provide support to Special Services in development of mobile travelling units to illustrate effective use of such equipment in teaching science and mathematics.

APPENDIX D (cont'd)

Special Services

The Special Services function of the Regional Centre would cater to the following main areas:

(1) Provision of consultant services to help solve certain national problems in curriculum development, adaptation, evaluation, etc.

(2) Assistance to National programs in the development evaluation of prototype equipment and instructional materials from locally available resources.

(3) Specialist support in planning Science Fairs, setting up exhibits and museums, etc.

(4) Inputs to Regional projects based on knowledge of special National problems.

It has become evident from the National and Regional Seminars that many specific National problems can best be solved by sending a specialist to the problem rather than vice-versa. Some problems the delegates believed could best be solved on a national basis will require technical assistance from the Regional Centre. Hence this function will probably start out by providing specialist consultant service to the member countries as required by their own peculiar needs in Science and Mathematics education. These services might take the form of special short courses, workshops on instruotional materials in the design and effective use of improvised laboratory equipment from resources locally available, or might be more directly related to the solving of specific problems.

Information Center and Clearing House

The major activities of the Information Centre, as they have evolved from the various Seminars and Third Task Force meeting will include the following:

- Library - including books, references, journals, subject area bulletins, reports and abstracts of reports (for each subject area and multi-disciplined subjects).

APPENDIX - D (cont'd)

- Reports Production and Distribution Centre for locally generated material, newsletters, monographs and other items.

- Graphic Arts and instructional materials fabrication.

- Audio-Visual Aids Centre.

- Support to the Training, Research and Development, and Special Services Functions as required.

- Public Relations responsibility, including press releases, publicity, etc.

This latter Public Relations function of the Information Centre is critical in that it will in effect help create the external image of the Regional Centre through its public relations activities and its newsletters, reports and other disseminated materials. This function is therefore vital to long range success and should be planned and staffed with extreme care.

APPENDIX E

HISTORY OF RECSAM DEVELOPMENT

1. History

A. Feasibility Study 1966:

1.1 During the part of 1966, SEAMES appointed a Feasibility Team, composed of Dr. W. Eilers, Representative of Asia Foundation, Malaysia, Dr. H. Foncannon of the National Science Foundation, United States of America and Mr. C. C. Little of the Summer Science Institute Programme, USAID/ED, India, to conduct a preliminary study relative to a proposed Regional Centre for Education in Science and Mathematics for South-East Asia. The Report of the Feasibility Team was examined at the Technical Workshops held in Kuala Lumpur, Malaysia, in July 1966 and further discussed by a Select Committee of Permanent Secretaries of the Ministries of Education of member countries on 17th to 21st October, 1966, in Bangkok. This proposal together with nine other proposals were then presented to the Second Conference of the Ministers of Education held in Manila in November 1966, at which Indonesia attended for the first time.

1.2 Five regional projects were approved at this Second Conference, namely the Asian Institute of Technology in Bangkok, Tropical Medical Centres in the member countries, a Regional Centre for Agriculture at Los Banos, Philippines, a Regional English Language Centre at Singapore and a Regional Centre for Education in Science and Mathematics at Penang, Malaysia.

B. First Pre-Project (Interim) Phase - May to December 1967:

1.3 In May 1967, the Steering Committee for the proposed Regional Centre for Education in Science and Mathematics, composed of two delegates from each of the six participating countries, held its First Meeting in Penang, Malaysia. At this First Meeting, the Steering Committee recommended a Budget of US$72,423 to carry out certain pre-project activities to enable it to identify the problems of teaching Science and Mathematics in this region and to prepare a Plan of Operations for the Regional Centre.

APPENDIX E (Cont'd)

1.4 Following upon a request made to the U.S. Government through SEAMES for the necessary funds to carry out these pre-project activities, a letter of agreement was signed on the 30th June 1967 between the Hon'ble The Minister of Education, Malaysia, and the U.S.A. Ambassador to Malaysia, approving a budget of US$50,000 towards financing the following pre-project activities of the Regional Centre for the interim phase, July to December 1967.

1.4.1 The First Meeting of the Task Force, composed of top-level educators from the member countries, representing the five subject areas of Biology, Chemistry, Elementary Science, Mathematics and Physics, at Singapore from 26th to 27th June, 1967, to draw up guide-lines for National Seminars in Science and Mathematics to be held in all member countries.

1.4.2 Six National Seminars in Science and Mathematics in the six participating countries were held between July 20 and August 15, 1967.

1.4.3. A Regional Seminar in Science and Mathematics at Penang, Malaysia, from 12th to 15th September, 1967, attended by five delegates from each of the six member countries to study the reports of the National Seminars and to draw up programme activities for the Regional Centre.

1.4.4. The Second Meeting of the Task Force in Penang from 16th to 19th September 1967 to draw up a Draft Plan of Operations for the Regional Centre.

1.4.5 The Second Meeting of the Steering Committee held in Bandung, Indonesia, from 16th to 19th October 1967 to consider the Draft Development Plan of Operations for Submission to the Third Conference of Ministers of Education.

C. Second Pre-Project (Interim) Phase - January to June 1968:

1.5 At the Second Meeting, the Steering Committee approved the Preliminary Draft Development Plan, prepared by the Interim Project Office, for submission to the Third Conference of Ministers of Education in December 1967. At the same time, it requested extension of the present interim phase to June 1968 in order to refine the Draft Development Plan and to work out details of the various specific proposals, including the Architectural and Engineering Studies.

APPENDIX E (Cont'd)

1.6 The Ministers of Education (SEAMEC) at their third conference held at Singapore, February 6th - 9th, 1968, approved the Draft Development Plan of the Centre and also approved the request for the extension of the Pre-project Phase to June 1968 in order to enable the Project Office to refine the Draft Development Plan and to work out the details of the specific projects in the plan.

