

Oon-Seng Tan · Woon-Chia Liu
Ee-Ling Low *Editors*

Teacher Education in the 21st Century

Singapore's Evolution and Innovation

 Springer

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Foreword

Our world is changing at lightning speed. It will continue to change on a global scale even if we as individuals or local communities do not. What are we doing to help to direct all of the change—technological, demographic, and cultural—that is happening around us? What can be done to help a rising generation to meet not only the demands of the time they now live in, but also the time they will have to live in for years to come?

One increasing focus of international attention in regard to these questions is the Singapore education system. This is a system that has surprised everyone with its meteoric rise in international rankings. It also is a system that avoids fashionable shibboleths that contend that the starting point for educational reflections should be the individual child and his or her momentary passions. Such a perspective will always fail to grasp the dynamic societal context in its evolving totality. Instead, one needs to begin with the adults with professional expertise who are most dedicated to the true purposes and aims of education to nurture and release talent with the goal of improving the human condition. Such a stance requires that educational professions take their vocation seriously and do not displace the timeless demands of their calling on to individual pupils or the most cacophonous policy concerns of a given moment. These tend to shift from month to month and from year to year. In an age of instant notoriety followed by Internet oblivion, “presentism” or short-term thinking must be anathematic for all serious educators. We need instead the concerted efforts of a community of professionals all working together with knowledge of the learning sciences and long-term societal requirements in support of the common good. In Singapore, this indispensable work is done at the National Institute of Education (NIE), the only teacher education institute in the country.

There is a growing consensus around the world among policymakers, international consultancies, and independent scholars, that no other education system is tied together with such interdependent synergies as the Singapore system. While some of this is due to the small size of Singapore, an over-emphasis on the singular nature of this city state would miss out on key design principles that undergird the system. The Ministry of Education, the NIE, and the schools are inextricably linked

as part of bold vision and consequential implementation. An isolated action from any part of the system will have significant impact on the whole entity. This is a system where “synergy”—the ancient idea that the whole is more than the sum of its parts—is not a slogan but a lived reality.

To attain this status, Singapore’s system needs to be open to continuous improvement. Not only does NIE respond to the Ministry’s policy changes, but it also constantly reviews itself to further improve instruction, curriculum, and assessment. In 2009, the NIE launched a new Teacher Education Model for the Twenty-First Century (TE²¹). As described by the editors of this book, the TE²¹ Model “encompasses curriculum improvements that align to new competencies; values development that re-envision teacher professionalism and calling; pedagogical changes that emphasise self-directed inquiry and technology-enabled learning; and a theory–practice nexus that strengthens and enhances teaching practices through school partnerships and mentoring”. The model looks to the future first and foremost, replacing “presentism” with an understanding of the gravity of the nature of the challenges that await young Singaporeans. This book describes how the key facets of the model have come to permeate the NIE. It describes how its features have been disseminated throughout the nation’s schools.

The book starts off by highlighting the way that Singapore as a system nurtures its teachers. Singapore recruits its teachers from the best of each cohort. It provides for the student teachers during the preparation years, offers excellent career pathways, and supports teachers throughout their careers. Few, if any, nations devote such resources with consistency and reliability to the teaching profession. Singapore does not take the “teacher factor” for granted. It marshalls the very best material and personnel to ensure that student teachers start off well.

Going beyond this, the NIE constantly reviews its ways of teaching. Underpinned by a strong teacher education philosophy, the NIE focuses on learners, nourishes a strong sense of teacher identity, and contributes to the larger professional community at the centre. School subjects, such as science, mathematics and geography, are highlighted here to show how the professional learning and development of student teachers to be masters of their subjects is being undertaken today at the NIE. The innovative pedagogies, well-designed curricula, and age-appropriate assessments enable Singapore students to place at or near the top of international benchmarking exercises, such as TIMSS and PISA. Ultimately, it is about how these subjects help student teachers to make an impact on their students’ lives, allowing these young learners to contribute to society and engage with the world around them, rather than only the examination papers before them.

The NIE is developing teachers through programmes and activities outside of the academic sphere. These include learning portfolios, practicum placements, opportunities to be mentored by senior practising teachers, service learning, and professional development. Developing professionals cannot stop when student teachers graduate from the NIE. The professional development starts at the NIE and continues well into the teachers’ careers. Continuous, challenging learning must be the hallmark of education for years to come if we are to address our planet’s most pernicious and hitherto intractable problems.

Teacher education in the twenty-first century cannot be just about teacher training. It must be about developing professional leaders in the field of education, who are proactive problem-solvers and empowered researchers. It must be about a long-term vision of education and an inventive approach to develop teachers with design skills and an inquiring mindset in understanding the whole learner in the fast-changing digital and mobile world. Teacher education has to be dynamic. It cannot be fixated with student outcomes based primarily on a limited set of measures and attribution of student achievements. Teacher education is the starting point to helping our children meet the world of a new millennium. This volume sets the stage for the next phase of teacher education in Singapore and around the world.

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Chapter 1

Teacher Education Futures: Innovating Policy, Curriculum and Practices

Oon-Seng Tan, Woon-Chia Liu and Ee-Ling Low

1.1 Introduction

The twenty-first century is a time of rapid changes in an increasingly diverse and complex world. The advent of social media and mobile learning means that we are living in an increasingly interconnected and media-saturated society. It is difficult to predict how the world will look like in the next decade, yet teachers need to prepare their students to meet the challenges of the global workplace and society in the new millennium. Students will need to grapple with new technologies and changing global and societal structures. They will also be facing many emerging and complex, social and environmental issues that are currently unfathomable and therefore almost impossible to predict.

Education has to meet current needs while anticipating emerging trends and challenges for the future. Schools will need to operate with different paradigms of learning. Teachers as the most influential school factor in preparing students need to be equipped with new competencies. We need greater capacities to think in multiple ways; solve novel problems; learn how to learn, unlearn and even re-learn new concepts; communicate using different modalities; and work collaboratively.

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We need to reflect on our roles, think systematically about our own practices, draw on research to deepen our understanding, and adapt our teaching in ways that most effectively support student learning.

Teacher education in the twenty-first century is not about teacher training. It is about developing professional leaders in the field of education who are proactive problem-solvers and empowered researchers. It is Singapore's long-haul vision of education and an inventive approach to evolve the practice to develop teachers with design skills and an inquiring mindset in understanding the whole learner in the fast-changing digital and mobile world. Teacher education has to be plugged into a dynamic system and be future-oriented. It cannot be fixated with student outcomes based primarily on a limited set of measures and attribution of student achievements.

This book looks at Singapore's evolution and innovation of teacher education in the twenty-first century. It will cover teacher education reforms in Singapore, specifically the experience in conceptualising and implementing the National Institute of Education's (NIE) Teacher Education Model for the Twenty-First Century (TE²¹; NIE 2009), which includes curriculum improvements that align to new competencies; values development that re-envision teacher professionalism and calling; pedagogical changes that linkage strengthens and enhances teaching practices through school partnerships and mentoring. The book will conclude by discussing how teacher education research, especially in areas such as assessment and the development of teaching competencies, practices and mentoring, point to the possibilities of teachers impacting student learning and development, and underline the promising further enhancements that are made to Singapore's teacher education model. This book is meant for not only scholars, researchers, policy-makers, teacher educators but also for teachers and anyone interested in finding out the latest thinking and philosophy behind Singapore's unique TE²¹ model for the twenty-first century and beyond.

1.2 Teaching and Learning in the Twenty-First Century

“Learning without thought means labour lost; thought without learning is perilous” (Confucius, *Analects* II:15). The latter part of the proverb is especially poignant as we think of what is needed for the twenty-first century education landscape that is filled with uncertainties. Singapore needs to keep thinking and learning what is needed for the future, even if it is now being looked up to by many as being educationally high-performing. Around the world, people ask what knowledge and skills are most important for the increasingly diverse, interconnected, globalised learning environment and innovation-oriented societies of the twenty-first century. The goals of education can no longer simply be to provide literacy skills to students. The purpose of school has taken a big leap, interweaving teaching, learning and

preparation for the future together. As such, schools will need to operate with different paradigms of learning. Schools must teach disciplinary knowledge, in ways that also help students learn how to learn so that they can use knowledge in new situations and manage the demands of changing information, technologies, jobs and social conditions (Darling-Hammond and Adamson 2010).

As a consequence, teachers, as the most influential and pivotal factor of educational success, need to be equipped with new competencies. In the last two decades, many governments have paid increasing attention to the recruitment, preparation and retention of teachers. Teacher quality has become a significant policy issue. As OECD (2005) put in their report *Teachers Matter*:

All countries are seeking to improve their schools and to respond better to higher social and economic expectations. As the most significant and costly resource in schools, teachers are central to school improvement efforts. Improving the efficiency and equity of schooling depends, in large measure, on ensuring that competent people want to work as teachers, their teaching is of high quality and that all students have access to high quality teaching. (p. 1)

Teachers need greater capacities to think in multiple ways; solve novel problems; learn how to learn, unlearn and re-learn; communicate with multiple modalities; and work effectively in collaboration with others. Teacher education in the twenty-first century must be dynamic and future-oriented. The issues of teacher education reforms are multifaceted ranging from macro-policy problems to micro-level challenges pertaining to the design of practices.

Since the launch of the government's initiative, *Thinking Schools, Learning Nation* (TSLN) in 1997, education policy in Singapore has emphasised a vision of "a nation of thinking and committed citizens capable of meeting the challenges of the future, and an education system geared to the needs of the twenty-first century" (MOE 2008). In addition, then Education Minister Tharman Shanmugaratnam (2005, cited in Ng 2008) noted:

We need less dependence on rote learning, repetitive tests and a "one size fits all" type of instruction, and more on engaged learning, discovery through experiences, differentiated teaching, the learning of life-long skills, and the building of character, so that students can...develop the attributes, mind-sets, character and values for future success.

More than just to cater to the increasing demands of twenty-first century learning, NIE is Singapore's education innovation think-tank. With its partners, the Ministry of Education (MOE) and schools, NIE is helping shape the future of education. This book has been put together to examine how teacher education programmes are being implemented and continuously improved at NIE. The papers reveal the holistic and comprehensive approach of NIE's philosophy. They provide substantial evidence that for teacher education programmes to be effective, policy goals must be congruent to meet national and societal needs of the present and future.

1.3 Quality Teachers Make a Quality System

Research has shown that teacher quality is one of the factors that affect the overall educational performance of a country. Low and Tan establish in Chap. 2 how Singapore recruits and prepares its teachers, giving a background on the country's unique education system which consists of a highly integrated tripartite relationship between MOE, NIE and schools. The authors go in-depth into various teacher education pathways designed to ensure that each teacher progresses according to each individual's potential. They also explore NIE frameworks and models, such as TE²¹, V³SK and Graduand Teacher Competencies (GTCs), that help guide a teacher from life as a student teacher to life as a professional. These frameworks and models are aligned with MOE's Teacher Growth Model (TGM).

Likewise, in Chap. 3, Tan and Liu examine how the teacher factor is enhanced through NIE's teacher education programmes to ensure that teachers are highly skilled, well resourced and motivated to perform their best. Furthermore, the chapter highlights Singapore's sustained commitment in elevating teacher status and symbol in Singapore's society, heightening teacher commitment and competency, and enhancing teacher professionalism by giving teachers a voice and autonomy.

1.4 A Holistic Teacher Education

Teachers are expected not only to have the knowledge and competence to teach well but also need to have a strong commitment and passion to the profession and to the students (Darling-Hammond 2001). How then can this be ensured? For Singapore, it starts with a value-driven paradigm to strengthen a holistic education. In Chap. 4, Tan, Low and Sim emphasise that values, skills and knowledge are what underpins teacher education in Singapore through its student-centred education model. The authors argue that values can be both caught and taught as expressed through the service learning programmes and values education courses that NIE offers (for the service learning programmes, see Chap. 3 for the Meranti Project, and Chap. 13 for the Group Endeavours in Service Learning [GESL] and the Youth Expedition Project [YEP]).

In Chap. 5, Chua and Chye present the EPIIC (Experiential, Participatory, Inquiry-based, Image-rich and Connected) Framework that is used in NIE's classrooms. The authors best summarise the importance of EPIIC as "Embedded in the EPIIC learning environment are opportunities for students teachers to be active in research and inquiry and to ride on technologies to connect with resources of information and knowledge across disciplines." This ensures that teachers of tomorrow are always relevant and responsive to the times at hand. It is increasingly recognised that teacher educators now need to nurture aspiring teachers to be self-directed learners, active collaborators and metacognitive reflective practitioners with advanced pedagogies.

1.4.1 Pedagogy and Understanding Learners

Teachers need to develop not only content and pedagogical mastery, but also the mastery of understanding their learners and facilitating their learning. Chapter 6 describes the role of the Education Studies (ES) modules being offered at NIE. The mandatory ES core courses offered in pre-service programmes are: Educational Psychology: Theories and Applications for Learning and Teaching (EP); Teaching and Managing Learners at the primary/secondary/junior college levels (TM); ICT for Meaningful Learning (ICT); the Social Context of Teaching and Learning (SC); Character and Citizenship Education (CCE); and Assessment. Building on one another through different perspectives, these core courses are designed to address four main questions that would help student teachers understand the fundamental theories and concepts of teaching and learning:

- Who are you as a teacher in school and society?
- Who are your learners and how do they learn?
- How do you teach your learners?
- How do you manage the learning environment?

A strong knowledge-based foundation for professional learning is needed for beginning teachers to aid them in responding to the increasingly complex and challenging work of teaching. To this, Lim and Huan argue that ES courses can prepare teachers to reflect on, develop and sustain a personal teaching and learning philosophy, which are supported by the V³SK Model. Student teachers examine and explore these topics during their practicum and service learning periods. Ultimately, student teachers will become knowledgeable, skilful, flexible and compassionate members of the teaching profession.

1.4.2 Subject Matters

NIE prepares teachers to teach across all subjects in Singapore's schools. This book will, however, only cover three subjects, namely Mathematics, Science and Geography.

Tay, Lim, Ho and Toh note in Chap. 7 that Mathematics teachers must be equipped with Mathematics content knowledge and Mathematics pedagogical content knowledge. The authors examine the literature regarding the relationship between the two and focus on the less understood Mathematics content knowledge. The authors interestingly note that it is important for teachers to be aware that mathematics content itself needs to be relevant to their immediate teaching needs. To bring this about, NIE conceptualised the School Mathematics Mastery Test (SMMT) which serves to motivate prospective teachers to acquire the mastery of the subject.

Chapter 8 discusses the professional learning and development of Science teachers to meet the changes in the Science curricula, especially in areas of scientific literacy and the development of the teachers' pedagogical content knowledge. To illustrate further, Wong, Tan, Lee and Tan highlight the use of case studies and snapshots from initial teacher preparation programmes and practicum. They also look into continuing teacher professional development through learning communities and networks. Through these initiatives, teachers should not only teach how Science contributes to the advancement society, but also how it can be used in decision-making in both socio-scientific and everyday issues.

Scholars have continually documented the importance and effectiveness of Geography education in invigorating the cognitive and affective domains of students. From her previous analysis on the reflections of student teachers, Tan (2012) revealed that many present-day teachers had minimal or no fieldwork experiences at their secondary schools or junior colleges, and NIE seeks to improve this situation. In Chap. 9, Tan lists nine guiding principles for the inquiry-based fieldwork module. She also documents how student teachers perceive fieldwork and describes how the course serves as a highly important transitional space where student teachers, through experiential learning, acquire the necessary Geography pedagogical content knowledge skills as well as the psychological readiness in planning and implementing fieldwork for when they are in schools. This transition has a powerful effect in altering one's perspective and better informs the student teachers on what is required in the field of teaching.

1.4.3 Practicum and Mentoring

As highlighted in other chapters, twenty-first century teacher education at NIE aims to prepare teachers who are able to think in context and are adept in skilful, reflective and innovative teaching (Tan et al. 2012). It is essential for teachers to be able to systematically reflect, think and continuously endeavour to strengthen their competencies so they can provide effective teaching and learning to their students. More than just being transmitter of knowledge, twenty-first century teachers have to also evolve into creative thinkers and researchers. NIE developed the e-Portfolio to provide a platform for student teachers to be autonomous learners, thinking teachers and reflective practitioners. How this was conceptualised is detailed in Chap. 10, where Liu, Koh and Chua describe how the e-Portfolio initiative opens an opportunity for student teachers to articulate their teaching philosophy, shares their reflections and understanding of their complete role as teachers. Not only is the e-Portfolio embedded within the Professional Practice and Inquiry course for concrete application, it can also be used in the student teacher's professional life. This gives them an opportunity to claim ownership of both their learning and professional development.

Supporting the autonomous thinking teacher framework, Chap. 11 explores the practicum component at NIE underscoring the five key tenets that contribute to the

success of student teaching and clinical experiences. These clinical experiences, along with reflection, allow student teachers to nurture the ability to consolidate thinking and action. NIE's enhanced practicum model uses focused conversations as a way to deepen inquiry and reinforce theory–practice relationship. Liu, Tan and Wong also accentuated the important roles school coordinating mentors (SCMs) and cooperating teachers (CTs) play in the development of student teachers' learning during practicum.

Chapter 12 looks at the mentoring climate in Singapore schools spearheaded by MOE and the Academy of Singapore Teachers (AST) and which NIE helped conceptualised. Png and Liu focus on the significance of mentoring and the roles of mentors in relation to student teachers as the former guides the latter's practicum in schools. Using the e-Portfolio makes it easy for mentors and the institute to see a mentee's holistic development. Also highlighted in the chapter is the strong partnership between NIE and the schools in order to make the mentoring framework work. The driving force of this initiative is to provide "purposeful mentoring." The NIE mentoring framework has gone beyond the transitional and transitional paradigms as SCMs and CTs become co-learners and co-inquirers. Mentees benefit from the mentor's experience, and this may even add to the mentor's own professional development.

1.4.4 Community and New Learning Spaces

Post-Singapore independence endeavours to have a character education that is concentrated on nation-building. This is emphasised in various national initiatives and syllabi, such as Social Studies, Civics and Moral Education, and National Education. Chapter 13 talks about building character and citizenship through service learning, where D'Rozario, Tan and Avila highlight two service learning programmes offered in NIE's pre-service teacher education. First, the Group Endeavours in Service Learning (GESL) is a programme which gives student teachers the opportunity to engage with the local community. In return, the community becomes their "teacher" and their learning environment. Second, the Youth Expedition Project (YEP) is a voluntary service learning programme offered to student teachers who want to serve in overseas communities. Both programmes are based on NIE's V³SK Framework and MOE's Twenty-First Century Competencies and Student Outcome (21st CC) Framework (MOE 2016). The chapter shows the reflections of some student teachers who have gone these experiences.

In accordance to the changing landscapes of holistic learning, NIE embraces the need to redesign activities and pedagogy to support student-centred learning. Divaharan, Wong and Tan in Chap. 14 describe how NIE strives to push initiatives that change the learning spaces and make use of technology for students to think critically, be creative and construct their own learning. In recent years, NIE has created collaborative learning spaces to enhance the learning experiences of student

teachers. The authors look into how digital learning spaces, NIE's classrooms and even the NIE Library were transformed to support this sort of learning.

1.4.5 Professional Development

Consistent with the aim of providing quality teacher education described in previous chapters, Chap. 15 describes professional development opportunities for teachers. Ng and Low explain that NIE provides both pre-service teacher education and in-service professional development to all teachers and school leaders from the primary and secondary schools to the junior colleges. NIE's pre-service education programmes include a 4-year undergraduate degree programme and a 1-year post-graduate programme. In-service education includes post-graduate masters and doctorate programmes, leadership and management programmes, and regular courses and seminars. The system acknowledges that more opportunities for initial and continuing professional development are needed to be able to provide the high-quality teachers it needs. Along with AST, NIE helps teachers in gaining new knowledge and skills as they advance in their career.

Several processes have been established to assess the quality of teachers produced by NIE. These processes are designed for self-improvement and accountability purposes. In Chap. 16, Neibart and Lee discuss the comprehensive evaluation system of NIE's pre-service and in-service programmes and highlight recent innovative efforts to collect authentic performance data that promotes students' professional practice and provides valuable information that feed into the strategic advancement of NIE as an institute. In Chap. 17, Tan, Liu and Low look towards the future and envisage how NIE is striving to keep relevant to the needs of the society, education system, teachers and students.

1.5 Summary

Overall, this book aims to focus on Singapore's perspectives on teacher education in the twenty-first century. The acknowledgement of the importance of a shared educational purpose, quality teachers, attention to student needs, parent and community involvement, and career and self-interest exploration are hallmarks of a successful twenty-first century education (Kaufman 2013). With globalisation and the rapid progression of technology, the influx of information is abundant. It is thus important for teachers and students to recognise what kind of information matters, why it matters and how to combine it with other information (Silva 2008). Even more, NIE sees how quality learning that comes with deep thinking produces gain and how deep thinking with good learning can create a good and stable future.

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Chapter 2

Teacher Education Policy: Recruitment, Preparation and Progression

Ee-Ling Low and Oon-Seng Tan

2.1 Introduction

Despite the small geographical size of the nation, the Singapore economy is one of the most prosperous in the world. Not only does it rank as the best country in the world to do business (*Economy Watch* 2011), but Singapore has also been highlighted as a high-performing education system with features that other systems could learn from (Barber and Mourshed 2007). The Organisation for Economic Cooperation and Development (OECD 2010) also commented on the strong link between education and economic development in Singapore, as well as between policy formulation and policy implementation. By continuously investing in the upgrading of its education system, Singapore's curriculum is well-developed with rigorous standards aligned to instruction and assessment. Education spending usually makes up about 20% of the annual national budget. In 2010, there was an increase of 11% budget over 2009's budget, providing a total of \$9.88 billion (Singapore Budget 2010, 2011). The total projected expenditure of the Ministry of Education (MOE) in FY2014 is S\$10.5 billion (Singapore Budget 2015). Of the total 2014 estimated expenditure, \$10.60 billion or 91.27% was for the operating expenditure, while the remaining \$888 million or 8.73% was for the development expenditure (Ministry of Finance 2014).

MOE oversees and manages all Singapore's state schools and has a strong supervisory role over private schools. In 2015, the island state had 182 primary schools, of which 46 are government-funded private schools, and 154 secondary

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schools, of which 31 are government-funded private institutions. The size of the teaching force stands at about 33,000 (En 2014). Being a single system, Singapore is able to design a comprehensive strategy to develop a high-quality educational system, and at the centre of this approach are the well-trained and well-supported teachers and school leaders (Darling-Hammond 2013).

Knowing that teacher quality makes the largest difference in student achievement, the most effective school systems invest in the professional and personal development of their educators (Mizell 2010). This chapter documents how teachers are selected from the top 30% of each cohort in Singapore, MOE's teacher education sponsorship of selected candidates, the teacher education pathways available and the career progression tracks. These are underpinned by a respective framework to ensure that each teacher's career development prospects are carefully tailored to the individual, thereby allowing each individual to fully realise his or her potential.

2.1.1 Singaporean Students' Performance in Internationally Benchmarked Tests

In recent years, Singapore has ranked among the top five countries in the world in internationally benchmarked tests of science, mathematics and reading achievement. In 2012, Singapore was ranked fifth in the world by the Pearson Group, which did a survey on the cognitive skills and educational attainment levels of children in 50 countries and territories (Yong 2012). In the 2012 Programme for International Student Assessment (PISA) given to 15-year-old school pupils of OECD member and non-member nations, Singapore emerged second in mathematics, science and reading (OECD 2014). In the 2011 Trends in International Mathematics and Science Study (TIMSS), Singapore's Primary 4 (Grade 4) students performed best in the world in mathematics and second best in science (Martin et al. 2012; Mullis et al. 2012a, b). Similarly, Secondary 2 (Grade 8) students led in science and came in second in mathematics (Martin et al. 2012; Mullis et al. 2012a, b). In the 2011 Progress in International Reading Literacy Study (PIRLS), Singapore's Primary 4 students also showed strength in reading, ranking fourth place out of 49 countries (Mullis et al. 2012a, b). National assessments tell a similar story. In 2013, 97.5% of Singaporean students passed their sixth-grade 'leaving' examination (*The Straits Times* 2013). Likewise, Singapore's universities are at par with the world's best. Based on the 2015/2016 QS World University Rankings, both the National University of Singapore (NUS) and the Nanyang Technological University (NTU) have improved their international rankings, with NUS at 12th and remaining the top Asian university and NTU at 13th place (*QS Top Universities* 2016). NTU is also the top ranked university for universities aged 50 years or younger (*QS Top Universities* 2015).

In 2007, McKinsey and Company recognised Singapore as one of the top-performing education systems in the world in its study (Barber and Mourshed

2007). Three important factors, which Singapore had, set the top 10 performing school systems apart were emphasised in the report: (1) get the right people to be teachers, (2) develop them into effective teachers and (3) ensure that the system is able to deliver the best possible instruction to all children. This chapter focuses on the first two factors and makes a deliberate attempt to take a deep dive into the systemic processes. The second section will first provide a broad overview of the Singapore education system to provide a background understanding before delving into the actual selection, recruitment, preparation and development process for teachers within the system.

2.2 Background of the Singapore Education System

The mission of education in Singapore is to mould the future of the nation—that is, to provide the best learning opportunities for young people who will eventually lead the nation and, hence, determine its future. What sets the Singapore education apart is that it is a well-structured, well-planned and efficient system which provides education pathways and differently paced curricula to tailor to the various student needs, capabilities, aptitudes and learning modalities. Abilities and interests of students are identified early on, and the system's flexible education programmes try to accommodate the different requirements of each group of students (Tan et al. 2007). Singapore's education is geared towards providing a holistic education allowing students to draw from a diversity of knowledge, learning experiences and opportunities in order to pursue their passions and develop special talents (MOE 2012). The goal is to nurture young Singaporeans to develop a strong moral conscience and a future-oriented mindset so that they will be ready to compete in the highly innovative and highly entrepreneurial economy of the future (Chen 2000; Lee 2006; Shanmugaratnam 2003, 2004, 2006; Teo 1999a, b, 2001a, b).

There is a minimum of 10 years compulsory education, comprising six years of primary education and four years of secondary education (Fig. 2.1), which every child in Singapore must undergo. Formal education begins at the age of seven with primary education that comprises a four-year foundation stage (from Primary 1–4 or Grades 1–4) and a two-year orientation stage from Primary 5–6 (Grades 5–6). Students are encouraged to participate in co-curricular activities (CCAs) and Community Involvement Programmes (CIPs). The six years of primary education end with the Primary School Leaving Examinations (PSLE). Following the successful completion of PSLE, all students proceed to do four or five years of secondary education. Depending on how they perform in PSLE, students are placed into the express, normal (academic) or normal (technical) streams. Students placed in the four-year express stream will work towards the Singapore–Cambridge General Certificate of Education (GCE) 'O' level examination (taken at Secondary 4 or Grade 10). Students posted to the normal (academic) stream will do the GCE 'N' level examination after four years and may progress for another year to do the GCE 'O' level examination; selected 'N' level students may also take certain 'O'

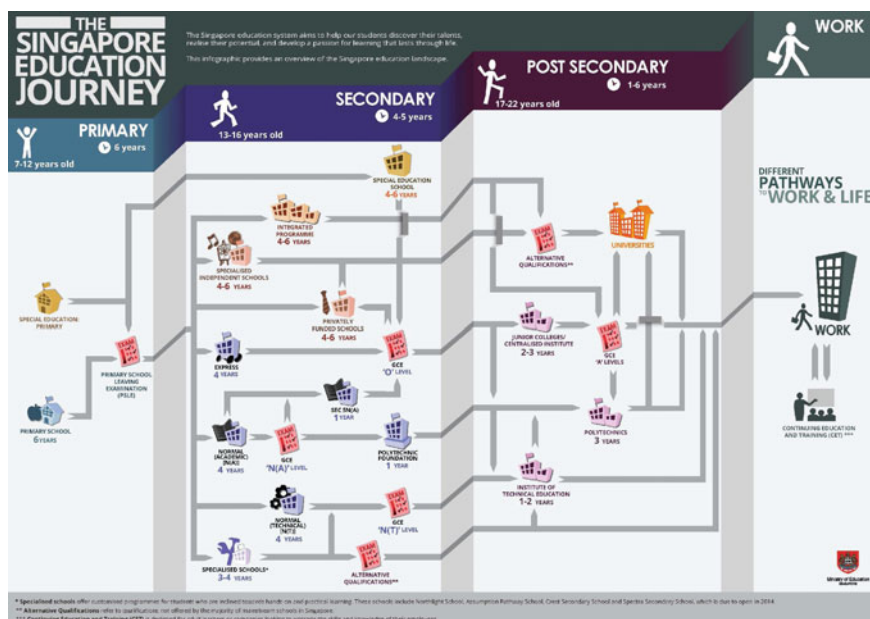


Fig. 2.1 Various education pathways in the Singapore education system (MOE 2016c). *Source* Ministry of Education, Singapore (2016)

level subjects in their fourth year. The normal (technical) course is a four-year course leading to the GCE 'N' level examination with subjects of technical and practical emphasis.

Post-secondary education lasts for two or three years depending on whether students are enrolled in junior colleges (JC), centralised institutes (CIs) and the Institutes of Technical Education (ITEs). Students from ITEs can continue to further their studies in the polytechnics. The five polytechnics, namely Singapore Polytechnic, Ngee Ann Polytechnic, Temasek Polytechnic, Nanyang Polytechnic and Republic Polytechnic, provide a comprehensive range of post-secondary programmes that meet the needs of industries and businesses. Alternatively, students in certain niche programmes may continue to pursue technical diplomas in ITEs. These technical diplomas, held in collaborations with quality foreign institutions, provide an upgrading pathway for students in niche, skills-based programmes. Upon the successful completion of post-secondary education from their respective JCs, CIs and polytechnics, students can then proceed to apply for entry into universities, either locally or abroad.

This section has provided a quick overview of the Singapore education journey, while the next section will explain how MOE, the National Institute of Education (NIE) which is the nation's sole teacher education institute, and all schools in Singapore work in close partnership to deliver a highly qualified teaching workforce for Singapore.

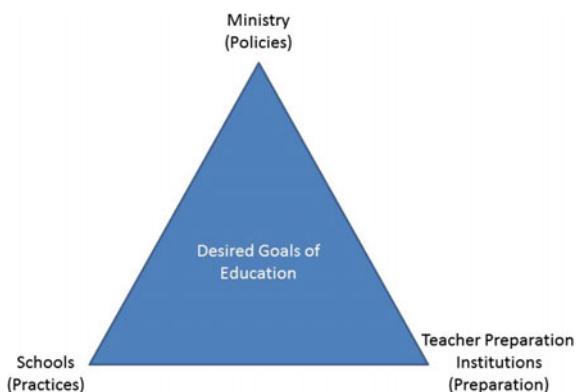
2.3 The Singapore Teaching Workforce

Singapore confronts the multifaceted challenges of education by a matrix of connectivity and alignment, enabling a balance of autonomy and optimal monitoring and resourcing. Teacher education at NIE builds on MOE's vision for education, which is for Singapore to become a nation of thinking and committed citizens who have the ability, attitude and skill to contribute towards Singapore's continued growth and prosperity, and can become creative thinkers, lifelong learners and leaders of change. There is a well-balanced 'autonomy versus standardisation' framework guiding MOE, NIE and the schools in their practices. Each plays a distinct yet harmonising role to achieve the desired education outcomes.

Having recognised that the quality of teachers determines the quality of education, Singapore was also cognisant that a strong and sustained strategic partnership was needed between the key educational stakeholders, namely MOE, NIE and all schools in Singapore (NIE 2009). The Policies-Practices-Partnership (PPP) Model (Fig. 2.2), mooted by Lee and Low (2014), aims to provide the necessary collaborative framework of shared values and goals which are aligned to a unified outcome.

MOE, being the pivotal lead agency of the education system, provides the leadership to establish the goals of education. MOE has articulated a set of desired student and key competencies that learners ought to possess for the twenty-first century (known as the Twenty-First Century Competencies and Student Outcomes Framework that is meant to produce a confident person, a self-directed learner, an active contributor and a concerned citizen; MOE 2016a). With these goals and outcomes of education being articulated, key education policies can be put in place in enabling these goals to be achieved. NIE and schools are key enablers in ensuring that the goals of education are achieved and are responsible for translating the policies into practices that allow students to be educated in a way that achieves the desired goals. For schools, this involves proper planning and implementation of the curricula studied, pedagogies adopted, design of the learning environment and

Fig. 2.2 Schematic representation of the PPP model for education in Singapore (Lee and Low 2014)



assessment practices. CCAs that ensure that values are being inculcated in students and a good character is developed are also essential. For NIE, this involves translating the policies into relevant preparation programmes to ensure that teachers have the competencies to deliver the desired outcomes.

2.4 Recruitment, Preparation and Progression of Singapore Teachers

In order to meet the changing needs and demands of the twenty-first-century learning environment, it is critical for Singapore to be able to attract, select and retain the people needed to educate the younger generation. While MOE takes sole responsibility over the recruitment, preparation, certification, appointment and deployment of teachers for Singapore schools, this is not done in isolation but by partnering NIE, schools and other stakeholders (e.g. teachers, parents, other government ministries, universities and the private sector). As Singapore seeks to continue providing high level of qualifications among teachers, engagements like these go beyond those related to licensing standards that are common in other countries. Every year, MOE gets feedback from schools as well as its own data to make strategic forecasting on recruitment, planning for new schools, initiatives and programmes. This section details the national teaching standards from recruitment to preparation to progression in the teaching career.

2.4.1 Academic Qualifications Required for Teaching

MOE recruits teachers from the top one-third of each cohort of the graduating class that qualifies for tertiary education, and only one of eight applicants interviewed is accepted. Apart from satisfying basic academic standards, aspiring teachers also must have the aptitude and interest in teaching. This is ascertained in the interviews held by MOE officers and experienced principals and teachers (Teo 2000). Throughout the year, MOE organises several recruitment seminars named as ‘Teaching as a Career’ for interested applicants to attend as well as an opportunity for them to ask questions. Prospective students can apply to either a graduate or non-graduate teacher education programme depending on their academic qualifications. The Ministry also invests heavily in the branding of the teaching career as one that is intricately linked with the important mission of nation building. For example, a bus advertisement on teaching had the following tagline, ‘Shaping the future of the nation: One student at a time’.

To be eligible to be a graduate teacher, students must possess a university degree (bachelors, undergraduate or college), including having done coursework in the requisite teaching subjects. If the desired programme involves teaching a major

subject in school, the individual must have studied at the undergraduate level to qualify to teach such a subject (see MOE 2015a, b, c for the specified disciplinary majors). To be considered in a non-graduate programme, the applicant must have the following academic qualifications: (a) the General Certificate of Education (GCE) 'O' level (Grade 10); (b) GCE 'A' level (Grade 12); or (c) a polytechnic diploma. Students are then shortlisted for the interview once they satisfy the admission criteria of the teacher education programme chosen. The interviews seek to find out more about a potential teacher in terms of the individual's passion for teaching, ability to communicate well with others, creativity and innovative spirit, confidence, leadership qualities and potential to be a good role model.

Unlike in other countries, the recruitment, preparation and deployment of teachers in Singapore are unique. It is important to note that student teachers are hired as full-time civil-service employees (called General Education Officers) of the Ministry and therefore are sponsored to attend NIE programmes. Student teachers receive a monthly salary, including Central Provident Fund (CPF)¹ contributions, year-end bonuses, NIE tuition grant and other benefits. As this is a huge capital investment by the government in terms of salaries and tuition grants, student teachers are required to serve a teaching bond, which ranges from three to four years, after they graduate from NIE. This teaching bond is also a guaranteed teaching position in schools. While the base salaries are not particularly high when compared to many other top-performing countries, they are high enough to make monetary compensation an unimportant consideration for candidates weighing teaching against other professions. As a guide, beginning teachers are paid equivalent salaries to those of beginning accountants and engineers in the civil service. Singapore also has a system of generous bonuses that boost teachers' salaries over the course of their careers. The bonuses are based on Singapore's sophisticated teacher appraisal system which will be described later in this chapter.

Having covered the stringent selection and recruitment policies, the next section will briefly describe the rigorous pre-service teacher education programmes.

2.4.2 Teacher Preparation

NIE, located within NTU, is the only teacher education institution in Singapore. NIE offers different programmes that cater to different teaching candidates, depending on their level of education and qualification. These are the Diploma in Education (DipEd), the Postgraduate Diploma in Education (PGDE) and the Bachelor of Arts/Science (Education) (BA/BSc Ed); and the course durations range from one to four years. NIE programmes focus on the development of pedagogical,

¹The Central Provident Fund (CPF) is a comprehensive social security savings plan for the Singapore workforce.

skills and knowledge competencies. The curriculum is regularly updated to reflect the changing needs of twenty-first-century learners.

In its endeavour to develop a strong teaching force for the twenty-first century, NIE designed and implemented a new Teacher Education Model for the Twenty-First Century (TE²¹; NIE 2009). TE²¹ comprises six recommendations that are intended to enhance the key elements of teacher education, which include the underlying philosophy, curriculum, desired outcomes for teachers and academic pathways. The V³SK Model (values, skills and knowledge; see Fig. 2.3) highlights the requisite knowledge and skills that Singapore teachers must possess in meeting the challenges of the twenty-first-century classroom. The V³SK Model represents the underpinning philosophy of teacher education at NIE, which is values-driven. How the model has impacted the pre-service and in-service teachers of NIE will be discussed in the subsequent chapters. The three value paradigms of V³SK are as follows:

- *Learner-centredness values* which place the learner at the centre of teachers' work. The teacher is acutely aware of the learner's development and diversity, believes that all learners can learn, care for others, strive for scholarship in content teaching, know how people learn best, and learn to design the best learning environment possible.
- *A strong sense of teacher identity* refers to having high standards and strong drive to learn in view of rapid changes in the education milieu and to being responsive to students' needs.

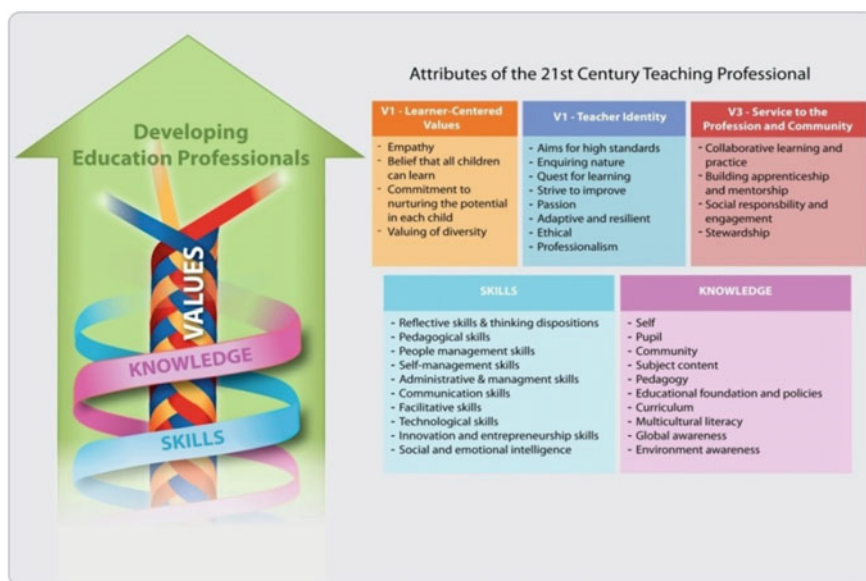


Fig. 2.3 V³SK model (NIE 2009)

- *Service to the profession and community* focuses on teachers’ commitment to their profession through active collaborations and striving to become better practitioners to benefit the teaching community.

Furthermore, an internal reorganisation at NIE in March 2014 created the Strategic Planning and Academic Quality (SPAQ) office to tap on the synergies and linkages between strategic planning and evidence-informed academic quality enhancement efforts to aid institute-wide planning, decision-making and quality assurance. SPAQ assists the NIE leadership in overseeing the formulation, implementation and communication of the Institute’s medium-term strategic plan. Figure 2.4 shows the framework used for evaluation to ensure that NIE teacher education philosophy set in the V³SK are upheld.

The evaluation cycle framework looks at three components—processes, product and input—that are essential in maintaining quality teaching and learning at NIE. Programmes are regularly assessed and an Academic Group Quality Review carried out to identify best practices, identify areas of improvement, and establish improved processes and performance outcomes. Likewise, to ascertain the preparedness of beginning teachers, surveys are conducted and graduation trends analysed. Finally, significant in maintaining consistent academic quality is the profile of student population; therefore, a rigorous admissions process is being observed.

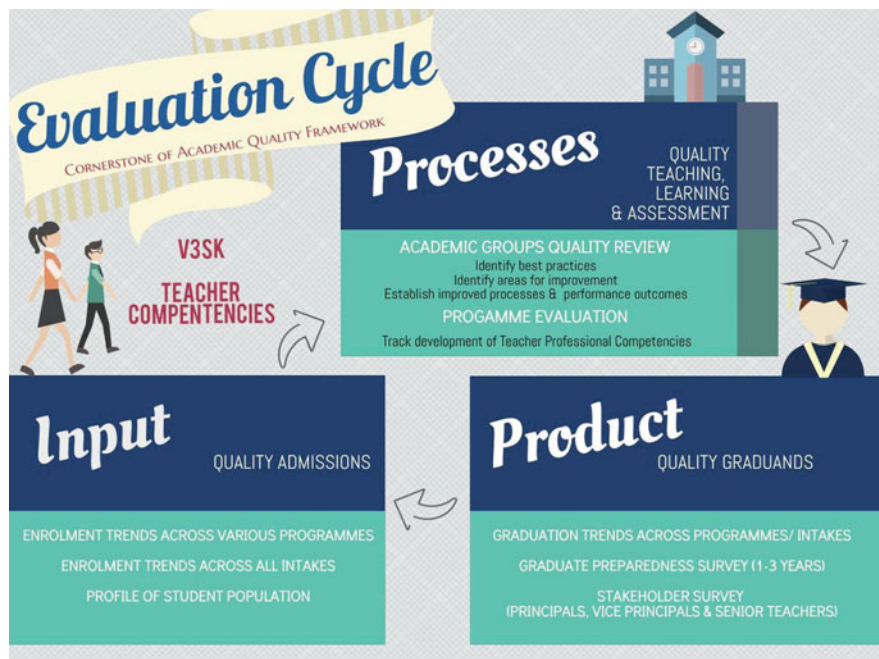


Fig. 2.4 SPAQ evaluation cycle (NIE 2014b)

2.4.3 Roles of NIE in Teacher Education

With the creation of the Teachers' Training College (TTC) in 1950, the offering of teacher education in Singapore on a long-term and organised basis commenced. Initially, TTC offered certificate courses in education for non-graduates. Graduate teachers were trained at the School of Education at the then University of Malaya (later the University of Singapore). Twenty-three years later, the Institute of Education (IE) was established out of TTC to train both graduate and non-graduate teachers on a full-time basis with a part-time teaching cadetship scheme. Less than a decade later in 1960, a full-time teacher-in-training programme was employed for all aspects of teacher preparation.

The present NIE is the product of the merger between IE and the College of Physical Education² in 1991, and it became an autonomous institute of NTU. Along with its autonomous status, NIE shares a dynamic relationship with MOE. While MOE hires the teachers, NIE prepares them and also collaborates with MOE to define the standards of academic qualifications when recruiting different categories of teachers and provides input into the selection process (Tan et al. 2007).

Due to this close partnership, all student teachers who successfully complete any of NIE's teacher education programmes automatically become certified to teach in the Singapore school system; there are no additional examinations and/or further certification needed through a separate teaching standards board as NIE under NTU acts as the accreditation board (Tan et al. 2007). Through its quality programmes and stated outcomes, NIE maintains the professional teaching standards that define what accomplished teachers should know and be able to do as they enter into schools. In this interrelated system, MOE and NIE act as the standards board.

Another pivotal role NIE plays in the Singapore education system is its involvement, through its faculty, in the numerous MOE curriculum review committees that make recommendations for any curriculum changes and initiatives. Such curricular changes are reflected in timely revisions to NIE's teacher education programmes with the aim that teachers are current in their knowledge and qualifications. This applies to both the preparation of new teachers and the professional development for over 33,000 practising teachers in over 360 schools (MOE 2012).

2.4.4 Programmes Offered by NIE to Prepare Teachers

NIE offers a variety of initial teaching preparation programmes to help individuals prepare for a teaching profession. These programmes are as follows: (a) Bachelor of Arts (Education)/Bachelor of Science (Education)/Bachelor of Education

²The College of Physical Education was set up in July 1984 to train specialist teachers in physical education.

(BA/BSc/BEd); (b) Diploma in Education programmes; and (c) Postgraduate Diploma in Education (PGDE) programmes.

The **undergraduate programmes** at NIE are positioned to combine the best of an academic degree with a good foundation in the field of education to produce graduates with the knowledge and skills to excel in careers in both education and education-related fields and beyond. The BA/BSc/BEd programmes admit candidates who hold either GCE 'A' Levels or polytechnic diplomas. Moreover, this programme also admits returning teachers with NIE Diploma qualifications, Certificate of Education and NIE's Advanced Diploma qualifications (NIE 2012–2013). Teaching tracks offered in the undergraduate programmes include the BA (Ed) (General) (Primary), BA(Ed) (Chinese/Malay Language Specialisation) (Primary), BA(Ed) (General) (Secondary), BA(Ed) (Chinese/Malay Language Specialisation) (Secondary), BSc(Ed) (General) (Primary), BSc(Ed) (Physical Education and Sports Science) (Primary), BSc(Ed) (General) (Secondary), BSc(Ed) (Physical Education and Sports Science) (Secondary) and BEd (Primary).

