Towards Professionalism: The Learning Journey of Mathematics Teachers in Singapore

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It may be said that a professional has expert and specialized knowledge in the field of practice. Therefore as professionals, teachers in Singapore are engaged in lifelong learning and their learning journey begins with pre-service education. Systemic infrastructure, which resulted from two significant initiatives of the Ministry of Education, regulates and sustains their learning and development. Specific approaches, such as lesson study, research projects, and professional development activities to meet individual needs, are often adopted to develop expertise in classroom instruction. Professional bodies such as the Association of Mathematics Educators, Singapore Mathematical Society and Academy of Singapore Teachers provide necessary platforms for teachers to network and build professional knowledge.

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MESC Classification: B50, C70, D40
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INTRODUCTION AND BACKGROUND

Teachers as professionals

It may be said that a professional has expert and specialised knowledge in the field of practice. As professionals teachers must be lifelong learners who develop themselves in specifically three domains: professional knowledge – knowledge of students, knowledge of mathematics and knowledge of students’ learning mathematics; professional attributes – be committed to the continual improvement of their teaching practice; and professional

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practice – make a positive difference to the learning outcomes, both cognitive and affective, of the students they teach (Australian Association of Mathematics Teachers, 2002). In Singapore two significant initiatives, launched by the Ministry of Education (MOE) since 1977, have placed considerable emphasis on lifelong learning and development of teachers. The learning journey of teachers begins with pre-service education at the National Institute of Education (NIE) and continues during their in-service years in varied ways.

**MOE Initiatives**

In 1997, Mr Goh Chok Tong the Prime Minister of Singapore in his speech (Goh, 1997) at the opening of the Seventh International Conference on Thinking held in Singapore noted that Singapore has a strong education system, one that is widely recognized for having produced high levels of achievements among pupils of all abilities. However, he also cautioned that what may have worked well in the past will not work well for the future as the old formulae for success are unlikely to prepare the young Singaporeans for the new circumstances and new problems they will face in the new millennium. He emphasized that we must ensure our young can think for themselves, so that the next and future generations can find their own solutions to whatever new problems they may encounter. He announced at the opening of the conference that Singapore’s vision for meeting this challenge is encapsulated in four words: THINKING SCHOOLS, LEARNING NATION (TSLN).

The second initiative, following TSLN in 2005, was the Teach Less, Learn More (TLLM) initiative (Shanmugaratnam, 2005). TLLM builds on the groundwork laid in place by the systemic and structural improvements under TSLN, and the mindset changes encouraged in Singapore schools. It continues the TSLN journey to improve the quality of interaction between teachers and learners, so that learners are more engaged in learning and better achieve the desired outcomes of education. TLLM aims to touch the hearts and engage the minds of learners, to prepare them for life. It reaches into the core of education - why we teach, what we teach and how we teach. It is about shifting the focus from “quantity” to “quality” in Singapore’s education. It emphasizes “more quality” in terms of classroom interaction, opportunities for expression, the learning of life-long skills and the building of character through innovative and effective teaching approaches and strategies. It also emphasizes “less quantity” in terms of rote-learning, repetitive tests, and following prescribed answers and set formulae.

Systemic infrastructure has been put in place to support the TSLN and TLLM initiatives. Arising from these initiatives, several specific approaches have also been adopted by teachers for developing their professional knowledge, professional attributes and
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professional practice.

**Systemic Infrastructure**

In support of TSLN vision, as of 1998 all teachers in Singapore are entitled to 100 hours of training and core-upgrading courses each year to keep abreast with current knowledge and skills. The Professional Development (PD) is funded by the MOE. To support teachers in mapping their learning trajectories, in 2005 the MOE implemented an Enhanced Performance Management System (EPMS) (MOE, undated). The EPMS is an appraisal system that contains rubrics pertaining to fields of excellence in the education system be it teaching, leadership or senior specialist. These rubrics delineate very clearly the competencies deemed necessary at each level and hence teachers are entrusted with responsibility of their own PD.

For the field, excellence in teaching teachers must slowly but surely develop themselves in the core competency (nurturing the whole child) which comprises of 4 main areas: cultivating knowledge (subject mastery, analytical thinking, initiative and teaching creatively), winning hearts and minds (understanding the environment, developing others), working with others (partnering parents, working in teams) and knowing self and others (turning into self, personal integrity, understanding others and respecting others). The levels in the teaching field are characterized as follows:

- Beginning Teacher
- General Education Officer (GEO) 1 / 2
- General Education Officer (GEO) 1A1 / 2A1
- General Education Officer (GEO) 1A2 / 2A2
- Senior Teacher
- Master Teacher
- Principal Master Teacher