1.7 At the Third Task Force Meeting held in Penang, April 30 - May 3, 1968, finalized project proposals were developed by the Task Force, assisted by a number of key consultants, These finalized project proposals are contained in Part II - Supporting Documents of the Final Development Plan.

1.8 The Third Meeting of the Steering Committee held in Manila, Philippines in May 27 - 30, 1968, considered the Refined Development Plan and approved the plan after suggesting some modifications.

D. Interim Centre (First Phase) 1 July 1968 - 30 June 1969.

A funding plan for the Centre was developed by the Ministry of Education, Malaysia. Based on this funding plan the Refined Development Plan was further modified resulting in the Final Development Plan of the Centre.

In August 1968 the Malaysian Government organized courses in Integrated Science and Nuffield Biology, Chemistry and Physics courses. Nineteen participants from SEAMEC countries attended these courses with their Malaysian colleagues.

The Fourth Meeting of the Steering Committee held in Bangkok, Thailand on Nov. 7 - 9, 1968, approved the Final Development Plan of the Centre.

The Fourth Meeting of the SEAMEC - Jakarta, January 1969 approved the revised plan.

The Fifth Meeting of the Steering Committee held in Tokyo from March 31 - April 7, 1969, decided that to prepare for the final course to be offered by RECSAM, a Primary Science Planning Workshop be held in Manila on April 24 - 28, 1969.

APPENDIX F

BIBLIOGRAPHY OF RECSAM REPORTS*

1. A Preliminary Study Relative to a Proposed Regional Centre for Education in Science and Mathematics for South East Asia SEAMES/041.02/F3 dated June 7th, 1966.

2. Final Report - SEAMES Technical Workshop. SEAMES/TW/7 July 1966 Kuala Lumpur.

3. Presentation of the SEAMES Proposals SEAMES/TW/7 July 1966.

4. Final Reports of S.E.A. Ministers of Education Council Conferences.

   (i) 1st Conference - 30th November 1965 - Bangkok
   (ii) 2nd Conference - SEAMES/SMC/7 - November 25th - 28th, 1966.
   (iii) 3rd Conference - SEAMES/TMC/7 - February 6th - 8th, 1968.
   (iv) 4th Conference - SEAMES/TCM/7 - January 7th - 10th, 1969. Volume I & II.

5. Reports of Steering Committee Meetings for the Regional Centre for Education in Science and Mathematics.

   (i) 1st Meeting - 23rd to 25th May, 1967 - SEAMES P5/SCMS/4
   (ii) 2nd " - 16th to 19th October, 1967 - Indonesia P5/SCMS/11
   (iii) 3rd " - 27th to 30th May, 1968 - Philippines P5/SCMS/13
   (iv) 4th " - 7th to 9th November, 1968 - Thailand P5/SCMS/15
   (v) 5th " - 31st March to 7th April, 1969 - Tokyo P5/SCMS/16

6. Reports of the Task Force Meetings for the Regional Centre for Education in Science and Mathematics.

   (i) 1st Meeting - June 28th - 30th, 1967 - P5/SCMS/6/TF/1
   (ii) 2nd " - September 16th - 18th, 1967 - P5/SCMS/6/TF/2
   (iii) 3rd " - April 30th to May 3rd, 1968 - P5/SCMS/TF/3

7. Reports of the National Seminars on Science and Mathematics held by:-

   (a) Indonesia - August 3 - 4, 1967
   (b) Malaysia - " 9 - 10, 1967
   (c) Philippines - " 20 - 21, 1967
   (d) Singapore - " 1 - 2, 1967
   (e) Thailand - " 9 - 10, 1967
   (f) Vietnam - " 10 - 12, 1967

*Most of these reports are available directly from the RECSAM Project Office.

APPENDIX F (Cont'd)

8. Report of the Regional Seminar on Science and Mathematics held in Penang - September 13th - 15th, 1967.

9. Final Development Plan of the Regional Centre for Education in Science and Mathematics:

   (i) Part I Operation Plan - P5/SCMS/14 - November 1st, 1968.

   (ii) Part II Supporting Documents - P5/SCMS/14 - November 1st, 1968.

10. RECSAM Workshop Reports

   (i) Primary Science Planning Workshop - Manila
   June 24th - 28th, 1969.

   (ii) Primary Mathematics Planning Workshop - Penang
   June 30th - July 4th, 1969.

11. Newsletters: No. 1 - July, 1967.

   No. 2 - January, 1968.

   No. 3 - June, 1968.

   No. 4 - April, 1969.

P5/SCMS/18.

APPENDIX G

REPORT DISTRIBUTION

(1) 1 copy to each participant.

(2) 2 copies to each member of the International Advisory Council.

(3) 6 copies to US.AID/Bangkok.

(4) 20 copies to U.S. Embassy, Kuala Lumpur.

(5) 1 copy to each Steering Committee Member.

(6) 1 copy to each Project Director.

(7) 1 copy to each Task Force Member.

(8) 12 copies to each Chairman, National Coordinating Committee.

(9) 6 copies to British Council, Kuala Lumpur.

(10) 5 copies to Director of SEAMES, Bangkok.

(11) 1 copy to each Consultant.

(12) 7 copies to Permanent Secretary, Ministry of Education, Kuala Lumpur, Malaysia.

(13) 1 copy to Chief Education Adviser, - do -

(14) 1 copy to Deputy Permanent Secretary - do -

(15) 1 copy to Chief Organiser (Maths). - do -

(16) 6 copies to each Chairman, National Maths Seminar.