There are two tracks a student can take when pursuing a **Diploma in Education**: the General and the Specialisation. The General track prepares student teachers to become generalist primary school teachers, while the Specialisation track provides for specialisation in the teaching of the mother tongue languages and Physical Education at the primary or secondary school level, and Art, Music or Home Economics at the secondary level. Another area is in Special Needs Education, and candidates who are interested may be offered a Diploma in Special Education (DISE). DISE is a one-year full-time programme that prepares student teachers to teach children and young adults with a range of disabilities, including intellectual, physical, sensory, behavioural and psychological. Generally, the diploma programmes admit candidates who hold either GCE 'A' Levels or polytechnic diplomas, and candidates applying for DISE should have one-month relevant experience (NIE 2015–2016).

The **Postgraduate Diploma in Education (PGDE)** programme aims to prepare university graduates to become primary school, secondary school or junior college teachers. It is a one-year programme except for those specialising in the two-year PGDE (Physical Education). Candidates must hold at least a bachelor's degree to be admitted to the PGDE programme (NIE 2015a).

The **NTU-NIE Teaching Scholars Programme (TSP)** is the latest addition to Nanyang Technological University's (NTU) Premier Scholar's Programmes (PSP). TSP is a four-year programme that includes a multidisciplinary curriculum that supplements the core curriculum in the Bachelor of Arts (Education)/Bachelor of Science (Education) programme (NIE 2014a). TSP scholars are encouraged to pursue their interest and create their own learning plan through an extensive selection of electives offered at NIE, NTU or partnered overseas universities. To hone their research skills, scholars will embark on a research project with an eminent research mentor or through the Undergraduate Research Experience on Campus (URECA) offered at NTU. They will be exposed to a wide-array of innovative pedagogical approaches used to enhance learning such as collaborative learning, self-directed learning, problem-based learning and flipped classroom.

With the aim of preparing scholars to be future leaders of education, the TSP curriculum is designed to help them acquire practical experience from industry and become thought leaders on best practices and managements globally, and to sharpen their analytical skills and develop their research expertise. Scholars are able to attend overseas conference presentation, guaranteed an international practicum and/or semester exchange, given the opportunity to be involved in leading-edge research, and have the option to pursue postgraduate study.

2.4.5 *The Graduand Competency Framework*

Teacher education needs to be transformative in order to produce quality teachers equipped with the values, knowledge and skills to raise a new generation of twenty-first-century learners. TE²¹, which aims to prepare autonomous *thinking teachers* for the twenty-first century, is value-based, with a strong focus on the theory–practice nexus. One of the defining elements in the TE²¹ model is the use of the e-Portfolio to help student teachers build their conceptual map of learning and teaching. Recent studies have shown that there has been an increase in the worldwide use of e-Portfolios in higher education across Asia, USA and Europe (Chou and Chen 2009).

First piloted with the PGDE JC July 2010 cohort (NIE 2010) and subsequently formally implemented, the e-Portfolio initiative provides student teachers with a structure within which they document what they know and are able to do as teachers, and affords them ongoing opportunities to reflect about their growing understandings of what constitute good teaching (NIE 2012a, b). While the portfolio can take on various forms, NIE has chosen to utilise an e-platform, which allows student teachers to share their e-Portfolio with their school coordinating mentors (SCMs) and NIE supervisors during the focused conversations and pre- and post-practicum conference.

The NIE e-Portfolio is a learning and teaching portfolio (Fig. 2.5; for more details about the e-Portfolio, see Chap. 10). On the personal level, the e-Portfolio serves as a means for the student teacher to track his/her growth and experiences as a teacher, to chart his/her developmental journey and to be used to explore, extend, showcase and

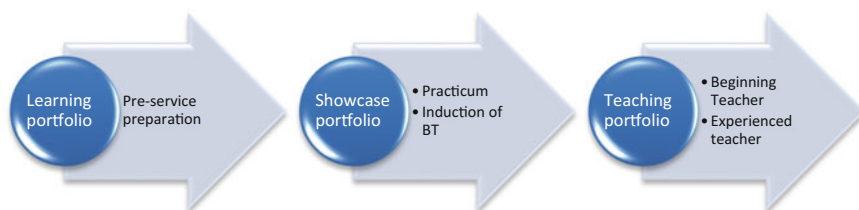


Fig. 2.5 Professional practice and inquiry (PPI) e-Portfolio model (NIE 2015b)

reflect on his/her personal learning. The e-Portfolio is potentially a vehicle for: (1) charting the academic journey of the student teacher from admission to graduation; (2) providing a platform for the student teacher to present his/her personal teaching philosophy over time; (3) providing evidence of the establishment of the theory–practice link in the student teacher; (4) providing an avenue for the integration of the reflective practice model (this will be explained further in Chap. 11); (5) providing evidence of the student teacher’s integration of V³SK; and (6) providing evidence of the attainment of the Graduand Teacher Competencies (GTCs).

The GTC Framework (Table 2.1) articulates a set of professional standards for NIE graduands. By aligning GTCs with the professional standards set by MOE, a common language is established and graduands will be able to continue developing these competencies beyond their pre-service preparation to the classroom. GTCs are also embedded in NIE’s programmes and courses, and used to evaluate student teacher outcomes. It provides student teachers with a common baseline to work towards, mentors with a good developmental framework to work with and stakeholders with clear expectations in terms of the competencies of NIE graduands should have upon graduation.

Table 2.1 Graduand teacher competency framework (NIE 2009)

Performance dimensions	Core competencies	Focus level of ITP learning
Professional practice	1. Nurturing the child	CB
	2. Providing quality learning of child	CB
	3. Providing quality learning of child in CCA	CB
	4. Cultivating knowledge:	AR
	i. With subject mastery	CB
	ii. With reflective thinking	CB
	iii. With analytic thinking	CB
	iv. With initiative	AR
	v. With creative teaching	AR
	vi. With a future focus	AR
Leadership and management	1. Winning hearts and minds:	AR
	i. Understanding the environment	AR
	ii. Developing others	AR
	2. Working with others:	AR
	i. Partnering parents	AR
	ii. Working in teams	CB
Personal effectiveness	1. Knowing self and others:	CB
	i. Tuning into self	CB
	ii. Exercising personal integrity	AR
	iii. Understanding and respecting others	CB
	iv. Resilience and adaptability	CB

What is noteworthy about GTCs is that they outline competencies where capacities have been built after the completion of pre-service education (i.e. capacities-built or CB) or where the awareness levels have been raised (i.e. awareness-raised or AR). Those marked AR outlines areas of professional development are required when they graduate to become beginning teachers.

2.4.6 Performance Appraisal and Career Pathways

Like any other profession in Singapore, the performance of teachers is appraised annually to enhance teacher effectiveness and ensure that the highest performing teachers have incentives to stay in the profession. Research has shown that given the prospect to progress in their careers and if they are generously remunerated for their outstanding work, high-performing employees are more likely to stay in the profession (Hausknecht 2009; Trevor et al. 2007). MOE is also a strong proponent that teacher quality affects the quality of the education system as much as curricula and that the performance appraisal system plays a key role in improving teacher quality (Teo 2001a, b). Instituted in 2005 as part of larger structural and cultural reforms throughout the educational system (Gopinathan 1999; Sharpe and Gopinathan 2002), the Enhanced Performance Management System (EPMS) provides a standardised framework of performance standards by which teachers, school leaders and administrators are routinely evaluated. EPMS encompasses the contribution of individual teachers to the academic and character development of their students, their collaboration with parents and community groups, and their contribution to their colleagues and the whole school. It sits within the context of great attention to the school's overall plan for educational excellence (OECD 2010). EPMS oversees the reward of promotions, tenure, salary increases and performance bonuses and underscores the importance of reflective practice among teachers.

Central to this system is the work review form, a standardised protocol that documents and evaluates the work of Job Holders (JHs) in MOE. The work review form enables reporting officers (ROs), heads of department, principals and ministry officials to 'track' the performances of teachers throughout their professional careers (Liew 2012). Recognising that teachers have different aspirations, MOE has identified three career tracks or fields of excellence for teachers to pursue depending on their interest, performance and potential. These are the teaching track, the leadership track, and the senior specialist track (Teo 2003; Fig. 2.6). (For more details about Singapore teacher career progression, see Chap. 15.)

The EPMS process involves performance planning, performance coaching and performance appraisal. Performance planning involves a teacher's self-appraisal and a discussion with his/her RO about goals setting and professional development plans. Performance coaching is ongoing and includes a formative mid-year review. By the end of the year, a performance appraisal is conducted through an interview and a rating of actual performance against goals set during the performance planning phase. Teachers are evaluated based on actual achievement as well as the

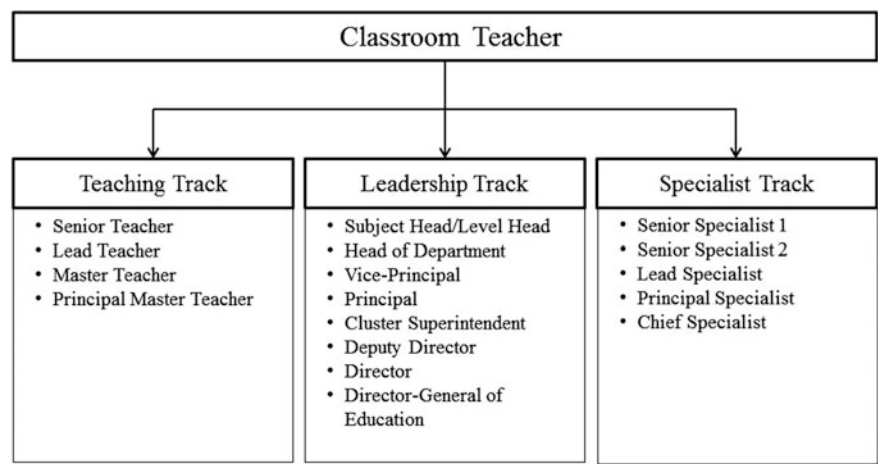


Fig. 2.6 Singapore career tracks in education (MOE 2016b). *Source* Ministry of Education, Singapore (2016)

teacher’s future potential known as the current estimated potential (CEP). CEP is decided by senior colleagues (e.g. department chairs, RO, principal) based on observation, dialogue, portfolio evidence and the teacher’s contribution to the school and community (Lee and Tan 2010). The final performance grade affects the annual performance bonus as well as promotions to the next level of the career pathway.

In 2014, EPMS underwent revision to improve implementation of processes and simplify programmes and activities. The Steering Committee led by the Human Resource Group (HRG) of MOE with the Academy of Singapore Teacher (AST) and the Organisational Psychology Branch actively worked with schools divisions and other stakeholder to review and enhance the EPMS appraisal and career planning process (Table 2.2).

The new system has a more qualitative approach and encourages JHs to go beyond numbers and include plans and outcomes. Even with the reduction in the quantity of information needed, the quality of information is not compromised since it captures the essential evidence and provides more room for in-depth discussion between JH and RO. With less time needed to complete the work review form, there is more time to plan for the teacher’s career growth more effectively.

2.4.7 Professional Growth

MOE introduced the GROW package in 2006 to promote the professional and personal Growth of Education Officers through better Recognition, Opportunities, and seeing to their Well-being. An enhanced GROW 2.0 package was introduced in

Table 2.2 Streamlining the EPMS appraisal and career planning process (adapted from MOE 2016d)

Items	Before (2005)	Changes (2014)
Work review form	The form was lengthy and tedious to complete. It consisted of 15 pages, 8 sections and 7 key result areas (KRAs)	Number of pages, sections and KRAs were reduced to five
Key result areas	Job holders (JHs) were unsure of the contributions to include in the appraisal form	The KRAs were categorised under three main headings: 1. Student outcomes: a. Quality learning of students b. Character development of students 2. Professional outcomes: a. Professional development of self b. Professional development of others 3. Organisational outcomes: a. Contributions to projects/committee work
Approach	More focused on quantitative outcomes	<i>Targets</i> were renamed <i>plans</i> to encourage JHs to go beyond numbers and include qualitative plans and outcomes
Merging sections (work review form)	Section 2.4: training and development plan during period under review Section 6: training and development plans for next assessment year	Sections 2.4 and 6 were merged into Sect. 2.3: learning and development plans
Connection between sections	The individual sections in the form came across as being separate, with no bearing on the other sections	The connections between various sections were indicated clearly for JHs to understand EPMS as a whole
Link between competencies and skills	There was no link between the competencies. JHs were tasked to develop and the skills highlighted in the learning frameworks, such as the Teacher Growth Model (TGM) and Leader Growth Model (LGM)	EPMS competencies were linked to the learning outcomes under the TGM and LGM
Broader definitions	Each competency was strictly defined by specific behavioural indicators (BIs). The JH was assessed on his competencies using a 4-point scale	In addition to BIs, each competency has a one-line definition that captures its elements. JH were more able to think more broadly about their development and were encouraged to have in-depth qualitative discussions with RO The 4-point scale had been removed. JH and RO will discuss the 13 competencies and identify areas of strengths in the context of

(continued)

Table 2.2 (continued)

Items	Before (2005)	Changes (2014)
		work outcomes states in Sect. 2.1 of the form The JH and RO will also identify competencies that the JH would like to develop for the year
Career development	There was one competency model for each career track—Teaching, Leadership and Senior Specialist. This made it difficult for those moving across tracks to monitor and plan their career development	The three models are integrated into one single Competency Model that is applicable to all three tracks. In the new Competency Model, there were 13 competencies categorised into four broad areas
Customised support	When EPMA was first rolled out in 2005, supporting materials comprising nearly 250 pages were provided to all educators regardless of their job function	The supporting materials had been streamlined into just two key documents—a 7-to-8-page user guide, and an A3 page checklist—to provide the right amount of customised support for teachers, ROs or school leaders

2007 with more attractive remuneration, better career development opportunities and greater flexibility to balance the demands of work and family. This complemented the introduction of the TEACH Framework to further support the professional upgrading and retention of teachers, as well as their aspirations and work–life needs (MOE 2016b; Heng 2012). The key thrusts of the TEACH Framework include supporting teacher-led professional development, supporting academic upgrading through postgraduate scholarships and awards, enhancing work–life harmony through greater flexibility in work arrangements and expanding the career advancement pathways for teachers (see Fig. 2.7).

There are several professional development opportunities for teachers to upgrade themselves and broaden their horizons. These include Professional Development Packages and Leave Scheme, Teachers’ Work Attachment programme, Management and Leadership in Schools (MLS) programme and Leaders in Education Programme (LEP), and AST. The Professional Development Packages and Leave Scheme programme (MOE 2016b) allows teachers to further their undergraduate/postgraduate studies through scholarships, study loans and leave provisions. The Teachers’ Work Attachment programme provides a chance for teachers to participate in short-term attachments at external organisations to gain new perspectives and exposure. Also available are opportunities for professional development courses and conferences to help upgrade their professional knowledge. Through AST, teachers are able to experience a stronger teacher-led culture of professional collaboration and excellence (2016b).

To deepen the engagement with teachers, the Education Ministry has partnered schools and teachers with human resource agencies, which will provide consultancy services on strategic. Likewise, MOE has provided multiple communication points,

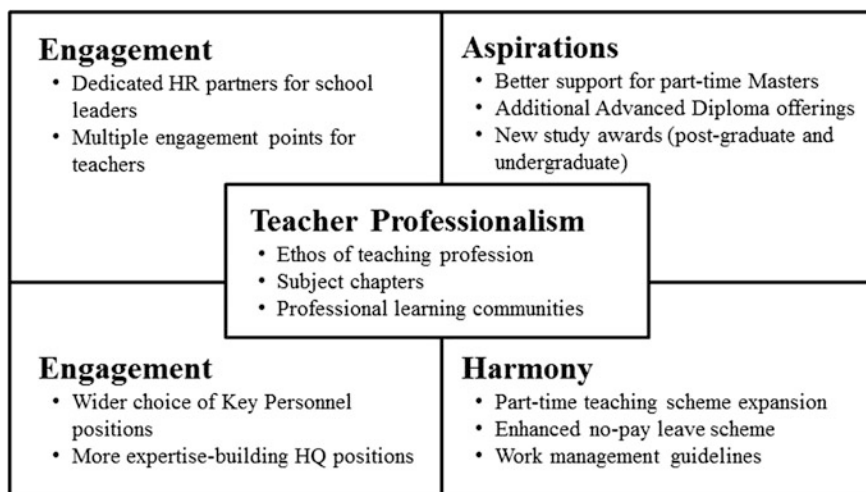


Fig. 2.7 TEACH Framework (MOE 2016b). *Source* Ministry of Education, Singapore (2016)

such as an online resource portal, administrative managers in school and a one-stop call centre, to strengthen engagement with teachers (MOE 2016b).

To upgrade their knowledge and skills, teachers are provided with opportunities to pursue further studies. For teachers who want to do a part-time master's degree, they are given the added option to take on part-time teaching while studying. Upon completing their part-time Master's degree in an approved course of study, teacher will be given a one-off monetary award of \$4,000. Additionally, the Ministry will introduce a full-time Postgraduate Award to encourage teachers to pursue higher studies. Non-graduate teachers can apply for a full-time Advanced Diploma programmes at NIE. Those who do well in the diploma course can pursue a degree programme. It is the objective that by 2020, almost all teachers will be graduates and those with postgraduate degrees increase to 20% (MOE 2016b).

With the creation of 1,500 more key personnel positions such as department heads and subject heads in schools, teachers can look forward to more chances of assuming middle-level leadership positions to enrich their career experience and deepen their expertise.

In achieving a work-life balance, a part-time teaching scheme will be extended to teachers pursuing part-time studies. Each school will be provided additional teachers and resources to support those who are doing part-time teaching. Flexible school-based employment will also be offered to teachers who need to go on no-pay leave due to childcare commitments or further studies. As part of the overall enhanced career management plan for teachers, schools will implement work management guidelines for the allocation of classroom, co-curricular and school duties.

2.5 Conclusion

As discussed, the V³SK framework embodied in the TE²¹ Model focuses on the main characteristics of the twenty-first-century professional, which reflect an extended role of the teacher as one with an enhanced sense of identity and mission directed towards students, colleagues and the wider community.

Perhaps the most striking feature of Singapore's teacher education and the process that produced is the comprehensiveness and coherence of the system. Good teacher education programmes entails a vision and mission of being able to prepare and equip teachers with the relevant values, skills and knowledge. The enormous will and expense it must take to design and fully prepare teachers involves a holistic effort of all key stakeholders in the education system who share the vision of education.

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Chapter 3

Championing the Teacher Factor

Oon-Seng Tan and Woon-Chia Liu

3.1 Introduction

In recent years, Singapore students have done well consistently in internationally benchmarked tests such as the Trends in Mathematics and Science Study (TIMSS), Progress International Reading Literacy Study (PIRLS) and Progress for International Student Assessment (PISA). This has led to much interest in our education system and speculations on the success factors. The achievement of the Singapore students, just like many other Asian students, has often been attributed to cultural antecedents of parental involvement and overemphasis on competition and grades. Such impressions obscure one of the cornerstones for enhancing education in Asia—the teacher factor. Although Singapore’s success can be accredited in part to the sustained commitment to developing a high-quality education system, the endeavour would not be possible without quality teachers. Teachers exert a huge influence on students. Their beliefs, motivation, knowledge and skill determine what students learn and how much they grow in their classrooms. This chapter will look at how Singapore champions the teacher factor through sustained commitment to the following fundamentals:

1. Teacher status and symbol
2. Teacher commitment and competence
3. Teacher advocacy and autonomy

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3.2 Teacher Status and Symbol

It is the status in society, the respect which fellow citizens hold you in, which is crucial in attracting to, and retaining within, the teaching service, a hard core of men and women in the schools who can maintain the high standards. (Lee 1972)

The status of teaching and the teaching profession is linked to the respect we accord teachers and the value we ascribe to the teaching profession. If a society does not respect or value teachers, it will not be able to attract and retain their best talents within the teaching profession, and teachers will not be able to do their job in the classrooms. With a focus on student achievement and accountability, there have been cases of teacher naming and shaming in some countries. With the advent of technology and proliferation of search engines, there have been doubts about the need for and value of teachers in the knowledge-based economy. Such erosion of the teacher symbol is a concern because teachers are more than just communicators of knowledge. They are leaders in pedagogical thinking, experts in content discipline and, perhaps more importantly, custodians of societal values.

In many Asian societies, teachers are held in high regards and have often been equated to the status of a “guru”, a “child’s first guide” or even a father. There is a Chinese saying that goes “a teacher for a day is a father for life”. Embedded in the wisdom of the saying is the high regard for teacher symbolism that signifies the deep respect the societies place on teachers. The cultural esteem for teachers is high in Singapore. A recent Varkey GEMS Foundation’s study asked 1000 people from all walks of life in 21 countries about how they viewed teachers in their society (Dolton and Marcenaro-Gutierrez 2013). The findings, published in the 2013 Global Teacher Status Index, showed that Singapore was ranked third, behind China and Turkey, in terms of the belief that students respect teachers. In addition, Singapore was ranked seventh out of 21 countries in terms of teacher status. Singapore emerged ahead of Finland, Britain and the USA but behind countries such as China, New Zealand and South Korea (Dolton and Marcenaro-Gutierrez 2013).

Nonetheless, the esteem a society has for its teachers cannot be taken for granted. It must be a key policy imperative. From the early years of nation building, Mr Lee Kuan Yew, Singapore’s founding Prime Minister, made it very clear that teachers are the decisive force in the classroom and in their care are entrusted the impressionable minds of young people and thus the future of the nation (Lee 1959, 1966). We proudly proclaim that our society believes in teachers (Tan 2012a). Teaching is viewed as a calling, not a vocation or a career, and a teacher is “not just a teacher of the subject but more importantly a teacher of the learner and a preserver and custodian of societal values” (Tan et al. 2012, p. 6). We are heartened that young Singaporeans with passion and conviction are drawn into teaching because they see it as worthwhile and meaningful work that is highly valued in the society. This high regard is reflected in political speeches and public media where teachers are lauded and the quality of teachers is upheld as a national priority (Goodwin 2012). It is also reflected in the 2013 Global Teacher Status Index report which showed Singapore

being ranked second, behind Finland, in the trust that we have in our education system and seventh in the trust we have in our teachers to deliver a good education (Dolton and Marcenaro-Gutierrez 2013).

To a large extent, the status of the profession is associated with the degree in which the profession is seen as a choice profession. According to the 2013 Global Teacher Status Index, the majority of respondents in Singapore would want their children to aspire to be teachers (ranked fifth; Dolton and Marcenaro-Gutierrez 2013). Whilst, according to the Singapore's Ministry of Education's (MOE) public perception survey, teaching is currently viewed as the most respected profession in terms of its contribution to society (Ministry of Education 2012a), and there is no shortage of outstanding young people who want to be teachers (Ministry of Education 2014), Singapore, just like South Korea and Finland, bolsters the teacher symbol by stringent entry requirements and a high standard of preparation and accreditation, and this, in turn, raises public perception of the quality of individuals entering the profession. We have a rigorous selection and recruitment process where only the top 30% qualify to apply and less than 50% of those who applied make it past the selection interview. To find the right balance between aptitude and attitude, Singapore uses a multi-pronged approach involving tools such as academic performance and/or an entrance proficiency test, interviews with experienced panels, classroom simulations, prior teaching experience, and/or vocational fit assessments. MOE and the National Institute of Education (NIE) set minimum prerequisites of qualification, attributes and preparation, as well as time and immersion in teacher preparation and development. The status of the profession is augmented by the fact that preparation and accreditation is by NIE, which is the sole teacher preparation institution in Singapore (see Chap. 2 for more details) and an autonomous institution within the research-intensive university Nanyang Technological University (NTU), highly ranked in the latest QS World University Rankings (QS Top Universities 2016). NTU is ranked thirteenth on the QS World University Rankings, whilst NIE is ranked tenth in the world and second in Asia in the subject of education in 2015.

Finally, although social standing is not linked to just salary, it is undeniable that it is one important dimension of how an occupation is regarded (Dolton and Marcenaro-Gutierrez 2013). In many countries, teachers' salaries tend to be below those of graduates engaged in other professions. However, in Singapore, the government closely tracks changes in the pay of professionals to ensure that the salaries of teachers remain competitive to other professions. In essence, a beginning teacher is paid as much as a beginning accountant and engineer. Like many top-performing countries, Singapore makes room for the best to progress towards higher salary scales through built-in merit increments. We also employ a range of related incentives such as performance and retention bonuses, and additional pay for extra duties taken. In addition, teachers are entitled to 100 h of fully paid professional development annually. They are also encouraged to continue learning with the provision of paid sabbatical leave (Goh and Gopinathan 2008).

3.3 Teacher Commitment and Competence

As mentioned earlier, Singapore champions the professionalism aspect of the teaching profession by maintaining, gatekeeping and striving for a high standard of preparation and accreditation. Although getting the right people to join the teaching profession is important, it is but the first step. To have quality teaching and teachers who are professionals, we need to have a rigorous teacher preparation that imbibes in them a sense of purpose and competence for their roles in the society. We need to develop teachers who see teaching as a calling, and have the intentionality and “unity of purpose in their personal aspirations, beliefs, interests and competencies with a view of impacting the next generation” (Tan 2012b, p. 6). We have to grow teachers who want to and can be depended upon to meet high standards of practice because they have undergone holistic and rigorous preparation (Goodwin 2012). We want them to be professional leaders in their classrooms, and help them develop the will and skills to draw upon theories and research to deepen their understanding and work with colleagues to better their practice throughout their career.

NIE has provided a voice for the kind of preparation and accreditation for the profession, and has mapped out the competencies required of twenty-first century educators. It has also played a major role in being involved in education research so that its teacher preparation programmes are evidence-based. To prepare teachers who are professionals, NIE initiated a new Teacher Education Model for the twenty-first century (TE²¹) in 2010 (see Chap. 1 for more details). NIE TE²¹ is a transformative endeavour that aims to develop autonomous thinking teachers (Tan and Liu 2015; Tan et al. 2012), that is teachers who are able to reflect on their roles, draw upon theories and research to deepen their understanding of learning, think systematically about their practice, and adapt their teaching to support their students’ learning (Cochran-Smith and Lytle 1999; Darling-Hammond 2006; Tan and Liu 2015).

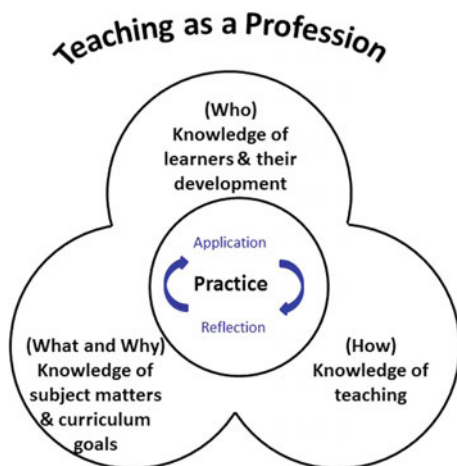
The conceptual framework of NIE’s pre-service programmes (see Fig. 3.1) is premised on the belief that for teaching and learning to be effective, teachers need to have the knowledge, skills and dispositions in the areas of

- knowledge of learners and their development,
- conceptions of curriculum content and goals, and
- ability to teach in the light of the content and learners to be taught.

The framework is built on Dewey’s notion that the needs of the child and the demands of the curriculum are mediated by teachers (Dewey 1902), and is adapted from Darling-Hammond and Bransford’s (2005) conceptualisation of the knowledge bases for teaching. It is also aligned to MOE’s Singapore Quality Teaching for Quality Learning (SCQTL) Framework comprising the domains of Learners and Learning, Curriculum, Assessment and Pedagogy (LCAP).

In the Singapore context, the interacting spheres of learners, content and teaching are framed by one important condition for practice, that is the fact that teaching is a profession. This means that teachers must be governed by professional

Fig. 3.1 A framework for understanding teaching and learning



ethos, as well as scholarly and technical expectations (Darling-Hammond and Bransford 2005; Shulman 1998). Amongst others, it means that teachers have a moral and ethical commitment of service to the nation and society. In addition, they are expected to acquire a body of scholarly knowledge that forms the basis of entitlement of practice and the judgement in applying the knowledge. Just like other professions, they also need to spend time in practice and developing their practice.

The emphasis on moral and ethical commitment of the teaching profession explicates why the underpinning philosophy of NIE's pre-service programmes is the V³SK Framework, where values (V³) form the central pillar with skills (S) and knowledge (K) expected of a twenty-first century teacher wrapped around it (see Chap. 4 for more details). It explains NIE's focus on building pre-service teachers' sense of intentionality and purpose by underscoring teacher identity and having a sense of pride and commitment to the teaching profession. It also highlights the significance of programme components such as (1) Meranti, where pre-service teachers are challenged to confront their beliefs and think deeply about their commitment to the child and the nation (Tan and Liu 2015), (2) Professional Practice and Inquiry (PPI), where pre-service teachers crystallise and share their teaching philosophy (see Chap. 11 for more details) and (3) Group Endeavour in Service Learning (GESL), where pre-service teachers "learn to serve" and "serve to learn" in the community (see Chap. 13 for more details). In addition, it underlines the significance of the recital of the Teachers' Pledge at milestone events such as the Teacher Compass Ceremony (commencement ceremony) and the Teacher Investiture Ceremony (graduation ceremony). Essentially, the recital of the Teachers' Pledge is akin to doctors taking the Hippocratic oath. It represents a public declaration of teachers' commitment to the mission of the profession and the professional ethical standards. It also serves to bind the teachers to the greater community of teachers.

Although it is important to have well-designed courses that include core knowledge bases of teaching and learning, the capacity for teaching must be learned through action. Thus, practice is at the centre of the framework. It is the spine of NIE's pre-service programmes and it is crucial to provide opportunities for practice and a process of "application" and "reflection" so that teachers can "learn for teaching" and "learn from teaching" (see Chap. 12 for more details; Liu et al. 2014). To help pre-service teachers integrate and aggregate their learning (see Chap. 2 for more details), NIE introduced a "Learning and Teaching Portfolio" situated within the PPI "meta"course (see Chap. 11 for more details). The course is the "glue" of the programmes, and it provides the framework for pre-service teachers to crystallise their teaching philosophy, build their cognitive map of teaching and learning, and demonstrate what they know and are able to do as teachers (Tan and Liu 2015).

Singapore has recently adopted a more long-term perspective of preparing teachers so that teachers go through an immersive experience to better prepare them professionally for the many demands of teaching. (Chap. 2 has given a thorough coverage of the programme offerings and highlights will be made herewith.) To this end, NIE has reviewed and developed an enhanced Bachelor of Arts (Education)/Bachelor of Science (Education) programme with teaching scholars as the mainstay for teacher preparation. Specifically, the core curriculum in the 4-year degree programme is positioned to integrate the best of an academic degree with a good foundation in the field of education. It has a strong research focus which exposes pre-service teachers to both education and content research. It provides pre-service teachers with opportunities to crystallise their teacher identity, explore global issues, develop unique insights and cultivate competencies that extend beyond the classrooms through experiences such as service learning, semester exchange and teaching assistantship in other high-performing education systems. The new NTU-NIE Teaching Scholars Programme (TSP) includes a multidisciplinary curriculum that supplements the core curriculum in the 4-year degree programmes. It aims to nurture graduates that are steeped in values, with intellectual rigour, strong leadership and global perspective so that they can make significant contributions to the future education landscape. It provides opportunities for TSP scholars to be mentored by eminent academics and research scientists in cutting-edge research, and to intern with government statutory boards and leading industry partners.

At a time where teacher preparation is being scrutinised worldwide and teacher education institutions find themselves trying to justify their existence, MOE's endorsement and support of TSP and the 4-year Bachelor of Arts (Education)/Bachelor of Science (Education) programme goes a long way in consolidating the status of the teaching profession in Singapore. In essence, Singapore is making the statement that if it takes 5 years to train a doctor and 3 years to train a lawyer, teachers, being the foundation of all professions, should have dedicated and immersive preparation too.

It is encouraging that the studies conducted on Singapore teachers showed promising results in terms of teachers' level of commitment. Research has linked the type of motivation with the level of commitment of teachers (Wang and Fwu 2001),

that is those who are driven by intrinsic motivation are more likely to be committed to the teaching profession compared to their extrinsically motivated counterparts. A study by Chong and Low (2009) found that Singapore pre-service teachers entered the teaching career not only with positive attitudes towards teaching but also motivated by intrinsic and altruistic factors such as interest in teaching and contribution to society as opposed to tangible rewards such as salary. Besides, Singapore pre-service teachers' belief in the value of teaching was also found to remain strong after four years in the teacher education programme (Chong et al. 2011). Together with the latest statistics showing 44.4% of the total number of teachers having length of service of 10 years and above (Ministry of Education 2015), it seems plausible to expect teachers in Singapore to be committed to the teaching career in the long run.

3.4 Teacher Advocacy and Autonomy

The “commonplaces” that all professions share include having an advocate for the profession and a professional voice (Shulman 1998). For the teaching profession, the setting up of the Academy of Singapore Teachers (AST) in 2010 was a significant milestone. It is now a home for teachers to grow as professionals and educators (Ministry of Education 2010). The AST champions teacher professionalism by building a teacher-led culture of professional excellence, being an advocate of the ethos of the teaching profession and fostering a culture of professional pride.

It is noteworthy that AST developed the Teacher Growth Model, which maps out the core learning areas of holistic professional growth and development for Singapore teachers. The desired outcomes are identified as (1) the ethical educator, (2) the competent professional, (3) the collaborative learner, (4) the transformational leader and (5) the community builder (Ministry of Education 2012b). As an ethical educator, the teacher must be able to display high professional standards of integrity and moral courage, and is a role model to students and colleagues. As a competent professional, the teacher must be able to continue to develop new knowledge, skills and dispositions to lead, care and inspire. As a collaborative learner, the teacher must actively engage in professional conversations and collaborates with other teachers to address professional concerns and challenges. As a transformational leader, the teacher must build trusting relationships amongst practitioners and manage changes. As a community builder, the teacher must understand Singapore's unique context and appreciates local and global issues (Ministry of Education 2012b). Moreover, in 2012, the teaching fraternity drew up its Code of Profession Conduct, which guides teachers in their words and actions.

Although the respect a society has for the teaching profession is important, the status of teaching is influenced by the extent to which teachers are treated as “professionals” and are empowered within the school system. Teachers need to have the autonomy in decision-making (Adedoyin 2012), in terms of exercising some influence on a school's capacity to improve student performance and having the professional judgment about “what” and “how” to teach (Muijs and Harris 2003).

This is exemplified in Finland where the success of the Finnish system has frequently been attributed to the culture of trust, and the “creation of a respected profession in which teachers have considerable authority and autonomy” (Darling-Hammond and Rothman 2011). To be professionals, teachers also need to have a say in their own professional development (Schleicher 2012).

From the early years of mud flats and shanty huts, the Singapore government has made a clear commitment that it is the duty of the government to create the conditions and give teachers the means to fulfil their role (Lee 1959). MOE offers various resources to support teachers in schools, from allied educators such as school counsellors to learning and behavioural support, from sponsored professional development to participating in professional learning networks. In terms of autonomy in the classroom, there has been greater decentralisation of administrative and pedagogical authority to schools within the last decade. As we enter the “student-centric, values-driven” education phase, there is a clear effort from MOE to empower teachers in classroom practice, and principals have been given more freedom to make management decisions.

Teachers have the potential to impact many generations of students. Hence, they need to possess a high level of expertise to do their job well and have the requisite competencies for performing their roles throughout their career. They must be able to teach increasingly diverse learners, and are expected to be knowledgeable about student learning, competent in complex academic content, and skilful in the craft of teaching (Darling-Hammond et al. 2009). They need to adapt to the dynamic needs of the students and the community (Day and Sachs 2004). NIE is aware that pre-service programmes, no matter how comprehensive, can never impart all the professional knowledge that teachers need or give them the solution to all eventualities. As such, we have strived to build a learning culture as part of the “DNA” of the teaching fraternity. MOE has also positioned professional development as an integral part of the teaching profession. Throughout their careers, teachers are encouraged to take charge of their own professional development, with a focus on developing their areas of interests and strengths, and helping them develop holistically.

After initial teacher preparation and accreditation at NIE, a Beginning Teacher Orientation Programme (BTOP) inducts newly accredited teachers into the teaching profession. They are mentored through induction and school-based structured mentoring as they continue to strengthen their teacher identity and deepen their craft. As they grow in their profession, teachers are supported so that they keep up with developments in their fields, and mentored to apply new educational theories and practices to the classroom. They are encouraged to translate education policies into practical and effective programmes to meet the learning needs of their pupils.

It will be recalled that MOE sponsors 100 h of paid professional development per year for each teacher, whilst paid higher degree opportunities tenable locally or abroad are made possible via the Professional Development Continuum Model. Professional development leaves are also funded by MOE and allow for part-time study, travel, work in an international school or work in other industries to develop a better understanding of the applications of their teaching to the real world (Sclafani and Lim 2008). Apart from the provision of time and funding, MOE has

also set up various platforms for teachers to learn and co-learn through participation in Networked Learning Community (NLC), Subject Chapters and Professional Learning Communities (PLC). In addition, nearly half of our teachers participate in some form of educational inquiry and research in a topic of their own interest. By participating in varied professional activities, teachers take charge of their own professional development and contribute to improving educational practice in their schools (Miedema and Stam 2008). As a whole, sharing ideas, experience and good practice helps in raising the education system to a higher level. But more importantly, it provides teachers with opportunities to connect, co-construct, collaborate and communicate within the community of professionals.

In Singapore, we not only invest in teachers but also recognise that different teachers have different aspirations and strengths. We celebrate the differentiations and have three career tracks specially designed to recognise the different talents of our teachers. They are the Teaching Track, Leadership Track and Specialist Track (see Chaps. 2 and 15 for more details). The career tracks allow teachers to be recognised for their passion and motivate them to work towards building their competencies and refining their skills in order to reach the pinnacle of professional excellence. The clear professional pathways also signal professional authority and autonomy amongst teaching professionals.

3.5 Conclusion

Our vision of teachers must go beyond them being mere transmitters of knowledge. They must be seen as professionals with the intention and purpose to impact the next generation through their roles as custodians of societal values, facilitators in learning, leaders in pedagogical thinking, experts in content discipline and even inspirational role models. The teacher factor has been variously described as being the “most important variable”, the “main driver” and the factor that “trumps all others” in explaining the forces shaping student development and learning. In Singapore, MOE and NIE have worked together in strong partnerships to champion the teacher factor through building a cultural regard for teachers, developing teacher commitment and competence, and enhancing teacher professionalism by giving teachers a voice and autonomy. As members of a valued profession, teachers must also recognise their responsibility in upholding their professionalism.

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Chapter 4

Underpinning Philosophy of Teacher Education in Singapore: A Values-Driven Paradigm

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4.1 Introduction

Education is a dynamic social phenomenon and can change with social transitions such as globalisation. Consequently, facets of the education system, such as teaching and learning which are the school's main core business and responsibility, must also be constantly updated to stay relevant. Specifically, it is important to ensure that school activities and resources are augmented to benefit both teachers and students. In the same way, various innovations in curriculum and pedagogy are regularly developed and experimented on to keep up with the fast-changing world. These changes have not only created new demands in the areas of knowledge and technology but have also transformed the trend and profile of students. In doing so, teaching and learning have been modified, making them more challenging than before. Scholars, such as Goodwin (2010) and Rong and Preissle (2009), have argued that three new norms are presently influencing education. First, classrooms are more and more diverse, almost regardless of where they are. Second, the faculty of teachers may well be a mix of local and international ones and present teachers

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can expect a high chance of this. They themselves may be the ones who are responding to regional or international job offers. Third, teachers will instruct children who do not only form a diverse group but will also have very unique and challenging needs. From an operational perspective, these challenges require mindful teaching (MacDonald and Shirley 2009) and a thoughtful curriculum to ensure that success in teaching and learning is achieved (Grigsby et al. 2010).

It has been extensively written that the main drivers in making these efforts more effective are the teachers, but not just any teacher. The presence of thoughtful, committed and passionate educators is a prerequisite in any school in the twenty-first century. Dewey, in *How We Think* (1933) and “The Relation of Theory to Practice in Education” (1904), emphasised the role of the teacher in the creating school experiences. Darling-Hammond (2001) noted that student teachers are expected to have the knowledge and competence to adeptly teach as well as a strong commitment and passion to the profession and to their students. Rowe (2004) explained that it is critical for teachers to develop a keen sense of identity and integrity. Accordingly, this would mean that teachers need to cultivate essential dispositions such as empathy, commitment and positive view of self and others that will deepen their understanding of the teaching profession.

4.2 Values: Caught and/or Taught?

From this perspective, an institution of teacher education is a vital step in the drive to improve the effectiveness of teaching and learning through a values-driven education. As Huebner (1996) argued, the activity of teaching is moral activity only when students are in the presence of teachers who are encouraging and helpful in dealing with life’s ambiguities. Arendt (1961) wrote that no one should be a teacher if that person does not love the world as much as that person loves a child. Her description places great moral demands upon the teacher. But how can values be instilled and character be developed in students? British writer Morris (2011) once said: “it is easy to agree about the importance of teaching citizenship and values, but it belongs to an area of learning that we’ve struggled to develop the language to discuss”.

Teaching values, in general, is much contested. Some believe that values should not be taught or imposed, rather should be transmitted. Kirk (1982) argued that values are learnt through a process and not formal studies and that students gather their moral and values from their experiences. He advocated for the presence of strong role models for the youth to follow. The danger, however, lies in the fact that students infer their values from highly visible people who are not living moral lives. Here is where schools can step in by surrounding students with teachers who are quality exemplars of what it means to live a moral life. Only when a student engages with the world, analyses it critically and judges it against their own experiences and feelings can they acquire values that are truly internalised.

On the other hand, there are those who believe that values can be both taught and caught. Shields (2011) noted that the relationship between having values taught or transmitted is a mutual one. Character develops best when teachers explicitly teach the skills (or competencies) needed to put values in action. These skills, however, must also be lived; they have to be part of the core norms guiding everyday behaviour. Davidson (2010) highlighted the military as an institution, which is almost without equal in their ability to consistently shape character and culture. Although most organisations are not like the military, he argued that every effective institution (e.g. school, family and team) must shape values and morals with the same intentionality.

What Singapore has done so far was reaffirm the central place of values and character development in its education system. Many of the schools have made their mottos and values come alive and have created innovative and whole-school approaches in character development (Heng 2011). Values are not just taught; they are often caught. It is the experiences in various contexts, especially the demanding and challenging ones, that build character and enable students to develop the feelings for others and opportunities to act on their values. This chapter explores the underpinning philosophy of teacher education in Singapore which has a three-pronged set of values as its central pillar.

4.3 Quality Teaching and Values Education

Quality teaching is intimately related to values education. Huebner (1996) has described teaching as a moral activity, in which he argued for the need to identify the moral and ethical problems created by the structures of schooling. These are the problems teachers face as they live and work in school. How teachers face and resolve these problems influences young people as much or more than the direct teaching of values. There have been an increasing number of researches on the nexus between quality teaching and positive relationship-building that have been observed in recent years (Lovat and Clement 2007; Lovat and Toomey 2009, 2010; Sykes 2003). Experts have noted the crucial call for teacher education institutions to afford student teachers with opportunities to gain knowledge and experience a “positive, encouraging, caring and trusting learning ambience where the relationships between teacher and student, and student and student, are the priority” (Lovat et al. 2009, p. 19). In their study, Lovat and Toomey (2009) highlighted values education as the missing link in quality teaching. More than competencies, research has shown that relationship qualities and values play an important role in the development of students. According to Harnett and Kline (2005), a good teacher is a person who can not only teach well but also understand and act upon the intricacies of the social dynamic within the classroom. The Senate Standing Committee on Education, Employment and Workplace Relations (Parliament of Australia 2007) stated:

Quality teaching requires that those entering the profession are committed to their vocation, have a strong academic rounding relevant to their field of teaching, including theories of teaching and learning, and have the capacity to grow in knowledge and skill as they promote growth in their students. (Para 3.1)

This implies that quality teaching is connected to the personal and professional commitment of teachers. Such commitments create an impact on the improvement of significant dispositions to be achieved in teacher education programmes. Likewise, attention has been drawn as to how values education creates the type of environment in which quality can grow and, in the process, develop well-rounded students (e.g. Davidson et al. 2010; Lovat et al. 2009). There are studies, however, that acknowledge the fact that values education is still largely a neglected area in most teacher education programmes around the world even though values education is not something new or extra but building upon what already exists. Seemingly, there are student teachers who receive little or no preparation in values education, compared to other areas of teacher education (Franberg 2004, 2006 as cited in Thornberg 2008). This is not surprising, because values can be personalised, politicised and contested and thus avoided in the school and teacher education curriculum.

In 2007, the Standing Committee of Australia identified four possible commitments or dispositions relevant to quality teaching that need to be developed (Parliament of Australia 2007). First, quality teachers need to have a positive attitude towards the vocation of teaching. Second, they need to attain an academic depth in a specialist learning area. Third, they need to recognise the importance of and engage in further and ongoing professional learning. Last, they should possess a desire to see students grow and develop as a result of their ability to explicitly teach and model a core set of values. These values help shape quality interpersonal relationships in ways that positively affect the ambience of the school and enable quality teaching and learning (2007).