Table 1 shows expectations of a mathematics teacher related to the domains of Knowledge and Skills for three levels of the teaching field. It is apparent from Table 1 that a teacher desirous of advancement in his/her career must engage in lifelong learning so as to gain deeper insights into both the content and pedagogical areas that are specific to his/her teaching needs. There is extrinsic motivation for teachers to advance from one level to another in their field, as their salaries and other performance perks are pitched to their levels in their field of excellence, in this case teaching.
Table 1: Expectations in the domains of Knowledge and Skills

<table>
<thead>
<tr>
<th>Level</th>
<th>Knowledge (Mathematics)</th>
<th>Skills (Teaching of Mathematics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning Teacher</td>
<td>Comprehend framework and core concepts of relevant school mathematics curriculum.</td>
<td>Understand pupil management skills. Competent in the delivery of mathematics lessons.</td>
</tr>
<tr>
<td>GEO 1A1/2A1</td>
<td>Demonstrate knowledge of: - relevant core concepts and broad coverage of mathematics curriculum; - teaching resources and enrichment/remedial programmes associated with level of mathematics being taught.</td>
<td>Demonstrate pupil management skills and appropriate application of a variety of pedagogic techniques in teaching mathematics. Deliver interesting lessons to students of varied abilities and profiles and instill learning in mathematics through interactive activities.</td>
</tr>
<tr>
<td>Master Teacher</td>
<td>Demonstrate knowledge of significant relationships, history, structure with Mathematics and the application of this knowledge to inspire interest in Mathematics; strong awareness of trends and issues surrounding mathematics beyond the school setting and in industry/field. Knowledge of core concepts of other related subjects which integrates the learning of mathematics to the world outside of school.</td>
<td>Demonstrate specialized techniques and strategies in the teaching of mathematics and curriculum integration to ensure achievement of learning objectives and inspire learning across schools in the cluster including customized approaches for niche groups of students.</td>
</tr>
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</table>

For teachers to work collaboratively at the school level, in September 2005, in support of the TLLM initiative “white space” was introduced. This is time-tabled time for teachers during curriculum hours to meet, plan and deliberate on their instructional practices. To provide structure for teachers’ collaborative work at the school level, in 2010, the MOE, unveiled the Professional Learning Communities (PLCs) framework (TDD, 2010). This framework encourages the formation of Learning Teams in schools. These teams have the choice of adopting a range of collaborative methods/tools, such as Learning circles, Action research and Lesson study, to improve instructional practice through development in subject content knowledge and pedagogy.

In 2009, the Academy of Singapore Teachers (AST) was formed. The subject chapters at the academy are led by master teachers. For mathematics there are three subject teachers and the key objectives of the chapter are to i) raise the professional standard in the learning and teaching of Mathematics, ii) serve as a focal point for teacher collaboration and networking, and iii) build a culture of professionalism and pride within the fraternity of Mathematics teachers.
THE LEARNING JOURNEY OF MATHEMATICS TEACHERS

Pre-service Teacher Education

The NIE is the sole teacher education institution in Singapore where all the pre-service primary, secondary and junior college teachers for the Singapore Education Service are educated. Like all other institutions of higher learning in Singapore, the programmes and courses at the NIE are constantly undergoing change so as to keep abreast of the rapid changes taking place both locally and internationally. Periodic reviews of all programmes are carried out and necessary revisions instituted. The NIE represents the nation’s hopes that its teachers will be well educated, committed, caring and dedicated to the task of moulding the future of Singapore (National Institute of Education, 2002).

The MOE in Singapore recruits suitable candidates for teaching positions in primary schools, secondary schools and junior colleges all year round. Information pertaining to all aspects of “Teaching as a Career” is posted on the MOE’s webpage: http://www.moe.gov.sg/teach. All successful candidates who do not have qualifications in teaching must undergo teacher education at the NIE. Successful candidates without teaching qualifications are appointed into the Singapore Education Service as trainee teachers on the General Education Officer 1 (GEO 1) or General Education Officer 2 (GEO 2) salary scales depending on their entry qualifications. Trainee teachers receive a full monthly salary while teaching in school or undergoing training at the NIE. Their tuition fee for study at the NIE is fully borne by the MOE. Upon successful completion of their training at the NIE, they are deployed to teach in schools and have to serve a 3-year teaching bond.

The numbers are controlled as the number of teachers recruited must match the number of vacancies in the Education Service. The number of trainee teachers in the various programmes of study at the NIE change over periods of time and are guided by factors such as,

- changes in the number of pupils in each education sector (primary / secondary / junior college),
- number of teachers leaving the Education Service, either retiring or resigning, and
- the prevailing economical and financial situation faced by the government.

