The Mathematics Educator
2000, Vol. 5, No.1/2, 83-90

Pre-Service Preparation and Professional Development of Mathematics Teachers in Singapore

Chong Tian Hoo
Fong Ho Kheong

Abstract

This paper will present the initial teacher training preparation of primary and secondary mathematics teachers in Singapore. It will include the philosophy, approaches, and implementation of different teacher education programmes in Singapore that have effectively prepared mathematics teachers to be knowledgeable, competent and reflective. As the professional development of mathematics teachers in Singapore is seen as a continuum beginning with foundation training, induction, continual training, and milestone programmes, this paper will also present efforts made in developing mathematics teachers professionally for a lifelong career in teaching.

Introduction

Since gaining independent rule, Singapore has undergone many changes not only in the commercial, financial, manufacturing and services sectors but also in producing a workforce which is highly efficient and productive. We have to keep on reviewing, revising and improving on our education system as well as the way that we train new teachers for the schools and those teachers who are already in service.

Mathematics Education in Singapore

In Singapore, children learn mathematics as young as at the age of 3 when they enrol in nursery followed by 2 years in the kindergarten. In the primary and secondary schools, Mathematics is a compulsory subject and by the time pupils take their General Certificate of Education (GCE) 'O' level examination, they would have done at least 10 years of Mathematics. Many of the science,

engineering and technological courses at the polytechnics and university levels require a pass grade in Mathematics as prerequisite.

Aims of mathematics education in Singapore

The aims of mathematics education are diverse and depend on the state-of-the-art of mathematical ideas and concepts, the emergence of new technologies, the stage of economic development and political leadership. Only four main aims are stated in our syllabuses, i.e. to enable pupils to:

(1) acquire the necessary mathematical knowledge and skills, develop thinking processes and apply them in mathematical situations that they will meet in life.
(2) use mathematics as a means of communication.
(3) develop positive attitudes and sense of personal achievement in mathematics.
(4) appreciate the importance and power of mathematics in the world around them. (Ministry of Education 1990a, b)

Conceptual Framework

Mathematical problem solving is the centre of the conceptual framework for Mathematics taught at both the primary and secondary levels. The five aspects of the framework are Concepts, Skills, Processes, Attitudes and Metacognition. The elements of each aspect are as follows:

Concepts - numerical, geometrical, algebraic, and statistical;
Skills - estimation & approximation, communication, use of mathematical tools, arithmetic manipulation, algebraic manipulation, and handling data;
Processes - thinking skills, and heuristics;
Attitudes - appreciation, interest, confidence, and perseverance;
Metacognition - monitoring one's own thinking.

Content for Primary and Secondary Levels

Primary

At the primary levels, pupils attend Mathematics classes at an average of 20% or 4 hours per week of the total curriculum time. The mathematics content focuses on the following:

Whole number; Fractions; Decimals; Money, Time and Measures; Mensuration; Geometry; Statistics; Rate, Ratio and Proportion; Percentage; Algebra.

Secondary

The secondary school mathematics syllabus is an extension of the primary school syllabus. The subject is allocated about 3 hours per week of curriculum time. The syllabus comprises 10 different areas as follows:

Arithmetic; Mensuration; Algebra and Graphs; Geometry; Trigonometry; Statistics; Sets; Probability; Vectors; Matrices and Transformations.

Mathematics Teachers And Materials

Teachers

Teachers are one of the important factors for the successful learning of mathematics. A teacher's attitude towards mathematics has a tremendous effect on whether the pupils like or dislike it. Instructional excellence and motivation for learning bring about the highest standard of both the cognitive and affective aspects of pupils' learning. They are likely to lead to higher achievement in mathematics.

In Singapore, mathematics teachers are generally well qualified. Primary school teachers are normally GCE 'A' level holders who have passed at least an 'A' level mathematics subject but in recent years, more and more graduates have filled vacancies in primary schools. They have been trained in pedagogical principles and practices in the teaching of Mathematics at the National Institute of Education (NIE).

At the secondary school level, university graduates with at least one year of mathematics taken at the university level will be allowed to be trained as mathematics teachers. Graduate teachers specialising in mathematics are recruited to teach at the pre-university levels. In addition to having a pass degree or honours degree, mathematics teachers are carefully selected for training. The admission criteria include a pass grade in an English proficiency test and a successful interview before a selection board which help to ensure the high quality of teachers in our schools.

Textbooks and Other Materials

Mathematics textbooks and instructional materials developed by project teams are normally adopted for use in the primary and secondary schools. There are also mathematics textbooks written by individual authors, usually teachers, who are commissioned by publishers on royalty basis.

Commercial instructional materials are readily available.

Preservice Training

Preservice Training of Mathematics Teachers

Primary School Mathematics Teachers

For the training of primary school mathematics teachers, there are mainly two programmes – one is open to university graduates and the other to GCE 'A' level holders.

University graduates can enrol into the Postgraduate Diploma in Education (Primary) programme (PGDE(P)) whereas GCE 'A' level holders can enrol into the Diploma in Education (DipEd) programme. The objective of the programmes is to provide students with a general foundation in teaching and learning mathematics. Students will be exposed to different areas ranging from the aims of teaching mathematics, problem solving, assessment and catering to high and low ability pupils.