Student teachers need personal and insightful experience of leadership, community engagement and care to strengthen their understanding of the connection between quality teaching and values education. They need to exercise ethical judgement and have a sense of social responsibility too. In their pre-service teaching years, student teachers learn ways of teaching, the value of teaching, the positive relationships they can foster with young people and their desire to make a difference and these are forged together to form “a good teacher”. As Palmer (1997) emphasised, “good teaching cannot be reduced to technique; good teaching comes from the identity and integrity of the teacher”. This identity and integrity, or self-efficacy, allows teachers to become “more real” to students and has the capacity to teach with authority. Ethridge (2006) also pointed out that “through experiential learning the (student teachers) faced their fears, learned from their mistakes and became effective advocates” (p. 62) for learning through risk-taking. Leadership is an important quality for teachers to develop, especially if teachers are to model active citizenship to their young charges.

4.3.1 Values Education in Pre-Service Teacher Education

If teaching values education is to be successful, then pre-service teacher education programmes must explicitly model and teach the knowledge and skills in values education and related topics. It has been shown that values education is seen to have a positive impact on student learning effects and school ambience (e.g. Lovat et al. 2009). If teachers are expected to develop critical thinking skills, reflection and lifelong learning amongst their students, it is necessary to involve a values education component in the pre-service teacher education curriculum. And if teachers want to be effective in the classroom, they themselves must have participated in the processes and reflected on the values and dispositions of becoming a teacher. In the first place, both student teachers and school students need opportunities to “walk the talk” of values education. This is what makes service learning essential in pre-service education where student teachers are able to direct their purpose more clearly at the quality teaching outcomes of communicative competence, self-reflection, empathic character and intellectual depth. A values-driven paradigm in teacher education programme focused on active citizenship offers such opportunities.

Crowe and Berry (2007) emphasised that beginning teachers need more than a set of activities, ideas and techniques to help them become deliberate, thoughtful teachers who understand the relationship between their teaching and the quality of their students’ learning. Long has it been stressed on the necessity behind substantive areas, such as psychology and pedagogical skills building in teacher education, where links between theory and practice are weak (Korthagen and Kessels 1999). Although knowledge and skills are unquestionably important, quality teaching does not stop there. In the twenty-first century, beginning teachers need the skills and strategies to be more reflective, critical and open-minded, as well as to possess a good disposition to lifelong learning (Curtis 2010). One way of developing these attributes in a pre-service teacher education programme is to underpin a values-driven paradigm as an integrated pedagogical orientation to teaching.

4.3.2 Quality Teaching, Service Learning and Teacher Education

Having service learning as a part of a teacher education programme is a beneficial avenue for pre-service teachers to further cultivate other important attributes of a quality teacher. Student teachers who participate wholeheartedly in service learning can practise empathy, service and leadership in different and challenging situations. This allows pre-service teachers to utilise these attributes and be able to understand where a student is coming from, thereby making a connection in order to teach well. They are able to develop trustful and caring relationships (Palmer 1997), creating a

quality teaching and learning environment that enables greater self-knowledge. Habermas (1990) asserted that through this growth of self-knowing, one can become a person of integrity and passion whom students can relate to and who can motivate students to learn.

Today, many education institutions use service learning to strengthen teacher education, enhance community life and foster civic responsibility amongst their students. Increasingly, service learning has been at the helm of the civic engagement of higher education, as more and more colleges and universities actively embrace the concept of “the engaged campus” and make civic education a priority (Bringle 2001; Hollander et al. 2001). In March 2001, then Tuft University President John DiBiaggio opened his keynote at the American Association of Higher Education Conference by saying: service learning has taken off.

Roots of service learning in the field of teacher education date back to the early twentieth century through the work of John Dewey, who spearheaded the progressive education movement and emphasised learner-centred instruction (Dewey 1938). Kolb (1984) adapted Dewey’s six-step inquiry process into a four-component learning cycle suited for experiential learning, which has been used widely to develop service learning curricula. These components are as follows: (1) concrete experience, (2) reflection on the experience, (3) synthesis and abstract conceptualisation and (4) active experimentation that tests the concepts in new situations. Service learning can also be defined as experiential education that engages participants in activities focused on human and community needs with opportunities that are purposefully designed to encourage student learning and development (Jacoby 1996). In addition to experiential learning models, theoretical constructs such as critical pedagogy (Ruiz and Fernandez-Balboa 2005), social reconstruction (Bond and McKenzie 1999) and civic responsibility (Wade 1995) have been used to investigate service learning. [For in-depth details on why and how the National Institute of Education (NIE) uses service learning to develop its student teachers, see Chap. 13.]

4.4 Philosophy of Singapore’s Teacher Education Values-Anchored Paradigm

Since 1950, teacher education in Singapore has kept relevant and responsive to changing local and global education landscapes and continues to be committed to ensuring the highest standards of quality and excellence (NIE 2009). It has kept pace with the education developments that are geared towards responding to the needs of the people. But beyond the economic pursuit of developing citizens, Singapore tries to maintain an education system that adopts a holistic approach that preserves national culture, identity and values rooted in the family and community (Lee and Tay-Koay 2009).

Teachers are the most significant resource in schools and are critical in raising the education standards of a country. Thus, ensuring that teachers are highly skilled, well-resourced and motivated to perform at their best will give students the best chance to learn well and improve the efficiency and equity of schooling. This is the policy direction most likely to lead to substantial gains in student learning (Organisation for Economic Co-operation and Development 2005). Teacher education in Singapore attempts to engage education with its multifaceted challenges by a matrix of connectivity and alignment allowing for a balance of autonomy and optimal monitoring and resourcing. Teacher education builds on MOE's well-grounded vision for Singapore to become a country of thinking, reflective and committed citizens who will contribute towards continued growth and prosperity of the nation and will become creative thinkers, lifelong learners and leaders of change.

4.4.1 A Shift to a Values-Driven Paradigm

In his keynote address at the MOE Work Plan Seminar 2013, then Minister for Education presented the new direction for the education system, a student-centric and values-driven education in three aspects: breadth, depth and length (Heng 2013). Breadth is about valuing children by giving them a broad and holistic education that allows them to explore and discover their interests and talents over a wide range of disciplines. Depth is about deep values and a deep commitment to Singapore where each child is instilled with a strong core of values and character, which further nurtures into a strong commitment to Singapore and fellow Singaporeans. Likewise, depth in foundation, that is, to develop a strong foundation of literacy, numeracy and twenty-first-century competencies, is encouraged. Length is about lifelong learning, where students find their purpose in life and their chosen field, explore the truth and contribute to the society.

What children experience in school and outside school today ultimately impacts the society of the future. Education influences how a child learns and how the child interacts with his/her environment. Governments of most nations today recognise that in the long haul, education is the most important investment and the quality of education will impact on the societal and nation building, people's capacity for adapting to change, value creation and innovation in every sphere of life.

The Singapore education miracle lies in her strategic goal congruence of education policymakers, school leaders and teacher educators. The tripartite partnership of the Ministry of Education (MOE), schools and NIE ensures that the vision (what we hope to achieve for the future), the mission (what we are called do) and the implementation (what eventually happens in the school and classroom) of education are dynamically aligned. To ensure that teacher education stays relevant and responsive, NIE constantly reviews and updates the curriculum and professional development programmes for teachers to ensure that teacher education stays relevant and responsive. This is important as teacher education is critical to the success

of curriculum reform. Holding the twenty-first-century learner at the heart of education, NIE equips twenty-first-century pre-service and in-service teachers with a broader set of competencies and this sets the basis for the transformative teacher education model for the twenty-first century (TE²¹; see Chap. 2 for more details).

TE²¹ presents recommendations that are intended to enhance the key elements of teacher education, including the underlying philosophy, curriculum, desired outcomes for teachers and academic pathways. NIE's V³SK Model (see Chap. 2 for more details), which stands for values³ (V), skills (S), and knowledge (K), underscores the requisite knowledge and skills that teachers must possess in meeting the challenges of the twenty-first-century classroom: first, placing the learner at the centre of the teacher's work; second, building a strong identity as a professional; and third, service to the profession and community.

The strength of NIE's programmes is based on its strong integration between content and pedagogical preparation backed by evidenced-based education research. At the same time, experiential learning is emphasised as student teachers are immersed into a holistic educational experience, so they can develop into twenty-first-century teaching professionals who will bring out enhanced learning outcomes for pupils in schools. The attributes highlighted in the V³SK Model and MOE's Twenty-First-Century Competencies and Student Outcomes Framework (MOE 2016) are eminently brought out through the service learning programme as a holistic approach in developing values, skills and knowledge of teachers. The programmes create opportunity for student teachers to understand oneself, to reach out to the community and foster care, to respect diversity, and to have a collaborative team spirit, professional commitment and dedication. Specific skills involve reflective, pedagogical, communicative, facilitative, social and emotional intelligence. Areas of knowledge desired include self, pupil, community, subject content and multicultural literacy. In addition to these values, equipping teachers with the most recent knowledge and most innovative skills will enable them to be twenty-first-century classroom-ready.

As student teachers graduate to become beginning teachers, they are expected to be lifelong learners. To enable this, NIE provides teachers with ample opportunities for professional development and this constant communication strengthens the links between teachers and the teacher education fraternity. This is further assisted by the Graduand Teacher Competencies (GTCs) Framework, which articulates a set of professional standards for NIE graduands. By aligning GTCs with the professional standards set by MOE, a common language will be established and graduands will continue to develop these competencies beyond their preparation to the classroom. GTCs have been embedded in NIE's programmes and courses and are used to evaluate student teacher outcomes. They provide mentors with a good developmental framework to work with, and student teachers with a common baseline to work towards. Last, GTCs provide clear expectations for stakeholders in terms of the competencies of NIE graduands. (See Chap. 2 for more details about the GTC Framework and its core competencies.)

4.4.2 Components of NIE Teacher Education that Reflects Values-Driven Paradigm

Group Endeavours in Service Learning

In line with MOE's vision for Singapore teachers, NIE seeks to develop teachers who will be able to lead, care for and inspire our youth, and to be future role models for their students, as well as to forge trusting partnerships with the community around the school. The purpose of service learning is to inculcate values of service, expose future teachers to the process of service learning, and to help student teachers gain a healthy attitude towards volunteerism and community service. NIE is one of the few institutions in Southeast Asia, which has adopted service learning as a pedagogical tool to provide opportunities for student teachers to reach out to the community and enhance these positive qualities as educators. The programme known as Group Endeavours in Service Learning (GESL) at NIE was made mandatory across all initial teacher preparation programmes from July 2005 onwards. To date, over 10,000 student teachers have learnt from and served the local community, such as schools, non-profit organisations and social welfare services.

NIE student teachers engage in a *group learning* experience with community partners to carry out their projects, and in the process, develop group skills such as managing time, setting goals and working towards a common purpose. Past participants felt they have learnt how to function in a group and as a group. Working within a group structure facilitates *personal growth* for student teachers in terms of their interpersonal skills, patience, conflict resolution skills, and manage and execute plans when collaborating with the group and community agencies. Student teachers become aware of community problems and how students of different backgrounds function and respond to various teaching and interaction strategies (Shumer et al. 2009; for more details about the service learning programme at NIE, see Chap. 13).

The Meranti Project

The Meranti Project is named after the Meranti tree, a rainforest tree that is native to Singapore and the region, producing resilient and valuable hardwood for timber. Growing strong and tall in the forest, the Meranti tree provides shelter and home for other plants and for many animals too. The Meranti Project uses this magnificent tree as a metaphor for an effective teacher. It is envisioned that student teachers emerging from the Meranti experience will be resilient and hopeful and help provide a conducive environment for their own students to thrive and grow.

The Meranti Project encourages student teachers to look inward and to reaffirm their teaching aspirations. NIE believes that it is critical for teachers to inculcate good values within themselves first before being an exemplary figure in the classroom. As such, the Meranti Project is an integral part of their values formation as educators and role models. The programme also complements the GESL programme that encourages student teachers to reach out to the community.

The Meranti Project is done mostly through personal reflection, artistic expression, group sharing and discussions; participants are invited to reflect upon their lives in the “Life Journey” segment. This aims to help participants develop better self-awareness by understanding episodes that made them the person they are today, their personal motivations related to the choice of the teaching career, and how they have been inspired and guided by their teachers. The strength of the programme lies in its interactive and “open-nature” structure. There is meaningful sharing between peers, resulting to a deeper understanding of themselves and others.

e-Portfolio and Psychology

Teacher education needs to be transformative in order to produce quality teachers equipped with the values, knowledge and skills to raise a new generation of twenty-first-century learners. TE²¹, which aims to prepare autonomous *thinking teachers* for the twenty-first century, is value-based with a strong focus on the theory–practice nexus. One of the defining elements in the TE²¹ Model is the use of the e-Portfolio to help our student teachers build their conceptual map of learning and teaching. (See Chaps. 2, 3 and 10 for more details about the e-Portfolio at NIE.)

The e-Portfolio initiative was first piloted with a Postgraduate Diploma in Education (PGDE) cohort and is currently adopted by all student teachers. There are two components to this e-Portfolio initiative. First, the e-Portfolio course serves as the cognitive framework that allows the student teacher to form connections between the various modules taken at NIE. This process of forming connections will serve to synthesise and aggregate the learning and strengthen the theory–practice connection. In particular, the e-Portfolio was designed to instigate reflection on their personal teaching beliefs, learning beliefs and their relationship to teacher competencies. The e-Portfolio allows students to upload any artefacts that demonstrate the range of expected teaching competencies. The structure provided by the e-Portfolio is underpinned by the psychology of constructivism and co-construction of knowledge. Student teachers will be able to construct their conceptual framework of the coursework in NIE. The e-Portfolio serves to prepare them for their teaching practice and conducts inquiring into their own practice with a focus on the theory–practice nexus. Student teachers will be required to share their e-Portfolio with their school coordinating mentors (SCMs) and NIE supervisors during the Focused Conversations and the pre- and post-practicum conference. The e-Portfolio is also utilised in sharing how their practicum experience has shaped their conception of teaching and learning, and their individual GTCs. Specifically through the e-Portfolio initiative, student teachers should be able to:

1. formulate and articulate their personal teaching philosophy;
2. share their conception of teaching and learning;
3. integrate and aggregate their learning across the different courses and practicum;
4. articulate the connection between theory and practice;
5. articulate their teaching and learning using their personal e-portfolio; and
6. understand the importance of inquiry and reflective practice.

4.5 Conclusion

The chapter has emphasised how quality teaching, values education and service learning come together to showcase an underpinning teacher education philosophy deemed by Singapore as crucial. Associated with this emphasis on values is the opportunity for student teachers to engage, learn and practise as part of their personal and professional development. The values outlined in the TE²¹ Model serve as an inspiring benchmark for essential and crucial aspects of teaching and learning.

In this rapidly changing environment, the emphasis on values and character cannot be regarded just as systematic but must represent a paradigm. The discussion on a values-driven teacher education in Singapore within the framework of learner-centredness, strong sense of teacher identity and service described in this chapter arguably helps student teachers in their personal and professional growth.

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Chapter 5

Nurturing Twenty-First Century Educators: An EPIIC Perspective

Bee Leng Chua and Stefanie Chye

5.1 Teacher Education in the Twenty-First Century

The teachers of tomorrow will find themselves dealing with a new generation of learners. The new generation has been variously called the Generation Y, the Millennials, the Internet or Digital Generation. These learners present new challenges to the teaching profession. Elmore (2010) describes the new generation as being overwhelmed, overconnected, overprotected and overserved. He perceives them to be eclectic and diverse, and regards them to be the most protected and observed. They are the first generation that does not need leaders to get information because they have electronic access to data at their fingertips. Most importantly, they learn differently (e.g. Elmore 2010; Kennedy et al. 2007).

Whilst education in Singapore appears to be doing well as evidenced by our students' achievements in international studies, such as the Trends in International Mathematics and Science (TIMSS) and the Programme for International Student Assessment (PISA), the changing profile of learners call for things to be done differently. Current education needs and characteristics of students require that tertiary institutions and schools provide curricula that are dynamic and which respond to the needs of the twenty-first century learner. The role of an educator is more important now than ever before, not least because he or she holds the key to the design and delivery of the curriculum.

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New challenges confronting the teaching profession call for a relook at the means of teacher education. The National Institute of Education's (NIE) Teacher Education Model for the twenty-first century (TE²¹) launched in 2009 (see Chap. 1 for more information) aims to nurture teachers that will develop the potential of each child under their charge. With the changing profile of learners, the challenge for teacher education is to advance pedagogies that can equip student teachers with the desired values, skills and knowledge to respond to the needs of the twenty-first century classroom and the twenty-first century learner.

Sweet (2000) called the new generation, an EPIC generation. He uses EPIC as an acronym to describe how this generation learns and receives information best. They respond best to input that is: Experiential, Participatory, Image-rich and Connected. To teach an EPIC generation of students, we need teachers who can reach out to them. We need EPIC teachers and more.

Teacher education should operate on the same fundamental principles. Building on and extending the initial ideas of Elmore (2010), and Sweet (2000), we formulated a number of design principles to guide the pedagogies employed at NIE for the development of student teachers. Our framework is built on Sweet's and Elmore's works on EPIC learners but extends it to include Inquiry as an important component in the preparation of twenty-first century educators. We contend that it is only by exposing student teachers to EPIIC learning experiences can they fully appreciate the essence of these modes of learning and be equipped with the skills of translating EPIIC principles into their classroom teaching.

5.2 An EPIIC Framework for the Design of Teacher Education at NIE

There is a wide range of pedagogical frameworks and principles of instructional design in the literature. Increasingly, work has burgeoned particularly as it relates to the needs of twenty-first century learners (e.g. Bereiter and Scardamalia 2006; Dumont et al. 2012; Sahin 2009). However, with some exceptions (e.g. Darling-Hammond 2006), there is a general lack of principles which can be used to directly inform the selection of pedagogical approaches in twenty-first century teacher education.

We maintain that the EPIIC framework could be useful for guiding how teacher education is carried out at NIE. Specifically, it suggests that teacher education should be Experiential, Participatory, Inquiry-Based, Image-Rich and Connected. In the following sections, we make explicit the foundational principles and beliefs upon which the EPIIC framework is based.

5.2.1 *Experiential*

I See, I Remember; I Do, I Understand

—Confucius

In the past, education had a tendency to be textbook-driven, preoccupied with content and teacher-centred. But when we consider Elmore's poignant observation of students today, where he points out that "[t]oday's learners want to *see* something, or *do* something, not just *hear* something (Elmore 2010, 173)", and it is clear that things must change.

Correspondingly, the EPIIC model is underpinned by Experiential Learning Theory (Kolb 1984) and emphasises experience as the foundation and stimulus of learning. The defining characteristic of this tenet is the crucial role of experiences, in influencing the learning experience of the pre-service teacher. Knowledge within the learner is a result of both grasping and transforming experience (1984). Experience can be transformed through both active experimentation and reflective observation. According to Dewey (1925, p. 13), "we don't learn from experience. We learn from reflecting on experience." From this perspective, the principle emphasising the importance of the Experiential is inherently intertwined with that of Inquiry. Dewey (1925) perceived education as a process of continuous reconstruction and growth of experiences. The role of an educator is to customise learning activities that allow learners to engage in meaningful experiences that comprise multifaceted aspects including the cognitive, behavioural and affective (Gentry 1990) and ensure that these activities are sufficiently structured for the learner's current developmental stage. When engaging in experiential learning, learners interact with their learning environments, materials and other learners to assimilate, accommodate and integrate information. This allows them to build on their prior knowledge, acquire and extend their knowledge base. Importantly, subsequent reflection or inquiring into one's experiences further helps the learner to consolidate and internalise learning.

Learning experiences must therefore move beyond didactic teaching to include an experience to accompany the point. Classrooms must shift from "Listening to Doing". This is particularly relevant in teacher education for it is only through their engagement in experiences guided by principles of Experiential learning, would they be better equipped to create significant learning experiences for their charges.

Teaching is a complex activity and educators have to constantly learn and grow in their professional competencies through actively engaging in practical experiences and reflecting and inquiring upon these experiences to make sense of and distil meaning and knowledge so that growth and mastery can be achieved. In teacher education, the lecturer/tutor can instruct "by example". This modelling approach enables the student teacher to experience, observe and learn the attitudes, skills, and behaviours demonstrated by the lecturer/tutor. This principle of teaching can be further consolidated by debriefing sessions that help student teachers integrate theory with practice (Tsien and Tsui 2007).

The Teaching Practicum is an important means by which meaningful experiences can be used to drive student teacher learning. Furthermore, a number of courses both in curriculum subjects, core modules and electives at NIE provide for students teachers to engage in the design of micro-lessons and engage in micro-teaching where they not only get to experience teaching, but also to reflect on the effectiveness of their pedagogical strategies. These are important steps in the right direction.

That teacher education should be fundamentally experiential in nature is supported by the oft-quoted but nevertheless relevant extract by William Arthur Ward, who we paraphrase here: The mediocre teacher tells. The good teacher explains. But it is the superior teacher who demonstrates and the great teacher who inspires.

5.2.2 *Participatory*

Life it is not just a series of calculations and a sum total of statistics, it's about experience, it's about participation, it is something more complex and more interesting than what is obvious.

—Daniel Libeskind

Such happiness as life is capable of comes from the full participation of all our powers in the endeavor to wrest from each changing situations of experience its own full and unique meaning.

—John Dewey

The above quotations encapsulate the mindsets of the students today who are inherently participatory. Students now want to play an active role in their learning, they want to participate and they want to be heard (e.g. Elmore 2010). While experiential learning is inherently participatory in nature, the participatory principle encompasses more than allowing student teachers to engage in and reflect upon experiences to make meaning. Underpinned by the principles of constructivism and social constructivism, it is clear that teacher education experiences needs to move beyond “chalk and talk” to incorporate social interaction and involve the student. This may involve the execution of collaborative activities or it may not.

Closely related to the experiential component of the EPIIC principles in teacher education then is the principle that teacher education needs to be Participatory. The participative model is one in which teachers and students co-create a trusting and innovative learning environment and make use of a variety of teaching methods, roles and relationships, based on the needs of the learner and the desired outcomes. The lecturer or tutor moves from a vehicle for the transmission of information and knowledge—the “sage on the stage” to one who is a co-participant in the learning process. Lecturers and tutors shift from playing the directive supervisory role to a co-learner working alongside the student teachers (e.g. Tsien and Tsui 2007).

As a corollary, student teachers move from taking on passive roles to the more complementary, proactive roles of partners in the learning process. Everyone performs complementary roles and tasks, and the consequent sense of partnership

eliminates the traditional power disparity between the lecturer/tutor and students. This opportunity allows student teachers to have hands-on frontline experience and encourages student teachers to empathise with their students as partners in the learning process (Tsien and Tsui 2007).

Teaching methods that follow the Participatory principle move from linear to reciprocal. The decrease in status and power disparities due to the new roles of the lecturer/tutor and the student teacher encourage the adoption of a new learning and teaching model. Instead of one-way teaching from teacher to student, there is a two-way interactive learning process based on discussion and sharing of values, knowledge, skills, feelings and behaviours. This new lecturer/tutor relationship allows students to become contributors rather than simply recipients (Itzhaky and Lazar 1997). Student teachers are empowered to have greater ownership, autonomy, agency and independence in the learning process (Tsien and Tsui 2007).

Classroom response systems such as Clickers and technological tools such as WallWisher amongst others are a good means to provide opportunities for student teachers to articulate their opinions, catalyse debate and discussion (e.g. EDUCAUSE 2005), and these too have been used at NIE to engender student teacher participation. Their experiences of such participatory modes of teaching better allows for student teachers to better translate such principles into their practice.

5.2.3 *Image-Rich*

Images, not words, are the language of the twenty-first century

—Leonard Sweet

Today's students are a visually oriented generation. As Elmore (2010) observes, the millennial generation grew up with social media, YouTubes, videos, digital cameras, the Internet, DVDs and cameras on their mobile phones. They think in images, and they want their communication to be either image-based or image-enhanced. Sweet (2000) believed that images, not words, are the language of the twenty-first century. Today, because of our media-rich society, images may be the perfect stimulus to help students grasp and retain valuable information. Just as important, they may have trouble listening if teachers try to communicate without images. Now more than ever before in history, a picture is worth a thousand words (Elmore 2010).

In this technological world, it is pertinent that students acquire both media and visual literacies. Media literacy can be defined as the ability to access, analyse, evaluate and effectively communicate through various channels of print and non-print texts (Considine and Haley 1992). Visual literacy refers to the ability to interpret visual messages correctly and turn information of all types into pictures or

graphics that are able to communicate the desired message (Heinich et al. 2002). Students and teachers alike are often required to simplify complex concepts into simpler, more concise diagrams. This visual literacy is especially important in a society which is saturated with videos and other media forms, to the point where one is constantly bombarded with such information. In their self-directed acquisition of knowledge, students will need to critically select necessary and relevant visual stimuli, whilst filtering out unnecessary and non-credible stimuli.

Information sources of the twenty-first century are richly layered with multiple mediums of information—words, charts, pictures and videos. To reach out to the millennium generation, teachers must similarly be exposed to and prepared to use imagery in their teaching. The imagery-rich component of EPIIC involves (i) the appropriate use of imagery in scaffolding the learning experiences of student teachers and (ii) inculcating media literacy, in particular visual literacy in them. Flood and Lapp (1997) described images, in both the still pictorial and moving form, as a medium of communication that has been neglected by modern educators. Teachers of the twenty-first century must acquire the visual literacy in selecting, interpreting and creating both types of visuals.

Within the teacher education classroom, images can be used to directly illustrate curricular concepts. Examples of such direct illustration would include the use of diagrams or models found in subject domains such as chemistry or mathematics. Images can also be utilised as the medium for indirectly representing a concept. Concept maps and flow charts are examples of such indirect representations. With the rapid development in media technology, visuals in the form of prints or video recordings can be used to enhance the authenticity of teaching materials and activities as well as to cater to more visual learners. Video-based classroom scenarios can be used as an authentic springboard for student teacher discussions on various educational issues and for student teachers to consider the applications of various teaching strategies. Apart from experiencing an image-rich learning environment, teachers must be empowered with the skills to create media products that successfully present information and emotions to others in order to communicate effectively (Considine and Haley 1992). Successful application of the Image-rich component will create teachers who are both competent consumers and creators of media messages and who can model these skills to their charges.

Consequently, student teachers require the awareness of technological tools, and they need to be empowered to create media products through courses and workshops on the use of various Information and Communication Technologies (ICT) available and how best to integrate ICT into their classrooms. At NIE, student teachers are exposed to various ICT tools and are provided with opportunities and the autonomy to create and use technological products. Teacher educators at NIE also teach using YouTube and videos of authentic classroom experiences and use these as launching pads for the discussion of educational issues.

5.2.4 Inquiry

What people think of as the moment of discovery is really the discovery of the question

—Jonas Salk

The problems that exist in the world today cannot be solved by the level of thinking that created them

—Albert Einstein

The half-life of information and knowledge today is short lived. Beyond content assimilation, students today must know how to problem-solve and to inquire. Inquiry as a design principle refers to a set of investigative and reflective mental processes that the learner engages in as he/she learns. There are two essential elements in the definition of inquiry. Firstly, inquiry begins with planned intentional reflection with a focus on problem-solving. Secondly, it is important that as learners engage in the process of inquiry, their thought processes should be made visible for discussion, sharing and purposeful conversation (Dana and Yendol-Hoppey 2009).

Learning environments based on an inquisitive style of learning encourages higher-order cognitive processes such as analysis, synthesis and evaluation (Garrison 1993), as well as metacognition and self-regulated learning. Inquiry-based approaches to learning takes on a wider and more open frame of reference in tackling questions or problems posed to the learners. It usually calls for multiple perspectives and often relies on the use of multidisciplinary knowledge (Magnussen et al. 2000). Learners will not only learn to appreciate the importance and value behind inquiry-based learning, but also acquire self-directed learning strategies in the process. Hence, it is believed that twenty-first century students will graduate from schools with the confidence that they can initiate and manage their own inquiry process in virtually any domain of knowledge—an essential quality much desired in the workforce of the twenty-first century.

Similarly, teacher education classrooms need to shift towards knowledge generation and creation, rather than information transmission. They need to shift from the focus on “data” to a focus on “discovery”. There is a need to create a “culture of inquiry” through incorporating the quest for solutions to solving authentic real-world problems (e.g. Darling-Hammond 2008). Student teachers become active problem-solvers who learn how to learn, and teacher educators become facilitators of learning. Various tutors at NIE already use inquiry and discovery-based approaches in their teaching (e.g. see Office of Education Research’s (OER) *SingTeach* [OER, n.d.]).

In addition, the Professional Practice and Inquiry (PPI) “meta” course (mentioned in preceding chapters) helps student teachers inquire into their own practice, shape their teacher identities and integrate various coursework and teaching practices as a coherent programme to help them understand about learners, teaching and learning. The course serves as the link between the various pre-service courses and teaching practices, providing the foundation for student teachers to understand the

process of integrating and aggregating their learning, to be reflective and inquire into their teaching practices and to establish the theory–practice nexus. PPI not only illustrates the principle of Inquiry, but also demonstrates how the principles of Inquiry can be used in conjunction with the Experiential in the creation of learning experiences for student teachers. An educational research module was similarly launched for student teachers in the undergraduate programme at NIE. In this module, student teachers will be provided with the opportunity to work with a faculty mentor to complete a research project on a topic related to education. Through this module, student teachers will be equipped to think more critically about research in general and have a better sense of the theory–practice link. The module further provides the foundation for helping student teachers inquire into their own practice and acts as a training ground for future teacher-researchers.

5.2.5 *Connected*

Everything in our world is sacred and interconnected – and we’re in the midst of an epochal shift to recognising that truth in every realm of human endeavour. It’s a magnificent time to be alive and participate in this evolutionary leap

—Stephen Dinan

Learners today live in an increasingly interconnected world. Problems today are complex and require transdisciplinary solutions. In this context, a lone individual engaged in the generation of linear solutions is no longer the *modus operandi*. It is apparent that with the growth of the Internet, social platforms, telecommunication devices and networks, connectivity is made available with greater ease. In the knowledge-based era, where information is easily accessible through the World Wide Web, it is not how much content we disseminate in the classroom that matters but rather being able to engage students’ learning process, helping them construct new knowledge and adding value to learners beyond providing them with information that they have easy access to. In addition, learners today are constantly connected both socially and technologically (Elmore 2010). To remain relevant today, the use of technology is essential.

The notion of being “Connected” in our framework transcends the mere usage and incorporation of technology into the curriculum and the integration of technology into pedagogy. Connectedness here refers to the process of (i) connecting different layers and different disciplines of information; (ii) connecting with people and experiences; and (iii) connecting via technological means. Emphasis is placed on interacting with interconnected and interdisciplinary information, experiences as well as people as a central means of problem-solving, with an emphasis on the interpersonal skills involved in regulating such discourse. Technology is used in support of such interactions when appropriate and necessary.

The teacher’s focus would be designing a cluster of individual or collaborative activities, supported by technology that enhances connectedness and where learners

are challenged to transcend disciplines. These activities and technologies are catalytic in connecting learners to other's perspectives, prior knowledge, new knowledge, knowledge of other disciplines, constructing new knowledge while ensuring that learners are connected socially whilst riding on the affordances of technology.

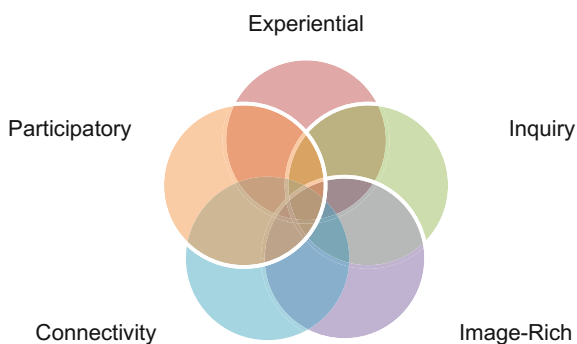
Social connections are important, and an interactive or participatory learning community is essential to fuel learning. Thus, learning should be coupled with communication and connection and healthy trusting relationships with the teacher and with one another. Teachers will need to revolutionise their teaching to harness the principle of connectedness if they plan to stay relevant and if they want to fully engage their students.

Teacher education classrooms must similarly model how connectedness can be applied through the presentation of interdisciplinary problems and knowledge, foster a sense of relatedness amongst the lecturer/tutor and the students, as well as harness the power of technology to facilitate these. The use of social media platforms such as Facebook, and collaborative platforms such as Google Docs and Google Sites can be used to connect student teachers both technologically and socially. The use of mobile technologies at NIE is also a step in this direction.

Figure 5.1 presents a diagrammatic representation of the EPIIC principles underlying teacher education at NIE. Importantly, none of the principles necessarily function *in silo* and are not to be viewed as disparate pieces but rather allows for overlapping areas, attained through drawing upon other principles, to work towards a holistic learning environment. For instance, the preceding discussion has highlighted how there could be overlaps between the experiential and participatory, the inquiry and experiential, and how the Image-rich can feature in experiential, participatory, inquiry and connected approaches to learning and teaching.

In order for teachers to better engage the twenty-first century learner, teacher education should model and reflect EPIIC practices. In this section, we reflect on what teacher education classrooms may look like with a number of pedagogies that we believe will fundamentally transform the learning experience and the teacher education classroom to help facilitate the development of the EPIIC teacher.

Fig. 5.1 Signature pedagogies at NIE anchored by EPIIC principles



Apart from using specific teaching strategies that address the EPIIC framework as alluded to in the preceding discussion, there exists a number of more holistic and encompassing teaching strategies that can offer our student teachers EPIIC learning experiences. We consider three of these specific pedagogical approaches that represent the signature pedagogies of NIE: (i) Problem-based Learning (PBL); (ii) Blended Learning, and (iii) Flipped Classroom. We suggest that these approaches to teaching and learning can be more extensively and deliberately incorporated at NIE as viable pedagogies in teacher education because of the potentials and possibilities they offer for providing student teachers with an EPIIC learning experience and its potential to foster EPIIC characteristics in learners.

(i) Problem-Based Learning

Problem-based learning (PBL) is a pedagogical approach characterised by the beginning of a unit with the posing of problems rather than the teaching of content (Tan 2003). The problems subsequently act as a catalyst for learners to develop their problem-solving skills whilst acquiring knowledge (Albanese and Mitchell 1993; Tan 2003). Through the reflective analysis of real and complex school or classroom problems, learners are able to utilise their theoretical knowledge to solve real-world scenarios and hence bridge the theory and practice gap. Furthermore, it harnesses and develops learners' ability to deal with novelty and complexity as they engage in solving authentic problems.

PBL is currently employed in the core Educational Psychology module at NIE. Following Tan (2003), There are five stages in the PBL cycle adopted: (i) Meeting the Problem; (ii) Problem Analysis; (iii) Discovery and Reporting; (iv) Solution presentation; and (v) Overview, Integration and Evaluation. An online PBL platform is setup to scaffold and document student teachers' thinking and learning processes. Embedded within this online system are resources such as video clips of authentic classroom problem scenarios, cognitive templates, tools for creating mindmaps and question prompts to facilitate learners' learning processes and deliverables.

PBL is a pedagogy that reflects important tenets of the EPIIC framework. A recommended group size of five collaborate together to solve an authentic classroom problem. The nature of problem-solving itself requires student teachers to thoroughly analyse their current and past course materials, in addition to their past teaching experiences, in order to determine the most applicable and relevant information for solving the problem posed. In the process of solving the problem, they co-construct their knowledge with fellow classmates, build and extend on their knowledge base and skills set. The PBL pedagogy is a learner-focused pedagogy, with the tutor serving the primary role of a coach or facilitator. Student teachers have to create their own interpretation of the problem scenario, reach a consensus on a problem statement, and then propose a solution to it. Both the question scaffolds and facilitators model the processes of hypothesis-driven reasoning and encourage reflective thinking. The question prompts employed at each PBL stage ensure that student teachers meet the necessary cognitive requirements for each stage of the PBL cycle. Empty templates are available for them to utilise as alternative forms of scaffolding. In this way, student teachers new to the pedagogy

would be able to visualise the complex PBL problem-solving process as a sequence of smaller, manageable tasks. PBL is thus inherently Participatory and Inquiry-based.

Imagery may be present in any of the two forms, via (i) the video footage used to present the authentic classroom scenario, and (ii) the group's representations of the problem solution. Furthermore, the student teachers are required to exercise media literacy in extracting the problem statement from the problem scenario. Tan and Looi (2007, p. 148) described the advantages of using multimedia representations of problem scenarios, specifically how it “enable(d) rich contextualised problem cases to be represented realistically and digitally”, whilst allowing the learner to “review the problems as many times as necessary, and scrutinise the problem in its rich context”. The PBL-based curriculum serves as an excellent training ground for the student teacher as an intelligent consumer and creator of media messages.

Connectedness is fostered through the discussion threads, and online collaborations hosted by the PBL collaborative platform, in addition to any face-to-face meetings that the student teachers organise at their own discretion. Dialogue and interpersonal interactions are central to the problem-solving process. Throughout all five stages of the PBL cycle, the group members will be constantly presenting multiple perspectives, seeking out clarification, questioning and challenging one another. The unstructured nature of problem-solving creates great potential for disagreement between group members, and they have to exercise restraint and tactfulness during discussions. It is thus evident that PBL is a viable pedagogy for teacher education, and it undergirded by tenets of the EPIIC learning framework. By modelling this pedagogical approach within the teacher education curriculum, student teachers in NIE can also experience the feasibility and potential of PBL in engaging their future students in the twenty-first century classrooms.

(ii) *Blended Learning*

Blended learning is an educational approach where face-to-face instruction is combined with computer-mediated instruction (Graham 2005). The computer-mediated aspect of instruction could take the form of an asynchronous discussion forum, a collaborative working space, an online reflection log, self-directed e-learning or any combination of these features. This computer-mediated aspect may occur in class or outside of class. At NIE, the blended learning mode of instruction is utilised in courses such as classroom management, instructional technologies and research methods (Cheung et al. 2008; Cheung and Hew 2011; Khine and Lourdusamy 2003; Ng and Cheung 2007; Wang 2009; Wang et al. 2009). In these courses, a combination of face-to-face instructions together with asynchronous online discussion forums, online reflection blogs, self-paced e-learning and uploaded video resources are used.

Blended learning approaches illustrate EPIIC principles in several ways. Many of NIE's blended learning modules utilise an online discussion forum, which is

usually situated within a learning management system, such as Blackboard or Moodle. Discussion forums within blended learning environments demonstrate the Participatory and Connectivity aspects described within EPIIC. Discussion forums have been used by student teachers to share their experiences and observations on classroom management (Khine et al. 2003), or their suggestions on their peers' web-based teaching material (Cheung et al. 2008). Tutors would read through the discussion posts, assess the student teachers' acquisition of the relevant knowledge and skills based on the quality of their posts, and facilitate further discussion among the student teachers. Asynchronous discussion forums have many advantages over traditional face-to-face discussions. The time-independent nature of asynchronous discussion allows participants to have more time to think, and to be more critical and reflective in their responses (Leeman 1987). In addition, learners have time to respond to other learners' comments. Student teachers would also have more time to think deeply about a particular issue (Hew and Cheung 2012) and more opportunities to express their views or receive feedback from others (Khine and Lourdasamy 2003; Ng and Cheung 2007). Using an online discussion platform, regardless of it being asynchronous or synchronous, creates a more democratic learning environment, which encourages expression from participants who are less vocally outspoken (Chen and Looi 2007). A discussion provides a means for learners to tap on their prior knowledge, exchange opinions, share multiple perspectives and clarify various doubts (Dunlap 2005). Some scholars have identified collective inquiries and discussions as being one of the activities that learners find most beneficial to their learning (Ertmer et al. 2007; Richardson and Swan 2003). Besides asynchronous discussion forums, collaboration spaces are made available for learners to share and discuss information online (Wang 2009; Wang et al. 2009). Online tools such as Moodle, Blogger and Google Docs have been used by NIE tutors, for their collaborative workspace function.

Inquiry can be incorporated into blended learning through the use of reflection logs. For instance, student teachers were tasked to write online reflection logs as a follow-up activity after each face-to-face tutorial session (Wang et al. 2009). The content of these reflection logs would usually revolve around what the student teachers had learned, issues that remain unclear, and how to apply the knowledge in similar situations (Wang 2009). Questions and guidelines were provided within these reflection logs to scaffold the reflective processes of the student teachers. In addition, student teachers were provided with opportunities to articulate and share their thoughts with their peers.

Imagery can be easily woven into existing curricula for blended learning via the use of video episodes. Through authentic video episodes of classroom teaching, classroom issues can be introduced into student teachers' learning context (Khine and Lourdasamy 2003). This allows teacher learning to be based on the daily activities of schools and teaching, as recommended by Darling-Hammond (1998). Student teachers are able to visualise, understand and engage in discourse on issues faced in real-life classroom situations. According to Chua (2013), utilising video footage for classroom scenarios allowed student teachers to personally relate to the issues presented and have a better understanding of the classroom challenges. This,

in turn, stimulated their interest and engagement. The use of such video footage also facilitates the theory–practice gap which has been acknowledged as a common weakness of university-based teacher education (Allsopp et al. 2006; Barksdale-Ladd and Rose 1997). It is also suggested that student teachers are engaged in Experiential learning as they interact in first person with their blended learning environments, materials and other learners. They are provided with a first-hand experience of building and extending their knowledge via such a pedagogical approach.

(iii) *Flipped Classroom*

Flipped Classroom is a pedagogical model in which the typical lecture and homework elements of a course are reversed. While there is no single model for the flipped classroom, the term is widely used to describe class structures that provide pre-recorded lectures, readings or learning material, disseminated by technology, followed by in-class activities, discussions or projects (EDUCAUSE 2012; Tucker 2013).

In Flipped Classroom, rather than devoting lessons into the presentation of material that is easily acquired, students are self-directed in learning and making meaning of the material. Class time can then be better spent engaged in extending students' learning. The value of a flipped classroom is in the repurposing of class time into a workshop where students can inquire about lecture content, test their skills in applying knowledge, and interact with one another in hands-on activities. In the flipped classroom, the role of students changes from one of passive recipients of instruction to one where they bear the responsibility for learning and experimentation. The role of the instructor changes concomitantly from sage on the stage to that of collaborative and cooperative contribution to the teaching process. Activities can be student-led, and communication among students can become the determining dynamic of a session devoted to learning through hands-on work (EDUCAUSE 2012; Tucker 2013).

In terms of the EPIIC principles, the flipped classroom provides opportunities for a Participatory, Inquiry-based and Connected experience. Flipped classrooms can be complemented by image-rich learning activities such as completion of concept maps and mindmaps in class, and the use of videos and other technological platforms to present information. Experiencing a flipped classroom via role modelling of the lecturer/tutors enables student teachers to have meaningful experiences of such pedagogical approaches and better appreciate the utility of this approach and translate it to their classroom. At present, flipped classroom is being used in core modules for teacher education at NIE, such as the course on the assessing of learning and performance.

Taken together, it is evident that when we create learning environments according to the EPIIC framework, we provide opportunities to trigger different learning processes with different kinds of learners in order to bring forth intended outcomes.

Table 5.1 Design considerations for pedagogies in teacher education

	Design considerations for pedagogies in teacher education
Experiential	Experiential refers to the need to engage in meaningful classroom experiences. Tutors need to actively design and elicit these experiences. Opportunities should be created for student teachers to build, construct and extend their knowledge and experience. Importantly, subsequent reflection or inquiring into one's experiences further helps the learner to consolidate and internalise learning. Classrooms must shift from "Listening to Doing"
Participatory	Participatory experiences allow for the student teachers' voice to be heard. The participative model is one in which teachers and students co-create a trusting and innovative learning environment, and make use of a variety of teaching methods, roles and relationships, based on the needs of the learner and the desired outcomes. The lecturer or tutor moves from the "sage on the stage" to a co-participant in the learning process. Student teachers take on the more complementary, proactive roles of partners in the learning process. Student teachers are empowered to have greater ownership, autonomy, agency and independence in the learning process
Inquiry	Inquiry is defined as encompassing the process of intended planned reflection coupled with the opportunities for learners to articulate and share their thoughts. This inquiry process may include the collection and analysis of data for evidence-based learning. Cognitive templates, question prompts, video clips and reflection logs are useful for instigating monitoring, reflection and inquiry amongst student teachers. Classrooms must shift from the focus on "Data to Discovery"
Image-Rich	Pedagogies should involve student teachers in the consumption and creation of imagery. With technological advancement, the use of images such as concept maps, video clips and visualisation templates can be used to facilitate learning. Opportunities should be created to educate the student teachers on the selection, interpretation and creation of images in their learning environment to engage their learners
Connected	Connectivity points to the connectedness between people, knowledge and experiences. It refers to processes that enable learners to see connections between (i) different learners' perspectives, (ii) prior and new knowledge, (iii) knowledge from different subject domains, (iv) general and contextual and (v) between theory and practice. Technological tools such as online forums, discussion threads, storage depositories and social media can be utilised to facilitate the processes of Connectivity

5.3 Conclusion

In order for teachers to better engage twenty-first century students, teacher education should model and reflect EPIIC practices. Most teacher educators accept and recognise the importance of EPIIC principles. However, in reality, many of them habitually employ frameworks of pedagogy that are often identified as didactic with the aim of "transmitting knowledge" (Maddux and Cummings 1999). Many teacher education programmes tend to focus on the domain knowledge of theories (Korthagen and Kessels 1999). But while theory comprises an important aspect of teacher education, the problem with this approach is that knowledge drawn from

various disciplines is often presented as fragmented pieces in separate lectures and courses. Therefore, student teachers' knowledge can become "compartmentalised" (Hung 2006). Furthermore, as Carlson (1999) noted, although all teacher education programmes aim to equip their student teachers with theories and applications in practice, many student teachers still feel that they are not prepared for life in the classrooms. By creating opportunities for student teachers to experience educational innovations and by immersing the student teachers in learning environments underpinned by the EPIIC framework, they would be able to extend their pedagogical repertoire of instructional practices and, at the same time, acquire the necessary values, skills and knowledge that are prerequisites of twenty-first century teachers.