There are numerous teacher education programmes at the NIE which cater to the pre-service preparation of primary, secondary school and junior college teachers. As the focus of this paper is not on the details of pre-service teacher education programmes, they are described elsewhere (Kaur, 2005). Upon graduation from NIE, teachers are posted to
In-service Teacher Education and Professional Development

In this section the ethos of the teaching profession and a few specific approaches that are often adopted for in-service teacher education and professional development by mathematics teachers are presented.

Ethos of the teaching profession

The ethos of the teaching profession in Singapore encapsulates the beliefs and practices of teachers (MOE, undated). It comprises their philosophy of education, vision, pledge, creed and desired outcomes of education. As part of the philosophy of education it is stated that “Educators need to understand the child and have a keen awareness of complex educational issues. They work towards deepening subject mastery and strengthening their competencies for effective teaching and learning.” As part of the vision it is stated that “As individuals and as a community of professionals we seek continually to deepen our expertise.” As part of the pledge and creed it is stated that “We will continue to learn and pass on the love for learning to our students.” It is apparent from the ethos that teachers need to continuously develop themselves through forms of in-service education and professional development activities that support their needs. As mentioned earlier in the paper systemic infrastructure provided by schools and the MOE supports teachers in lifelong learning and professional development.

Specific Practices

There are many and varied ways by which teachers partake in-service education and professional development to meet their needs. In this section, three practices that are commonly used for improving teachers’ expertise in mathematics instruction are detailed. The three practices are Lesson study, research projects and professional activities to suit individual needs.

Lesson study

Lesson study, an important tool utilised in Japan to facilitate teachers’ collaborations and professional development is also presently commonly used in Singapore for the same purpose. The adoption of lesson study from Japan by educators in Singapore began around the year 2005 (Fan, Lee and Sharifah Thalha, 2009). In a research project, believed to be the first on Lesson study in Singapore, conducted by Fan, Lee and Sharifah Thalha (2009) from 2006-2007, it was found that through the actions of planning, teaching, reflecting, and revising, teacher participants deepened their knowledge and skills.
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which resulted from the diverse community that worked together in the study. It was also found to be a good means of mentoring the beginning teachers by senior teachers in a school. Dr Yeap Ban Har, principal of the Marshall Cavendish Institute in Singapore is presently leading numerous Lesson study groups of mathematics teachers. One can follow the chronological development of the groups on


Research projects

With a quest for professional learning and development that reflects a gradual shift in the centre of gravity away from the University-based, “supply-side”, “off-line” forms of knowledge production conducted by university scholars for teachers towards an emergent school-based, demand-side, on-line, in situ forms of knowledge production conducted by teachers with support from university scholars, schools are now welcoming researchers from the university into their schools to work with teachers. Such work is made possible by the Centre for Research in Pedagogy and Practice (CRPP), which was set up in 2002 and funded by the Ministry of Education. CRPP encourages and supports academics from the National Institute of Education to situate their research projects in schools and work with school communities.

Examples of two such projects are the Enhancing the pedagogy of mathematics teacher (EPMT) project (Kaur, 2011; 2009) and the Think-Things-Through (T3) project (Yeap & Ho, 2009). The aims of the EPMT project were three fold: to provide teachers with training, to facilitate teachers’ work (practice and feedback) at the school level and to enthuse and support teachers to contribute towards the development of fellow teachers. The deliverables, namely resources crafted by teachers (Kaur & Yeap, 2009a; 2009b, Yeap & Kaur, 2010) of the project have contributed to several school-based professional development activities that have had positive impact on classroom practice of many teachers in Singapore.

The T3 project investigated the effects of the use of word problems that require the consideration of context on students, teachers and classroom environment over a period of three years. The secondary goal of the project was to study teacher change in an informal professional development programme.

Professional activities to suit individual needs

The EPMS entrusts teachers with the responsibility of developing in their fields of work, specifically teaching in this case. Teachers are guided by their mentors in school and self to pursue professional activities that address their needs. For teachers who wish to pursue further professional qualifications, they may enrol for higher degree courses at
the NIE and universities. Others may choose to enrol for relevant short in-service courses, workshops, seminars and institutes. These professional learning activities are conducted by university academics, master teachers and senior teachers.

Professional bodies such as the Association of Mathematics Educators (AME), Singapore Mathematical Society (SMS) and the Academy of Singapore Teachers (AST) are active in providing professional development and learning activities, such as conferences, talks, workshops, for mathematics teachers on a regular basis.

CONCLUDING REMARKS

As professionals teachers must engage in lifelong learning and professional development. It must also be noted that teachers themselves are significant contributors to the development of fellow teachers, as much of their tacit knowledge is never easy to locate in archives or other media resources. Therefore senior teachers in schools and master teachers at the Academy of Singapore Teachers play a pivotal role in developing professional knowledge, professional attributes and professional practice of mathematics teachers in Singapore.

REFERENCES