In both programmes, preservice teachers are required to attend compulsory courses in the teaching of mathematics. For the PGDE(P), the modules offered are: (a) Principles and Practice of Primary Mathematics, (b) Fostering Mathematical Thinking, and (c) Assessment in Mathematics. Those modules offered in DipEd are: (a) Principles and Practice of Teaching Primary Mathematics I, (b) Principles and Practice of Teaching Primary Mathematics II, (c) Mathematical Thinking and Enrichment for Primary Mathematics, and (d) Problem Solving and Assessment for Primary Mathematics.

Secondary School Mathematics Teachers

For the teacher preparation of secondary school mathematics teachers, only one programme is available, i.e. Postgraduate Diploma in Education

(Secondary). There are two modules on the teaching and learning of Mathematics spread over a period of one and a half semesters.

Training Package

The training package covers four components, viz. curriculum, methodology, assessment and micro-teaching.

Curriculum

The aims of the training component on Curriculum are to introduce to student teachers the content of mathematics to be taught to their pupils, guide them in the interpretation of the syllabus, instruct them how to plan and prepare mathematics lessons, and strengthen their knowledge of the content and skills in mathematics.

Methodology

Student teachers are taught the different methods and approaches of teaching mathematics. These include exposition, investigation, discussion, problem-solving, project work, remedial teaching and groupwork. The strategies of teaching specific topics as well as organising hands-on and enrichment activities, and developing instructional materials are also dealt with in depth.

Assessment

It is recommended in the school syllabus to use a variety of methods to assess pupils taking mathematics, viz. observations, oral communication, practical and project work, and written assignments and tests.

The assessment methods dealt with in the training packages include the design, construction and analysis of tests; assessment for diagnosis and remediation; project, practical and written work.

Micro-teaching

Micro-teaching is an essential component of the training package. It is 'teacher in action' where every student teacher practises his/her teaching skills in a simulated situation. The micro-teaching laboratory is an air-conditioned sound-proof room with lighting accessories and videotaping facilities, such as a video camera, and a television screen which provides playback of recorded micro-

teaching sessions for student teachers' self-evaluation as well as for critiques by peers.

Practicum

Micro-teaching prepares students for practicum when they are attached to schools. Students usually work in groups to prepare teaching and learning materials for use in the classroom. They are expected to apply pedagogical principles when they design their teaching materials.

Students are supervised by both NIE professors and co-operating teachers in schools. Their lessons are observed, advice and suggestions given and at the end of the practicum period, a grade is awarded.

In-Service Training

Aims

In-service training for mathematics teachers aims to develop them further after their initial teacher preparation. It will not only update and upgrade them in pedagogy and content to help them keep abreast with local as well as international developments in educational research and technology but also provide them with the opportunity to gain higher educational qualifications through an accreditation system.

Continual Training

It is a requirement of every serving teacher to undertake about 100 hours per year of attendance in professional activities. This is to ensure that teachers keep on updating and upgrading themselves in continual professional development. Activities could include attending conferences, seminars, discussion sessions among colleagues or workshops on effective teaching methods, handling non-achieving pupils, ad hoc courses like the use of computers in teaching, seminar on thinking skills, and talks on creativity. Daily problems can receive immediate attention through sharing of experiences/solutions.

After graduating from teacher preparation programme, mathematics teachers go through a year of induction into the education service followed by continual training either taking short courses or modules leading to an advanced diploma in mathematics teaching. When it is time for them to take on new

responsibilities, such as heads of departments, vice-principals and principals of schools, they will be required to enrol in full-time special in-service programmes such as in departmental management or educational administration.

Types of Courses

Short Courses

There are short courses for mathematics teachers. These courses aim to meet specific or limited needs. They are offered mainly for the purpose of updating and upgrading teachers' knowledge in keeping abreast of new initiatives and new areas in education as well as familiarising them with curriculum changes in mathematics.

Advanced Diploma Level Courses

This series of coherent and related courses will enable teachers to work towards becoming a specialist in mathematics teaching. They cater to the need of teachers who aim to upgrade themselves for an advanced diploma, degree or higher degree qualification. The content would have a certain acceptable level of depth and rigour at different levels.

The advanced diploma courses consist of 3 levels, viz. basic, intermediate, and advanced. They comprise such modules as using information technology in teaching mathematics, helping children with problems in mathematics, enrichment activities for primary mathematics, action research in primary mathematics, and assessment and evaluation in mathematics.

Course Delivery

The in-service delivery will be in various modes which include the following:

Face-to-face lectures; tutorials; workshops; project work; fieldwork; academic exercises; video-based lectures; on-line distance learning; and several different combinations of the above.

Assessment

Various modes of assessment are employed, viz. exercises; assignments; examinations; tests; group and individual presentations; projects; case studies; practicum; performances/exhibitions.

Certification

On the completion of each course, participants will be awarded either a certificate of attendance or a certificate of successful completion. While the former is based solely on attendance requirement, the latter includes an additional requirement of attaining a minimum standard of performance.

Conclusion

Singapore is a country that undergoes many changes in various sectors. Education is no exception. Changes are also inevitable because of changes in circumstances and aspirations. Our preservice and in-service teacher training programmes have always to remain relevant and cater to the needs of the teachers. Only then can our workforce be able to cope with growing demands as a consequence of our attempts to regionalise and globalise.

References

Ministry of Education. (1990a). *Mathematics Syllabus (Primary)*. Singapore.

Ministry of Education. (1990b). *Mathematics Syllabus (Primary)*. Singapore.

National Institute of Education. (1999). Handbooks published on various teacher training programmes conducted in the Institute, namely, Postgraduate Diploma in Education, Diploma in Education, and BA/BSc with Education.