Designing learning environments is an important concern for both teacher educators and student teachers who will eventually become future practitioners in the teaching fraternity. Embedded in the EPIIC learning environment are opportunities for student teachers to be active in research and inquiry and to ride on technologies to connect with resources of information and knowledge across disciplines. EPIIC provides a vantage point for understanding how student teachers could acquire the various types of pedagogical and theoretical knowledge within teacher education programmes and subsequently (re)create meaningful EPIIC experiences for their own students. Drawing from the five tenets of the EPIIC framework, Table 5.1 summarises the design considerations for pedagogies in teacher education.

In conclusion, using the EPIIC framework to guide our pedagogical approaches in teacher education will not only enrich the learning experience of our student teachers, but also ensure that twenty-first century teachers provide a quality learning experience to their students. There is no sequential order to the processes described in EPIIC, as the learning that occurs is usually a result of the interplay of the various processes. Classroom environments and pedagogical approaches could operationalise the principles of EPIIC none of which operate singularly but often overlap and operate in interconnected wholes.

Classrooms based on the EPIIC model are relevant in today's complex educational settings as the visually enhanced, participation-centric inquiry approach to authentic learning experiences introduces a degree of interaction and connectivity far beyond the traditional instructor–student dyad. In this context, learning will become a collaborative experiential process that fuels students' engagement to learn.

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Chapter 6

In Focus: The Role of Education Studies in Teacher Education

Kam Ming Lim and Vivien Swee Leng Huan

6.1 Who Are Professional Teachers?

Let us begin with a discussion of who a professional teacher is. Let us be more specific: who is a professional teacher in the twenty-first century? What defines this teacher? Is it someone with years of work experience in the classroom? What are the knowledge and skills sets required? Does it merely involve possession of well-honed skills for implementing a wide range of techniques for managing the curriculum and learners? Alternatively, does having strong subject knowledge suffice? Do we really need teachers to start off with a strong knowledge base of understanding the theories and concepts underlying the practice of teaching and learning before they start to hone their craft knowledge?

The debates surrounding these issues are not new (Collins 2004). Over the years, different perspectives on teacher education have emerged ranging from subject matter approach to craft apprenticeship model. Regardless of the perspectives of the model, the focus of the debate is on the type and scope of the knowledge bases required for teacher education and for the teaching profession.

6.1.1 *The Professional Teachers*

Research evidence supports the stance that education is an evidence-based profession. Professional teachers used research findings and theories to guide their

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work while considering the unique contextual factors in their own classes and schools (Hargreaves 1996, 1997). At the same time, teachers also need to develop craft knowledge, that is, knowledge of what works in practice (Galton 2000).

In order to have the knowledge base required to effectively understand the increasingly complex challenges and demands of teaching and learning, teachers need to have relational understanding, that is, knowing what to do and why to do it (Collins 2004; Skemps 1989; Lim and Tan 2001; Tan and Lim 2004; Tumposky 2003). Studies have shown that teachers (including student teachers) are likely to be more concerned with instrumental understanding, defined as knowing what to do without actually understanding the reasons or basis for these applications (Ball 1990; Hill 1997; Lim and Tan 2001; Tan and Lim 2004). Emphasis should be placed on the importance of theoretical knowledge and understanding. Linkages between theories, research and practice are critical, and teachers need to know what to do and why we are doing it, that is, to develop relational understanding of the craft of teaching (Lim and Tan 2001; Tan and Lim 2004; Tumposky 2003). The teaching profession cannot improve its practice or professional status if teachers merely possess craft knowledge only (Adams and Tulasiewicz 1995; Collins 2004; Soder 1999). If teaching professionals were defined as those who have been prepared according to a set of competencies through teacher education programmes that prescribe “recipes of how to teach” albeit systematically and seemingly in a scientific manner, it is questionably as to whether such teachers would have the relational understanding and mindfulness required to individually and collectively develop and advance the teaching profession in the face of the rapid and complicated shifts and currents in the twenty-first century. Collins (2004) stated that teacher education should include university-level knowledge base which enables student teachers to learn a wide range of ideas and theoretical frameworks. Such a deep and integrated knowledge sets facilitate teachers’ reflections, understanding and abilities to reflect on, refine and redefine the teaching profession as it raises to meet the challenges of the twenty-first century.

However, a knowledge base is not sufficient. Teachers need to collectively embrace the idea that the teaching profession must be based on, supported and guided by sets of values, knowledge and skills that are cultural and temporarily relevant.

Teachers need to develop a professional identity. The development of professional identity includes the acquisition of professional knowledge, pedagogic act and the understanding of teaching in the social, cultural, scientific and ethically legitimate practice areas relevant to the cultural and temporal context (Sa-Chaves and Alarcao 1998). Part of the professional identity of teachers includes the deliberate act of nurturing the beliefs and values among teachers to protect the fundamental human values in children, as well as heritage conservation and protection (Sa-Chaves and Alarcao 1998).

The next section will spell out the role of education studies in the making of a professional teacher, one who is truly care for her learners, able to use her extensive knowledge base while guided by an evidence-based framework to develop and use

effective approaches to cater to the unique needs of her learners, and committed to the ideals and values of the teaching profession.

6.2 Purpose of Education Studies

Education studies as a collective cluster help teachers understand how people develop and learn throughout their life, the nature of knowledge and critical engagement with theories and perspectives related to the way of knowing. Education studies guide teachers in intellectual discourse and analysis of education processes in the context of their unique cultural, social, political and historical factors (Ward 2013). Such critical analysis within the paradigms of education studies provides teachers with the intellectual readiness to explore philosophical questions such as the purpose of education, the nature of education, alternative forms of education and the future state of education, as well as seemingly more practical issues of understanding the essential components of learning and teaching that is the epistemology of knowledge, learning and learners.

Education studies help teachers by providing them an evidence-based framework to enable them to develop their collective teacher philosophy and individual approaches to how they view and help learners (Ward 2013). Teachers' professional vision refers to a repertoire of ability to analyse the unique contextual features of a cohort of learners and their learning environment and use appropriate pedagogical knowledge and skills. Through a systematic and critical knowledge-guided process of development, teachers can gain significant declarative knowledge and professional vision from courses such as education studies (Sturmer et al. 2012).

Good teacher education programmes should help student teachers reflect on, develop and sustain a philosophical paradigm of teaching and learning (Carpenter et al. 1999). Carpenter et al. further suggested that exceptional teachers have the following beliefs and values about children:

- Children are self-managing learners: teachers encourage children to be self-disciplined in their learning
- Community learners: teachers value, respect, understand and are aware of the children's respective cultures and communities, and their influences on children's learning process
- Children can succeed: Teachers believed that all children can succeed. Teachers can provide a non-judgmental and non-competitive environment for children to learn, grow and experience successes

In this respect, teachers need to understand their own beliefs about themselves, their students and about the process of learning and teaching. Self-reflections activities are useful in this aspect. Education studies are central in terms of the foundation and prerequisite knowledge base for teachers' development of their

fundamental views towards learning and teaching during the initial teacher education phase (Ward 2013).

Hanrahan et al. (2001) posited that teachers should have the following attributes:

- Knowledgeable and insightful learners: Teachers are themselves lifelong learners and are effective communicators about their learning journeys
- Committed to their students and communities: Teachers are learner focused and embrace an inclusive stance to education
- Skilled in curriculum design, pedagogy and assessment
- Dedicated to professional and ethical practice

Although Hanrahan et al. (2001) outlined these desirable attributes of teachers, these remain relevant as important attributes of professional reflective teachers, even more so in the Volatile, Uncertain, Complex and Ambiguous (VUCA) world today. Cornish (2014) described the need for teacher education programmes to develop reflective practitioners, teachers who know, understand and determine their own approaches to teaching amid a VUCA environment.

Teacher education programmes that provide student teachers with an evidence-based foundation are useful, if not necessary if teachers are to succeed in the twenty-first century. We will describe the National Institute of Education's (NIE) Model of Teacher Education for the twenty-first century (TE²¹) before proceeding to discuss how the Education Studies (ES) core cluster work within this model.

Before we proceed to describe the NIE TE²¹ Model and the ES core courses, it may be useful to compare the ES courses at NIE with those completed at reputable teacher education programmes in other countries. For convenient sampling, we refer to the ES courses completed for the NIE Bachelor of Art (Education)/Bachelor of Science (Education) programmes and compare these with the ES courses at a number of top teacher education universities in Australia, Hong Kong and Finland as ranked in the QS World Universities Ranking (2016; see Appendix A).

In terms of contact hours, the number of contact hours for NIE ES courses (182 h) was comparable to some of the universities in the sample. The range was from 108 to 360 h. The average number of contact hours was 217 h.

The ES courses that were common across the sample—Educational Psychology, Teaching and Managing Learners, and Social Context of Teaching and Learning—provide the foundational knowledge for student teachers who are starting to acquire the values, knowledge and skills necessary for professional teachers. These types of courses seem to be core across the universities surveyed. Other common ES courses were ICT and Assessment although these courses were not offered by all the universities surveyed. The ES courses at NIE were quite similar to those offered by comparable teacher education programmes.

6.2.1 *NIE's Model of Teacher Education for the Twenty-First Century (TE²¹)*

NIE's TE²¹ revolves around the Values, Skill and Knowledge (V³SK) Model which focuses on three value paradigms (NIE 2009; Lim 2013, 2014; Lim and Tay 2016):

- Value 1: *Learner-centredness* highlights the emphasis that the learner is at the centre of the teachers' work. As such, teachers must be aware of the theories and knowledge of learner development. They also value and respect diversity within the context of teaching and learning. As teachers, they believe that all learners can learn. They are committed to the duty of care for their learners. Teachers understand the importance of scholarship of teacher education. They understand how people can learn best, and how best to facilitate their learning through inclusive learning environment.
- Value 2: *Development of a strong sense of teacher identity* involves reflections on and understanding the question: "Who am I as a teacher within the cultural and social context in which I am in?" This refers to developing a personal commitment to uphold the highest standards in teaching and in "living out" the professional expectations of being a teacher. Professional teachers also have a strong drive to learn in view of rapid changes in the education milieu in order to be able to respond to students' evolving and diverse needs. Development of a personal sense of teacher identity necessitates questioning, reflecting on, clarifying, refining, developing and, at times, discarding beliefs and values.
- Value 3: *Service to the profession and community* focuses on teachers' commitment to be mentored as well as to be mentors to others in a collective effort to advance the teaching profession. Active collaborations and teacher-led profession developments are ways for achieving these objectives. Teachers strive to become better practitioners in order to benefit the teaching profession as a whole.

As discussed earlier, certain knowledge bases are required for professional teachers. The knowledge and skills components of NIE's TE²¹ Model prepare teachers who are ready for the challenges of nurturing and mentoring their students in the twenty-first century. Teachers should possess skills such as reflective skills and thinking dispositions, pedagogical skills, people- and self- management skills, administrative and management skills, communication and facilitative skills, technological skills, innovation and entrepreneurship skills, as well as social and emotional intelligence. Knowledge necessary for the twenty-first century competent teachers includes knowledge of self, pupil, community, subject content, curriculum and pedagogy, educational foundation and policies, global and environment awareness as well as multicultural literacy.

These requisite skills and knowledge are closely aligned with the desired outcomes, articulated by the Ministry of Education (MOE), Singapore, for students to

be collaborative learners, confident persons, active contributors and concerned citizens (MOE 2010).

NIE's TE²¹ serves as the philosophical framework for guiding the review, enhancement and delivery of the courses within the NIE initial teacher education programmes. In addition to the V³SK Model, NIE's Graduand Teacher Competency (GTC) Framework states clear representation of the types of competencies for beginning teachers, using the three performance dimensions—professional practice, leadership and management, and personal effectiveness (NIE 2009).

6.3 Education Studies at NIE

6.3.1 *Rationale for the Review of Education Studies Course Structure in 2013*

At the school level, MOE has placed increasing emphasis on preparing students with the requisite twenty-first century skills, knowledge and values to be able to be successful in the rapidly changing professional work and social environment. Students today, more than ever, need to be adaptable, lifelong learners. It is critical that the NIE teacher education programmes be regularly reviewed and refined to ensure that student teachers are equipped with the relevant knowledge and competencies to support the implementation of new developments and initiatives by MOE in the local schools.

A review of the ES structure and assignments was convened by the Office of Teacher Education (OTE) between October 2012 and February 2013. Representatives are from the Curriculum, Teaching and Learning (CTL), Humanities and Social Studies Education (HSSE), Psychological Studies (PS), Policy & Leadership Studies (PLS), Early Childhood and Special Education (ECSE) and Learning Sciences and Technology (LST) Academic Groups and the Citizenship and Character Education (CCE) Curriculum Sub-Committee participated in the review. A “TE²¹ Implementation: ES Retreat” was held on 14 February 2013 to discuss the recommendations of the review committee.

The ES course structure was revised in order to facilitate the introduction of a new CCE and Assessment courses as part of the pre-service programme. In addition, an experiential learning platform is used to strengthen the current Group Endeavours in Service Learning (GESL; for more details, see Chap. 13) to support the new CCE course. A series of six online-blended learning modules was used to bridge the theory–practice gap in service learning. The revised course structure for GESL aimed to provide a stronger theoretical foundation for student teachers to understand the basis of service learning, as well as to develop their knowledge and skills in planning and implementing meaningful projects with the community. Separately, the currently using e-portfolio for learning and teaching courses was

renamed and revised as Professional Practice and Inquiry. The revised ES course structure was implemented with effect from July 2014.

6.3.2 ES Courses

The mandatory ES core courses covered in all NIE pre-service programmes are: Educational Psychology: Theories and Applications for Learning and Teaching (EP); Teaching and Managing Learners at the Primary/Secondary/Junior College Level (TM); ICT for Meaningful Learning (ICT); The Social Context of Teaching and Learning (SC), CCE and Assessment.

These courses form one of the pillars in the pre-service teachers' curriculum and they cover the key concepts and principles necessary for effective teaching and reflective practice in schools. These courses provide the foundation for understanding the social, emotional and cognitive development of children, and shaping the pedagogical approaches for their holistic development. In addition, the ES courses help student teachers understand how the social, emotional and cognitive theories of development come together within the education system and policies in the education of the child in Singapore. The ES courses prepare the student teachers to see themselves as educators and facilitate their journey in developing as teachers with a clear personal purpose as members of the teaching profession. These courses also provide the foundational knowledge for student teachers as they complete other courses within the initial teacher education programmes, such as curriculum studies in which they learn the knowledge and skills to teach the subject matters.

In essence, these core courses are designed to address four main questions that would help student teachers understand the fundamental theories and concepts of teaching and learning (see Fig. 6.1).

The first, second and third questions relate to the learner-centred values (Value 1 of the V³SK paradigm), that is: who are your learners and how do they learn? How do you teach your learners? How do you manage the learning environment? EP, TM, ICT and Assessment courses address these three questions.

The fourth question relates to the Teacher Identity (Value 2) and Service to Community (Value 3) of the V³SK paradigm. These questions—“*Who are you as a teacher in school and society? What are your roles?*”—help student teachers to reflect and develop their personal teacher identity and attempt to build their bond to the teaching profession. The topics covered in CCE, SC and TM courses are relevant to these issues.

The ES courses take the approach that the SC course provides an overview of the social, cultural and political context in which the Singapore education system operates. Student teachers also consider their own teaching paradigms and beliefs about their roles as teachers during the SC course. The EP, TM, CCE and Assessment courses enable student teachers to acquire the necessary knowledge and

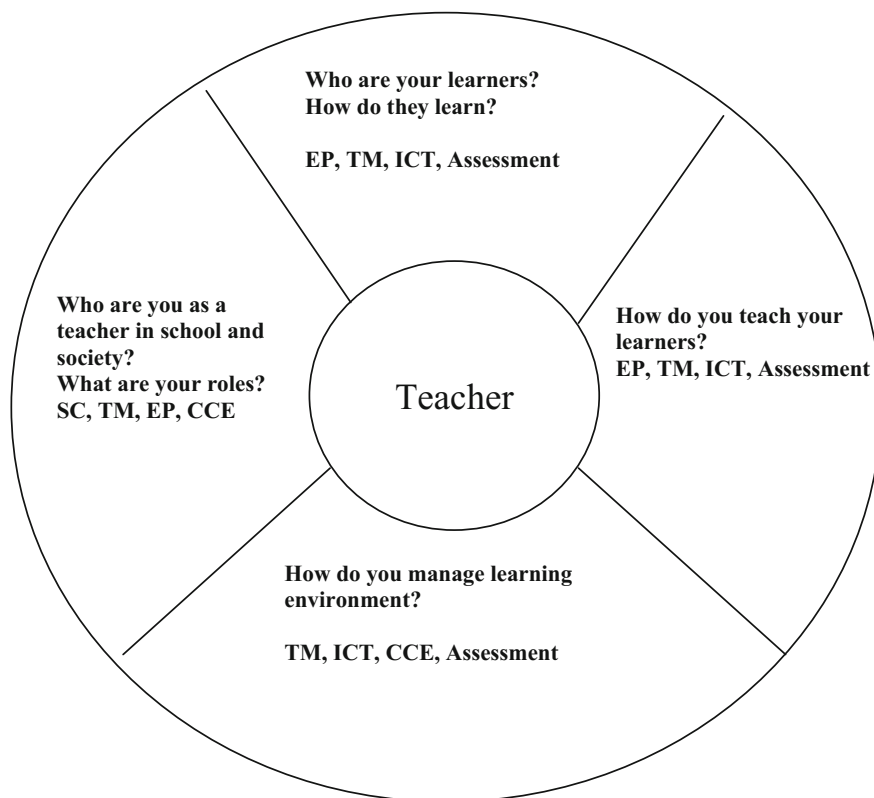


Fig. 6.1 Areas covered within the ES courses

skills for learning and teaching, as well as reflect on their own values and beliefs. The ICT course provides the support through technology-enabled tools to help teachers manage and improve their practice. Figure 6.2 illustrates the approach and delivery of the ES courses as described earlier.

Revisions to the ES core cluster in 2014 have further strengthened the linkages and coherence between the ES courses and with other courses in the teacher education programmes.

A key change is the revised sequencing of the ES core to facilitate a spiral approach to the coverage of the topics in the ES courses. Topics will be introduced, revisited, reinforced and used in different context and analysed through different perspectives across the ES core cluster. For example, the EP course will first introduce the topic of individual differences in learning ability while the Assessment and TM courses would discuss different approaches to facilitate effective learning among diverse learners. Separately, the ICT course will follow-up with looking at technological affordances to support diverse learners. The SC course examines social factors for diversity of learners' readiness.

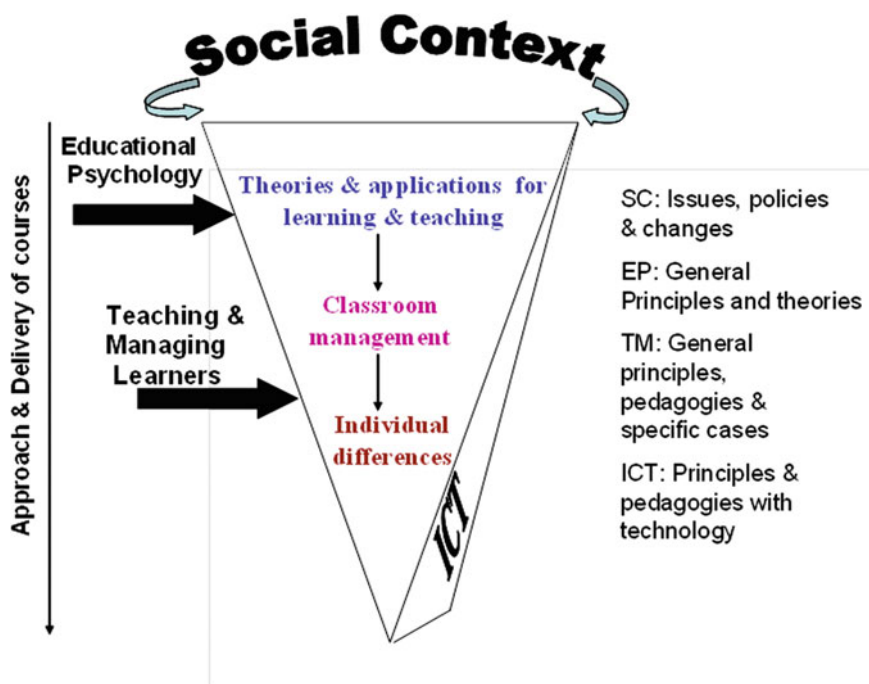


Fig. 6.2 Approach to ES courses

Another key change is how the ES core interlinks with the practicum, especially for the 4-year degree programme. Student teachers will have the opportunity to examine and explore topics covered in the ES core during their practicum stints in schools. This will help student teachers to analyse and learn to use their learning from the ES courses in a real school context.

6.3.3 Coverage of ES Core

To show how tenets from the NIE's TE²¹ Model are integrated into the ES courses, it will be useful to examine the course content of the ES courses and their inter-relationships in greater detail. We shall illustrate these relationships in terms of the relevant issues and how these are related to how student teachers are guided in reflecting on the essential questions pertaining to their profession vision, values, beliefs and teacher identity.

6.3.4 Educational Psychology: Theories and Applications for Learning and Teaching

The course description for EP is as follows:

This course provides the foundation for understanding learners, learner development, and the psychology of learning. The ways in which these aspects influence the processes of learning will be considered, and proactive approaches to enhancing student motivation, learning, and thinking explored. Theories with a focus on students' psychosocial and cognitive development will be introduced and its implications for classroom-practice considered. In particular, the course will consider areas such as why and how some students learn or fail to learn, and how students' intellectual, social, emotional, personal and moral development occurs.

As stated in the course, the EP course equips student teacher with the foundation theoretical framework and knowledge to understand how learners learn. A key aspect emphasised in this topic is the research evidence of individual differences in learning. By understanding how individual learners progress, teachers are better able to appreciate and accept individual differences in students, describe the developmental needs of students, understand how individual differences can affect student learning, explain cognitive, psychosocial and cultural factors that may facilitate or impede the development of students and their learning and be able to synthesise the concepts of student development and learning theories, use different theoretical explanations for learner motivation to enhance student engagement in learning and apply this knowledge in teaching and the design of learning experiences. A sound understanding of theories on psychosocial and cognitive development is useful to bolster teachers' willingness to formulate ways to support the physical, emotional, moral and social well-being of students, and to use strategies to promote higher-level thinking skills (such as creativity, critical thinking, decision-making and problem-solving) among learners. Through better understanding of the role of educational psychology in the teacher's decision-making process, new student teachers are one-step closer to becoming professional teachers who model a positive attitude towards learning and teaching. One of the central research evidence that is constantly discussed and reinforced in the EP and other courses is the fact that all students can learn. A professional teacher is one who holds firmly to this belief. In terms of linkages to the TE²¹ Model, the EP course relates to Value 1: Learner-centred values and Value 2: Teacher Identity.

6.3.5 Teaching and Managing Learners (TM)

The course description for TM is as follows:

Teachers attend to learners of various needs and abilities across their stages of development. Beginning teachers require relevant classroom management skills and pedagogical approaches to effectively accommodate their students' differentiated learning needs. By the end of this course, student teachers will be aware of the necessary skills and knowledge

required of beginning teachers to design conducive learning environments supported by relevant pedagogical approaches and to manage diverse learners in their classrooms.

The TM course helps the student teacher to develop an understanding of basic concepts, principles, models and practices for working with diverse learners in the classroom. The key idea is to reinforce the value for teachers to work with and help each and every learner regardless of their diverse needs and background. Valuing diversity in the classroom is a value espoused in TE²¹. A basic teacher skill is still the ability to understand and use strategies and skills for managing student learning and behaviour. As part of the development of their own teacher identity, the TM course helps student teachers to develop a personal approach to discipline, understand their own self-identity as a classroom teacher, articulate their preferred classroom management styles and consolidate their initial beliefs about teaching and learning. Through examination of topics—such as physical environment of the classroom, socio-emotional environment, setting of rules and routines, building of rapport, managing teaching and learning activities, effective lesson delivery and management, whole-class instruction: presentation (lecture), direct instruction, concept teaching, small-group activities: collaborative learning, jigsaw, learning centres, group management strategies, hierarchy of management intervention, various discipline models (e.g. behaviour modification model, assertive discipline, logical consequences), and whole-school approach to behaviour management—student teachers are better able to use different discipline models for managing student behaviour for facilitating learning and teaching.

A key objective of the TM course is to help student teachers develop their personal philosophy of education and personal approach to discipline while holding firmly to the belief that all learners can learn. This relates to all three values stated in TE²¹.

6.3.6 *ICT for Meaningful Learning (ICT)*

The course description for ICT is as follows:

This course prepares student teachers to engage learners in meaningful with the use of ICT. Student teachers will learn to analyse the affordances of technology tools for promoting meaningful learning. Opportunities will be provided for student teachers to analyse critical issues related to designing technology-enabled lessons supported by appropriate instructional strategies. They also need to consider appropriate measures in ensuring cyber wellness. Student teachers will be assessed for their skills and knowledge in designing meaningful ICT-enabled teaching and learning activities.

The ICT course provides the foundation knowledge related to teacher-centred versus student-centred pedagogies in ICT-enabled teaching and learning strategies. Student teachers learn the key concepts related to effective ICT integration and the roles of teachers, students and technologies in facilitating learning and teaching. Student teachers also learn about learning contract and analyse the case studies for ICT integration in Singapore Classrooms. In summary, student teachers learn to use ICT in a student-centred environment. The ICT course helps to reinforce Value 1: Learner-centredness.

6.3.7 Social Context (SC)

The course description for SC is as follows:

This course aims to promote deeper understanding about the socio-political development of the Singapore education system among pre-service teachers at the National Institute of Education. They will appreciate the functions of the education system in socializing citizens for economic, political and social roles in the context of a multi-ethnic and multicultural society. They will have the opportunity to understand the rationale of major education policies and new government initiatives that impact the work of school leaders, teachers, students and other stakeholders in order to achieve the Desired Outcomes of Education laid out by the Ministry of Education. At the same time, they will be made aware of the diverse and multiple roles that are played by teachers in the education system. It is hoped that pre-service teachers will become aware of the challenges that teachers face when engaging in pedagogical developments and initiatives in schools, and be empowered to become innovative, effective and caring teachers. Pre-service teachers are encouraged to link the content learnt in this course to what they have learnt in other courses at NIE, as they discuss major challenges and issues in the Singapore education system.

The SC course provides student teachers with the space and content to explore, reflect and define their own understanding of two key issues: (1) teachers as professionals and (2) teachers' beliefs and roles. The content of the SC course includes roles of the Singapore education system, key education policy initiatives, (in)equalities in education, strategies for equitable education, working with stakeholders in education and changing world, changing family, challenges, role model for change. These issues help student teachers to define and refine their own perspectives related to Value 3: Community and Value 2: Teacher Identity stated in TE²¹.

6.3.8 Character and Citizenship Education (CCE)

The CCE syllabus was implemented in both primary and secondary schools by MOE starting from 2014. Three overarching ideas—Identity, Relationships and Choices—are to be covered in six domains, starting with self and extending to the family, school, community, nation and the world. This forms the structure for the new CCE course in schools. MOE has developed the CCE toolkit and disseminated it to schools. However, the design and implementation of programmes to support the objectives of the CCE syllabus are left to individual schools to work out. Teachers will be expected to facilitate activities or lessons to implement school-based CCE. Although CCE is currently infused in various NIE courses and through experiential learning platforms such as GESL and the Meranti Project, a separate CCE course will be useful in NIE pre-service programmes. (For the NIE service learning programmes, see Chap. 3 for the Meranti Project, and Chap. 13 for the Group Endeavours in Service Learning [GESL].)

The course description of the new CCE course is as follows:

This course helps pre-service teachers to understand the key concepts and issues in Character and Citizenship Education (CCE) and get a good grasp of their roles in CCE in school. As schools play a nurturing role in the development of students, teachers have the responsibility to be aware of their professional commitments with regards to CCE: What roles do teachers play in the character development of students? What are the relevant attitudes, knowledge and skills that teachers should possess to enable them to contribute meaningfully to the character development of their students in schools? How should teachers introduce students to the notions of citizenship through citizenship education? Hence, the new CCE course will allow pre-service teachers in NIE to learn about character development, elements of citizenship, key approaches and pedagogies for CCE, as well as current MOE CCE policy and curriculum. Furthermore, the course will emphasise the relevant knowledge and skills teachers will need in order to deliver the CCE curriculum. Pre-service teachers will learn about the policies associated with CCE and be given opportunities to discuss the implementation of CCE in their future roles as teachers.

The CCE course aims to help pre-service teachers understand and appreciate the rationale for CCE in Singapore and MOE policy and curriculum. Through the examination of key concepts and critical issues concerning CCE, student teachers also gain an understanding of their future roles as teachers in CCE. CCE also introduces key pedagogical approaches to delivering CCE in schools.

6.3.9 Assessment Course

The current NIE initial teacher education programmes include various modes of assessment, such as projects, tests, assignments, reflections and presentations to enhance their knowledge and skills. It is critical that student teachers develop skills in assessment as a way for student teachers to understand the learning progress of their pupils. As part of TE²¹ review and implementation, the Assessment Competency Framework (ACF) was developed. ACF aims to provide the criteria regarding the expected assessment literacy competencies of NIE student teachers. Seven sets of competencies (see Appendix B) were defined in ACF, ranging from assessment of learning to assessment for learning in order to complement the range of pedagogies in NIE.

Under ACF, a series of initiatives were implemented including the compilation of different assessment modes used in each individual course. At the same time, efforts were also made by the Curriculum Studies (CS) course coordinators to better align or highlight the interlinkage between the assessment literacies covered in ES courses. This has resulted in a more coherent and more comprehensive coverage of assessment literacies within the NIE pre-service programmes. Student teachers were given access to lists of assessment terminologies and key readings on Assessment for Learning and Assessment of Learning which were made available online as supplemental information. Assessment literacy is currently covered in EP and infused at varied degrees across CS subjects in pre-service programmes.

The core course on Assessment will better ensure that student teachers are prepared to take up tasks such as redesign assessments at their schools, to support

sustained assessment practices for various learning, and to actualise new assessment policies set forth by MOE. The assessment course will aim to provide a baseline foundation in assessment literacy for pre-service teachers. This will help ensure there is a common baseline assessment literacy that is aligned with NIE's ACF and MOE's Assessment Literacy Professional Development Continuum (ALPDC; see Appendix C).

The course description of the new assessment course is as follows:

This course provides participants with the ability to understand and apply the basic principles of educational assessment. The course will discuss the principles of educational measurement of learning. It aims to equip future teachers with the necessary knowledge and skills monitor, appraise and evaluate learners' content knowledge, progress and performance achievement. This course will cover traditional paper and pencil testing methods and performance-based, authentic assessment procedures. The course will also include discussions on using assessment for learning.

The course objectives of the assessment course are to help student teacher to:

1. know the roles and functions of assessment in teaching and learning;
2. know the relevance and usefulness of the different approaches and types of assessment formats;
3. craft a variety of assessment items for conventional paper-and-pencil tests;
4. craft a variety of performance-based tasks for alternative, authentic assessment;
5. design mark schemes and scoring rubrics;
6. analyse and evaluate the effectiveness of measurement tools in terms of reliability, validity, level of difficulty and discrimination;
7. analyse, interpret and evaluate the outcomes of assessment in terms of student achievement and performance;
8. use assessment to promote learning and instruction; and
9. know how to address the impact of assessment on students' psychological well-being.

This course provides the pre-service teachers with the ability to understand and apply the basic principles of educational assessment by equipping them with the knowledge and skills to monitor, appraise and evaluate learners' content knowledge, progress and performance achievement. Content areas include discussions on the principles of using assessment of learning, educational measurement of learning such as traditional testing methods and performance-based authentic assessment procedures and use of assessment to promote learning and instruction. This course provides participants with the ability to understand and apply the basic principles of educational assessment. The course discusses the principles of educational measurement of learning. It aims to equip future teachers with the necessary knowledge and skills monitor, appraise and evaluate learners' content knowledge, progress and performance achievement. This course covers traditional paper-and-pencil testing methods and performance-based, authentic assessment procedures, and it will also include discussions on using assessment for learning.

6.4 Inter-relationships Among ES Courses

A structure was established to help strengthen the coherence, coverage and inter-links of the ES courses in 2007. An Educational Studies Curriculum Committee consisting of the course coordinators of the ES courses meet regularly to review and refine the ES courses.

It is important for student teachers to see that the knowledge bases they acquire in teacher education are frameworks to help them understand the complexity of the multitude of factors that impact teaching and learning (Collins 2004). Teacher education is not about dispensing set formulas and recipes for the practice of teaching. As such, efforts were taken to ensure coherency and links between the ES courses at NIE in the hope that student teachers appreciate the theoretical frameworks and relational understanding that would help them grow as professional teachers. Examples of the interlinkage among the ES courses are shown in Appendix D.

6.4.1 Other Components Supporting *V³SK*

National Institute of Education's believes that values are the key characteristics of a true teacher. Both the formal curriculum and experiential learning such as service learning are effective in promoting the essentials of values. To ensure that values are central in the teacher preparation programmes, all student teachers participate in two core mandatory programmes: GESL and the Meranti Project (a personal and professional development 2-day, non-residential workshop). GESL provides hands-on opportunities for student teachers to engage with a community partner of their choice and to contribute towards furthering the cause of that community and, in so doing, helps student teachers to hone values such as teamwork, resilience, empathy, service to the community to name a few. Service learning has been used as a pedagogical tool at NIE since 2004 to develop teachers who will be able to lead, care and inspire the young people and forge trusting partnerships with the community. As of 2012, a total of 17,200 student teachers have completed GESL and contributed more than 71,000 h in serving the community (for the NIE service learning programmes, see Chap. 3 for the Meranti Project, and Chap. 13 for the Group Endeavours in Service Learning [GESL]).

6.5 Conclusion

Education studies are seen by many teacher education institutes as providing the core fundamental knowledge bases for student teachers (Collins 2004; Moore 2007). It is also interesting to note that the education study courses do cover a

significant proportion of the critical skills included in the Skilful Teaching Framework (Saphier et al. 2008; see Appendix E). While some critics may argue for a traditional craft apprenticeship model in which student teachers are exposed to the practice of teaching, watching experienced teachers at work, learning teaching skills and understanding the curriculum, this approach has been deemed as insufficient for preparing teachers today (Adams and Tulasiewicz 1995; Collins 2004, Cornish 2014; Soder 1999). This implies that a strong knowledge-based foundation for professional learning is needed for beginning teachers to aid them in responding to the increasingly complex and challenging work of teaching. The ES courses highlighted in this chapter endeavour to prepare teachers of the twenty-first century who are knowledgeable, skilful, flexible and compassionate members of the teaching profession.

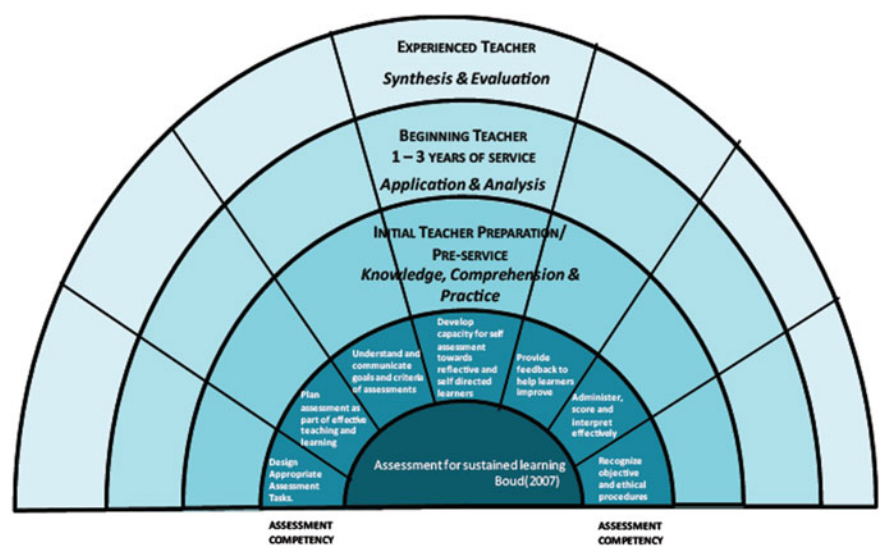
Appendix A: Education Studies Courses in Teacher Education Programmes of Selected Top Teacher Education Universities

Based on QS Rankings 2016 <http://www.topuniversities.com/subject-rankings/2016>.

ES University programme	Educational psychology	Teaching and managing learners	ICT	Social context	Assessment	CCE
NIE BA/BSc (Ed) (primary)	Educational psychology	Teaching and managing learners	ICT	Social context	Assessment	CCE
Monash BEd	Child and adolescent development	Inclusive education: teaching diverse learners Indigenous perspectives on teaching and learning Learners with special needs	ICT across curriculum	Education policy and practice	Curriculum, assessment and evaluation	Active citizenship and community connections: local and global
U of Sydney BEd (Pri)	Educational psychology	Education, teachers and teaching Human development and education Indigenous education: secondary schools Positive approaches to special education	Information technology in schools	Social perspectives on education		
The University of Queensland BEd (Pri)	Identity, youth cultures and education	Introduction to education Indigenous knowledge and education Learning, mind and education	Learning tools for the twenty-first century			
University of Hong Kong Double degree: BEd and BSc BEd and BA	Understanding and guiding whole-person Development	Becoming a teaching professional: understanding learning and teaching 1 Becoming a teaching professional: understanding learning and teaching 2 Catering for diverse learning needs		Social and philosophical foundations of education Becoming a teacher professional: education in a globalised society 1 Becoming a teacher professional: education in a globalised society 2	Curriculum and assessment	
University of Helsinki Bachelor of Arts (Education)	Growth, development and learning Knowing of the pupils Contextual in institutional early childhood education	Introduction to educational science	ICT driving licence: Practical skills test ICT driving licence: information seeking	Education and social justice Social, historical and philosophical foundations of education		

Course titles may differ. Referring to similar content covered

Appendix B: NIE Assessment Competence Framework (NIE 2009)



Appendix C: Links Between Core Assessment Course and MOE Assessment Literacy Professional Development Continuum

Based on NIE Assessment Competency Framework (NIE 2009).

	Designing assessment tasks appropriate for instructional decisions	Planning assessments as part of an effective teaching and learning process	Understanding and communicating the purposes and criteria of assessments	Developing capacity for self-assessment for reflective and self-directed learning	Providing feedback to the learners to help them improve	Administering, scoring and interpreting the results effectively
<i>Education Officers in this tier should be able to</i>						
Pre-service teachers	<ul style="list-style-type: none"> Design worksheets and tests based on sound guidelines of item construction Understand that curriculum, pedagogy and assessment need to be aligned for effective teaching and learning 	<ul style="list-style-type: none"> Incorporate assessments into a lesson plan as part of the assessment–feedback–learning cycle – e.g. diagnostic tests, Assessment for Learning strategies, performance tasks 	<ul style="list-style-type: none"> Understand the purpose and use of different assessment tasks, and the alignment between assessment and learning outcomes – e.g. Bloom's taxonomy, concept of validity 	<ul style="list-style-type: none"> Understand the interdependence of assessment as learning on assessment for learning (AFL) – e.g. know how AFL strategies can be used to help students monitor their own learning 	<ul style="list-style-type: none"> Understand and use a variety of questioning and feedback strategies for learning and reporting purposes 	<ul style="list-style-type: none"> Understand basic statistical concepts in assessment – e.g. considerations of reliability and validity
Topics covered in core Assessment course	<ul style="list-style-type: none"> Conventional assessment and its methods Test planning and design Different types of assessments Constructing different test items Planning and designing alternative and authentic assessment tasks 	<ul style="list-style-type: none"> Different levels of learning objectives Assessment of learning Assessment for learning Using assessment to promote learning and instruction 	<ul style="list-style-type: none"> To distinguish between assessment, testing, measurement and evaluation Analysis, interpretation and implications of assessment results with learning outcomes Effectiveness of assessment tools <ul style="list-style-type: none"> reliability validity usability 	<ul style="list-style-type: none"> Basic types of assessments Using assessment to promote learning and instruction Strategies used in assessment for learning 	<ul style="list-style-type: none"> Strategies in assessment for learning 	<ul style="list-style-type: none"> Effectiveness of assessment tools <ul style="list-style-type: none"> Validity Reliability Item difficulty and discrimination Analysis, interpretation and implications of assessment results or outcomes Criterion, norm and self-referencing

Appendix D: Education Studies Courses—Topics and Possible Links

Social context (SC)

Topics covered in social context	Interlinks between ES courses	Additional links
<p>Schools and society</p> <ul style="list-style-type: none"> – Roles of the Singapore education system, e.g. efficiency, ability-driven education, human resource development for the country – Issues: promoting social cohesion, promoting interaction between races in classrooms and CCAs <p>Key education policy initiatives, e.g. desired outcomes of education (DOE), national education (NE).</p> <p>Problems and controversies within the DOE and how to promote the outcomes</p> <p>(In)equalities in education, e.g. different social classes of students, ethnicity, SAP schools, gifted, special needs</p> <ul style="list-style-type: none"> – Issues: strategies for equitable education <p>Working with stakeholders in education, e.g. COMPASS (parents, community school relations), roles of parents, parenting</p> <p>Issues: changing world, changing family, challenges, role model for change</p>	<p>TM: creating the “We” atmosphere in classrooms—races, gender, individual differences, inclusive society</p> <p>EP: Psychosocial development—social context of development</p> <p>TM: individual differences, Gifted Ed</p> <p>ICT—ICT Master Plan 1 and Master Plan 2</p> <p>EP: character building/thinking/SEL</p> <p>TM: (individual differences) gifted Ed</p> <p>EP: psychosocial development-self-esteem, e.g. students from different streams, students with special needs</p> <p>TM: Individual differences (role of teacher in a diverse classroom), family background affects student behaviour</p> <p>EP: influence of family, peers and teachers on psychosocial development, working with parents, moral education, teacher as role model</p> <p>TM: individual differences, teacher’s awareness of personality and styles; reconciling personal and professional styles</p> <p>ICT: teacher beliefs, student-centred approaches</p> <p>EP: metacognition self-regulated learning</p>	<p>Music: multifarious-nature. The use of world music leads to learning about different culture; cohesion through school songs, national songs</p> <p>Literature: world Lit: introducing student to different culture, awareness of social cohesion</p> <p>Infusion of national education and desired outcomes of education as part of field trip for curriculum studies courses</p> <p>GESL</p> <p>Belief of teachers in education as informed by discipline, their own beliefs as well those of MOE’s views for them as subject teachers</p>
<p>Teachers as professionals, e.g. MOE mission statement, EPMS</p> <p>Issues: beliefs of teacher in education and role versus MOE’s</p> <ul style="list-style-type: none"> – The necessary ASK required – Support from MOE sufficient 		

ICT			Additional links
Topics	Possible links		
Teacher-centred versus student-centred pedagogies in ICT	EP—constructivist learning theories		Experiential; student-centred; ICT in music used as a tool; Use of ICT through data loggers, simulations; focused on integration, laboratory management in science courses
What is effective ICT integration?—The roles of teachers, students and technologies			
Introduction to learning contract			
Teacher-centred versus student-centred pedagogies in ICT	EP—constructivist and social constructivist learning theories		
Case studies for ICT integration in Singapore classrooms			
Teacher-centred versus student-centred pedagogies in ICT	EP: psychosocial development; role of the teacher; motivation; constructivist and social constructivist learning theories		ICT in lesson plans; WebQuest
How can I use ICT in a student-centred environment?	SC: teacher as a professional, personal beliefs/attitudes Learning theories TM: individual differences; classroom management		
• What is online learning?	EP: constructivist and social constructivist learning theories		
• Self-learning professional development	TM: Individual differences		Mathematics: some software packages learned
• Expanding your ICT Toolkit	SC: Different academic streams		
Developing a problem-based learning (PBL) ICT-based Learning Package	EP—PBL 5 stage approach TM: individual differences SC: different academic streams		ICT projects can be used in science courses
Thrust: developing a PBL ICT-based learning package	EP: critical and creative thinking		
Multimedia design principles	TM: curriculum differentiation, individual differences SC: different academic streams		
Classroom management: managing the ICT learning environments	TM: classroom management		

Education psychology (EP)

Topics (2 sessions per week)	Possible links	Additional links
Psychosocial development of learners Physical, cognitive, social emotional development Identity issues (Erickson's theory)	TM: Individual differences SC: schools and society: issues of social cohesion	Dance, movement and playing instruments: Application of affective and physical domains plays a part in the learning of music; (reinforcement of EP)
Psychosocial development of learners – Moral development, moral reasoning	TM: teachers' beliefs in pedagogy and discipline, models of discipline SC: how to address social prejudices? TM: individual differences, teaching for maturity and growth ICT: moral values	
Self-esteem/self-concept – Theories, e.g. expectancy values and self-determination	TM: building rapport, Individual differences ICT: social context of ICT, skills and empowerment with technology	
Learning Theories	ICT: engaged learning and learning theories TM: behaviour modification—skinner, Individual differences	Mathematics: learning theories (application) Science: behaviourist; socio-constructivist; only certain theories of learning are appropriate for science learning
Influence of family, peers and teachers – Parenting styles, dealing with parents – Teachers' counselling skills	TM: counselling approach to discipline)	

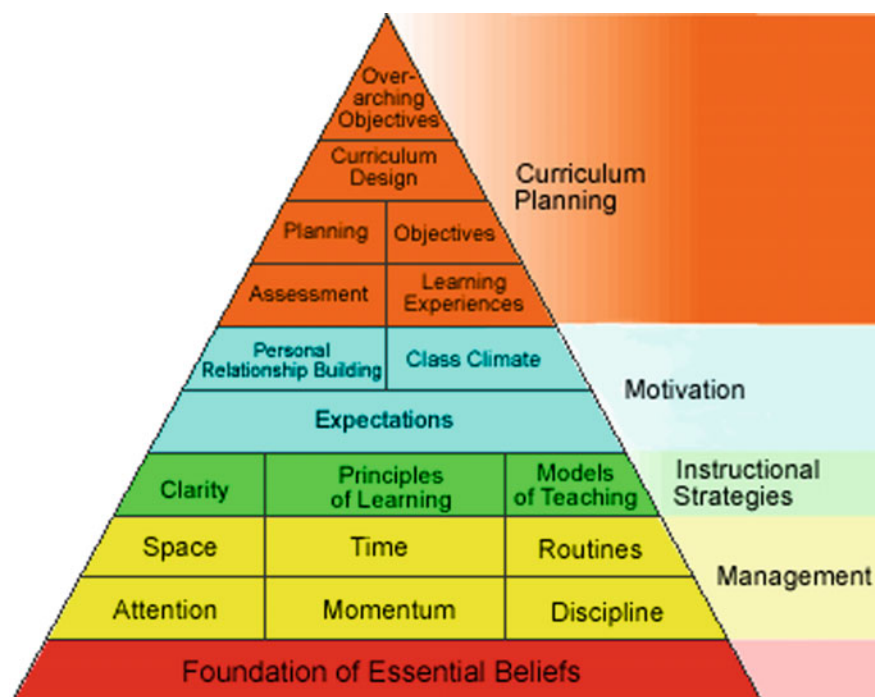
Teaching and Managing

Topics	Possible links	Additional links
Getting started in your classroom Learning environment—physical, psychosocial Establish rapport, setting rules and routines	EP—Maslow's theory; teachers' prosocial values, motivation and attribution to create positive learning environment, students' self-esteem ICT—classroom management (computer laboratory) virtual environments, online discussion	
Managing learning activities Common management problems and challenges pertaining to conducting learning activities Planning, implementing and managing—group work and individual work (group management strategies)	EP—relate to learning theories ICT: management of computer classroom	
Teacher's awareness of own behaviour Teacher-induced versus student-induced misbehaviours Hierarchy of management intervention (HMI)	EP: role of the teacher ICT: managing behaviour in computer laboratories	
Group problem-solving local classroom cases	EP: psychosocial development of the learner	
Seeking assistance beyond the classroom Within school—consultation with peers, senior teachers and management Beyond school—consultation with parents, authorities	SC: working with stakeholders, different academic streams, personal beliefs EP: role of teacher and working with parents; helping skills	

Appendix E

Components of Skilful Teaching Framework covered in the Education Studies core cluster in NIE Initial Teaching Education (ITE) programmes.

Skilful Teaching Framework (Saphier et al. 2008, <http://www.rbteach.com/rbteach2/teach.html>).



Components of skilful teaching framework covered in the education studies cluster in NIE Initial Teaching Education (ITE) programmes	
Curriculum planning	Components
	<p>Overarching objectives</p> <ul style="list-style-type: none"> • How do the teachers' personal values, passions and objectives influence their teaching in relations to the political and social demands of the educational system?
	<p>Curriculum design</p> <ul style="list-style-type: none"> • Agreements of curriculum—how closely is the official curriculum designed by MOE actually carried out in schools? • Elements of curriculum—e.g. topics, units of study, learning expectations • Lesson planning • Designing curriculum
	<p>Planning</p> <ul style="list-style-type: none"> • Lesson planning • Teaching to cater to diverse needs of all learners
	<p>Objectives—teachers' thinking skills in terms of lesson objectives</p>
	<p>Assessment</p> <ul style="list-style-type: none"> • Validity and reliability • Classroom assessment
Learning experiences—how to differentiate learning experiences for diverse learners?	
<p>Covered in education studies core courses</p> <ul style="list-style-type: none"> • The social context of teaching and learning • Critical perspective on education (for degree programmes only) • NIE V²SK Model • CCE 	
<ul style="list-style-type: none"> • Educational psychology: theories and application for learning and teaching • Teaching and managing learners at the primary/secondary/junior college level 	
<ul style="list-style-type: none"> • Educational psychology: Theories and application for learning and teaching • Teaching and managing learners at the primary/secondary/junior college level 	
<ul style="list-style-type: none"> • Educational psychology: theories and application for learning and teaching • Core assessment course 	
<ul style="list-style-type: none"> • Educational psychology: theories and application for learning and teaching 	

(continued)

(continued)

Components of skilful teaching framework covered in the education studies cluster in NIE Initial Teaching Education (ITE) programmes	
	Components
Motivation	<p>Personal relation building</p> <ul style="list-style-type: none"> • Good teacher student rapport • Teacher traits
	<p>Class climate</p> <ul style="list-style-type: none"> • Supportive learning environment
	<p>Expectations</p> <ul style="list-style-type: none"> • Standards and expectations • Clarity, communication, key messages and matching
Instructional strategies	<p>Clarity</p> <ul style="list-style-type: none"> • Making concepts and skills clear and accessible to students
	<p>Principles of learning</p> <ul style="list-style-type: none"> • How to design more efficient and effective learning experiences
	<p>Models of teaching</p> <ul style="list-style-type: none"> • How to teach content and thinking skills? • Types of models of teaching
(continued)	

Covered in education studies core courses

- Educational psychology: theories and application for learning and teaching
- Teaching and managing learners at the primary/secondary/junior college level

- Educational psychology: theories and application for Learning and teaching
- Teaching and managing learners at the primary/secondary/junior college level
- ICT for meaningful learning
- Assessment

- Educational psychology: theories and application for learning and teaching
- Teaching and managing learners at the primary/secondary/junior college level

- ICT for meaningful learning

- Educational psychology: theories and application for learning and teaching
- Teaching and managing learners at the primary/secondary/junior college level
- Core assessment course

- Educational psychology: Theories and application for learning and teaching
- Teaching and managing learners at the primary/secondary/junior college level

(continued)

Components of skilful teaching framework covered in the education studies cluster in NIE Initial Teaching Education (ITE) programmes		
	Components	Covered in education studies core courses
Management	Space <ul style="list-style-type: none"> – Ideal use of space and furniture 	<ul style="list-style-type: none"> • Teaching and managing learners at the primary/secondary/junior college level
	Time <ul style="list-style-type: none"> – As construct – Time allocation and efficiency – Pacing and rhythm 	<ul style="list-style-type: none"> • Teaching and managing learners at the primary/secondary/junior college level
	Routines <ul style="list-style-type: none"> • Purposes • Clear communication and standards 	<ul style="list-style-type: none"> • Teaching and managing Learners at the primary/secondary/junior college level
	Attention <ul style="list-style-type: none"> • How to get students to pay attention and stay on task? 	<ul style="list-style-type: none"> • Teaching and managing Learners at the primary/secondary/junior college level
	Momentum <ul style="list-style-type: none"> • How to maintain pace of lesson? 	<ul style="list-style-type: none"> • Teaching and managing learners at the primary/secondary/junior college level
	Discipline <ul style="list-style-type: none"> • Approach to discipline • Managing students 	<ul style="list-style-type: none"> • Educational psychology: theories and application for learning and teaching • Teaching and managing learners at the primary/secondary/junior college level • CCE
Essential Beliefs	Teacher beliefs <ul style="list-style-type: none"> • About intelligence and children's capacity to learn • About learning • About teachers and teaching • About schools and schooling 	<ul style="list-style-type: none"> • CCE • Educational psychology: theories and application for learning and teaching • Teaching and managing learners at the primary/secondary/junior college level • The Social Context of Teaching and Learning • Critical perspective on education (for degree programmes only) • NIE V³SK Model

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Chapter 7

Preparing Mathematics Teachers in Singapore: The Issue of Mathematics Content Knowledge

Eng Guan Tay, Suat Khoh Lim and Weng Kin Ho

7.1 Introduction

Lee Shulman (1986) brought to the forefront the need to distinguish the different dimensions of teacher knowledge that will help guide teacher preparation. Instead of the then prevalent view of ensuring that the student teacher enters teacher education with adequate subject content knowledge and then equipping her with generic pedagogical knowledge, Shulman introduced the dimension at the nexus of subject content knowledge and generic pedagogical knowledge as pedagogical content knowledge. We, as Mathematics educators, are happy to claim Shulman as one of our own, as he based much of his research and writing on the discipline of Mathematics.

Others such as Ball et al. (2008) have added other dimensions or subdimensions of teacher knowledge, but in this chapter, we shall just use Shulman's original trichotomisation for its parsimony and its direct relation to the teacher education curriculum—for example, in the National Institute of Education (NIE), the three dimensions of content knowledge, pedagogical content knowledge and generic pedagogical knowledge neatly fall into our three main components of academic subject, curriculum studies and educational studies.

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This chapter is on Mathematics teacher education, so we shall use the following abbreviations for mathematical content knowledge (CK) and mathematical pedagogical content knowledge (PCK), leaving out the “M” for brevity. As Mathematics educators, our areas of concern are academic subject and curriculum studies, and so we will leave the area of general pedagogical knowledge to our generalist colleagues. Mathematics teacher educators also generally gear their curriculum studies courses along the lines of Shulman’s PCK. However, the twin foci of general pedagogy and PCK quite often leave CK unattended, particularly for NIE’s short Postgraduate Diploma in Education (PGDE) programmes, where the student teachers’ prior university education is expected to have prepared her with the subject content. Yet, this expectation has not always been fulfilled because of the broadening and diversification of qualifications of the intakes over time. Before we proceed to detail why CK is lacking and how NIE has responded to make-up for the deficit, we shall spend some time elaborating first on the nature of CK and its relationship with PCK, and the performance of Singapore prospective teachers in these areas in an international survey.

We first refer to the celebrated work of Liping Ma (2010) in her book *Knowing and Teaching Elementary Mathematics: Teachers’ Understanding of Fundamental Mathematics in China and the United States*. She made the important assertion that even the hierarchically lowest field of Mathematics, that is elementary Mathematics, is a “field of depth, breadth, and thoroughness” (p. 122) which makes it possible (and thus, necessary for good teaching) for elementary school teachers to attain a “profound understanding” of elementary Mathematics. Ma remarked that Chinese elementary school Mathematics teachers seem to know more even though they do not have college degrees:

Chinese students typically outperform U.S. students on international comparisons of Mathematics competency. Paradoxically, Chinese teachers seem far less mathematically educated than U.S. teachers. Most Chinese teachers have had 11 to 12 years of schooling – they complete ninth grade and attend normal school for two or three years. In contrast, most U.S. teachers have received between 16 and 18 years of formal schooling – a bachelor’s degree in college and often one or two years of further study. (p. xxvi)

Ma (p. xxvi) then proceeded to explain that “Chinese teachers begin their teaching careers with a better understanding of elementary Mathematics than that of most U.S. elementary teachers...continues to grow throughout their professional lives.”

Usiskin (2001) argued that the Mathematics in CK, which he called teachers’ Mathematics, should be seen as a special kind of Mathematics.

Even though taking more and more Mathematics courses would not seem to have any down side, it can create a problem. Often the more Mathematics courses a teacher takes, the wider the gap between the Mathematics the teacher studies and the Mathematics the teacher teaches. The result of the mismatch is that the teachers are often no better prepared in the content that they have to teach than when they were students taking that content. (p. 86)

He proceeded in the paper to lay out three kinds of Mathematics not found in typical college Mathematics courses, that is Mathematics generalisations and extensions, concept analysis, and problem analysis.

An important study by Baumert et al. (2010) convincingly showed that the CK and PCK of teachers affect the mathematical achievement of their students. The study, “Professional Knowledge of Teachers, Cognitively Activating Mathematics Teaching, and the Development of Mathematical Competence,” was conducted in Germany within the COACTIV over a 1-year period. It involved a representative sample of 4353 Grade 10 students and their 181 teachers. The study conceptualised CK as “a profound mathematical understanding of the Mathematics taught at school” (p. 142). PCK is seen as a “distinct body of instruction-[related] and student-related mathematical knowledge and skills—the knowledge that makes Mathematics accessible to students” (p. 142). One key claim is that the study has distinguished CK and PCK of secondary Mathematics teachers conceptually and empirically. Also, PCK was reported to have explained 39% of the between-class variance in achievement at the end of Grade 10, with the implication that PCK largely determines the cognitive structure of mathematical learning opportunities. Although CK was found to be highly correlated with PCK, the results show that CK has lower predictive power for student progress.

Baumert and his colleagues’ conceptualisation of CK as a “profound mathematical understanding” is certainly derived from the work of Ma (2010). Baumert et al. (2010, p. 245) cited Kahan, Cooper, and Bethea’s (2003) assertion that strong CK is “a factor in recognising and seizing teachable moments” and themselves add that “CK defines the possible scope for the development of PCK” (Baumert et al. 2010, p. 166) to emphasise their view that CK is “necessary for, but not identical with, a rich repertoire of skills and methods for teaching Mathematics” (p. 146). Thus, any emphasis on “subject matter knowledge” in teacher preparation should clearly explicate this conception in terms of CK and PCK, and then take into consideration that CK alone is not enough but that PCK makes greater contribution towards student progress. These need to be made clear so as to finally construct a teacher preparation curriculum that foundationally covers enough of the depth, breadth and thoroughness of the Mathematics to be taught at school, and then builds in PCK modules on top of the CK foundation.

The International Association for the Evaluation of Educational Achievement (IEA) conducted the Teacher Education Study in Mathematics (TEDS-M) 2012 in 17 countries “to provide data on the knowledge that [prospective] primary and lower-secondary school teachers acquire during their Mathematics teacher education...[and] to examine variations in the nature and influence of teacher education programmes within and across countries” (Tatto et al. 2012, p. 17). Chapter 5 of the TEDS-M report (Tatto et al. 2012) is devoted to the CK and PCK of prospective primary and lower-secondary teachers. Items spanning four content subdomains (number and operations, algebra and functions, geometry and measurement, and data and chance) were used to assess CK. Items addressing PCK spanned three subdomains, that is curricular knowledge, planning for teaching and learning, and enacting teaching and learning.

Prospective teachers' CK and PCK were reported in scaled scores generated through the use of item response theory (IRT) with the mean for each of the four scales (primary CK, primary PCK, lower-secondary CK and lower-secondary PCK) at 500 and the standard deviation at 100. Tables 7.1 and 7.2 are adapted from four tables presented in Tatto et al. (2012, pp. 139, 143, 147, 150). (We have no space in this chapter but it must be noted that the authors take pains to list the limitations with regard to the country coverage for each of their tables.)

Table 7.1 Prospective primary school teachers' Mathematics CK and PCK

Programme group	Country	Valid data	Mean for CK (SE) [Rank]	Mean for PCK (SE) [Rank]
Group 1: lower primary (to Grade 4 maximum)	Georgia	506	345 (4) [21]	345 (5) [21]
	Germany	907	501 (3) [14]	491 (5) [16]
	Poland	1799	456 (2) [17]	452 (2) [18]
	Russian Federation	2260	536 (10) [8]	512 (8) [12]
	Switzerland	121	512 (6) [12]	519 (6) [11]
Group 2: primary (to Grade 6 maximum)	Chinese Taipei	923	623 (4) [1]	592 (2) [2]
	Philippines	592	440 (8) [19]	457 (10) [17]
	Singapore	262	586 (4) [4]	588 (4) [3]
	Spain	1093	481 (3) [16]	492 (2) [15]
	Switzerland	815	548 (2) [7]	539 (2) [9.5]
	United States	951	518 (5) [11]	544 (3) [7]
Group 3: primary and secondary generalists (to Grade 10 maximum)	Botswana	86	441 (6) [18]	448 (9) [19]
	Chile	654	413 (2) [20]	425 (4) [20]
	Norway (ALU)	392	509 (4) [13]	539 (3) [9.5]
	Norway (ALU+)	159	553 (6) [6]	564 (6) [5]
Group 4: primary mathematics specialists	Germany	97	555 (8) [5]	552 (7) [6]
	Malaysia	574	488 (2) [15]	503 (3) [14]
	Poland	300	614 (5) [2]	575 (4) [4]
	Singapore	117	600 (8) [3]	604 (7) [1]
	Thailand	660	528 (2) [9]	506 (2) [13]
	United States	132	520 (7) [10]	545 (6) [8]

Adapted with permission from International Association for the Evaluation of Educational Achievement (2012)

Although not reported by Tatto et al., we did a calculation for the Pearson's product-moment correlation between the scaled scores for CK and the scaled scores for PCK, and obtained a very high $r = 0.964$ for the prospective primary teachers and $r = 0.963$ for the prospective secondary teachers. The corresponding Spearman's rank correlations were $p = 0.938$ and $p = 0.949$, respectively. The high correlations validate the close relationship between the two kinds of knowledge, but lack of complete conformity also endorses the current understanding that CK is not sufficient by itself for classroom teaching.

The 17 countries in the survey each had prospective teachers in different teacher preparation programmes, and the report grouped them into six programme groups. With regard to Singapore, the PGDE (primary), BA/BSc (Ed) (primary, non-Mathematics major) and Diploma in Education cohorts were classed as Group 2 (primary—Grade 6 maximum), the BSc (Ed) (primary, Mathematics major) cohort was classed as Group 4 (primary, Mathematics specialists), the PGDE (lower-secondary group) cohort was classed as Group 5 (lower secondary—Grade 10 maximum), and the PGDE (secondary group) cohort was classed as Group 6 (lower and upper secondary—Grade 11 and above). It was unfortunate that there was no BSc (Ed) (secondary, Mathematics major) graduating cohort in the year that the survey was conducted because the intakes 4 years earlier had only admitted the primary tracks in the BA/BSc (Ed) programmes. As it stood, the Singapore primary prospective teachers were ranked very highly in CK (4 and 3) and in PCK (3 and 1). While the PGDE (secondary) cohort placed well (CK 3 and PCK 4), the PGDE (lower secondary) cohort was more modestly placed (CK 7 and PCK 7).

Overall then, Singapore prospective teachers ranked well among the 17 countries in the survey but more in-depth analysis of the items in the survey showed that there is still much room for improvement. For example, a rough calculation from the data given in Tatto et al. (2012, pp. 144, 146, 147) shows that less than 50% of the Singapore PGDE (lower secondary) prospective teachers were able to correctly answer the straightforward combinatorics question below:

A class has 10 students. If at one time, 2 students are to be chosen, and at another time, 8 students are to be chosen from the class, which of the following statements is true?

- A. There are more ways to choose 2 students than 8 students from the class.
- B. There are fewer ways to choose 2 students than 8 students from the class.
- C. The number of ways to choose 2 students equals the number of ways to choose 8 students.
- D. It is not possible to determine which selection has more possibilities.

NIE faculty was aware of the inherent deficiencies in CK for some of the programmes. For all of the PGDE (lower secondary) and a large proportion of the PGDE (secondary), the prospective teachers were not graduates with Mathematics majors. Applicants for the secondary programmes were, however, screened to ensure that they had read at least two modules of Mathematics at their

Table 7.2 Prospective secondary school teachers' Mathematics CK and PCK

Programme group	Country	Valid data	Mean for CK (SE) [Rank]	Mean for PCK (SE) [Rank]
Group 5: lower secondary (to Grade 10 maximum)	Botswana	34	436 (7) [17]	436 (9) [20]
	Chile	741	354 (3) [22]	394 (4) [22]
	Germany	406	483 (5) [12]	515 (6) [10]
	Philippines	733	442 (5) [18]	450 (5) [18]
	Poland	158	529 (4) [9]	520 (5) [9]
	Singapore	142	544 (4) [7]	539 (6) [7]
	Switzerland	141	531 (4) [8]	549 (6) [4]
	Norway (ALU)	344	435 (3) [20]	455 (4) [17]
	Norway (ALU+)	148	461 (5) [16]	480 (6) [12]
	United States	121	468 (4) [15]	471 (4) [16]
Group 6: lower and upper secondary (to Grade 11 and above)	Botswana	19	449 (8) [19]	409 (16) [21]
	Chinese Taipei	365	667 (4) [1]	649 (5) [1]
	Georgia	78	424 (9) [21]	443 (10) [19]
	Germany	362	585 (4) [4]	586 (7) [2]
	Malaysia	388	493 (2) [11]	472 (3) [15]
	Oman	268	472 (2) [14]	474 (4) [14]
	Poland	139	549 (4) [6]	528 (6) [8]
	Russian Federation	2139	594 (13) [2]	566 (10) [3]
	Singapore	251	587 (4) [3]	562 (6) [4]
	Thailand	652	479 (2) [13]	476 (2) [13]
	Norway (PPU & Masters)	65	503 (8) [10]	494 (16) [11]
	United States	354	553 (5) [5]	542 (6) [6]

Adapted with permission from International Association for the Evaluation of Educational Achievement (2012)

undergraduate level before they were admitted. However, at the primary programmes, almost all the students except for those in the BSc (Ed) (primary, Mathematics major) had not done any Mathematics at the undergraduate level. The next section of the chapter will describe the various curriculum initiatives taken by the NIE to develop the CK of Singapore teachers. These have contributed to Singapore's generally high standing in the TEDS-M survey but could certainly be enhanced in the light of further research into their efficacy. The first of these was the introduction of a subject knowledge component to the programmes for the preparation of primary school teachers, the second was a means to ensure content mastery

in the pre-service PGDE (secondary) programme targeted at secondary Mathematics teachers and the third was the introduction of a Master's programme for Mathematics in-service teachers who sought to deepen their mathematical content knowledge. Each component will be reported with regard to its motivation and development, the course design and evolution, and some results on its impact.

Some teachers have stated that they “do not teach Mathematics” but that they “teach children.” Correctly used, this statement draws the teacher into the realisation that teaching is a human endeavour that involves human beings. Wrongly used, this statement downplays the importance of a subject matter in the education of a child. We should be “teaching Mathematics to children.” To this end, any self-respecting and child-respecting teacher should never shortchange her charges by being deficient in the CK that she is supposed to develop in the child. Due to her strong effect on her students, the “caring” teacher who teaches the wrong content may cause more damage than a less influential teacher. To this end, the NIE teacher education review for the teacher education model for the twenty-first century (TE²¹; NIE 2009; for more details, see Chap. 1) has emphasised the holistic development of the student teacher in its V³SK model (for more details, see Chap. 1) which places the child/student at the centre of the teacher education mission and equally highlights that “knowledge and skills...form the basis of teachers’ scholarship, which in turn informs their practice of classroom teaching.” (NIE 2009, p. 44).

7.2 The Subject Knowledge (SK) Mathematics Courses

Within the primary track of the degree and diploma programmes prior to 1998, the student teachers read two academic subjects at university level, and while the objective of having these subjects in the programme was to develop the CK of the student teachers, there are two reasons why the academic subjects did not meet their teaching needs. Firstly, the student teachers were being prepared to teach three subjects as generalists and these two academic subjects may not even correspond to two of the three teaching subjects. For example, most primary teachers would be teaching English and Mathematics and a third subject such as Science, Social Studies, Art or Music but the two academic subjects could easily have been History and Literature. Secondly, even if the academic subject matched the teaching subject, the curriculum of the academic subject tended to follow normal tertiary-level content topics which are not directly relevant to the knowledge necessary for a deeper understanding of the topics they would teach at primary schools.

The situation then was that many of the student teachers in the programmes would only have high school knowledge in the three teaching subjects, some of which were learnt at a superficial level, and hence there was a need to not only

revise but to re-learn the primary school content of these subjects from a teacher's perspective. This need motivated the introduction of a component known as the subject knowledge (SK) component with courses whose content would be specifically designed to be strongly linked to the primary school content in each of the subject areas, with the objectives of building up the student teachers' own understanding in the content and disciplinary processes in these subjects. In addition, these courses would be aligned with the rationale and approaches of the pedagogy courses (called curriculum studies [CS] courses) so that they would mutually complement and reinforce each other.

The SK component was first introduced into the primary track of the BA/BSc (Ed) programme in 1998, and this was for all subjects taught by generalist teachers, namely English, Mathematics, Science, Social Studies, Art and Music. While the student teachers in this track continued to read one academic subject of their choice, they had to do three sets of SK courses corresponding to their three CS areas. In most cases, the students would do English and Mathematics with one choice from Science, Social Studies, Music or Art. For the 2-year Diploma in Education programme for preparation of primary generalist teachers, the SK component was introduced in 2001, replacing the academic subject component. Due to the short 9-month duration of the PGDE (primary) programme, such SK courses could only be included in one of the three options made available when the programme was revised in 2005. In this option, where the potential teachers were being prepared to teach two subjects instead of three, the curriculum time freed up from the pedagogy courses for the third subject was freed up for the subject knowledge courses of the two remaining teaching subjects.

As tertiary-level courses, these SK Mathematics courses had to be both rigorous as well as firmly linked to the primary school Mathematics curriculum topics. The course designers were fully cognisant that most of the student teachers were not inclined towards pursuing Mathematics at tertiary level and would be disinterested in abstract Mathematics concepts as normally covered in pure Mathematics courses in universities. For example, while a successful study of axiomatic systems, group structures and number theory may provide deep understanding of the number concepts which dominate primary Mathematics, taking an abstract, logical pure Mathematics approach with such topics would not only be beyond the learning capabilities of most of the student teachers at this stage in their Mathematics learning journey, but also it would likely adversely affect their attitude towards Mathematics if they cannot appreciate the relevance of what they are learning. Nevertheless, these potential teachers of Mathematics need to appreciate some of the disciplinary reasoning processes of Mathematics so that they do not view and teach Mathematics as pure computational procedures. Thus, the selection of topics from such abstract Mathematics and the teaching approaches for the courses had to satisfy three basic requirements:

- (a) The content and teaching approaches must clearly show how each topic is relevant to primary school curriculum and, hence, the teachers' professional needs;

- (b) The teaching approaches should model strong pedagogy; and
- (c) The course content and processes should seek to develop in the potential teachers a familiarity with the practice of the disciplinary processes of Mathematics.

In its current form, the SK Mathematics component is structured as two courses for the diploma programme and three courses for the degree programme. For both programmes, the first course covers number topics and the second course deals with topics in geometry and measurement. The third course in the degree programme deals with further explorations in geometry and data topics and is an optional course taken by those who intend to specialise in upper primary teaching. We will use the topic of quadrilaterals to illustrate how the three requirements for the course are met and how the approach seeks to enable students to make sense of what they are learning.

For the topic of quadrilaterals, Singapore teachers are expected to teach properties of special quadrilaterals such as parallelograms, rectangles and squares in the primary school syllabus, and the student teachers are made aware of this fact when the topic is taught. The topic is covered in greater depth and scope to include quadrilaterals and properties beyond what is taught in the primary curriculum. The approach taken does not merely deal with properties of each type of quadrilateral in isolation (as tends to be the case at primary schools) but emphasises the relation between the different types of quadrilaterals through the exploration of their properties. These explorations are often carried out using manipulative or dynamic geometry software followed by the use of short deductive proofs. It was felt that short deductive proofs were necessary to develop in the student teachers an understanding of two disciplinary attributes of Mathematics: (a) the concept of definitions and inclusions, and (b) the logical reasoning method of establishing mathematical truths. At an inter-topic level, the topic of quadrilaterals is well connected to the prior topic of triangles, and there is constant use of logical deduction to connect the topics. Using this approach, the course seeks to build up the teachers' own reasoning skills, as well as bring home the importance of having a holistic overview of geometry through connections between various geometrical entities as well as across various geometry topics. This principle of making mathematical connections between topics and within topics with the theme of mathematical consistency running through the various topics undergirds all the courses in the SK component.

The Mathematics pedagogy courses at NIE advocate the principle that teachers should not be dispensers of knowledge but instead try to facilitate sense-making from their pupils in the constructivist sense. Although the student teachers appreciate the pedagogical principles in their pedagogy classes, they were unable to see such teaching methods actually put into practice as the content of what they are learning are theories and methods of teaching and not Mathematics content. One important objective of the SK Mathematics courses, therefore, is for student teachers to experience for themselves such sense-making from the perspective of learners of Mathematics. As mentioned above, geometrical properties were

established through initial exploration followed by deductive proofs. Such an approach models the learning process in schools where children learn properties through exploration and experimental means and where logical reasoning is taught at a later stage as proposed by the van Hiele theory (1985). Student teachers are given opportunities to experience as learners the pedagogical approaches learned in their PCK courses.

Using such approaches throughout the SK, Mathematics courses pose quite a few challenges for those teaching the courses since the approaches need to be very different from the more didactic ways of teaching tertiary Mathematics and yet somewhat different from the constructivist concrete methods suitable for teaching younger students. The Mathematics teacher educators are, however, convinced that such approaches are necessary, and positive feedback has been received. For example, the use of multi-base blocks to illustrate the re-grouping processes in unfamiliar bases alerted the student teachers to difficulties in learning place value and re-naming and how such teaching approaches could help in developing the concept. Some feedback from students shows that they are appreciative of the use of concrete materials to bridge the gap from experiential reality to abstract concepts and reasoning.

The student teachers' mathematical backgrounds also span a wide achievement range, and they lack the motivation of the academic subject Mathematics students who generally have stronger mathematical ability. Not having faced Mathematics classroom situations, while the student teachers find their pedagogy courses useful, they need some convincing that their Mathematics CK need to go beyond procedural knowledge and skills and that the content topics of SK Mathematics are truly relevant and useful. Not surprisingly, those stronger in Mathematics tend to realise these needs more quickly and, thus, appreciate the objectives and content of the courses more than those who find the learning more heavy-going. The duration of the course was also a constraint against deeper learning by the less mathematically capable student teachers who needed more time to internalise the mathematical process which were unfamiliar to them.

Despite the fact that the SK and pedagogy courses are taught by colleagues from the same academic group, the connection between the SK Mathematics courses and the Mathematics pedagogy courses could be much stronger. Logistical and resource constraints as well as programme structures and curriculum space required the SK and CS courses for any particular class of student teachers to be taught by different academic staff across different semesters (more details pertaining to this issue are discussed by Lim-Teo 2010).

The effectiveness and impact of these courses on PCK of the student teachers is difficult to ascertain since there are many variables which affect a teacher's PCK, and comparisons between groups are not possible because SK Mathematics is a core component taken by all student teachers in the degree and diploma programme who are being prepared to teach elementary Mathematics. Nevertheless, there is one piece of evidence from another local study on the PCK of primary Mathematics teachers of a PGDE (primary) cohort where the subgroup which did SK Mathematics performed significantly better in the Mathematics PCK test than those

who did not have SK Mathematics (Cheang et al. 2007).¹ Matthews et al. (2010) also provided evidence from a study in the USA that student teachers who took specialised content courses meant for teaching at elementary school level had significantly higher mathematical content knowledge than student teachers who took more general Mathematics courses.

Similar SK courses have also been offered as in-service courses across the past fifteen years and feedback from practising teachers has been very positive particularly when they found mathematical justification for Mathematics results which they had always accepted at face value and simply re-conveyed to their students. The feedback from those who had taught the SK courses to both pre-service and practising teachers is that the latter were more appreciative because they had experience with real difficulties faced in Mathematics classrooms which were addressed by the courses whereas the pre-service student teachers treated the courses as just programme requirements without real appreciation of their relevance to their future teaching.

While it seems that the SK courses may be more effective for practising teachers than for prospective teachers, it will be impossible to ensure that all primary Mathematics teachers would come back for such content courses once they complete their pre-service education. Thus, in view of the SK courses' role in developing teachers' content knowledge, the SK Mathematics courses will continue to form an essential component of our pre-service programmes for primary teachers. It would be even more ideal should teachers be able to return to re-visit and build on such knowledge after some years of teaching experience.

7.3 The School Mathematics Mastery Test for Secondary Mathematics Teachers

7.3.1 A Brief Developmental History

The PGDE (secondary) programme which spans a little more than 9 months has been the oldest and most economical way of preparing secondary teachers in Singapore. The programme focuses on pedagogical courses and general education courses. Up to around 1990, most of the student teachers in this programme would have acquired the content knowledge for their two teaching subjects through the corresponding subjects at undergraduate levels. For example, to be a Mathematics teacher in the 1980 s, the recruits would have been Mathematics majors. Therefore,

¹Due to the shortness of the PGDE (primary) programme, curriculum time was only available for the inclusion of SK courses in the upper primary track where the student-teachers were prepared to teach two subjects instead of three subjects in the general track. However, this track was only operational for two cohorts in 2004 and 2005 because the Ministry of Education decided that all subsequent student-teachers entering the programme would be channelled to the general track.

in those days, the PGDE (secondary) programme had always assumed that the recruits had the requisite CK.

However, since the mid-1990s, the requirements to be admitted for the two teaching subjects have been broadened tremendously, due to the Ministry of Education's (MOE) need to increase the teaching force very substantially. In the area of Mathematics, large numbers of non-Mathematics majors could be assigned to teach Mathematics even if their highest Mathematics qualification was A-Level Mathematics. For example, in the July 2001 cohort of 374 pre-service Mathematics teachers, 31% were engineering graduates and 13% were business graduates; only 28% were Mathematics majors. Moreover, with the broadening of university curriculum at the local universities, even those who had taken some modules in Mathematics may not have read the relevant modules necessary for a solid understanding of the content needed at the secondary school levels. It is not surprising that the anecdotal experience of those teaching the Mathematics pedagogy course as well as from school Mathematics heads was that the general level of CK of the PGDE (secondary) teachers had declined.

In 2003, in response to this apparent lack in CK in beginning Mathematics teachers, the NIE teacher educators for Secondary Mathematics decided to pay close attention to the mastery of the content of secondary Mathematics. The team had already collected data from the 2001 cohort which showed that a quarter of the potential Mathematics teachers failed to score half the maximum score for a competency test based on O-Levels Mathematics content.

7.3.2 *Conceptualisation of the Content Upgrading*

The idea of having PGDE (secondary) CS Mathematics prospective teachers sit for a Mathematics Proficiency Test (MPT) was mooted, and four models of content upgrading were considered:

- Model 1 Use MPT as a qualifying test to disqualify and reject candidates who fail.
- Model 2 Use MPT to identify prospective teachers who need to take a separate module on Mathematics content during their preparation at NIE.
- Model 3 Use MPT to inform prospective teachers and school administrators on the prospective teachers' proficiency level of secondary school Mathematics. The grade for the test can be separately reflected in an "appendix" to the prospective teacher's academic transcript.
- Model 4 Use the passing of MPT as a pre-requisite to passing the PGDE (secondary) CS Mathematics course.

There were reservations for the first three models. For Model 1, having a qualifying test may turn away those who want to teach Mathematics. The reduced intake may not meet the high demand from the schools for Mathematics teachers at that time. For Model 2, running a separate module for prospective teachers would

mean a strain on the existing Mathematics staff. Moreover, the content level would be below what is expected at a tertiary institution. For Model 3, a grade on an “appendix” to the prospective teacher’s transcript was deemed as not sufficient motivation for prospective teachers to want to pass the MPT well. In addition, if a prospective teacher passes the CS Mathematics module but has a poor grade for MPT, it may send an ambiguous signal with respect to his/her qualification to teach secondary Mathematics. Model 4 was finally adopted in 2004 as most colleagues agreed that basic proficiency for secondary school Mathematics is essential for teachers, and failure of MPT should rightfully render the prospective teacher not qualified to teach secondary Mathematics. Eventually, MPT was renamed as School Mathematics Mastery Test (SMMT) (for more details, readers may refer to Toh et al. 2007).

The guiding principle for developing SMMT was to make teachers aware of the Mathematics content relevant to their immediate teaching needs and their readiness in this respect. This CK would be the “teachers’ Mathematics” of Usiskin (2001), including “explanation of new ideas, alternative ways of approaching problems” (p. 96). Hence, the Mathematics content to be tested for the SMMT only includes O-Levels Mathematics and Additional Mathematics knowledge, albeit from a higher perspective. The prospective teachers must already have acquired mathematical knowledge of the O-Levels Mathematics when they were students. However, this extensive knowledge is largely limited because it is based mainly on their experience as students (Jaworski and Gellert 2003). Hence, SMMT serves as a “reflection” component for the prospective teachers on the secondary school Mathematics content.

The goal of the SMMT is to provide a mechanism that will motivate prospective teachers to revise, self-study and build up their secondary school Mathematics content up to a mastery level adequate to meet the demands in teaching Mathematics in the secondary schools. For a prospective teacher who has not mastered secondary school Mathematics content, it is expected that the learning will take time and so any short intensive module will unlikely be pedagogically effective in helping them attain the desirable proficiency level. However, it is also our belief that the prospective teacher, being a university graduate, will certainly be able to achieve mastery through their own self-study given sufficient time and awareness of the importance of school Mathematics content knowledge.

SMMT was not used to assess the performance of the prospective teachers in the PGDE (secondary) CS courses. Instead, a “pass” in SMMT is seen as indicative of the proficiency of the O-Levels Mathematics content knowledge. SMMT “mastery level” is equivalent to a distinction according to the O-Levels standard. Merely scoring more than 50% would not indicate that the candidate has sufficient CK for teaching, and, hence, does not warrant a “pass.”

For the PGDE (secondary) cohorts beginning in July 2003 up to January 2005, SMMT was required to be “mastered” within three attempts as part of the course requirement for CS Mathematics. This is essentially Model 4 discussed above. For those who failed to clear SMMT by the second attempt, online help in the form of self-paced learning was provided. A series of three lectures was also conducted to

clarify the errors and misconceptions common to secondary school Mathematics. Eventually, all prospective teachers were expected to pass SMMT by the third attempt. It was observed that, indeed as believed, many prospective teachers picked up the content through self-study and also through sufficient exposure to the course materials presented in the CS Mathematics module.

In July 2005, after an NIE curriculum review conducted by the Office of Teacher Education to streamline the different content upgrading modules across subjects, it was decided that content upgrading be moved before the PGDE programme proper. Effectively, this meant delinking SMMT from the PGDE (secondary) Mathematics course, and that the performance in SMMT would no longer have any bearing on the awarding of the postgraduate diploma. Other than that, the entire structure of SMMT remained.

7.3.3 *Format of SMMT*

The SMMT is a 2-hour paper consisting of about 18–20 questions of varying length. For each round of testing, two sets of SMMT papers (secondary and lower secondary) are generated.

SMMT (lower secondary) test content covers the entire Mathematics syllabus while SMMT (secondary) test content includes also all the topics from additional Mathematics (see <http://www.seab.gov.sg> for the detailed Mathematics syllabi). It should also be noted that the questions of SMMT are not directly similar to the typical O-Levels examination questions. Most of the questions test the candidates' understanding at a deeper level of mathematical concepts that are taught in O-Levels. Two sample questions are shown in Fig. 7.1 below. These were taken from <http://math.nie.edu.sg/information/smmt.aspx>, a site that provides information about SMMT.

(For more sample SMMT questions for other topics, readers can refer to <http://math.nie.edu.sg/information/smmt.aspx>. A collection of typical SMMT questions with complete solutions and the underlying rationale behind these questions can be found in Toh 2009).

- | |
|--|
| <ol style="list-style-type: none">4. Give two triangles that satisfy the SSA (or ASS) property but are not congruent, hence demonstrating that SSA is not a congruency test for triangles. Under what conditions do two triangles satisfy SSA property and are congruent? (Note that in fact RHS is a “special” condition for SSA).5. Use the congruency test for triangles to prove that any point on the perpendicular bisector of line segment AB is equidistant from A and B. |
|--|

Fig. 7.1 Two SMMT sample questions

7.3.4 Prospective Teachers' Performance in SMMT

We shall next report the performance of the PGDE (secondary) prospective teachers from four recent cohorts of the students, for both the secondary (S) and lower secondary (LS) groups (Table 7.3).

We adopt the classification of the prospective teachers in Toh et al. (2007) using three categories: Cat A, Cat B and Cat C. Cat A reflects the prospective teachers who passed their SMMT in the first two attempts. They were not given additional help by their NIE tutors on additional secondary school Mathematics content knowledge. Given sufficient time for their revision and raising their awareness of school Mathematics, they were able to beef up their content knowledge and clear the mastery test. Cat B prospective teachers did not manage to pass the SMMT in the first two attempts in which independent self-study was expected. They attended a series of content upgrading lectures on secondary school Mathematics and managed to pass the SMMT in the third attempt. In other words, they needed additional help to pass their content upgrading. Cat C prospective teachers failed the third attempt, that is they were not able to reach the “mastery level” of school Mathematics content despite the additional help provided by the NIE.

Table 7.3 Performance of two cohorts of PGDE (secondary) prospective teachers in SMMT

Cohort	Pass attempt 1	Pass attempt 2	Cat A: pass attempt 1 + 2	Cat B: pass attempt 3	Cat C: fail attempt 3	Total
January 11 (LS)	13	0	13	5	3	23
January 11 (S)	47	0	47	6	1	54
July 11 (LS)	46	14	60	7	4	71
July 11 (S)	85	26	111	5	2	118
January 12 (LS)	6	2	8	2	0	10
January 12 (S)	52	5	57	12	1	70
July 12 (LS)	26	15	41	18	3	62
July 12 (S)	69	46	115	7	1	123

It can be seen that a very high percentage of prospective teachers in these four cohorts were able to reach the “mastery level” by their own effort (Cat A), while a relatively small portion of them needed additional help to build up their school Mathematics content knowledge (Cat B). Very few teachers (Cat C) were not able to reach the content “mastery level” by the end of their PGDE programme.

After every cohort, MOE would be informed about the prospective teachers who were not able to clear the SMMT by the third attempt. These teachers would then be required to attend a series of intensive Mathematics content upgrading lectures as (in-service professional development courses) stipulated by the NIE after their graduation from the PGDE programme.

7.3.5 Prospective Teachers’ Feedback About SMMT

A course feedback was conducted at the end of the PGDE (secondary) programme for every cohort of prospective teachers. The following two questions about SMMT were included among the feedback questions:

E1. SMMT motivates me to revise secondary school Mathematics.

E2. I am able to make adequate preparation for SMMT.

A five-point scale (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree) was used to obtain their opinion. The summary of the feedback for those who responded from the July 12 cohort (for both S and LS) is shown in Table 7.4.

Generally, most prospective teachers (74%) agreed that SMMT motivated them to revise secondary school Mathematics content. A slightly lower percentage (51%) agreed that they were able to make adequate preparation for SMMT.

In anticipation of this feedback, the SMMT team has always included information about SMMT before the prospective teachers begin their PGDE programme during the e-briefing. In response to a relatively low positive response to E2, the SMMT team had decided to do a face-to-face briefing about SMMT prior to the commencement of the PGDE programme.

Table 7.4 Feedback about the SMMT from July 12 (S and LS) prospective teachers

	Number	SD	D	N	A	SA
E1	164 (100%)	7 (4%)	16 (10%)	19 (12%)	68 (41%)	54 (33%)
E2	163 (100%)	20 (12%)	34 (21%)	26 (16%)	62 (38%)	21 (13%)

7.4 Master of Science (Mathematics for Educators)

7.4.1 A Brief Developmental History

MOE in Singapore has, since the turn of the twenty-first century, repeatedly emphasised on the importance of maintaining high quality of our teaching force and developing teachers professionally. During meetings with schools, the Ministry often cited Finland's success in teacher education: one of her secrets being high standards for teachers' qualifications. In particular, all Finnish teachers hold a Masters' degree: primary school teachers major in education, while upper-grade teachers concentrated their studies in a particular subject, for example Mathematics, as well as didactics (Sahlberg 2010).

For Singapore, although all Mathematics teachers in public schools are, by requirement of the Ministry, PGDE graduates and, thus, have received preparation in pedagogical matters concerning their teaching subjects, not all of them are Mathematics graduates. Recent years saw an increasing emergence of Mathematics teachers who held undergraduate degrees in engineering or majored in a Mathematics-related discipline (e.g. computer science) other than Mathematics. Therefore, many of such Mathematics teachers acknowledged that their university education had not adequately prepared them for the teaching profession. They saw the need to deepen their CK so as to become more confident Mathematics teachers. In addition, in-service Mathematics teachers would want to refresh their CK and meet greater demands (e.g. gifted education, curriculum planning).

The Master of Science (Mathematics for Educators), or MSc (MAE) for short, is a graduate programme designed to meet the aforementioned needs. Designed as a coursework programme to provide rigorous preparation in Advanced Mathematics for Mathematics teachers, this programme differentiates itself from other competing courses offered elsewhere in that the acquisition of wide and in-depth knowledge in Mathematics is emphasised along with its connection with Mathematics teaching. The programme design is founded on the belief that a strong mastery of Mathematics will enable a Mathematics teacher teach better and promote higher-order thinking among Mathematics learners.

We now give some examples of questions, contributed by teachers as well as NIE Mathematics faculty staff, which pose difficulties with regard to the Mathematics content of the school Mathematics taught in Singapore.

- Does $\frac{\bar{X}-\mu}{S/\sqrt{n}}$ always have a t -distribution with $n-1$ (and why not n) degrees of freedom? [A-Levels H2 Mathematics]
- When expressing $\frac{1}{x^2-1}$ as a sum of partial fractions, one student wrote:

“Multiplying both sides by $x^2 - 1$, one gets

$$1 = A(x + 1) + B(x - 1).$$

Substituting $x = 1$ and $x = -1$, we obtain respectively $1 = 2A$ and $1 = -2B$. Therefore, $A = 1/2$ and $B = -1/2$.”

Is there anything wrong with his answer? Does this method lead to problems and how does one overcome them? [O-Levels Additional Mathematics]

One of the desired outcomes of the MAE programme is that graduates are equipped with the knowledge to answer these questions. Mathematics teachers who have a “profound understanding” of the school Mathematics they teach are less likely to (i) convey wrong concepts to students, (ii) make wrong sequencing decisions when planning for lessons and schemes of work, and (iii) create noise that obstructs accuracy in students’ assessment.

7.4.2 Course Design

To build the connection between Advanced Mathematics learning at a Master’s level and teaching of (comparatively simpler) Mathematics in schools, this programme offers a wide range of Level-1 courses that specifically highlight the deeper mathematical structures underlying the topics of both elementary and additional Mathematics listed in the secondary school Mathematics syllabus. As mentioned earlier, some amount of Mathematics at the undergraduate or postgraduate level is required to tackle content-related questions, such as those stated in the preceding subsection. Level-1 courses are intentionally designed to meet this requirement. For illustration purpose, we show in tabular form how the course content for MSM815 Discrete Mathematics and Problem-solving is designed, together with some design rationale/principle (Table 7.5).

The Level-2 courses will then further develop expertise in a number of mathematical fields. Intended to be more abstract and sophisticated in nature, Level-2 courses allow the course participants to deepen their roots and securing them to firmer grounds in various mathematical disciplines. These courses range over both pure and applied Mathematics. The coverage of topics in each course is chosen by practising mathematicians in the respective fields with an emphasis on advanced concepts related to most recent developments. Level-2 courses are intentionally pegged at a much higher level than those of Level-1. Table 7.6 displays some courses at Level-1 and their corresponding Level-2 courses offered in this programme.

The core course, Mathematical Inquiry, is a capstone course, that is the only mandatory course in this programme which is aimed at providing students with an

Table 7.5 Structure of a Level-1 course MSM815

Topic	Contents	Rationale
Counting—its principles and techniques	Addition principle, multiplication principle	Permutation and combination (A-Level Mathematics) Elementary probability (O- & A-level Mathematics)
	Divisors of natural numbers	Number topics in primary and secondary school mathematics
	Subsets and arrangements, bijection principle, principle of inclusion and exclusion	Event space, mutually exclusive events, elementary probability
	Binomial expansion, Pascal’s triangle	Binomial theorem (O-level additional Mathematics)
Graph theory and applications	Graphs, travelling salesman problem, graph colouring, the Konigsberg bridge problem, the Chinese postman problem	Mathematical modelling in secondary schools Real-life applications of matrices (O-level additional Mathematics)

Table 7.6 Examples of Level-1 courses and corresponding Level-2 courses offered in MAE

Level-1	Level-2
Advanced calculus and applications for educators; elements of mathematical analysis with applications in the teaching of calculus	Real analysis; functional analysis
Abstract algebra for educators	Commutative and non-commutative algebra
Discrete mathematics and problem-solving	Directed graphs: theory, algorithms and applications; vertex colouring and chromatic polynomials
Statistical reasoning for educators	Statistical methods

excellent opportunity to examine current research in a chosen area of pure or applied Mathematics. For this course, a student is supervised by an academic staff member who is a practising mathematician in a specific field and required to perform independent desk study on selected research journal articles or chapters of specific graduate textbooks. A proposed MSM800 project, for instance, may require a student to read recent Mathematics journal articles on say, partial fractions (Bradley and Cook 2012) or exponential functions (Ho et al. 2012), and present his or her understanding of the paper in the form of a concise report of no more than 30 pages. Most of these projects are crafted to help students appreciate the deep mathematical theories associated with the Mathematics they teach at school, and thus enhance both their CK and PCK.

7.4.3 Course Requirement

Guided by the aforementioned course design rationale, it is mandated that the award of the MSc (MAE) degree takes place upon the successful completion of 10 courses consisting of (i) MSM800 Mathematical Inquiry, (ii) at least two and no more than five Level-1 courses and (iii) at least four Level-2 courses. While it is important for teachers to equip themselves with a deep understanding of the content knowledge related to school Mathematics, there must be a certain level of expectation that master's degree graduates in Mathematics demonstrate a respectable level of familiarity and competency with proof and proving, mathematical rigour and abstractness in Mathematics. The condition that at least four Level-2 courses be taken is enforced to produce this desired outcome.

7.4.4 Students' Feedback

Quality management surveys were conducted from 2010 to 2013 to obtain feedback from students to provide us with some indication of the effects of the course on the students' professional competency and also areas of concern which need address. We shall now employ a qualitative treatment of the survey data to highlight these effects and concerns.

Not surprisingly, the survey returns indicate that the programme has a positive effect on the *students' professional competency* in teaching Mathematics. There is a general consensus that the programme has been successful in increasing the content knowledge and understanding of the teachers who graduated:

Good programme to revise and **strengthen mathematical concepts and knowledge**.

This course has been very beneficial because it gave me a **deeper conceptual understanding** of many topics that I am currently teaching at JC.

Graduates were aware of the intentional connections made with the Mathematics topics taught in schools and also the manner in which the knowledge imparting was carried out:

It **stimulates the mind** and **adds breadth to the knowledge we are imparting** to our students in school.

The lecturers also **made links** to the teaching of the topics (where applicable) in schools.

The courses in this programme promote the affective components of learning Mathematics:

I began to **appreciate the connections** between various areas of Mathematics which I was not able to see during my under-graduate course. In particular, I was amazed at the links between two seemingly unrelated areas of Mathematics, like statistics and matrix algebra, graph theory and topology, and even topology and abstract algebra. This programme has further **stimulated my interest and passion for Mathematics**.

There seems to be substantial indication that the knowledge upgrade acquired and the preparation received by these graduates has translated into positive outcomes in students' learning in the classrooms:

The content taught also connects what I am currently teaching to a higher level which is a very good platform for me to **stretch my students' ability** in Mathematics.

A number of comments were regarding programme matters, and these shed some insight on the *quality of the programme* offered on the whole. The first thing to notice that is relevant to the programme design is that there is a wide spectrum of students' background and standards in Mathematics. A small number of students expressed that the courses were easy:

Overall, I felt the courses that I took had a low difficulty and expectation level.... But in general many of the courses felt like they were similar difficulty or even easier than undergrad courses (MSM 813, 815, 826, 829).

There were, however, a sizeable number who thought otherwise:

[M]ost **challenging** as the topic was an area that is totally new to me, but I enjoyed the course thoroughly.

The analysis and topology courses were plenty **difficult** though!

Concerning the capstone course MSM800 Mathematical Inquiry, graduates agreed that though it was challenging because it required them to perform independent desk study, the experience of having gone through it is nonetheless rewarding:

I also really **enjoyed** the Inquiry course, though it was the one I was **most worried** about.

The most **difficult** period was when I was doing my mathematical inquiry where I had to **do self-study** and **depended a lot on my own**.

I find particularly useful the course requirement on Mathematical Inquiry as it is thorough research, one is forced to understand and **think more critically** about the topic.

The programme was perceived to be one of high quality and value-addedness as summarised by the following remark:

The course is **rigorous, engaging and fulfilling**.

I became a more **confident, competent and independent learner**.

One of the aims of NIE is to prepare and nurture a high-quality teaching force in Singapore. To do so would mean that the faculty does what it preaches and be *exemplary in its own teaching practices*. Guided by their research in both content and pedagogy, instructors ensure high standards in their lessons. The following feedback confirmed the above:

Luckily, I had my supervisor, who helped me along the way. He gave me an **insight of how Mathematics can be seen as beautiful and interesting**. Though, I was just an average student, he has given me an opportunity to learn from him in depth and breadth of Category Theory. I really appreciated his effort and time taken for me during that period.

The **lecturers are understanding and patient**, and build a good rapport with the students.

It was nice that the **programme and faculty take into account that we are current teachers and thus busy**.

[A]nd very inspiring professors who not only are well-versed in their content but also being a **role model in teaching**.

7.5 The Way Forward

The three innovations described above were our response to improving teachers’ CK. What type of CK is actually needed or appreciated by the teachers remains not completely understood. Subject knowledge taught in NIE is an attempt to have a better understanding of Mathematics *related* to elementary Mathematics as conceptualised by Ma (2010). We feel that it can be improved with a sharper focus of “better understanding elementary Mathematics” (Ma 2010, p. xxvi). To this end, prospective and practising teachers can be made to see the relationship of what they are learning to their teaching by actually motivating the course with actual elementary school problems and concepts and building the course materials directly around these.

The MAE programme will also benefit from a review of its courses from a perspective of Usiskin’s teachers’ Mathematics, which we see as a generalisation of Ma’s profound understanding of fundamental Mathematics. In particular, the original notion of courses to be taught with a view to their direct application to school Mathematics ought to be explicitly refreshed for faculty teaching in the programme.

As an example of what content would attract teachers to improve their CK, we would like to refer to a workshop entitled “Touching on Infinity in the Secondary Mathematics Syllabus” conducted by one of the authors early in 2013. Teacher participants were asked whether they agreed with the statement “0.999... is *exactly* equal to 1.” Table 7.7 shows the number of responses (ranging from 1—Strongly Disagree to 5—Strongly Agree) before and after an explanation of the concepts of representations, sequences and ϵ – N definition of convergence, which was finally brought to bear on answering the question. The dramatic increase in the number of “correct” answers shows that the teachers were able to follow a quite mathematically rigorous explanation for a secondary Mathematics issue.

The feedback for the workshop also showed that teachers would appreciate CK courses with direct application to their teaching. Post-workshop comments were positive, and some comments are reproduced below.

Table 7.7 Agreement with the statement “0.999... is *exactly* equal to 1”

	1	2	3	4	5	Mean
Before	8	3	4	2	3	2.45
After	0	0	1	3	16	4.75

- The strengths of the workshop are as follows: interesting way of explaining limits; explanation of $0.9999... = 1$; clear explanation of concepts to maths theory; relevant content, insightful, challenging presumptions; concepts were explained very clearly with appropriate and relevant experiences; it goes to the very fundamentals of maths ... I really enjoyed as it helps me recall the maths learnt in university; interesting and engaging; provides formal proof of certain concepts involving infinity.
- I will use the knowledge and skills I have learnt in: Additional maths—exponential functions; there is scope for infinity in the recurring numbers and representation; to explain and prove concepts in Maths; teaching high-ability students; recurring numbers and representation; self-development; teaching of numbers; explaining to my students on the concept of infinity.
- I would like to participate in workshops on the following areas: more thought-provoking Mathematics (e.g. symbols representing numbers); similar workshop; areas related to Mathematics on research and problem-solving; more on conceptual understanding; similar to this workshop (content-based).

Thus, in all our reviews, we will probably need more feedback from practising teachers to help shape the course content for CK development in the future.

Besides constantly reviewing that the CK in the programmes are really relevant to the Mathematics in the school curriculum, enough time must be allocated for sufficient coverage of CK. One immediate solution in the Singapore context would be to have teachers specialise in only one subject at the secondary level. Table 7.8 shows the number of Mathematics teachers and the number of teachers teaching only Mathematics from a convenience survey of three mainstream secondary schools conducted in 2013.

Since the survey did not include junior colleges where teachers specialise in only one subject, it would not be unfair to estimate that at least half of all Mathematics teachers finally teach only Mathematics in the school. In this light, the current policy of preparing all prospective secondary teachers in NIE to teach two subjects would seem to be wasteful with regard to the minor teaching subject and the loss of curriculum time to enhance the preparation of the teacher for the major subject. The main reason for having two teaching subjects for secondary teachers in Singapore was that, from the logistical point of view, the principal of a school would find it easier to deploy four halves than two wholes within the school timetable. On the whole, this comes at an educational cost because the teacher who is prepared in two subjects within a given time will necessarily have learnt less in her major. Both CK

Table 7.8 Specialisation of secondary Mathematics teachers

School	Mathematics teachers	Only teaching Mathematics	Percentage
A	21	14	67
B	21	9	43
C	20	9	45
Total	62	32	52

and PCK would be affected. However, prospective secondary Mathematics teachers in Korea (Park 2010), another TIMSS high-performing nation, take only Mathematics as their academic subject when in the university and are prepared to teach Mathematics only. The way forward for Singapore and NIE is to loosen the requirement that secondary teachers be prepared for two subjects. [Latest update: In the enhanced degree programme beginning July 2015, the number of academic units allocated to the first teaching subject and the second teaching subject was changed from 39:24 to 51:12. This ensured that the teacher graduating from the degree programme would be well prepared for his/her first teaching subject and only allocated the second teaching subject in the school at the lower secondary level under exigencies.]

Certainly, a case can also be made for extending the PGDE programme for secondary teachers. Singapore did not fare as well in the TEDS-M survey for the secondary track as in the primary track. One possible reason is that the secondary teachers were all prepared in a 1-year PGDE programme and all the time allocated for Mathematics was spent on PCK. There was only the SMMT tool that was used as somewhat of a last resort to at least show the student teachers where they stood with regard to CK. We would recommend extending the programme for another semester for content upgrading to ensure that beginning teachers will at least be ready content-wise when they step into the schools. [Latest update: The PGDE programme beginning January 2017 will be extended to 16 months.]

A similar argument on specialisation could be made for the primary school teachers to specialise in teaching just one or two subjects, particularly at the upper primary levels. The TEDS-M study had showed that our BSc (Ed) (Mathematics major) group were ranked first for PCK and third for CK and, as mentioned in the section on SK Mathematics, the PGDE (primary) subgroup which had specialised in two subjects and, hence, undergone the SK Mathematics courses outperformed their cohort mates who were prepared for three teaching subjects and had no curriculum time for taking any SK courses. Since it is difficult for any single person to have strong content mastery in three subjects, specialisation would not only allow more curriculum time to develop relevant CK but also build on relative subject strengths of the student teachers, particularly for the 1-year PGDE (primary) programme.

For those with no intention to take on a postgraduate content programme, in-service courses are currently the only avenue for CK development. However, there is often a mismatch between what the teachers think they need and the courses that are available. In addition, teachers sometimes do not know what they need—this can be seen from the pre-workshop responses to the statement “0.999... is *exactly* equal to 1.” Since any top-down measure where teachers are recommended to attend in-service courses in identified areas of weaknesses is likely to be demoralising and hence de-motivating, a possible solution would be to post a self-assessment for teachers in a widely viewed site, for example MOE’s curriculum website or the Academy of Singapore Teachers website. In this self-assessment, teachers may try to solve a number of problems and view their results

anonymously. The feedback would direct them to courses which would be suitable to develop that deficient part of their CK.

This chapter has discussed the importance of relevant mathematical content knowledge for teachers and the measures which NIE has taken to ensure and/or develop such knowledge in prospective as well as practising teachers. With varying teacher profiles in future, the curriculum content of such courses to enhance teachers' content knowledge will continue to evolve over time and determination of what content is most useful will need to be informed by further research. While teacher educators can focus on determining such curriculum details, given time and resource constraints of teacher preparation courses and the myriad demands on practising teachers, further proposed measures to meet the needs of teachers in the area of their own subject content knowledge will only be possible, provided the crucial importance of teachers' subject content knowledge is strongly recognised by the education leaders in the system.

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Chapter 8

Science Teacher Education for the Changing Landscape

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8.1 Preparing Teachers to Teach Science

Teaching has become increasingly complex and multifaceted against the backdrop of changing demands in society. More than ever, learning and teaching has to take into consideration Schwab's (1969) four "commonplaces of education" where the teacher, learners, subject matter and milieu (or context) are in dynamic and constant interaction. A teacher is not simply a conduit to deliver a planned teacher-proof curriculum but plays an inextricable part during curriculum development, implementation and evaluation. The nigh unteachable "problematic" way in which a teacher actively makes pedagogical decisions in response to the particular and varied learning demands of the situation is well known:

Teachers' active decision making and the reasoning that directs and informs their practice has a great deal to do with the ways in which teaching and learning experiences unfold in the practice setting. Hence, from a teacher thinking perspective, teaching is problematic. There is no one way to teach a subject and no one way that all students learn that subject. There are multiple decision points that need to be negotiated by both teacher and learner, hence teaching is problematic. (Loughran 2013, p. 120)

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In making these informed though often implicit decisions about practice, a teacher would be tapping on an elaborate knowledge base, a central piece of which is the teacher's pedagogical content knowledge (PCK), as first coined by Shulman (1986, 1987). While skilful performance may be honed through experience, there is a need to help educate teachers to reason soundly about their teaching—equally across successful as well as less than spectacular episodes. Teachers would need to not only know what to do but also why they do what they do; that is, to learn to provide defensible grounds for choices and actions from their accumulated knowledge base (Morris and Hiebert 2011). Teachers gain a better understanding of the learning–teaching relationship by reflecting on the judgments and actions made in teaching, and linking these to student outcomes such that they learn how to teach particular content in productive ways over time to enhance understanding. This is in line with Clarke and Hollingsworth's (2002) model of teacher professional growth which suggests that change occurs through the mediating processes of “reflection” and “enactment”, in four distinct domains which encompass the teacher's world: the personal domain (teacher knowledge, beliefs and attitudes), the domain of practice (professional experimentation), the domain of consequence (salient outcomes) and the external domain (sources of information, stimulus or support).

In this chapter, we begin by reviewing briefly the changing landscape of science education over the past decades from content-focused “science for the scientist” modes to the current emphasis on developing scientific literacy for all students. This will help us gain a better understanding of reforms in science education that inevitably influence what good science teaching means at different periods. A fundamental question, of course, is what knowledge science teachers require to be effective in their profession. However, across international science education communities, there exists no consistent description of proficiency in science teaching, partly as a result of the difficulty in defining proficiency, and partly as a reflection of how complex science teaching is as a research field. As a result, there is a great variance between science teacher preparation programs. This great variance also leads to difficulty in understanding how national systems can be organised to support meaningful science teaching (Darling-Hammond et al. 2005), which is the concern of this paper that describes one such system from Singapore.

We next review the literature on science teachers' knowledge base, especially the concept of PCK and use this as a lens to discuss the implications for science teacher education. What working models of PCK might help us conceptualise the design of teacher preparation programmes? What would be an optimal (if at all possible) mix of content instruction and pedagogy in preparing prospective teachers? How do we nurture teachers to be reflective practitioners, and to help them develop their PCK through professional development and reflective practice? These are some of the questions that are uppermost in our minds. We adapt a model of PCK for science teaching, drawn from literature, which we use as a conceptual framework to frame our approach in developing science teachers' PCK in the NIE, especially for initial teacher preparation.

8.2 Changing Landscape for Science Education

The focus on what it means to prepare teachers to teach science will be affected in part by the concomitant emphasis of science education policy and reform movements at the local and international levels. It will be instructive to review how the emphasis of science education has evolved in the USA and Singapore through the past decades.

Pea and Collins (2008) identified four waves of reform over the past half-century in America, with each wave contributing to new insights on what was necessary to achieve desirable outcomes for science education. The first wave (1950–1960s) began in response to Sputnik, which led to the development of challenging new science curricula with the main emphasis on the mastery of structured subject matter and on the development of scientific inquiry skills. The second wave (1970–1980s) was characterised by cognitive science studies of learners' reasoning in the context of science education, with emphasis on examining novice and expert reasoning differences, resulting in a promotion of strategies such as confronting misconceptions and providing bridging analogies. The third wave (in the late 1980s–1990s) involved the creation of national and state standards, to specify what students should know and be able to do at particular grade levels in specific subject domains. The fourth wave (2000 onwards) involves the emergence of a systemic approach to designing learning environments for advancing coherent understanding of science subject matter by all learners.

However, in Singapore, changes and demands in the economic, political and social landscape often act as precursors to changes and innovations in the educational arena, which subsequently impacts science education. Singapore has consistently transformed its education system in tandem with our nation's economic development since independence in three phases (Boon and Gopinathan 2006): (1) *survival-driven phase* (1965–1978), (2) *efficiency-driven phase* (1979–1996) and (3) *ability-driven phase* (1997–current). Through the 1960s, the focus was on nation building. There was a large-scale recruitment of teachers and a rapid expansion of school places, with a focus on giving every child basic literacy and numeracy skills. A strong emphasis was placed on mathematics, science and technical education so as to produce a labour force with the requisite skills for the industry.

By the end of the 1970s, Singapore had grown to become a newly industrialised nation. There was, however, a relatively high attrition rate in school, with an increasing gap between labour market needs and school leaver skills. To support the drive towards sustainable development and economic restructuring, a New Education System (NES) was introduced in 1979, with the emphasis on efficiency, aimed at reducing educational wastage and meeting the economic demands of the time. In line with the changes in the NES, the science syllabuses at all levels were revised to cater more effectively to the differences in ability and aptitude of students and to provide a broader secondary-school science curriculum. For example, the "S" paper was introduced at the A-Levels for each of the three science disciplines

(biology, chemistry and physics) that consisted of higher-order thinking questions to stretch the students with greater ability in the subject. Given the continuing drive to upgrade the nation's workforce to meet the increased demands for knowledge workers, the science syllabuses of all levels were subsequently revised in 1990. Less emphasis was placed on descriptive and factual recall, and greater emphasis was placed on understanding, application, processes and skills. The first two phases of Singapore's education system can be seen to be broadly similar to the first two waves of science education reform in the USA in that both systems were grappling with the same issues of helping students to achieve content mastery, conceptual understanding and process skills in science.

The next milestone towards educational reform was a shift from an efficiency-driven education to an ability-driven one, initiated in 1997 and encapsulated in the vision, *Thinking Schools, Learning Nation* (TSLN). The transition to a knowledge-based economy (KBE) shifts the emphasis of value away from production towards innovation and creativity. The *Teach Less, Learn More* (TLLM) movement launched in 2005 continues the TSLN journey by engaging students more deeply in learning. Schools were given greater ownership and flexibility to develop customised school-based curriculum and programmes to better meet the needs and aptitudes of their students. For science, the emphasis was on authentic and inquiry-based learning in the curriculum. Instead of the traditional one-off examination of practical skills, the School-based Science Practical Assessment (SPA) was implemented in 2004 at the A-Levels (grades 11–12) and in 2007 at the O-Levels (grades 9–10) with the aim of strengthening the teaching and learning of science as an inquiry process and allowing for greater flexibility in the design and choice of practical tasks. The implementation of the First IT Masterplan (1997–2002) saw the provision of data loggers to schools at all levels by the Ministry of Education (MOE) to facilitate science learning and experimentation. To support schools with the TLLM initiative, additional funding was given to schools to develop, implement and evaluate innovative school-based pedagogical practices and curricular resources. This has encouraged a host of school-based curriculum innovations with a focus on inquiry and engaged learning in science (MOE 2008). Examples include teaching investigative questions to students with the aim to develop higher-order process skills, pedagogical approaches that help the less academically inclined students to develop a passion in science and outdoor learning in science using electronic handheld devices.

In line with these changes, the National Institute of Education (NIE) has reviewed its initial teacher preparation programmes to meet the objectives of TSLN. NIE has to ensure that its pre-service curriculum and professional development programmes stay relevant and responsive. In 2009, the new NIE Teacher Education Model for the twenty-first century (TE²¹) was launched (NIE 2009; for more details, see Chap. 1), after reviewing how NIE's teacher education programmes can be enhanced to equip them to meet the needs of the twenty-first-century learners, with the focus on nurturing the whole child. In tandem, the science education courses were also revised to focus on the development of scientific literacy competencies that students need to take their places in society. Underpinning the TE²¹

Model is a value-based philosophy of teacher education which guides the design, delivery and enhancement of NIE's teacher education programmes and courses. In particular, TE²¹ adopts a framework of values, skills and knowledge (V³SK) that focuses on three value paradigms:¹ (1) Learner-centred, (2) Teacher Identity and (3) Service to the Profession and Community, as well as the skills and knowledge teachers must possess to be ready for the twenty-first-century classroom.

8.3 Science Teachers' Knowledge Base and Review of PCK

Since the second half of the 1980s, scholars and policymakers had asked: what knowledge do teachers require to be effective in their profession? The answer to this question has been predominantly influenced by Shulman's (1986, 1987) two seminal articles about teacher knowledge, where he introduced seven domains of teacher knowledge, including the notion of PCK as the special amalgam of content and pedagogy that is part of the professional knowledge base unique to teachers. Shulman (1987, p. 8) further described PCK as representing the "blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organised, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction". To Shulman, how the teacher transforms his or her subject matter knowledge (SMK) into ways that learners can understand is at the heart of teaching.

Since then, there have been numerous studies and reviews on teacher knowledge (e.g. Abell 2008; Cochran 1993; Corrigan et al. 2011; De Jong 2009; Fischer et al. 2012; Gess-Newsome and Lederman 1999; Grossman 1990; Kind 2009; Loughran et al. 2008; Magnusson et al. 1999; Tamir 1988; Verloop et al. 2001), with PCK examined as one of the central domains of a teacher's knowledge base, but with varied interpretations of what PCK actually constitutes and its relationship with the other knowledge domains.

Despite the different conceptualisations about PCK among different researchers, certain aspects of PCK development in science teacher education are generally well established. Firstly, there is no dispute that teachers need to understand the subject matter that they are teaching. Adequate SMK is a necessary precondition (though not sufficient) for developing effective PCK. However, having a Bachelor's degree

¹As stated by Low et al. (2009): (1) *Learner-centred values* put the learner at the centre of teachers' work by being aware of learner development and diversity, believing that all youths can learn, caring for the learner, striving for scholarship in content teaching, knowing how people learn best and learning to design the best learning environment possible. (2) *Teacher identity values* refer to having high standards and strong drive to learn in view of the rapid changes in the education milieu, to be responsive to student needs. (3) *The values of service to the profession and community* focus on teachers' commitment to their profession through active collaborations and striving to become better practitioners to benefit the teaching community.

in science does not necessarily imply that a student teacher will possess “good” SMK to teach science well. In fact, SMK of student teachers is often vague and fragmented even after having completed their academic studies, especially at the start of their teacher preparation programmes (Gess-Newsome and Lederman 1993). The question that remains is to what extent academic SMK is necessary for effective science teaching. When teachers transform SMK to useful PCK, what knowledge is actually being transformed?

Deng (2007) argues that secondary-school science teaching has more to do with the teacher’s understanding of a particular secondary-school science subject than with his or her knowledge of the related academic discipline. However, a secondary-school science teacher needs to know beyond the content of the school subject; he or she needs to have knowledge of the related academic discipline which is critical to enhancing and broadening his or her understanding of the school subject. He pointed out that it is the subject matter knowledge of school science, often embodied in curriculum materials, which includes knowing several intersecting dimensions: the logical, the psychological, the epistemological and the sociocultural, that the teacher transforms when creating powerful learning experiences for their students in particular classrooms.

Secondly, PCK is discipline specific. Shulman in his original conception defined PCK as topic-specific knowledge for teaching a particular subject. Veal and MaKinster (1999) presented a taxonomy of PCK comprising three levels of specificity. At the top level is general PCK or discipline-specific PCK which is related to science as a discipline. Domain-specific PCK is connected to different domains within science, such as chemistry, biology and physics. At the bottom level is topic-specific PCK which is relevant to a list of concepts, terms and topics in each domain. It has been suggested that student teachers’ PCK mainly includes the lower levels of PCK, while experienced teachers’ PCK also includes the highest levels of PCK.

Thirdly, PCK develops over time as a result of experiences within teacher education programmes, classroom experience and professional development opportunities, coupled with reflection and mentoring (Appleton 2008) to support PCK development. The important role of reflection as part of professional practice has been emphasised by Schön (1983), where he described two levels of reflection: reflection-in-action (during teaching, sometimes described as “thinking on our feet”) and reflection-on-action (thinking back on teaching, to explore what worked, and what did not work, and why, etc.). The important role that school-based mentors play in developing student teachers was investigated by Luft et al. (2003), who found that an experienced mentor has a positive impact on development of the student teacher in progressing towards becoming an independent classroom practitioner more rapidly.

Grossman (1990) highlighted the relationship among three knowledge domains that influence a teacher’s PCK: (1) subject matter knowledge (SMK), (2) general pedagogical knowledge (GPK) and (3) knowledge about context or hereinafter referred to as general contextual knowledge (GCK). According to Grossman, PCK is knowledge that is transformed from these three knowledge domains and is more

powerful than its constituent parts. Grossman's PCK model includes four components. The first overarching component is the conceptions of purposes for teaching subject matter, and the other three components are knowledge of students' understandings, curricular knowledge and knowledge of instructional strategies. In developing their model of science teaching, Magnusson et al. (1999) built on Grossman's (1990) model and added a fifth PCK component, namely the knowledge of assessment. The component of knowledge of assessment includes knowledge of the dimensions of science learning that are important to assess and knowledge of the methods by which learning can be assessed. Assessment is not an afterthought but teachers use assessment methods throughout the instructional process to find out what students know, still do not know or have learned, and will adjust their instructional strategies accordingly. Recent moves in the UK towards assessment for learning (Black et al. 2003) make this integral to teachers' instructional strategies. More recently, Park and Oliver (2008) built on the model by Magnusson et al. (1999) but with the components of PCK placed in a hexagonal form to emphasise the interrelatedness among the components. They added a sixth component: teacher efficacy, which they termed as "an affective affiliate of PCK" (p. 270). PCK is to them as integration of the different knowledge components, with the development of PCK facilitated by reflection-in-action and reflection-on-action, as described by Schön (1983).

A way of conceptualising PCK is to view it as being situated within a continuum of models of teacher knowledge, as proposed by Gess-Newsome and Lederman (1999):

At one extreme, PCK does not exist and teacher knowledge can be most readily explained by the intersection of three constructs: subject matter, pedagogy and context. Teaching, then, is the act of integrating knowledge across these three domains. For convenience, I will call this the Integrative model. At the other extreme, PCK is the synthesis of all knowledge needed in order to be an effective teacher. In this case, PCK is the transformation of subject matter, pedagogical, and contextual knowledge into a unique form – the *only* form of knowledge that impacts teaching practice. I will call this the Transformative model. (p. 10)

In the integrative model, PCK is the result of the intersection of SMK, GPK and GCK in which the constituent parts retain their identities (PCK as a *mixture*). In the transformative model, PCK is the result of the synthesis of these three domains of teacher knowledge which results in new knowledge (PCK as a *compound*). These extremes have implications for science teaching and science teacher education. From an integrative perspective, an expert teacher will select information from a set of knowledge base components in deciding what and how to teach students in a specific context. These components are organised such that they can be drawn on with flexibility and accessed readily. Gess-Newsome and Lederman (1999) noted: "When observing an expert teacher, the movement from one knowledge base to the next will be seamless, giving the appearance of a single knowledge base for teaching" (p. 11). However, integrative models lack explanatory power as no mechanism is suggested that shows how the interaction between SMK, GPK and GCK results in PCK (Kind 2009). Transformative models, on the other hand, imply a mechanism exists where a highly skilled teacher draws on SMK, GPK and GCK

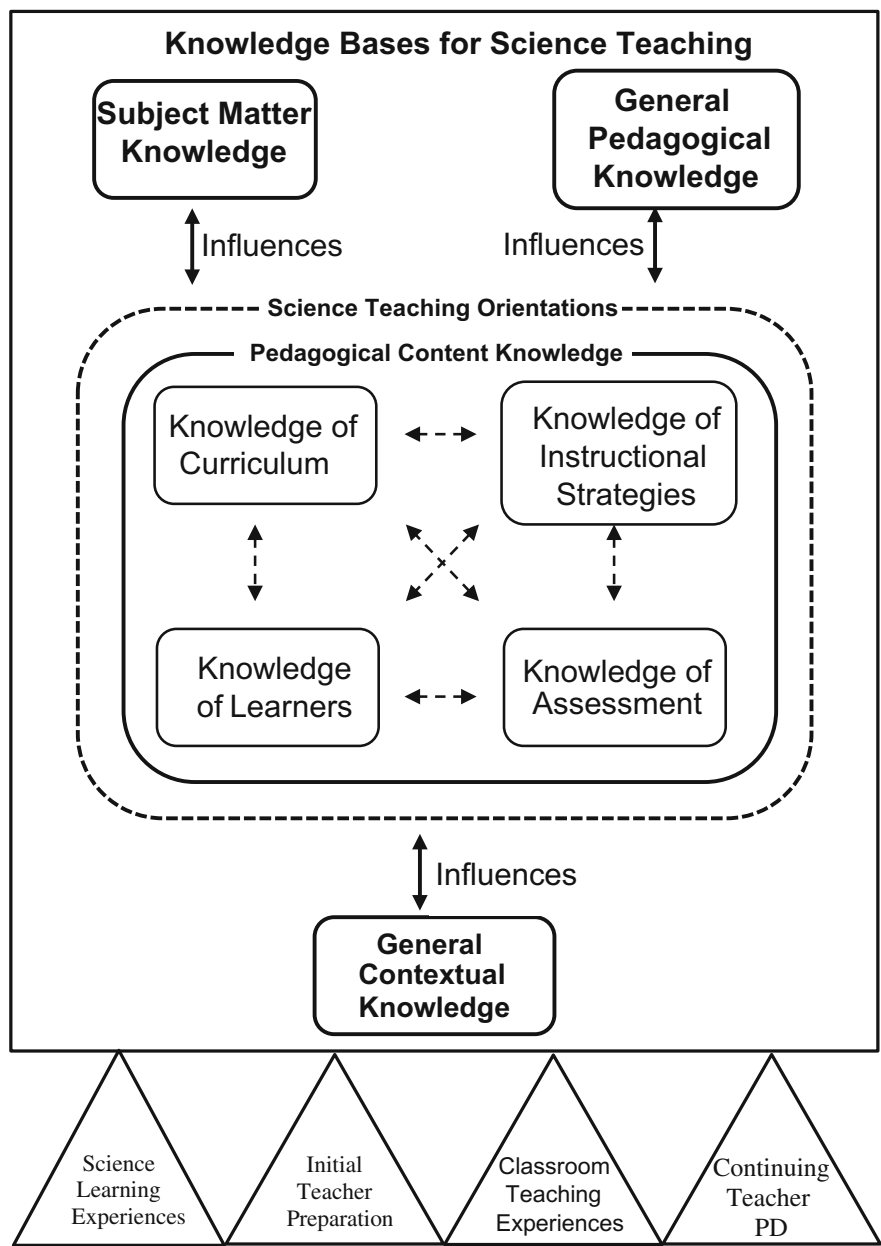
to create PCK for instructing students. With particular regard to the SMK–PCK interaction, the teacher could be doing one or more of the following: (1) converting SMK to PCK, (2) using SMK to create PCK or (3) adapting SMK for school use. If we are able to distil such a teacher's PCK and find out how this develops, it might perhaps give hints about the process of gaining it, which can then provide student teachers and beginning teachers with explicit strategies of combining material from different sources in order to teach a particular topic.

8.4 Developing Science Teachers' PCK at NIE

The model of PCK for science teaching that we will use to frame our description of initial teacher preparation programme is adapted and modified from Shulman (1986), Grossman (1990), Magnusson et al. (1999) and Friedrichsen et al. (2009), as shown in Fig. 8.1. This is not an empirical model but one where we use as a framework to conceptualise the approach NIE takes in enhancing the development of PCK for science teachers. At the bottom are the sources from which a science teacher's PCK is developed, adapted from Grossman (1990): (1) science learning experiences or the so-called apprenticeship of observation (Lortie 1975), (2) initial science teacher preparation, (3) classroom-teaching experiences and (4) continuing teacher professional development. The three main knowledge domains or bases which influence the development of PCK are (1) SMK, (2) GPK and (3) GCK.

At NIE, SMK development is mainly developed for the Bachelor of Arts (Education)/Bachelor of Science (Education) (BA[Ed]/BSc[Ed]) programmes through the Academic Subject (AS) modules and the Diploma programmes (DipEd) through the Subject Knowledge (SK) modules. Those taking the Postgraduate Diploma in Education (PGDE) programmes would have had already obtained their SMK preparation in a relevant academic discipline at the minimum of the undergraduate level. It had been discussed previously that SMK for the academic subject differs from SMK of school science. Hence, articulating the precise requirements for school science and supporting graduates in developing their school SMK is an important component of science education courses at the NIE.

GPK and GCK developments for all programmes are done through Education Studies (ES) courses. For GPK, the relevant ES courses deal with basic educational concepts such as pupil development, the learning and thinking process, the application of psychology in teaching and learning, and the use of instructional technologies. For GCK, the student teacher will learn about the social context within which schooling operates. These include the function of the school system in socialising citizens for economic, political and social roles in the context of a multi-ethnic and multi-cultural society such as Singapore. Student teachers will understand the rationale of major education policies and new government initiatives that impact the work of school leaders, teachers, students and other stakeholders in order to achieve the Desired Outcomes of Education laid out by MOE. At the same



Sources from which knowledge bases for teaching are developed

Fig. 8.1 Developing science teachers' PCK

time, they will be made aware of the diverse and multiple roles that are played by teachers in the education system.

The development of PCK, whether through transformation and/or integration, is done through the Curriculum Studies (CS) courses, which will deal with aspects such as the nature of science, the history of science, school science curriculum structure, how students learn science, student alternative conceptions, teaching and learning strategies including the use of ICT, practical work in science and assessment in science. We will elaborate by giving examples of how we have sought to develop the key components of a student teacher's science PCK: (1) knowledge of curriculum, (2) knowledge of learners, (3) knowledge of instructional strategies and (4) knowledge of assessment. While we describe snapshots of how we have sought to develop a particular PCK component in turn, it must be remembered that in reality, it would often not be possible to develop one component in isolation from the rest of the components.

8.4.1 Science-Teaching Orientations

Before delving into the PCK knowledge components, it will be needful to discuss the role that science-teaching orientations play in shaping the content and development of the PCK components. Both Grossman (1990) and Magnusson et al. (1999) included an overarching PCK component—conceptions of purposes for teaching subject matter—as the teacher's knowledge and beliefs about the goals for teaching the subject at a particular grade level and about the nature of subject as a school subject. Anderson and Smith (1987), on the other hand, described orientations as a general way of viewing teaching science and connect views with teachers' actions. This dual conceptualisation of orientations was well discussed by Friedrichsen et al. (2010) and we agree with the authors in proposing to (re)define orientations towards science teaching as consisting of a set of beliefs that teachers hold about science and science teaching, namely the goals or purposes of science teaching, the nature of science, and science teaching and learning. Rather than viewing science-teaching orientations as a PCK knowledge component, we would rather conceptualise orientations as acting as filters with which teachers develop an understanding of classroom-teaching issues and their knowledge for teaching science. For example, Hashweh (1996) found that teachers with constructivist epistemological beliefs had greater aptitude to learn from experience and to develop richer PCK. It is well-documented in the literature that while science teachers' knowledge and practice are shaped by their beliefs about science and science teaching, the relationship between orientations and practice is complex, and that teachers' orientations are not always consistent with their science-teaching practices due to contextual factors such as learner behaviours, curriculum content and assessment requirements, and influence of social expectations of stakeholders (Mansour 2009).

8.4.2 Knowledge of Curriculum

First, the knowledge of curriculum includes knowledge of the broad curriculum goals. Not least is the goal of developing students to be scientifically literate, who understand how science relates to the things around them and are able to take part in decisions as informed citizens where science and technology play a part, which is an aim of the primary and lower secondary science curriculum in Singapore. Other than understanding science as a *body of knowledge* (the products) and a *set of methods* by which this knowledge is generated (the processes), student teachers need to also be cognisant of science as a *way of knowing*. This includes the understanding that accumulated scientific knowledge is based on empirical evidence of the natural world and is verifiable, while at the same time subject to revision in the light of new evidence. In Singapore, the recently revised Lower Secondary Science curriculum has a new section known as “The Scientific Endeavour” (MOE 2012) with the aim “to deepen students’ understanding of what science is and how it is practiced and applied” (p. 19). This includes the understanding of the nature of science and the interactions that science has with society, technology and the environment.

Second, the knowledge of curriculum includes understanding the big ideas in science and how key concepts are related to one another. Student teachers should understand that big ideas have far-reaching ability to explain a broad range of observable phenomena and are expressed at various points of the student’s school education in ways appropriate to their stage of cognitive development. In primary science teacher preparation, there is an emphasis on understanding and integrating the big ideas of science as specified in the syllabus, which is similar to the publications from the National Academies of Science from the USA (e.g. Duschl et al. 2007). Educators in Singapore have been implementing the science curriculum using the spiral approach where concepts are revisited at greater depth, and research in the area of learning progressions in science education can further inform us on how big ideas in science can be coherently developed across years.

We have found *Content Representations* (CoRes) developed by Loughran et al. (2008) to be a useful conceptual tool for helping student teachers brainstorm and develop their initial topic-specific PCK. The CoRes template helps student teachers think about the big ideas for a particular topic and has a set of pedagogical questions that probes thinking: (1) why is it important for the students to know this? (2) Difficulties connected with teaching this idea, (3) Knowledge about student thinking which influences teaching about this idea, (4) Teaching procedures and (5) Ways of ascertaining student understanding or confusion about the idea. The CoRes template provides a scaffold for student teachers to explicitly tap on their existing understanding of the knowledge structure of the subject matter as they consider how best to teach particular topics to specific learners. As they plan and design the lesson, they will need to exercise their pedagogical judgements based on content and contextual considerations.

We want all student teachers to develop a coherent understanding of the conceptual framework of the school science curriculum and how the concepts in science can be systematically introduced to students. To this end, having student teachers involved in the content or concept analysis of the school curriculum is a useful exercise, which is undertaken during teacher preparation here. In order to teach a concept, the teacher has to explain the critical and variable attributes of the concept as well as the examples and non-examples of the concept (Herron 1996). For example, when filtration is taught, many lessons will focus on the doing of the experiment, drawing and labelling of the apparatus (filter paper, filter funnel and beaker) and the substances (mixture, filtrate and residue) involved in the process. Unfortunately, the critical attributes of the filtration process—how it actually separates substances—may be overlooked. Thus, in the pre-service chemistry pedagogy class, student teachers are advised to draw students' attention to the fact that substances bigger than the pores of the filter paper will be retained by the filter paper as the residue, while those which are smaller will pass through the filter paper as the filtrate. Animations or a demonstration with the use of a vegetable sieve and rubber balls in a beaker of water can help students visualise the sub-microscopic processes involved. Daily life examples of filtration such as making beverages using tea bags or coffee filters, or removal of dirt in a vacuum cleaner should also be presented to students to see the relevance of what they are learning to the real world. The student teachers are then asked to describe how filtration is different from decantation to illustrate a non-example of filtration. They are also advised to step back from focussing on specifics to help students see the big picture. For example, after teaching the various separation techniques such as filtration, distillation, decantation and chromatography, students should realise that the basic principle of all separation techniques is the focus on the differences between the properties of substances and the exploitation these differences to separate them. Finally, the student teachers are introduced to concept mapping (Novak 1996) to help students link all the concepts in separation techniques together, and how to assess the extent and accuracy of students' understanding through their concept maps (Markham and Mintzes 1994).

For aspiring primary science teachers, the mastery of relevant science knowledge, however, has remained a challenge because their selection for the course has been made on the basis of not having a strong graduate background in science in the first instance. Various ways have thus been used to mitigate this shortcoming; for example, familiarity with the topics in the national syllabus is maximised as a wide range of topics is randomly assigned to teachers for planning a lesson package. Tutorial activities here likewise draw across material from the biological and physical sciences equally, thereby giving wide exposure and coverage of the topics in the syllabus. Given the brevity of preparation in NIE, knowledge of subject matter of primary science teachers is ultimately dependent upon the student teacher's personal motivation to gain proficiency during this period and especially while in school. Insofar as is possible, all student teachers are made to realise that scientific inquiry should be at the heart of their instruction through modelling by lecturers during the course. Rather than a monolithic so-called scientific method,

teachers are instead taught a range of inquiry pedagogies that they can flexibly apply depending on the context and purpose (Yeo and Lee 2012).

8.4.3 *Knowledge of Learners*

Studies have shown that pre-service teachers may have similar alternative conceptions as their students (Abell 2007); they may not realise that these conceptions are not scientifically acceptable and will not think that there is anything wrong with these conceptions when they teach them or when their students exhibit them (De Jong et al. 2002). Thus, there is a need to determine the student teachers' understanding of the concepts that they are going to teach and not assume that possession of a university degree guarantees that they have adequate understanding of the concepts (Abell 2007). Multiple choice diagnostic instruments such as those on ionic bonding (Taber 1997), ionisation energy (Tan and Taber 2009) and qualitative analysis (Tan et al. 2002) have been administered to chemistry student teachers to help them determine their understanding of the topics. The student teachers will discuss their answers in small groups and later present their groups' answers to the whole class, resolving differences in answers with their classmates. The feedback from the student teachers is that answering the questions in the diagnostic instruments and discussing the answers are valuable to them as these tasks revealed their own alternative conceptions and help clarify their understanding of the topics (Tan and Taber 2009). From this exercise, it is hoped that the student teachers will realise the importance of being able to negotiate one's understanding with one's peers and the meaningfulness of the process. With the awareness of the student alternative conceptions (as well as their own), the student teachers will be better equipped to prepare lessons to help students learn the difficult topics, negotiate and co-construct their understanding and minimise alternative conceptions.

Another important aspect of the knowledge of learners is that there are individual differences in learning and that our students come to class with different backgrounds, levels of preparation, interests, attitudes and aptitude towards learning science. Hence, addressing students' prior knowledge, knowing how to motivate different learners and the strategies to support different ability groups are important knowledge and skills for the student teacher to acquire. In short, student teachers need to learn how to pitch instruction and the tasks for particular students in a given context at the right level of challenge and support.

8.4.4 *Knowledge of Instructional Strategies*

We find it useful to differentiate between an instructional *model* and an instructional *strategy*. The model is the philosophical orientation with which teachers view the overall learning and teaching process, and it provides a broad plan or frame to

organise instructional practices in the classroom. Models are used to select and to structure teaching strategies, technique and activities for a particular instructional emphasis. Some common instructional models used in science teaching include the learning cycle model, the cooperative learning model, the problem-based learning model and the direct-interactive teaching model. We help student teachers to make explicit links to the learning theories from behaviourist, constructivist or socio-cultural perspectives that help underpin the practice of these instructional models. In Singapore, the 5E inquiry model (Engage, Explore, Explain, Extend and Evaluate) is commonly used in primary-school science teaching to help guide teachers in the planning, implementation and assessment of a science instructional unit. More recently, we have also introduced investigative case-based learning (ICBL) as a good model (Stanley et al. 2012) to help teachers develop students' scientific literacy, while developing their twenty-first-century competencies. ICBL uses cases set in realistic contexts that allow students to carry out self-directed investigations, and incorporates three phases: problem-posing, problem-solving and peer persuasion. The existing school structure may not always allow for entirely student-centred approaches. Whole class teaching, interspersed with small group discussions and activities, or individual practice time, is not an uncommon occurrence. Hence, the direct-interactive teaching model which emphasises active learning may be a suitable model to adopt. Again, there is no best single model of learning; a teacher's approach to teaching in the classroom will be an integration of the different models to achieve a particular goal or situated to a particular situation or student groups.

Within each model, several strategies can be used to effectively achieve the learning objectives and improve student learning. Effective strategies in science instruction include questioning, use of conceptual change strategies, multi-modal representations and analogies. Often ICTs such as videos, computer simulations, data logging and video analysis are infused with the other strategies to enhance science learning. Perhaps the single most powerful tool in a teacher's repertoire is questioning. Effective teachers use their questions to elicit, clarify, probe and extend student thinking. A useful framework was derived from research in Singapore to represent productive questioning approaches such as Socratic questioning, verbal jigsaw, semantic tapestry and framing (Chin 2007). Another is Mortimer and Scott's (2003) framework for analysing discursive classroom interactions in terms of its authoritative and dialogic functions. A common conceptual change strategy is to use demonstrations together with the predict–observe–explain sequence. The demonstration is designed to elicit student alternative conceptions and designed to place student in cognitive dissonance (especially when a discrepant event is used) so that they are forced to confront and resolve any discrepancies with their earlier prediction. This elicit–confront–resolve sequence is also frequently found in the *Physics by Inquiry* guided inquiry curriculum (McDermott et al. 2000), which we have successfully used with our student teachers.

Science often involves the modelling of real-world physical phenomena using external representations that range from concrete to abstract forms: pictures, diagrams, words, graphs and equations (Gilbert 2010). Indeed, new representational

tools can be developed to scaffold student learning from the more concrete physical situation to the more abstract, but generalisable forms of representation. For example, the system schema (Hinrichs 2005) can serve as a conceptual bridge between the pictorial representation and the free-body diagram, to help students better understand the application of Newton's third law in physics. This is achieved by identifying and labelling all objects of interest and the different types of interactions between objects. In chemistry, student teachers are introduced to the three main types of knowledge in chemistry, experiences, models and visualisations (Talanquer 2011) and the importance of teaching all three types of knowledge to students. Experiences are encounters with chemical substances and phenomena using our senses, usually sight, smell and hearing, and through the use of instruments such as pH metres and spectrophotometers. Models are used to describe, explain and predict the chemical behaviour and interaction of substances, while visualisations are "static and dynamic visual signs (from symbols to icons) developed to facilitate qualitative and quantitative thinking and communication about both experiences and models in chemistry" (Talanquer 2011, p. 187). Thus, to understand a phenomenon such as the reaction of magnesium with dilute hydrochloric acid, students need to see the phenomenon of a magnesium strip moving about in a beaker of dilute hydrochloric acid with bubbles forming around the metal. Heat is also given off and the metal becomes smaller and smaller until it disappears and the bubbling also stops. Teachers need to explain that there is a reaction between the hydrogen ions (or hydroxonium ion, depending on the level of the students) and the magnesium metal in which the magnesium atoms lose electrons to the hydrogen ions, forming magnesium ions which go into solution and hydrogen gas which escapes as bubbles into the atmosphere. In order to visualise the explanation, animations can be shown to the students and chemical equations can be used to summarise the reaction between the metal and the acid or the redox reaction between the metal atom and the hydrogen ions. If the focus of the phenomenon is on the rate of the metal-acid reaction, graphs can also be used to illustrate the progress of the reaction and how concentration of the acid, size of the metal and temperature can impact on the rate of reactions. In summary, learning chemistry requires more than being able to "remember the facts": the students have to be able to relate the experiences, models and visualisations involved to derive meaning in their learning, and the teacher has to plan lessons which allow students to accomplish this.

One aspect of primary science teaching in NIE deserves mention with regard to developing deep knowledge of inquiry science: its use of Knowledge Building pedagogies and software (Yeo and Lee 2010, 2012). In some courses, pre-service primary teachers are made to partner with nearby primary schools to facilitate inquiry science lessons over a number of weeks in a term. Working in small groups around a common theme such as seed germination, they facilitate student questions and simple science investigations that originate from the students themselves. Even with young children, they have never failed to amaze our teachers with their diverse projects such as whether beans that are larger will germinate faster than smaller ones or whether crowding conditions affect the rate of seed growth. Because of the

emphasis on working on ideas (i.e. theories) that can be improved in Knowledge Building, student initiative is not hampered and their trajectory of learning is potentially unlimited. Part of the assessment for the course involves videotaping the facilitation of teaching and giving critical peer commentary based on both teaching theory and Knowledge Building principles. While student teachers have said that this pedagogy was initially unfamiliar and extremely demanding in all senses of the word, the overall assessment was that it was an invaluable learning experience to be working at the forefront of student-led inquiry, a far-cry from cookbook style activities so common in their experience. Moreover, organising links with schools in the community to support better teacher–pupil ratios during inquiry projects has been a good example of the synergy derived between schools and pre-service teachers as part of practice-based teaching.

8.4.5 Knowledge of Assessment

Assessment is essentially finding out what students know and are able to do in relation to the learning outcomes of instruction. A key aspect of the knowledge of assessment is the ability to construct and implement assessment, using a range of strategies, at the right time and for the right purpose. Knowing how to reliably evaluate student learning has been an important part of assessment and this includes knowing the strategies to elicit prior ideas, to monitor student progress and to guide instruction. Seen in the context of a 2009 report by the Primary Education Review and Implementation Committee (MOE 2009) that endorsed more holistic forms of assessment, much effort has been taken to help primary science student teachers develop and use rubrics coupled with feedback that assess a range of competencies in the subject. Teaching forms of school-based assessment that departs from paper-and-pencil formats have also been given priority during the course. Active assessment strategies (Naylor and Keogh 2007) such as annotated drawings, card sorts, KWL grids, deliberate mistakes, graphic organisers and concept cartoons have been introduced to student teachers. Other examples of alternative modes of assessment in science include concept mapping, debates, journals, learning trails, portfolios and performance tasks, such as designing a container to keep ice cream from melting or building a solar cooker to cook an egg.

8.4.6 Developing PCK in Real Classroom Contexts

At NIE, we try to acculturate our student teachers early into the actual school environment so as to help them build their contextual knowledge base on the realities and issues related to teaching in schools. For example, for our 4-year BA (Ed)/BSc(Ed) programmes, the school-based practicum for student teachers is spread throughout the programme and is developmental in nature. It comprises four

school attachment periods, one in each year: a 2-week School Experience, a 5-week Teaching Assistantship, a 5-week Teaching Practice and a final 10-week Teaching Practice. For the first 2 years, student teachers observe classroom teaching and do assisted teaching. They start teaching independently only in the last two years. The PGDE programmes, on the other hand, have a 4-week Enhanced School Experience (ESE) programme before they begin their 1-year full-time formal lessons at NIE. This is to induct student teachers into classroom teaching and to help them gain contextual knowledge of the school environment such as the school organisational structure and protocol, and expectations of key stakeholders such as parents, students and the school leadership team. They also keep a journal and write their observations and reflections related to the broad aspects of science teaching and learning; for example, the goals and structure of the curriculum, teaching approaches, difficulties students having with learning science, practical work and assessment. Similar to the undergraduates, they also have a 10-week practicum where they have to put all the education theories that they have learnt into practice.

While student teachers can develop their initial topic-specific PCK through lesson planning and microteaching, the limitation is the absence of a real classroom setting with which student teachers actively make decisions as they respond to the problematic nature of the teaching and learning experiences with real students. Hence, providing student teachers with real teaching practice plays a major role in helping them to bridge the theory and practice gap and to develop their personal teaching competence. We have in recent years introduced a component of practice-based work (PbW) in some of our high school PGDE Physics courses to allow student teachers to experience the interactional and dynamic nature of teaching early in the programme before their final 10-week teaching practice. The student teachers are assigned specific topics to prepare and to review the literature regarding student alternative conceptions and difficulties associated with learning the concepts in the topic. They also research on a specific learning issue or instructional strategy pertaining to instruction in science such as constructivist and sociocultural perspectives to learning in science, the use of multi-modal representations and productive classroom discourse. The student teachers are assigned into groups where they team teach a specific topic three times to three different groups of students. Each group of student teachers collaboratively prepares a teaching package with inputs from peers, NIE instructors and teacher-mentors from partnering schools. The lessons are video-recorded to help with the post-lesson reflection. Through PbW, the student teachers are given the opportunity to develop their PCK and gain a better understanding of the theory–practice nexus through iterative cycles of research on learning issues, lesson planning, implementation and evaluation.

PGDE Chemistry student teachers also have school-based sessions included in their high school chemistry pedagogy course. To prepare the student teachers for the school-based sessions, the student teachers have to answer the questions in a diagnostic quiz on ionisation energy and read up a relevant paper (Tan and Taber 2009) to determine their understanding of the topic as well as to introduce them to chemistry education research papers. As mentioned in an earlier section, many of

the student teachers will have similar alternative conceptions as the students and this exercise will help them address their alternative conceptions as well as realise the usefulness of the research papers as a source of information on students' learning difficulties in various chemistry topics and a repository of suggestions on how to address these difficulties. The next task given to the student teachers is to search and read up on student difficulties in the topics which are chosen by the school and prepare multiple choice questions based on these learning difficulties and possible student alternative conceptions. In addition, they need to think of ways to address the learning difficulties and alternative conceptions. At the school, for three to four sessions, they will administer different sets of questions to the students who come for these sessions, review the students' answers with them and address difficulties that the students have. Towards the end of a session, the student teachers will administer a few more questions to check whether the students have acquired more acceptable scientific conceptions. The school-based sessions provide the context for later lessons on pedagogy and assessment as well as the impact on research on practice.

8.5 Conclusion

This chapter has focussed on the elaborate knowledge base that science teachers require in order to be effective in their profession, with particular emphasis on developing their PCK as a vital part of their learning and growth as a teacher. Currently, the broad goal of school science seems to be shifting towards developing students' scientific literacy with greater focus given to viewing science as being dynamic, and set in a social and cultural context. This includes the ability to understand media accounts of science, to recognise and appreciate the contributions of science in society, and to be able to use science in decision-making on both everyday and socio-scientific issues. As Singapore advances towards the threshold of yet another phase of education—one that is student centric and values driven, there is a need to develop teachers who are competent and confident to assume their roles in helping our new generation of learners thrive in this new landscape.

The student teacher's time during the initial teacher preparation phase is indeed just the start of a long journey. It will not be possible for teachers to acquire all the necessary knowledge and skills to be effective teachers in such a short time. What we can try to inculcate are positive values such as the love for (re-)learning on the job, passion for science, modelling the qualities of good teaching and putting a human face to science. Teacher education will not be content delivery per se (else we could as well learn everything online) but we in NIE foreground learning with and alongside a human teacher who loves the subject matter and one guides youth along in the best way, given their needs, interests and aspirations. PCK and indeed all science teaching and education in general have to be governed by such an ethic of care for the whole person (Noddings 2013). Educating teachers as persons with all their fallibilities is arguably our aim, not just the preparation of instructors in

science. Indeed, the teacher education in the twenty-first century does not negate what the essence of teaching was in the past, it might look different but at its heart we believe that it is still the same.

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Chapter 9

Reconceptualising Experiential Learning in the Pre-service Geography Fieldwork Module

Geok Chin Ivy Tan

9.1 Introduction

Fieldwork is a very distinctive feature of geography and is integral to the teaching and learning of geography (Gold et al. 1991; Kent et al. 1997). The field has been defined by Lonergan and Andersen (1988, p. *) as any place “where supervised learning can take place via first-hand experience outside the constraints of the four-walls classroom setting”. Fieldwork refers to the carrying out of an investigative work at a field site to achieve some learning outcomes. It requires the students to be physically present at the field site and actively doing something at the field site to find out more about the site. Its primary goal is to enable students to gain a direct experience and acquire the knowledge in the field while out of the classroom. Such experiential learning can reduce the gap between the abstract concepts learnt in the classroom and enable them to understand, apply and appreciate what is out there. Essentially, what fieldwork does is to integrate theory into practice (Clark 1996; Gold et al. 1991; Lai 1999, 2000; Lidstone 2000). Fieldwork has long been emphasised by researchers and educators all around the world as an unmistakably distinctive and essential component in geographical education. The importance and effectiveness of geography fieldwork in stimulating students’ cognitive and affective domains have been abundantly and continually documented by researchers (Boyle et al. 2007; Cook 2008; Fuller et al. 2006; Lai 1999; Orion and Hofstein 1994; Oost et al. 2011). Fieldwork emphasises first-hand experiential learning which engages more of the students’ sense so that their learning is consolidated, their memory is enhanced, their understanding of ideas and concepts is expanded, and their sense of time and place is deepened (Stimpson 1995; Kent et al. 1997; Lidstone and Lai 1998). Fieldwork develops students to be

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caring and thinking citizens who are aware of issues such as the environment and are willing to make responsible decisions about them (Gerber and Goh 2000). Fieldwork builds up the self-esteem of the less able students and motivates those who are disinterested to learn. It fosters the development of interpersonal relationships as students work in groups during fieldwork (Lai 2000).

Yet despite the overwhelming endorsements and recommendations for more students to experience the benefits accrued to fieldwork, field-based learning still remains largely in the periphery of geography curricula all around the world. Many researchers have uncovered coinciding factors that could explain this disappointing trend (Chew 2008; Han and Foskett 2007; Munday 2008; Oost et al. 2011). Teachers cited repeatedly the lack of time amidst a tight curriculum; lack of monetary resources on the part of the school or students; and lack of school, parental and departmental support. Furthermore, the logistical and the administrative challenges required in planning and conducting fieldtrips can be very demanding. All these considerable challenges would, understandably, explain why teachers are reluctant to carry out fieldtrip. While support and help on all levels is important, fieldwork remains, considerably, a teacher-directed initiative. In other words, geography teachers are the pivotal figures in initiating and endorsing field-based studies and in doing so, determine whether or not a geography student gets the chance to experience fieldwork. However, as pointed out by Lonergan and Andresen (1988), effective learning cannot be expected just because we take students out into the field for fieldwork. The effectiveness of fieldwork is largely dependent on the type of fieldwork approaches adopted by the teachers in the field.

Lidstone (2000, p. 137) highlighted the significant absence of “the perception of teachers and the perceived effects of fieldwork on their personal and professional life” in the fieldwork literature. He believed that the fieldtrip conceptions that teachers carry with them can powerfully affect their attitudes, which can, in turn, affect (for good or bad) their students’ fieldtrip experience. The aim of this paper is to document the student teachers’ conception of fieldwork and to use the understanding of their conceptions and beliefs to reconceptualise the geography fieldwork module such that the module stays relevant to their needs. The new geography fieldwork module serves as a highly important transitional space where student teachers, through experiential learning, acquire the necessary geography pedagogical content knowledge skills as well as the psychological readiness in planning and implementing fieldwork when they are in schools. This paper will also provide the background of the change in the new geography syllabuses in secondary schools and junior colleges as well as the background of the pre-service geography academic studies and curriculum studies modules, conducted at the National Institute of Education (NIE). This is followed by a discussion on the assessment of the conceptions, beliefs and concerns of the student teachers with regard to fieldwork in geography education module. Finally, the paper examines the implications of these prior conceptions, beliefs and concerns of the student teachers and recommends guiding principles for the restructuring of the geography fieldwork module to enhance experiential learning both as a participant in the fieldwork as well as a designer, organiser and facilitator of geography fieldwork.

9.2 The New Geography Syllabuses in Schools

In the previous geography syllabuses for secondary schools and junior colleges in Singapore, fieldwork was recommended to be conducted whenever opportunities are available. Hence, it is not compulsory for teachers to organise fieldwork nor was it a part of the examination component. Most of the fieldwork conducted in schools was found to be the traditional field excursions which are more like “Cook’s Tour” or sightseeing fieldtrips. Students participating in such fieldtrips are mainly passive. Many schools even engaged external agencies to conduct such fieldtrips. During these fieldtrips, the students will primarily be tasked to complete the field work-sheets which usually require them to record what they have heard from the teachers or tour facilitators in the field (Chew 2008).

Moving forward, the geography curriculum has been revised such that the desired student outcomes of developing a confident person, self-directed learner, active contributor and concerned citizen can be achieved through geography education (see Fig. 9.1). The New Upper Secondary Geography Syllabus 2236, which is implemented in 2013 and with the first examination in 2014, adopts an inquiry-based approach to the teaching and learning of Geography. Following the change in the upper secondary syllabus, the New Lower Secondary Syllabus which will be implemented in 2014 will also prominently feature the inquiry-based approach. Adopting the inquiry-based approach with the requirement of embarking on geographical investigations into an authentic geographical issue through fieldwork in both lower secondary and upper secondary will give secondary students a deeper and critical understanding of the complexities of the changing world. It involves the geographical inquiry process of formulating questions, gathering data, exercising reasoning and reflective thinking.

The other salient feature of the new syllabuses is the introduction of geographical investigation as a component in the examinations for both upper and lower secondary levels. Teachers are now required to create opportunities for students to engage in geographical inquiry in the field in order to prepare their students for this component in the examination. Conducting fieldwork is now a necessity and included in the syllabus. It is explicitly written that geography students at secondary schools should be familiar with the inquiry approach to fieldwork. The students should know how to formulate aims and hypotheses, collect data in the field, analyse field data, present their data and form conclusions. The assessment components for the secondary school syllabuses have also been modified to assess inquiry in fieldwork through geographical investigations.

Since fieldwork is now being emphasised as critical and crucial in the teaching of geography, the objectives of this paper are to appraise the pre-service geography fieldwork module and articulate the guiding principles for the module. The paper correspondingly reports on a background study on the student teachers’ personal experiences in fieldwork, their beliefs and conception of fieldwork, their perception of strengths and effectiveness of fieldwork, and their perceived problems and challenges in designing and implementing fieldwork. The deeper understanding of

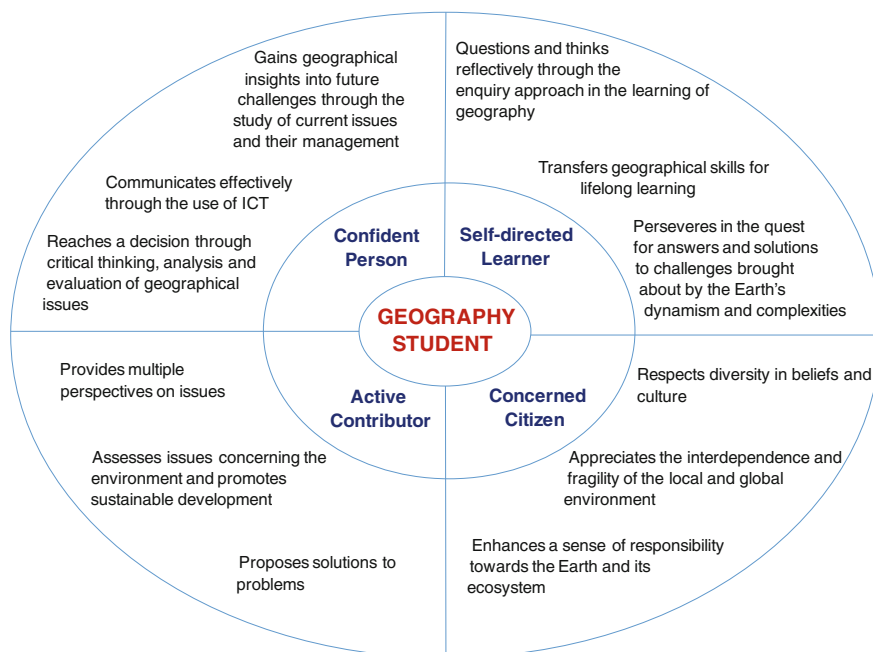


Fig. 9.1 Desired outcome of education through geography (with permission from the Government of Singapore (c/o Ministry of Education), Singapore Examinations and Assessment Board 2013)

the fieldwork background and profile of the student teachers has facilitated the process of reconceptualising and actualising a more relevant fieldwork module to effectively prepare the student teachers for the teaching of twenty-first-century students in schools.

9.3 Pre-service Geography Teacher Education in NIE

This section provides a brief overview of the pre-service Geography teacher education in the 4-year Degree programme and the 1-year Postgraduate Diploma in Education (PGDE) programme in NIE. For the Degree programme, the student teachers would read both academic studies geography modules and curriculum studies modules while the PGDE student teachers would read only curriculum studies modules. The academic studies and curriculum studies modules for Geography have constantly been reviewed by the academic staff so as to ensure that they are responsive and relevant to the changes in the educational scene in

Singapore. Embracing the TE²¹ Model and the V³SK Framework (for more details, see Chap. 1), these modules were conceptualised with the firm belief that twenty-first-century teachers need to have the necessary values and competencies are for twenty-first-century learners.

Student teachers in the Degree programme have to read four core academic studies modules at Year 1. These core modules are as follows: Elements of Physical Geography, Elements of Human Geography, Techniques in Geography and Singapore in Asia. Each module is 3 Academic Units (3AU) which is equivalent to 36 h. At Year 2, they will select two modules from two strands. The first strand consists of topics on Physical Geography and Techniques and the second strand are topics on Human Geography. This is to ensure that they have good content knowledge in both Physical Geography and Human Geography. At Year 3, student teachers are free to choose four modules out of seven modules offered. Finally, at Year 4, they have to complete an academic exercise within the module Geographical Methods and Fieldwork. The curriculum studies start at Year 3. They have to complete two curriculum studies modules at Year 3: Planning for Geography Teaching and Classroom-based Teaching Methods. At Year 4, they have to complete the module: Field-based Teaching Strategies and Assessment in Teaching Geography.

As for the PGDE programme, the geography student teachers have to complete three geography curriculum studies modules. The modules aim to provide student teachers with the pedagogical content knowledge and skills to teach geography in secondary schools and junior colleges. The pre-service geography curriculum studies modules have gone through several reviews and revisions. Each review and revision has been to ensure that the modules stay relevant and in alignment with the direction in education and the changing syllabus. Tan and Lian (2007) have documented why and how the geography curriculum studies module was reconceptualised to emphasise the teaching for understanding.

The first module is Developing Understanding in Teaching and Learning Geography (3AU, 36 h). This module addresses the relationships among three aspects of teaching and learning: the subject matter of the curriculum, the diverse learners and the learning activities. The emphasis is on designing thoughtful units and lesson plans that will promote student understanding in the classroom. The second module is Teaching and Learning Geography outside the Classroom (2AU, 24 h). This module has been reconceptualised from the earlier module from the previous years to sharpen the focus on designing fieldwork through inquiry to facilitate the learning of geography. Finally, the last module is Assessment in Geography (1AU, 12 h). This module explores the design of summative assessments to check for students' understanding. The team of geography educators at NIE are constantly using student teachers' feedback and reflections to ensure that within a short span of one academic year and for 72 h, the modules would be able to effectively prepare the student teachers for their beginning years of teaching

career. This study was done by collecting and analysing the online reflections of a batch of student teachers during the fieldwork module Teaching and Learning Geography outside the Classroom.

9.3.1 Assessment of Student Teachers' Prior Beliefs, Conceptions and Concerns on Fieldwork

In 2010, 54 PGDE student teachers were in the geography curriculum studies class, Teaching and Learning Geography outside the Classroom. In that module, the inquiry and critical approach was adopted to enable student teachers to understand how to design and conduct fieldwork in the teaching of geography. The student teachers were engaged through field demonstrations and professional conversations to deepen their understanding of fieldwork. At the end of the module, each group of four or five student teachers was expected to design a fieldwork package which can be used in the teaching of geography in either secondary schools or junior colleges.

As part of the module requirement, the student teachers had to write online reflections at four points in time. These reflection exercises were incorporated to help student teachers document their learning experiences and to consolidate their thoughts about learning as they progress through the module. The reflection exercises become an open space for them to ask questions and give their views. Most importantly, the student teachers' reflections gave the tutors greater insights into understanding their fieldwork experiences, concerns and readiness for teaching in the field and hence further shape the module to tailor to their background and concerns. The first reflection was written at the beginning of the module where they wrote about their own past experiences regarding fieldwork in geography. The second reflection was written after they have participated in either an overseas or local fieldwork conducted by the tutors in the module. The third reflective piece was written after they had designed their own fieldwork packages. Finally, the last reflection was written at the end of the module when they had presented their fieldwork packages to their peers. For discussion, the reflections will be analysed in terms of:

- i. Student teachers' past experience or lack of experience in fieldwork;
- ii. Student teachers' prior beliefs, conceptions and perceived benefits of fieldwork; and
- iii. Student teachers' perceived challenges in planning and conducting fieldwork.

i. Student teachers' past experience or lack of experience in fieldwork

The reflections of the student teachers revealed that few had, if any, fieldwork experience before entering NIE. Of the fortunate few who had been on fieldtrips, even fewer had positive fieldwork experiences. The few with positive fieldwork experiences stated that fieldwork has "induced their curiosity in Geography". Most of the student teachers shared their negative memories, especially during their

secondary and junior college days, of what they perceived to be ineffective and largely meaningless “excursions” with no “real learning”. Some of the negative statements in their reflection are as follows:

I remember my first Geography fieldtrip was in secondary school, and we had the opportunity to travel to Melbourne, Australia for one week. I was in Secondary 3, and the fieldtrip was to last one week. The total cost of the trip for 5 days was \$2,800. We went to the coasts to see the twelve apostles, the old churches and some abandoned gold mine, and Victoria market. **However, what I remembered was that it was more of a “sight-seeing” trip rather than a geography fieldtrip.** We did not bring any field equipment with us, we were not told to bring a camera, and did not have to prepare any reading materials or to read up beforehand... **There was no link to the subject of Geography.** (GSJ)

I have a confession to make – when I was a student I viewed fieldwork as an extra-neous component which is there simply to “spice up” the content. I did not undergo any fieldwork during my secondary school, and in my junior college days the only fieldwork we did was to go to the hill nearby to measure the slope angle and draw the slope profile, which I felt was rather interesting but nothing special. In addition, although all of the geography students went for a fieldtrip to Kuantan in my opinion we did not do fieldwork there but rather were having lessons at real-life locations with real-life examples. **Looking back, I realise that my apathy towards fieldwork was because I did not feel empowered or enthused to look at the world through geographical lenses, as I felt I could find all the answers in the textbook and thus I view fieldwork as just a gimmick.** (MFBZ)

It was only until university that some student teachers began to feel like they are doing “actual” fieldwork.

My opinions about fieldwork started to change as majoring in geography in university opened up my eyes to the physical landscape that was present in Singapore and overseas. Certain modules required us to go out and explore Singapore for fieldwork sites. This opened up my eyes to the many fieldwork opportunities that are possible in Singapore. I also saw that fieldwork is important as it teaches us to apply the concepts we have learned in the classroom in the field. (BGNM)

ii. Student teachers’ beliefs, conceptions and perceived benefits of fieldwork

Since the student teachers had few opportunities for fieldwork especially the ones involving meaningful field engagement, two fieldwork demonstrations were included in the module. A local fieldwork to the wetland reserve and an overseas fieldwork in Western Australia were organised with the objective to help shape the student teachers’ conception of fieldwork and to engage them both as student and teacher in the field. The benefits of fieldwork, as recognised by the student teachers, were tremendous and multi-fold after they have participated in either the local or overseas fieldwork demonstration.

In most of their reflections, fieldwork is deemed to be an essential component of geography, an exercise that all students of geography must undertake an initiation into the “field” that is according to a student teacher, “right in front of our eyes”. For many, the tactile and multi-sensory aspects of fieldwork immediately appealed as an exciting, fresh and new way of learning, relating, understanding and experiencing geography. Fieldwork provided rare opportunities for student teachers to touch and operate field equipment for the very first time in their years of studying

geography. Being able to measure and see the results first hand, identify gaps in theoretical knowledge and practical skills, and reaffirm figures previously only memorised from textbooks jointly contributed in arousing enthusiasm for the subject and eagerness to take charge of their own learning.

Prior to this fieldtrip, the only field equipment I have come across is probably the wind vane, anemometer and the Stevenson screen, and these were only read in geography books! Definitely, using **field equipment has enhanced the experience, and the fact that having hands on, provided that extra curiosity to really want to find out the answer** (e.g., Humidity level, etc.).

[B]eing able to directly do the activity itself also helped in my learning and understanding, especially so, during the touching and smelling of the soil. **It really confirms my understanding of what goes on down underneath, instead of just reading it off the books. I guess being able to use the five senses to experience the activity beats pure textbook reading.** (GSJ)

Being physically out in the field, as opposed to sitting down in a comfortable classroom listening to one's teacher, one's senses are especially heightened due to the stark contrast. Out in the field, one is able to interact with more than just words and abstract theories. Real life-people, mountains, mountains, trees are out there in the "field". While authors do their best by scattering photographs throughout textbooks, the beauty and grandeur of a place or natural formation can perhaps be best taken in only by being physically present. One participant shares her experience in the field:

However, it is also **very rewarding to be able to witness textbook diagrams and words being put into perspective in real life, and to be able to appreciate the scale and monumental-ness of processes and formations.** (WYZ)

Fieldtrips bring out the reality in what could only be imagined." (RB)

Fieldwork thus allows participants to observe, deduce, understand and proceed to make valuable connections between textbook theories and real life, since the former is inspired by the latter. When the spheres of theory and real life are bridged, it constitutes a wonderful and inspired "eureka!" moment for the student teachers, as evident below:

After participating in the Western Australia fieldtrip, I have now learnt to appreciate and believe in how fieldwork is the essence to learning and understanding geography (yes, it took me so many years to grasp this). **I say so because in those 7 days, I understood much, much more about physical geography than I ever did in my 6 years of education in geography. Everything suddenly fell into place for me – I can link the words and diagrams in textbooks with real, tangible landforms! It was a real learning trip for me.** (NXPS)

While fieldtrips allow students to affirm for themselves that knowledge garnered from textbooks is in tangent with reality, they highlight also significant discrepancies between the two. Fieldtrips hence serve as important counterpoints to textbook accounts of "reality".

At wave rock, for example, we learnt that exfoliation and pressure release can occur simultaneously, when they are usually two different categories of physical weathering in the

textbook. Students, and even beginning teachers, assume that the textbook reflects reality.

Field trips help to shatter this misconception and encourage them to think critically in future and consider alternative possibilities. (GMYM)

The transition from reading textbooks to actually being in the “field” has the effect to powerfully alter one’s perspective. The student teachers reported that this transition into real life engendered new ways of “seeing” and subsequent ways of analysing and understanding what is before them. Prior theoretical knowledge is enforced and takes on tangible forms and everything takes on richer meaning. Geography becomes “alive” and imbues one’s lifeworld with geographical significance.

However, if pitched correctly, fieldwork can be used to allow students to understand that Geography is omnipresent as we cannot divorce our everyday experiences from the nuances of space and place. As such, a fieldwork experience can be a platform from which we equip our students with the lenses with which they can gain a more geographically informed perspective of the world in which we live. (LKW)

I believe, therefore, that one of the most powerful aspects of fieldwork is where we realise the real world is far more complex, far less predictable, and less organised than how textbooks may lead us to believe. No amount of textbook reading is going to pre-empt one in discovering just how exceptional the real world can be. And I realised it is through this discovery and investigation of the exceptional that truly triggers intellectual discourse and brings out the geographer in all of us. (THWE)

Fieldwork exercises can achieve several important student-centric learning outcomes such as developing important geographical skills like observation, deduction and data collection. Students will have to apply abstract textbook knowledge through interaction in the field and derive their own conclusions.

Fieldtrips provide more room for authentic student-centred learning. The teacher is able to construct knowledge with the students by examining phenomena that may not be found in the textbook or the classroom, or even the Internet. The “materials” for learning in fieldtrips are literally diverse and limitless. (BGHM)

Fieldtrips provide rich learning experiences for students due to several working factors. Firstly, the **students are engaged in learning because they are put in the environment that they are studying itself, and thus, are able to make their own observations. Fieldtrips force students to notice, identify and relate different ideas together to form stronger, enduring understandings about a topic.** The worksheet we did guided us in identifying the types of trees, its characteristics and features as well as its location in the mangrove. Since we were at the mangrove itself, we were able to see all the varying factors contributing to these ideas more holistically. Fieldtrips actually, help to integrate and consolidate knowledge.

Secondly, I realised from the fieldtrip that I wasn’t simply learning new information but also applying prior knowledge as well as questioning what I already knew. **Fieldtrips raise inquiry through more than just curiosity. Fieldtrips raise questions that seek to clarify and contradict, further develop new or original ideas and also deepen understanding. The fieldtrip gives students the opportunity to realise that knowledge about a particular subject is not entirely exhaustive.** There is always more to learn about any topic! (NYBE)

Aside from inculcating within students an appreciation for the great outdoors (and etc.), fieldwork at one's "backyard" can also instil within them a larger appreciation for their "home" by making the ordinary seem extraordinary, often simply through a shift in perspective. A student teacher elaborates below:

Fieldwork in our own backyard is also important as when we bring students down there next time, we can make them realise that there are many interesting places in Singapore to do fieldwork and make them realise that Singapore is an inherently interesting place and that despite its intense level of development, there are still many of these places around to explore. **I think that doing fieldwork, especially at home allows students to appreciate Singapore better and give them a stake in their own learning.** (TYZ)

The beauty and value of fieldwork is that the benefits are not limited only to students; it is just as much for the teachers too:

Also, more than anything, fieldtrips are important for teachers too! The Geography teacher needs to know how to observe and analyse in order to be able to point out to students significant phenomena often overlooked. Also, it gives the teacher new perspectives to engage in and helps the teacher consolidate and make cross-references between topics in Geography. (BGHM)

Outdoor fieldwork also enables teachers to try out a different pedagogical approach (inquiry approach) from the usual classroom-based pedagogy that they adopt, with arguably, better results.

[T]here is more meaning in learning data collection and field enquiry when students are set in actual setting for such work. The teacher and students could form or test a hypothesis together when presented with the actual setting in learning Geography to reinforce their content knowledge or to test such knowledge. **Also, a more inductive inquiry approach to learning Geography content knowledge is possible as well.** (BGHM)

The quality of not knowing what to expect lends a spontaneity to fieldtrips that can be quite exciting (at times stressful) in this "quest" of discovery. This draws back to an age-old romanticism surrounding the intrepid traveller's journey into the vast unknown, not knowing what to expect or what s/he will find. While not quite unstructured in terms of destination and objectives, fieldtrips nonetheless preserve some of that mystery of the unknown and unexpected. These unexpected moments, in turn, can serve as valuable opportunities to teach outside the perimeters of a fixed curriculum.

Besides building content knowledge, **fieldtrips also provide teachers with unexpected teaching moments that we can take advantage of, especially when students are out in the real environment and looking at the things around them first-hand, something that will not be able to achieve in the classroom.** The most exciting part of a fieldtrip is getting to see things that we normally don't. For this particular fieldtrip, one of the best was the crocodile at its natural habitat! (NKAJ)

Outdoors, freed from the mental and physical constraints of the classroom, the air of spontaneity of the situation is perhaps keenly felt by participants of the fieldtrip. Students are easily motivated and engaged into asking questions in the field.

I realise that whilst students usually don't think or ask questions in the classroom, the opposite occurs on the field. As a student, because my senses were engaged, I naturally asked questions and began to think about what I saw, smelt, touched and heard, without being prompted or forced by the teacher. I guess that is the beauty of fieldwork or fieldtrips. (JS)

Beyond the academic, student teachers believe that fieldtrips foster character development among the students, especially for youths these days who are somewhat lacking in outdoor knowledge and experience. As a student teacher sees it:

Conducting fieldwork and on fieldtrips are essential times to inculcate values in students. As urban dwellers, being exposed to "the field" trains one in resilience, perseverance, responsibility, getting out of your comfort zone, looking out for others, the list goes on. (JCPE)

Quite often, fieldwork can involve tasks that forces participants to venture outside their comfort zones and partake in activities that engenders potential physical discomfort, social embarrassment, unease, inadequacy, that is approaching and interviewing strangers, and trekking through natural sites that city dwellers are not used to, among others. We see how then, apart from functioning as a rare opportunity for teachers to introduce students to the joys of working in the "field" and achieve curriculum targets and learning outcomes, fieldtrips also double up as a "space" for teachers, whether (un)consciously or (un)willingly, to transcend beyond the curriculum into the realm of character building.

In some cases, these non-academic lessons of life can be of such significance that they stay with the individual for a long time.

Education doesn't usually end when the fieldtrip ends. Interest generated during the trip can extend beyond the few days or few weeks, inspiring students to seek and question more. The life skills and learning skills gained from the trip are definitely useful after the student leaves the education system too. (HSMC)

Besides, learning about the landforms and other physical features on the site also made me understand how the physical environment influenced people's lives and vice versa, in ways I never knew. Besides learning about the physical environment, the opportunity to have an exchange session with the students in Thailand had benefited me in many ways. Experiencing being friends with them and understanding their culture and beliefs made me grow so much more as a person. I have learned to appreciate the opportunities and comfort that I have as a Singaporean and learned to get along and share what my knowledge with people vastly different from me. The experience and knowledge about their lives, their society stays vividly with me till today. (EWLS)

Most importantly, it helps them appreciate their world, and perhaps seed in them a love for geography. (LKLM)

iii. Student teachers' perceived challenges in planning and conducting fieldwork

After the demonstrated fieldwork sessions, the tables were turned, and the student teachers found themselves taking on the role of fieldtrip organisers, a role they will find themselves embodying in a couple of months when they become full-fledged teachers. With the help of a few peers in a group, they had to design a fieldwork

package. The student teachers reported that the exercise forced them to really think through their rationales when implementing a fieldtrip. The need for a clear guiding objective was evident to many, for this in turn determined the type of fieldwork the student teachers perceived to be necessary or best suited to achieve the desired learning outcomes for their students. As seen below, some of the student teacher articulated their overriding objectives for their students during fieldwork:

In general, the essence of fieldwork is to allow students to learn what they would not be able to in the classroom. Therefore, through the fieldwork activities, **we wanted students to be able to pick up skills and techniques – e.g., using the weather-tracker, using Google Earth to hypothesise the microclimate of the sites, presenting primary data, etc. – techniques that they would not have been able to apply without the fieldwork, as well as expose them to the dynamism of the real world as opposed to linear textbook knowledge.** (HWLD)

As I have mentioned before, fieldwork should not be too restrictive such that students miss opportunities to learn things that are not necessarily in their textbooks. I realised, from our fieldwork in the CBD, that while it is important to align all fieldwork to syllabus aims, it is also **beneficial to students to conduct fieldwork that enhances learning and an understanding of geographical big ideas and concepts such as spatial location and relationships.** (NYBE)

Hence, the notion of getting students to create their own hypothesis, survey questions, evaluations, observations and rationale **provides the avenue for independent learning, also to pique their interests** (since they now dictate their own areas of study). (LBB)

Having been acquainted with the vantage points as both students and now teachers/planners, several student teachers reported that this double consciousness has helped significantly in terms of a better and clearer fieldwork conceptualisation and student expectations in the future.

We also had to consider the abilities of our students while designing the fieldwork package. We also need to imagine certain parameters to work within. **Hence, this fieldwork package experience was interesting in the sense that it let us design a possible package which we could use next time.** (TLL)

As designers, we learnt the skills that we eventually hoped to impart to our students, including fieldwork techniques, presentation, even graphicacy skills as we had to decide what and how we wanted our students to present their findings. (LLL)

The experience of learning to plan a fieldtrip with fellow student teachers has been extolled by participants as a shared and conducive space where fruitful peer learning and collaboration took place. Ideas different from their own and differences in fieldwork rationales, objectives, methodologies, among others, were introduced and underwent a process of challenge, discussion, consensus and eventual adoption as a group.

All in all, my group members were bouncing boards for ideas and providers of constructive criticism. **We learnt together, from each other and definitely from our mistakes.** (LLL)

Proper alignment and clear rationalisation must be made obvious in the lesson plan too so that teachers have a proper guideline to follow upon. As a teacher, it is also ideal to be passionate about the fieldwork too like my members as they were constantly probing as

they walked about the fieldsite and this **lead to us teachers sharing knowledge with each other.** (BGHM)

Having experienced fieldwork in its entire process from the standpoints of both student and teachers-to-be, the student teachers have attained the awareness of how drastically different the fieldwork experience can be for both camps: the student–learner–participant and teacher–organiser–facilitator. Different degrees of knowledge to work with, varying degrees of power and control over the fieldwork experience, and different agendas to fulfil ultimately lead to different fieldwork experiences.

Perhaps the biggest take away from this module is the awareness of what goes on behind the scenes of fieldtrips/work. I have encountered useful fieldtrip and worthless ones. Reflecting on these while working on designing a field work package allows me to be conscious of the entire experiential learning, including the design of prompting questions for students. Having been on both sides of the fieldtrip dichotomy - teacher and student – I am better suited to introduce experiential learning on the field when teaching Geography to my JC students. (HSMC)

Having gone through the entire fieldwork module, from a mere student–participant throughout various stages of one’s educational journey to that of a student teacher planning a fieldwork package for one’s future students, all the student teachers involved in this exercise have affirmed their firm beliefs in the irrevocable benefits of fieldwork. We see below how for some, they look forward to the day they too, can ignite the love for geography among their future students:

Even after I have gone through the tedious process of planning a fieldwork trip in geography, **my initial view on fieldwork being a very powerful pedagogical tool does not waver. Fieldwork encourages a lot of hands-on and experiential learning and it especially appeals to visual and kinaesthetic learners.** In my first reflection, I talked about how I thought that my conceptual understanding/knowledge of mangroves increased tremendously, just after that particular fieldwork trip to Sungei Buloh Nature Reserve. Consequently, with that vivid experience, I am more than convinced that my future students should also experience that same impact/effect. **As such, having a chance to plan a fieldwork trip, forces me to translate that personal “magical” experience into my own planning, so that my students will have a wholesome learning experience as well.**

The primary guide to my practice of teaching in time to come? Is to have unwavering belief in continuous learning and learning that goes beyond the classroom. I personally feel that students nowadays lack idealism and imagination and are easily jaded and bored. **Out-of-classroom learning will bring back that rigour in their eyes to find value in learning... and relevance in the knowledge that they have gathered.** (MBM)

The overall strengths of fieldwork as perceived by the student teachers echo their perceptions from earlier reflections. If any, they are even more convinced of its tangible and intangible value in aiding students on their learning and enjoyment of geography, and also instil within them a profoundly deeper appreciation of the world that they live in.

Lastly, I do believe in the merits of fieldwork given the opportunities for bonding and understanding our students as well as the many teaching moments on the values of life. Furthermore, I also learnt that through fieldwork, teachers can spot the misconceptions

which students may have and identify gaps of knowledge while challenging our students to apply the concepts which they have learnt. (LKW)

After the process of designing a fieldwork package from scratch and seeing the brilliant ideas from our module mates, I realised that fieldwork could be adopted as a useful strategy in the teaching of geography. The hands-on learning activities within the fieldwork experience makes learning enjoyable and relevant to our students' daily lives and really makes geography "come alive". It depends on the teacher's creativity and effort to conduct meaningful learning tasks to ensure actual learning is done, and that students benefit from the fieldtrip. (CSJ)

9.4 Implications and Guiding Principles for the Geography Fieldwork Module

The understanding gain from knowing the student teachers' fieldwork experience (or lack of experience), their prior negative conceptions of fieldwork and their lists of concerns and challenges in organising fieldwork has enable the curriculum academic staff to be aware and, hence, address the multi-faceted issues raised in the pre-service fieldwork module. A set of guiding principles can be recommended for the enhancement and enrichment of the pre-service geography fieldwork module. These guiding principles are as follows:

1. To provide the opportunity for student teachers to check their personal beliefs and conceptions of fieldwork;
2. To provide hands-on experience to enable the student teachers to experience as a student-participant as well as a teacher-facilitator;
3. To address student teachers' misconceptions and augment their content knowledge in the field;
4. To engage student teachers in fieldwork techniques (including the use of field equipment);
5. To engage student teachers in developing fieldwork packages;
6. To engage student teachers in the organisation of fieldwork to provide a glimpse of the behind-the-scene preparation needed to conduct fieldwork;
7. To address challenges of organising and conducting fieldwork;
8. To provide success stories from fieldwork conducted by teachers in schools; and
9. To provide student teachers with the psychological readiness and confidence to conduct fieldwork.

The 24-h fieldwork module with eight 3-h sessions has since been restructured to embrace these principles and to introduce the inquiry-based approach in fieldwork.

At the very first session, student teachers are to explore their conceptions and understanding of fieldwork. They are affected very much by their own prior fieldwork experiences when they were students themselves or when they had opportunities to conduct fieldwork during their stint as relief teachers or during their contract teaching in school. At the onset of the module and based on Principle 1,

student teachers will construct their understanding of fieldwork by sharing their fieldwork experiences and evaluate their own beliefs and assumptions on fieldwork.

The sequent three sessions are actual field inquiry demonstrations. The first fieldwork is on the topic of Weather Studies; second, on the topic of Coastal Studies; and last, on the topic of Tourism. These are the topics specified in the Upper Secondary Geography Syllabus where geographical investigations must be carried out in the field. For those who have never been on a fieldwork, these will be their first time out in the field. These three sessions would provide the student teachers with the hands-on experience and guided by Principles 2, 3 and 4 and with the goal of including Principles 6–9. They will go through an experiential learning as a student–participant as well as picking up field facilitation skills from the tutors. All the three fieldwork sessions are grounded in the geographical inquiry processes (Roberts 2003).

By Week 5, the student teachers are back in class to focus on data analysis and representation. They will analyse the data collected from the three sessions of fieldwork and discuss the various ways of representing the data. Student teachers will also be engaged in a professional discourse on the findings from their analysis of field data. This is also a good session to reflect on the entire field inquiry processes.

For the next two sequent weeks (Weeks 6–7), the students will work in groups of four members to develop their own fieldwork packages (Principle 5). In developing their field inquiry packages, they have to conduct reconnaissance trips to look for fieldwork sites and evaluate the suitability of the sites in terms of safety and opportunities for their field study. Within the written package, the student teachers have to articulate (1) the rationale of the fieldwork, (2) the inquiry questions/hypotheses and (3) the field inquiry tasks and activities. They can organise their package into the pre-fieldwork phase, fieldwork phase and post-fieldwork phase or according to the Roberts' (2003) geographical inquiry process model. Finally, for the last week, each group will present their field inquiry package gather feedback from their peers.

In terms of module assessments, they have also been modified to incorporate salient features of inquiry in the field. The student teachers have to keep individual portfolios of reflection on how to spark learners' curiosity in the topic and in the field, on data collection and representation, and finally on the overall field inquiry process. The next important component of the assessment is their fieldwork package.

9.5 Conclusion

Many of the student teachers expressed that they did not give much thought about fieldwork as they had little fieldwork experience during their secondary and junior college days. The kinds of fieldwork that they have experienced were mainly the Cook's Tour type with little student engagement in the field. It is also significant

that the fieldwork module can be an extremely important part of the pre-service programme in altering and transforming the student teachers' lingering negative preconceptions that they might have carried from the uninspired fieldtrips that they have participated as students into positive and meaningful ones. For student teachers who have never been on a single fieldtrip throughout their geography education, this fieldwork module serves as crucial and necessary experience before they are expected to teach and conduct fieldtrips with their students in the future. A very important goal of the module is not just to equip the student teachers with the necessary pedagogical content knowledge within the field but to provide student teachers with the psychological readiness in planning and implementing fieldwork when they are in schools. The geography team of tutors will continually learn from the student teachers' reflections and feedback on the module. Features which are relevant and can cater to their needs will be purposefully included so as to enable these student teachers to ignite in the students their passion for geography. In conclusion, one student teacher has this to share about her fieldwork journey in the module.

As a learner I was humbled by the vast experiences and content knowledge that I have yet to master and come to terms with in the subject of Geography and honing of fieldwork skills. I was taught the value of patience and respect as I slowly broaden my pedagogical and content knowledge when I seek advice/consultations from my tutors and peers who may have deeper subject knowledge and fieldwork experiences than me. Through lengthy but meaningful discussions, I gained new perspectives and learnt to develop my management skills in interacting with people and more importantly, to rationalise and articulate my cognitive processes/thoughts into tangible goals. As a teacher, my beliefs and teaching attitudes have definitely been substantiated and renewed in a positive light. **I would raise both hands and feet in agreement that a well-designed meaningful fieldwork package is powerful and almost unbeatable tool to reach out, engage, and pump up our interest and love for Geography.** (LFSW)

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Chapter 10

Developing Thinking Teachers Through Learning Portfolios

Woon-Chia Liu, Caroline Koh and Bee Leng Chua

10.1 Introduction

The rapid pace of globalisation, the exponential rate of knowledge generation, and the revolutionary evolution of technology and social media have resulted in a flatter, more interconnected, and interdependent world. The empowerment of individuals to contribute globally through the dynamism of connecting knowledge and people in a single global network brings forth innovation and creativity. This borderless sharing of knowledge and values increases the complexity of the world we are living in. It is increasingly pertinent that our students today be equipped with the essential twenty-first century skills such as critical thinking and problem-solving skills that are grounded on values to face challenges not documented in manuals and textbooks. They need to develop a deep passion for lifelong learning, nurture an inquisitive and creative mind, and cultivate a strong sense of responsibility to the community and environment (Tan et al. 2012). Therefore, the focus of education must shift from efficiency to diversity, from knowing to thinking and creating, and from fitting people to specific jobs to equipping them with values and skills essential for lifelong learning.

With these changes, we see an increased challenge for teachers as well. According to Darling-Hammond (1995, p. 10), “The knowledge, skills, abilities,

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and commitments of teachers prepared today will shape and inform what is possible for the future generation of students”.

The role of teachers is not just to disseminate knowledge, but to shape character, instil values, nurture an inquisitive mind for continuous learning, and also contribute to be architects of the learning environment (e.g. Darling-Hammond 2006; Tan et al. 2012). Most importantly, the fundamentals of teacher preparation in the twenty-first century are to prepare teachers to be **custodians of the values of society** (Tan et al. 2012) and are **thoughtful, reflective, and inquiring**.

10.2 Teacher Education in NIE (TE21)

According to Hoban (2005), teacher education frameworks in the past are fragmented and courses are conducted in a manner that causes pre-service teachers to be inflexible and narrow and possesses fragmented views on learning. They do not help pre-service teachers to make sense of their role as practitioners of education. The fragmentation of knowledge bases in many teacher education programmes, where there is no tight integration of their coursework with how it can inform their teaching practices and further develop them as teaching professionals (Hoban 2005), gives rise to the theory–practice (T-P) gap widely accepted as a common weakness of university-based teacher education (Allsopp et al. 2006; Barksdale-Ladd and Rose 1997; Tan and Liu 2014; Korthagen 2010). Stemming from the fragmentation of courses in teacher education may be due to the misunderstanding in the nature and purpose of theoretical and practical instruction. The aim of the practice is not to gain immediate mastery. But imparted properly, theories can inform the teaching practices of pre-service teachers and form a lens through which they see things from different perspectives. Theory, as such, is not merely instrumental or to be applied into action, but seeks to form and inform perspectives and shapes lens (Soltis 1990). Furthermore, to bridge this gap, Darling-Hammond and Bransford (2005) proposed a stronger collaboration with schools in teacher education programmes. Moving forward, researchers of teacher education reforms have identified critical components of teacher education programmes (Darling-Hammond 2006). These include tight coherence and integration among courses, between coursework and clinical teaching experience, linking theory and practice, and closer and proactive relationships with schools that serve diverse learners effectively.

With the increasing complexity and demands of teaching, teacher educators at the National Institute of Education (NIE) are cognisant that teacher education curriculum should not only address the above-mentioned gaps but also strengthen the teacher personhood. We aim to nurture teachers who are not only ethical, adaptable, and resilient in this rapidly changing world but also positive towards teaching and have a strong commitment to their students and profession. As such,

NIE propels the importance of a value-based teacher education programme. This **value-based teacher education** resides on the V³SK framework, which captures the values (V), skills (S), and knowledge (K) expected of a twenty-first century teacher (for more details on the TE21 Model and V³SK framework, see Chap. 1). This framework resides on three value paradigms, namely learner-centred values, teacher identity values, and values of service to the profession and the community. Pre-service teachers are expected to uphold learner-centred values, espouse teacher identity values, and show their commitment and service to the profession and community.

Residing within this value-based teacher education curriculum is NIE's Autonomous Thinking Teacher Model as conceptualised in Fig. 10.1. The underlying philosophy for this model is that teaching is a **professional thinking activity** (Liu et al. 2014). It aims to nurture teachers who are autonomous and self-driven in improving their own practice, **reflective** of their own roles, and capable of drawing upon theories and research to **inquire** and **innovate** their teaching to support their students' learning (Cochran-Smith and Lytle 1999; Darling-Hammond 2006; Labaree 2003; Norlander-Case et al. 1999; Rodgers 2002). It is evident from the model that there is a tight integration and coherence among courses, and between coursework and practicum experience through innovative pedagogical approaches. As reflected, practicum in NIE is conceptualised as the spine of teacher education programmes—an integrated element in a systematic and coherent programme. This interdependence of practicum experience and courses is pivotal to NIE's mission of developing autonomous thinking teachers by helping them to “learn for practice” and “learn from practice”. In essence, the right-hand side of the framework shows the “relationship” between coursework and practicum, while the left-hand side of the framework outlines the “process” in which pre-service teachers build their conceptual map of teaching and learning with the structure provided by the e-Portfolio, which will be discussed in depth in this chapter. Inevitably, the theory–practice link is reinforced when the various courseworks are integrated with practicum experience as part of a cohesive programme.

In this chapter, we will delve into how the structure provided by the NIE's e-Portfolio embedded within the professional practice and inquiry (PPI) course that is tightly integrated with pre-service teachers' practicum experience helps them (i) own their learning, to be empowered to learn about teaching and about themselves as teachers; (ii) crystallise their teaching identity, to be aware of their core beliefs about teaching and being a teacher; (iii) build their conceptual map of learning and teaching in NIE, to integrate and aggregate their learning; and (iv) inquire into their practice, to develop their ability to draw on research and theories to deepen their understanding of teaching and learning and innovate their teaching practices.

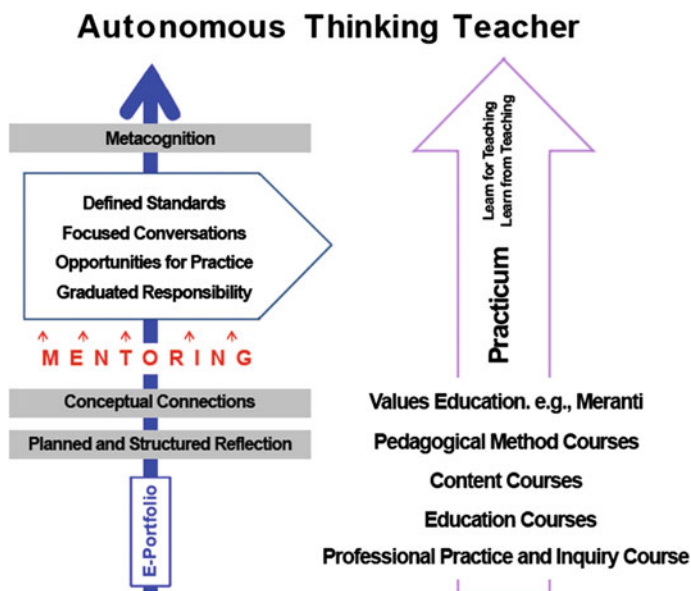


Fig. 10.1 Autonomous Thinking Teacher Model (with permission from Cengage Learning Asia, Tan and Liu 2015)

10.3 Professional Practice and Inquiry (PPI) Course

The PPI course is the “glue” of the initial teacher preparation programme in NIE, and it cuts across all courses and practicum experience as conceptualised in Fig. 10.2. There are two components to this PPI initiative. First, the PPI course aims to (i) develop a set of understanding about learners, teaching, and learning and (ii) provide knowledge, skills, and attitudes to develop pre-service teachers to be thinkers and researchers with a strong teacher identity. The course content for the PPI course includes (i) understanding the “why”, “what”, and “how” of PPI; (ii) formulating one’s teaching philosophy; (iii) applying the Reflective Practice Model to scaffold one’s reflection of his/her teaching; (iv) inquiring into one’s practice using the Inquiry Model; (v) using data to inform and substantiate inquiry; (vi) using theories and research to educate one’s perspectives, beliefs, and assumptions; (vii) understanding the characteristics and components of good teaching; and (viii) recognising the importance of co-inquiring and co-constructing knowledge within a community of learners in the educational fraternity.

Second, with the structure provided by the e-Portfolio, pre-service teachers will be able to construct their conceptual framework of teaching and learning and demonstrate what they know and are able to do as teachers (e.g. Mansvelder-Longayroux et al. 2007). The e-Portfolio serves as a cognitive framework that allows the pre-service teachers to form connections between the

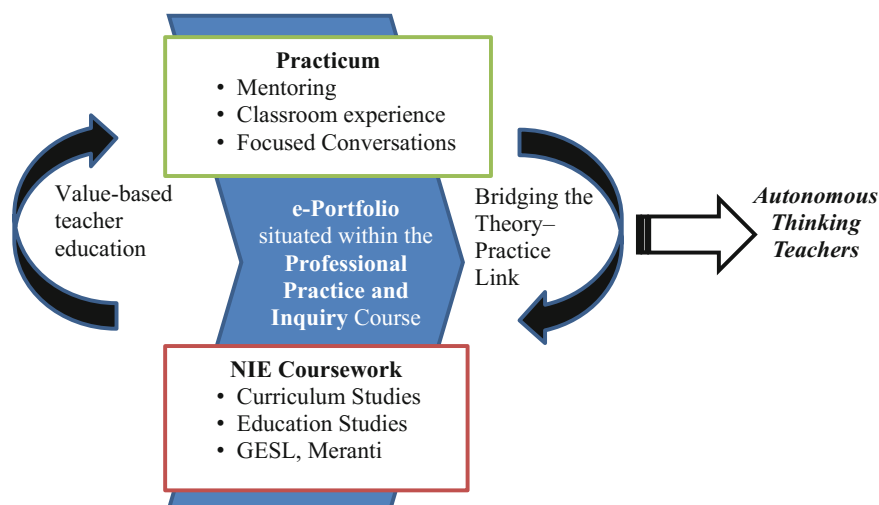


Fig. 10.2 Conceptual framework of the professional practice and inquiry (PPI) course

various modules undertaken at NIE. This process of forming connections will serve to synthesise and aggregate their learning and strengthen the theory–practice connection. In particular, the e-Portfolio was designed to instigate reflection on their personal teaching beliefs, learning beliefs, and their relationship to NIE’s Graduand Teacher Competencies (GTCs; for more details, see Chap. 2). The e-Portfolio allows pre-service teachers to upload any artefacts that demonstrate the range of expected teaching competencies.

The PPI course and the e-Portfolio are seamlessly weaved into the pre-service teachers’ practicum experience. Pre-service teachers are tasked to articulate their teaching philosophy, share their conceptions of teaching and learning, and inquire into their own practices during their practicum experience through the use of e-Portfolio with their school coordinating mentors (SCMs) and NIE supervisors (NIEs) during the Focused Professional Conversations and the pre- and post-practicum conference. This inevitably facilitates a culture of learning among the pre-service teachers where they start to co-inquire, co-construct, and grow their knowledge.

The use of portfolios in teacher education is not new. Portfolios in teacher education serve as a tool for documenting growth and for showcasing learning as the portfolios contain artefacts representative of the pre-service teacher’s performance in the classroom and school practice. Before we discuss the four enduring principles of NIE’s PPI course in greater depth, it is essential that we offer some insights on the use of portfolio/e-Portfolio in teacher education.

10.3.1 Role of Portfolio in Teacher Education

Teacher colleges worldwide have used the portfolio as a way of monitoring, documenting, and assessing both the pre-service teacher and in-service teacher education programmes (Snyder et al. 1998; Porter et al. 2001; Gray 2008; Wray 2008). Through the portfolio, pre-service teachers have the opportunity to claim ownership of their own learning and professional development. They may select artefacts that illustrate their learning and how closely it is translated into actual teaching. The portfolio process helps them to identify, analyse, and apply principles, content, and dispositions that will be needed to accurately and convincingly document their competency as a teacher (Stolle et al. 2005). By showcasing what they have learnt, how they engage in the learning process, and how they apply their knowledge, pre-service and in-service teachers demonstrate their preparedness for teaching.

Another benefit of building a portfolio is the opportunity for pre-service teachers to engage in reflection (Lyons 1998). An unreflective teacher tends to carry on with the daily routine in school unquestioningly and inclines to lose sight of the purpose and goal towards which they are working. On the other hand, reflective action involves active, persistent, and careful consideration and response to issues and challenges (Dewey 1933). Reflective teachers actively review their teaching in relation to the underlying educational, social, and political contexts. By owning their learning and engaging in constant reflection, pre-service teachers are able to bridge the theory–practice link—by making deliberate connections of the theoretical foundations acquired during their teacher education programmes with their practice of teaching.

Working on portfolios also supports the opportunity for pre-service teachers to reflect on their own learning and to communicate their professional identities as teachers (Zeichner and Liston 1996; Lyons 1998). Through the process of reflection, pre-service teachers are able to evaluate their own teaching and to question their own teaching philosophies. The formulation of one's teaching philosophy is of pertinent importance as it articulates the pre-service teacher's core beliefs on his/her learners, teaching, and learning (Wolf and Dietz 1998). The teaching philosophy will inform one's teaching approaches and decision-making process in the classroom. In essence, the final portfolio product is a personal diary in which the pre-service teacher is able to showcase his/her creative potential, professional characteristics, and innovative teaching style.

According to Shulman (1994), a teaching portfolio is a structured and documented history of carefully selected sets of coached or mentored accomplishments substantiated by samples of student work. It is fully realised only through reflective writing, deliberation, and serious conversation. It is evident that building a portfolio facilitates conversation on one's teaching and learning. These conversations could happen within oneself in the form of intentional reflections or with other fellow pre-service teachers whereby sharing of experience and co-construction of knowledge could happen. Ultimately, the goal is for pre-service teachers to improve their ability to articulate, evaluate, engage in, and refine their own teaching for the

benefit of student learning. Indeed, as Lyons (1998, p. 4) argued, “Ultimately, the portfolio as a process demanding at its best constant reflection on teaching and learning, holds the promise—however fragile—of forcing a broader reflection on the ways teachers are educated and continue in their professional development”.

10.3.2 The Value of e-Portfolio in Teacher Education

The rapid development of commercially developed and free open-source applications in information and communications technology (ICT) has accelerated the move from hard copy portfolio to electronic portfolios or e-Portfolios in teacher education (Strudler and Wetzel 2005; Yancey 2001). The use of e-Portfolios in higher institutions across Asia, the USA, and Europe is also a common trend noticed by Chou and Chen (2009) in their studies. In 2002, the US National Council for Accreditation of Teacher Education Standards has mandated the use of e-Portfolio technology across teacher education programmes (Foley 2008). More than half of the higher education institutions in the United Kingdom (UK) have reported use through surveys, of one or more electronic resources that are akin to e-Portfolios.

The e-Portfolio is defined as an electronic collection of authentic and diverse evidences relating to a learner’s progress, development, and achievements (Beetham 2005; Gray 2008). Similar to the use of portfolio in teacher education, studies have verified the value of e-Portfolios as a tool to promote learners’ learning and development, to document their growth, to encourage self-assessment and reflection, and to provide evidence for the assessment and accountability (Anderson and DeMeulle 1998; Banks 2004). The affordances of technology have enhanced the mobility, content richness, and the ease of use of portfolio by providing greater autonomy for learners to personalise their learning anytime, anywhere as well as richer content presentation through the use of text, graphics, audio, videos, and animations that can be integrated into the e-Portfolio. Indeed, the e-Portfolio learners represent the information of their learning in different formats and carry this information with them as they move between institutions or organisations (Banks 2004; Foley 2008).

However, despite the benefits of the e-Portfolio, the fragmentation in the teacher education framework and the theory–practice gap further prevents pre-service teachers to use their e-Portfolios beyond the collative function and are unable to reflect deeper into their learning and teaching. The lack of guidance in helping pre-service teachers to make sense of their role and the lack in follow-up use of the e-Portfolio once pre-service teachers graduate and enter the professional environment (Wray 2008) further exacerbate this issue.

In NIE, as mentioned previously, the PPI course provides the fundamentals to initiate thoughts and conversations on pre-service teachers’ (i) formulation of their teacher identity; (ii) empowerment to own, document, and chart their learning; and (iii) inquiry into their teaching practice. This is complemented by the structure

provided by the e-Portfolio whereby pre-service teachers construct the conceptual framework of their learning journey with the focus on learning from their various courses in NIE to **prepare them for their teaching practice** as well as **learning from their practice** during their practicum attachment. In addition, the use of e-Portfolio rather than portfolio supports the continuous professional development of teachers from pre-service to in-service as the pre-service teachers are able to carry the artefacts and evidences of their learning processes together with them as they transit from NIE to the schools.

Taken together, prior literature has articulated the promises of the use of portfolio/e-Portfolio to develop autonomous thinking teachers who reflect on their practice (Darling-Hammond and Snyder 2000; Hallman 2007; Lombardi 2008; Lyons 1998; Meeus et al. 2008; Tomostsuj 2010; Wade and Yarborough 1996) as well as its potential limitation of being a repository of artefacts and documents (Wray 2008). The next section will look at four enduring principles of the conceptualisation of NIE's learning e-Portfolio that is embedded within the PPI course contextualised within a value-based initial teacher education programme to develop autonomous thinking teachers.

Enduring Principle 1: *Ownership of Learning*

At NIE, we recognise the importance of shifting the onus of learning on to the pre-service teachers. It is important that we start empowering our pre-service teachers to exercise their autonomy for their learning right from the start as pre-service teachers. The PPI initiative aims to prepare the mindset as well as provide the e-Portfolio as a vehicle to groom the pre-service teachers to being autonomous learners who are self-motivated to improve themselves. As reflected in Fig. 10.3, the PPI e-Portfolio is conceptualised to be a vehicle to facilitate professional development from pre-service to in-service.

The PPI e-Portfolio is used as a learning portfolio during initial teacher preparation, a showcase portfolio during pre-service teachers' teaching practice, and a teaching portfolio when they are qualified teachers. It is advantageous in providing pre-service teachers with a holistic view of their development through time. It showcases the growth and development of pre-service teachers, how far they have come, and how much they have grown over time and allows them to review past learning and plan future learning and development (Banks 2004). The following are comments from our pre-service teachers:

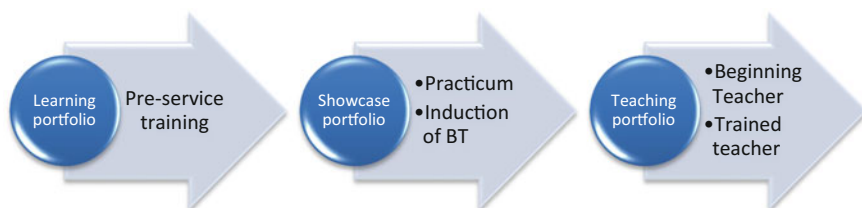


Fig. 10.3 PPI e-Portfolio (NIE 2010)

It's a good initiative. It provides a platform for us to consolidate what we have learnt. At least there is a platform for us to put something there [and] it's not just for show. It's also like, when we look back [like a form of] record...[where] you, have some written record of what you did.

One is to really keep track of ourselves, to keep track of our own growth, and the second one was to be able to...keep a record. A repository of our artefacts to present ourselves to people.

Enduring Principle 2: *The Crystallising of Teaching Philosophy*

From the start of their initial teacher preparation, pre-service teachers are engaged in redefining themselves as teachers. This personal teacher identity will shape every teacher's approach to teaching. An awareness of pre-service teacher's identity during his/her initial teacher preparation provides an understanding of current practices and establishes the basis for areas of his/her growth and future professional development (Krzywacki 2009; Walkington 2005). The construction of teacher identity and its development is an important part of the teaching experience (Coldron and Smith 1999; Danielewicz 2001; Mayer 1999). A teacher identity is a personal construct and indicates how one sees oneself as a teacher and how one feels as a teacher (Coldron and Smith 1999; Mayer 1999; Gee 2001).

In NIE, we believe that teacher identity is a dynamic construct and is understood to be dynamic and in a continual flux and under construction (Mayer 1999; Walkington 2005). It is something teachers employ to justify, explain, and make sense of themselves in relation to their sociocultural milieus. From the start of the PPI course, pre-service teachers are asked to reflect on their teaching beliefs and how it would guide their conception of teaching and learning. Furthermore, during the PPI course, pre-service teachers are taught how to craft their fundamental teaching philosophy, one that will guide the formation of their future perceptions and beliefs for the different facets of teaching, be it in the context of classroom management, the use of information technology to engage their students, or in the area of students' motivation to learn. In addition, the use of the PPI e-Portfolio (Fig. 10.3) can support pre-service teachers' growth and ability for self-reflection, providing a context for ongoing discussions about the construction and negotiation of teacher identity (Hallman 2007).

NIE provides opportunities and platforms such as pre-practicum conferences with the NIEs prior to pre-service teachers' practicum experience and Focused Professional Conversations with SCMs during practicum, whereby pre-service teachers are invited to share and articulate their teaching philosophies and beliefs, leading to the culmination of their teaching identity. This was evident in the comment below given by a graduating teacher:

I made sense of how I developed as a teacher through the use of my portfolio which I diligently documented my thoughts and reflections. The e-Portfolio was really a helpful tool to crystallise my growth in NIE and also have served as a platform which I consolidated my perception of teaching and articulated what I believe about teaching in my teaching philosophy. Having my teaching philosophy documented in my portfolio also allowed me to see whether I am true to my beliefs and whether the way I teach is in line with my teaching philosophy.

Enduring Principle 3: *Building a Conceptual Map of Learning and Teaching*

An effective teacher education programme calls for appropriate links and coherence between the various courses and with the overarching teaching practice. Therefore, it is pivotal that pre-service teachers are able to integrate and aggregate their learning in NIE before their practicum experience. While doing their coursework in NIE, pre-service teachers are tasked to build their conceptual map of their learning by collating and combining diverse forms of digital artefacts and outputs from their courses that are meaningful to them for their e-Portfolios. By having visual representations of how facts, theories, and ideas fit into a conceptual framework (Darling-Hammond 2006), pre-service teachers will better be able to understand, internalise what they learn, and track their growth and development. They would be able to draw links to shape their teaching philosophy and inculcate their values and beliefs. Through the use of the e-Portfolios, pre-service teachers make connections between the courses, consolidate, and share their “learning for teaching” with their NIESs and SCMs before their practicum experience.

My teaching philosophy was crafted at the same time as the production of my e-Portfolio.... I had collected things and that helped me to shape my philosophy.

[It] helps me to have a clearer picture of what I have gone through so far.

As the PPI coursework is integrated with practicum, key ideas are reinforced, thus helping pre-service teachers to build a deeper understanding of teaching and learning. Moreover, the theory–practice link is strengthened during “learning in practice” as they are reflected during Focused Professional Conversations with their school cooperating mentors and cooperating teachers (Tan and Liu 2014). Through their PPI e-Portfolio and with guidance and discussions with mentors and friends, pre-service teachers would be able to understand how they learn and manage their own learning (Darling-Hammond 2006), applying the appropriate learning strategies and instructions necessary to aid their growth and facilitate their development.

So when I was putting them together trying to draw links...it was useful. So for example, the things I did for micro-teaching, or for various assignments, then I realised that actually those things as I did them there is an underlying meaning...there's an underlying link to my own philosophy, my own ideas. And, that did help. And when I went to, when I prepared for FC 1, using the, using the e-Portfolio, the experiences also kinda helped me see that my learning took place in this areas and there was a linking bit as well.

Learning about the theories helps you to decide what to reflect on. Rather than just, okay do reflection heck care, okay what do I reflect on that kind of thing.

Thus by building their own conceptual map of learning and development, pre-service teachers take charge of their own learning and choose artefacts meaningful and significant to their growth to upload on to their PPI e-Portfolio.

I think there's more autonomy in choosing...when you want to reflect. And if there's really things for you to reflect then of course you put in. If not like it's, you have to force something out.

Enduring Principle 4: *Inquiry into Practice*

While the importance of reflection is not new to education, the techniques of reflective practice are relatively recent. NIE defines reflection as a “deliberate pause to assume an open perspective, to allow for higher level thinking processes”. NIE’s Reflective Practice Model is an adaptation of Sparks–Langer model (Fig. 10.4 adapted from Langer et al. 2003; York-Barr et al. 2001), and it is shared with the pre-service teachers during the PPI course. The Reflective Practitioner Model illustrates how personal and professional knowledge can be built through the interaction between the teachers’ dispositions, professional knowledge, and practice. It also helps pre-service teachers to improve their teaching craft and strengthens the theory–practice nexus. The model illustrates the interaction between the teacher’s dispositions (being), practice (doing), and professional knowledge (knowing). As such, it indicates how personal–professional knowledge is built. At the heart of the model, the four-stage cyclical process of Observing, Reflecting, Planning, and Acting facilitates reflection in action and on action.

The structured and systematic reflection is important as it enables the pre-service teachers to restructure their prior conceptions and refine their thinking on pedagogical approaches (Calandra et al. 2008). The model allows pre-service teachers to

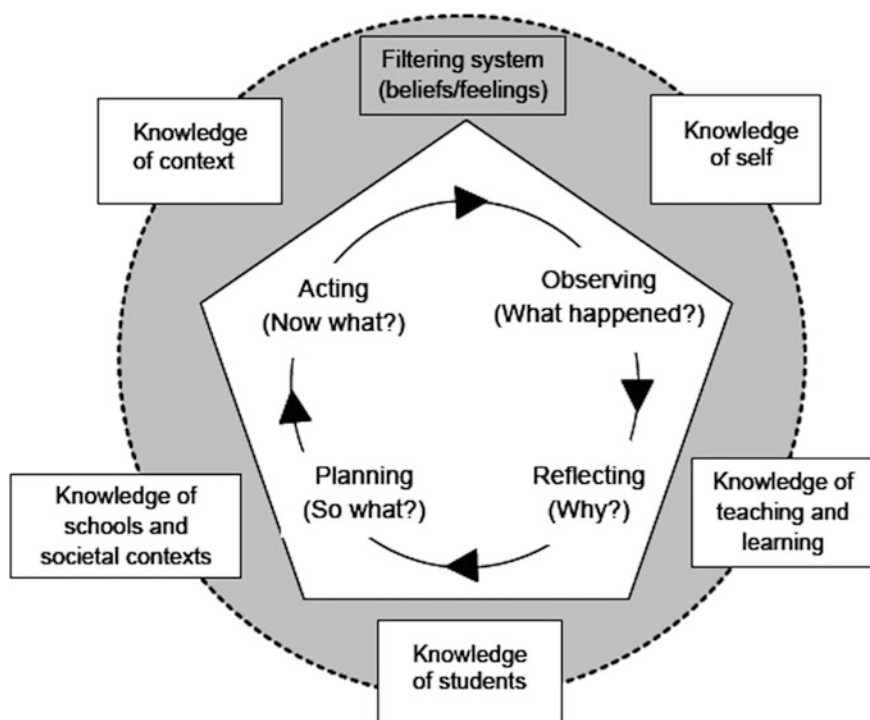


Fig. 10.4 Reflective Practitioner Model (adapted from York-Barr et al. 2001)

reflect in action and on action and go through the process of self-awareness as a teacher professional, on informing their teaching practices, knowledge of students, and school environment and culture.

They first begin by recalling the things that they had observed “what happened”: *What did I do? What did others say? How did they react? Did I achieve the right outcome?* By becoming more aware of the self, pre-service teachers then are able to take on a third-person perspective and reflect on the “why”: *Why did I choose to act the way I did? Why did I choose to adopt this mode of instruction?* Weighing between cause and effect, and reflecting on the pedagogies that informed their teaching practices in the classroom, pre-service teachers enter the Planning phase by asking “so what”: *What might I do differently? How might this change my classroom pedagogy and my approach or interactions with others?* By taking into consideration also the student profile within the classroom and the school’s culture, pre-service teachers ask “now what”: *What do I want to remember to think about in a similar situation? How do I want to respond?*

The shaded area in Fig. 10.4, situated between the reflective cycle and the professional knowledge base, illustrates the prior beliefs, attitudes, values, and assumptions that pre-service teachers have. These form a filtering system that “filters” impact on their teaching experiences and knowledge bases that inform their teaching pedagogies and practices in the classroom (Wubbels 1992).

The Reflective Practitioner Model is developmental and continuous. Each stage is based on the previous one and serves as an impetus for the next. It can occur at different levels of sophistication. Van Manen (1977) proposed three major hierarchical levels at which reflection may take place.

- i. Technical Reflection

Technical reflection is the most basic level of reflection that focuses on what works in the classroom. At this level, teachers are concerned with applying knowledge to achieve instrumental outcomes, and actions taken are evaluated on the basis of their success or failure in the classroom.

- ii. Practical Reflection

Practical reflection is the next level of reflection that focuses on the learning experiences of the student. It goes beyond technical rationality and investigates questions and clarifies end objectives and assumptions held that inform teaching practices carried out to achieve those objectives.

- iii. Critical Reflection

Critical reflection is the highest level of reflection. It focuses on the value of knowledge in the context that it is formed by. At this level, teachers go beyond and reflect upon the larger context of education and critically question their teaching practices, in particular connection with ethical and moral issues and societal context at large.

It is expected that pre-service teachers will exhibit technical rather than critical reflective skills in the beginning. However, the usefulness of this model offers scaffolding techniques that supervising or cooperating teachers would find useful in

guiding the reflections of pre-service teachers. The Reflective Practitioner Model should not be seen as a prescriptive, but rather as a common framework provided to help pre-service teachers consolidate their experiences and guide them in systematically reflecting in and on their practices (NIE 2009). Shown below are reflections from student teachers that reveal the different levels of reflection and different aspects of learning.

One student teacher engages in technical reflection as she recounts her past lessons.

“.. I used **Dreikurs’s Discipline Model – logical consequences**, where I set clear rules, routines and consequences for all my classes (1A, 2B, 2C). Therefore, students were conscious of what was expected of them every lesson, which made class management more manageable. Yet, I understood that each class is always so different in dynamics and attitude, that each class’ set of **logical consequences** were differentiated and personalised. I therefore personalised each class’ set of consequence and rules after observing how they were like. I also made use of **classroom’s physical space** and made sure to move around to let students know I had **withitness**. Though I must admit, my level **withitness** can always be improved.

During my FC2, I was eager to share with Mr A some of motivational and instructional strategies I made use for my literature classes. I realised I favoured using **cooperative learning strategies**, creating meaningful activities for the students while using personalised teaching skills to best accommodate to them. Personally, I feel that students engage better and learn better by discovering together with their peers, instead of just relying on teacher-directed teaching. Conducting group work for Literature is always a tall order, but in order to sustain and engage my students’ (who did not have an interest at all in Literature), I had to challenge both myself and the students. To challenge the students, I gave them a larger task and created **group roles** and also established **group goals**, this enabled students to stay focused and have comfortable group **interactions**.

Focusing on just class 2C, (since 2B barely had lessons this term due to holidays), I shared with Mr A class 2C’s process- I noticed that students were initially disinterested in Literature and were often restless and bored. So I eagerly dived into group work, failing to understand the class better to grasp how they learnt. Needless to say, the first lesson on group work was nothing short of a disaster. I then decided to adapt **Marshall’s model**, where I emphasized on **positivity, reflection and choice**. The use of positive tone as well as the empowerment of choice gave them confidence, and each lesson, I established expectations and enabled students by asking reflective questions. This triggered a positive change in the students, which I witnessed from my first lesson to current lessons. However, I feel that there is much to improve on my part, and I need to continually encourage students and positively reward them for their improvements.”

Another student teacher engages in practical reflection as she recalls her experiences across different classes.

For class A, I will observe how they behave in class, in terms of **how they ask questions, why they ask questions and the type of questions they ask**. I think this is critical in building a culture that is safe to enquire and learn. In turn, **I will also have to learn to respond accordingly**, whether it is to give them the opportunity to speak with each other in front of the class, or giving sufficient wait-time for students to respond.

For class B and C, I will continue to observe how the students behave in class during each new/build-up/scaffolded activity, in order to decide whether to scaffold more or challenge these students.

I will also **analyse all my students' work, whether group or individual, to perceive if that particular method of task was effective** and if I should continue to use it or scaffold it further. At time, it is also necessary to set manageable standards for each class- enough for them to know that they are challenging themselves, but not to an extent that they are not sure what they are doing.

I should also continue to ensure that each piece of work given is always checked to see if there is a need to fit in supplementary lessons to help their weaknesses. (EG: Re-teaching/revising after having done draft 1 of a particular task.)"

Here, two student teachers engage in critical reflection.

In particular, I felt the artefacts I had brought to the table were very memorable artefacts for me as they reminded me of the key milestones in my teaching journey. These artefacts pointed out the memories of teaching the material as well as the strategies that I had used to nurture the student holistically. **While I showed the artefacts**, which ranged from holiday assignments using ICT, worksheets on poetry that incorporated popular song lyrics, teachings on irony using key pictures for student to recall the concept easily, **I took the time to explain how these artefacts help shaped my teaching techniques** in class. I explained how I tried to use **a range of activities to engage the students in learning meaningfully** as well as **understand the real world implications of their learning**.

In my sharing, I also showed how these artefacts were used to support my other colleagues in terms of their teaching. For example, I had come up with a set of rubrics and worksheets to facilitate the freeze-frame activity that the Secondary 1 Literature teachers were already planning to conduct. **I was also a part of many group discussions with my fellow colleagues** during department meetings **where we shared good practices and consolidated the students' progress for the week**. I felt very much a part of the department in these meetings and **I was always eager to support my colleagues in areas where they needed help, as well as contribute ideas and practices that I thought might help our students learn more effectively**.

As I reflect on the "central purpose of teaching as helping students develop critical thinking and other desirable capacities and dispositions rather than merely passing on knowledge and information." (p. 20), **I find that in teaching my subject content, I have to seek significance to what I teach that is beyond the classroom context**. This significance must be relevant not only to their lives now, but must also help build and sustain the lives that they will have in the future. In English Pedagogy classes, we learn that there must be some enduring understandings in which our language lessons are grounded. These Enduring Understandings give meaning to learning, and range from broadening our perspectives (e.g. learning about other cultures and alternative viewpoints) to critical literacy/thinking (e.g. represented and discounted viewpoints) to knowing what is good for the self and society (e.g. health and living well). To do this, **I have to broaden my own perspectives and think deeply and have an open mind to learn and explore new lessons with my students**. I also have to hone my skill of finding meaning (and meaningful activities) in what I teach and what my students learn, so that they can lead meaningful lives.

The model (Fig. 10.4) is shared with the pre-service teachers during the PPI course and is used during their coursework and practicum as a common framework to help them consolidate their experiences and guide them in systematically reflecting on their beliefs, assumptions, as well as their notions of learning and teaching. It also facilitates pre-service teachers to think deeper and more critically (Borko et al. 1997; Freidus 1998; Walkington 2005; Lorenzo and Ittelson 2005; Cherubini 2009).

Ya, I didn't realise you need to know what to reflect on. We need to be scaffolded to know what to reflect on.

You just, need to learn to structure it and all that. So I guess when you structure your thoughts, you structure your reflection, it becomes clearer to you. Because you have a sequence...you have a structure that you can follow.

[As] we go through this course,...our thinking is really sharpened. Like, as we go through our assignments we really think critically.

Ya. Definitely deeper than before. Because we...we have learnt more things already what. Ya...so we have to think more.

Pre-service teachers also use it to examine their practice after every lesson during their practicum experience to gain a deeper understanding and improvement of practice. Working closely with schools and strengthening school partnerships, SCMs use the model when facilitating Focused Professional Conversations. Furthermore, through the affordances of the e-Portfolio, pre-service teachers are able to document their practice, evaluate their own learning and development, as well as provide mutual feedback. Four graduand teachers noted:

The e-Portfolio also provided a conducive platform for us to reflect not only on each of our modules specifically, but on our NIE journey as a whole. It allowed me to chart my progress in each course I undertook, to draw lessons learnt, and to postulate and think about how I was going to use my newfound knowledge and skills during my practicum stint as well as a beginning teacher.

The time spent completing the reflection portfolio allowed me to see how each piece fit into the larger scheme of things. It allowed me to see connections and relationships.

In my case, the e-Portfolio was the first thing that set me on the path of becoming a reflective practitioner. Before my practicum, I had utilised the platform to document the pedagogical skills and knowledge that I had acquired. This allowed me to record and look back on what I learnt in NIE so that I could apply it when I start teaching proper. I was also taught how to go about reflecting on my lessons during my History pedagogy classes where my teacher would always get us to critique on what went well as well as how we can improve out lesson plans. Subsequently, I also used the e-Portfolio platform during my practicum to document sample lesson plans, reflections as well as my takeaways from the whole experience. This allowed me to reflect on my teaching and served as a reminder as to which areas I needed to improve on.

I would strongly encourage the keeping of e-Portfolio as it had helped me in areas of tracking my own growth, documenting my artefacts and work, and more importantly, allowed me to share thoughts and receive feedback from those whom I shared the e-Portfolio with.

As Jay and Johnson (2002) and Cattley (2007) posited, reflections help pre-service teachers to make sense of their classroom and teaching experiences and how these contribute to the formation of their teacher professional identity. Building on the Reflective Practice Model, the PPI course guides pre-service teachers to understand what is useful and relevant to informing their teaching practices in the classroom (Korthagen et al. 2001). It helps them to make sense of their lived experiences and how to link their everyday experiences with what they have learnt (Wray 2007).

I think the reflections are quite useful...forces you to think and take note of certain things that otherwise you wouldn't be doing.... So the reflection requires us to pick out, strategies used, challenges the teachers face, and how I'm going to implement it in my own class...so by doing the reflection it forces me to think of all these points...some of the points are not new to me, but.. I wasn't really aware that I know of all these things. Ya, so the reflections really helped me to point out more important things.

Through the PPI e-Portfolio, pre-service teachers are able to reflect upon their own practices. The PPI e-Portfolio provides a space for them to showcase these developments, should they forget over a period of time. It promotes reflective practice as it becomes a tool for participants' reflection on their student teaching experience. It also allows for them to take a broader perspective on their teaching experience and revisit specific lessons for deeper understanding (Borko et al. 1997).

So, ya...it forces you to think about your own practices and how you want to change them. But I think it's important for us to, document it. Write it down somewhere. Because, most of the time it's just talk, I would just say, and then I would just forget. So that's where I feel that e-Portfolio is important. Once you think of something just jot it down somewhere and then you have to document it uh. Because its human nature we will just forget.

The PPI e-Portfolio also serves to provide scaffolding for pre-service teachers to be guided in their reflection and organisation of their thoughts.

But never really having the discipline to write it [reflections] out. Ya. So what I'm hoping that, after this experience in NIE, I actually able to write out my thoughts. Because I think sometimes when you write out your thoughts, you can...organise your thoughts I guess.

The opportunity for self-reflection is an important aspect of building and grooming teachers to be autonomous thinking teachers. However, in NIE, we recognise the importance of going beyond mere reflection their teaching practices. We aim to provide pre-service teachers with the ability to inquire into their practice. Pre-service teachers will gather evidence and data and analyse it alongside relevant literature, making changes and altering their practices based on new understandings that have developed during this inquiry and investigation process (Dana and Yendol-Hoppey 2008).

Teacher inquiry invites intentional planned reflection, heightening the focus on problem posing. As pre-service teachers engage in the process of inquiry, it is important that their thinking and reflection are made public for discussion, sharing, debate, and purposeful educative conversation (Dana and Yendol-Hoppey 2008). Throughout their learning journey in NIE, the e-Portfolio is a vehicle for them to make learning visible and thus to invite comments and sharing from their peers and tutors. Also, during the second Focused Professional Conversation during practicum, pre-service teachers will discuss an issue they face in their classroom and share with their peers, CTs, and SCMs on how they can go about solving the problem. Three graduand teachers commented:

Through the e-Portfolio, I was also able to gather feedback and insights on my assignments from my peers and professors in NIE, as we shared our presentations and assignments with one another. This helped me further improve my pedagogical understanding of Economics as an A-Levels subject.

In recording these insights within my e-Portfolio, I was able to crystallise a set of pedagogical tools that was tried and tested, and crucially, aptly suited for my teaching style since it was developed through my own successes and setbacks. Collectively, the opportunities offered by the e-Portfolio in terms of presentation, reflection, and sharing added to my learning and professional growth throughout the practicum experience. By facilitating a more fruitful teaching practice, I am confident that it helped me become a better teacher.

Yes. [Reflections help me to] improve. To look back, then oh you can see next time when you do this, don't do this. Ya...when you are going through the lesson you don't really know, only when your CT points it out to you then you would be able to see.

10.4 Concluding Remarks

The NIE TE21 transformative teacher education model has its strong philosophical underpinning on values, skills, and knowledge (V³SK). This model is characterised by a coherently planned curriculum which consists of curriculum studies, education studies (see Chap. 6), Meranti, GESL (see Chap. 13), and teaching practice (see Chap. 11) to prepare our pre-service teachers for the multifacets of teaching in the twenty-first century classroom. The interconnectedness of the courses, between courses, and clinical experience is further reinforced through the PPI “meta” course and the use of PPI e-Portfolio which provides the integration of an otherwise fragmented teacher education programme. Through this integrative pedagogical approach, we believe our pre-service teachers are able to “learn for teaching” and “learn from teaching”. Through the shaping of their teacher identity, engaging in constant reflection, challenging their own assumptions, and inquiring into their practices, our pre-service teachers are empowered to develop the necessary skills, values, and knowledge needed for them to be autonomous thinking educators of the twenty-first century and adaptive diagnosticians of education.

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Chapter 11

Redesigning and Reconceptualising of Field Experience for Teacher Accreditation

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11.1 Introduction

The National Institute of Education's (NIE) TE²¹ Model, as mentioned in the earlier chapters (for more details, see Chap. 1), is one that aims to prepare teachers who are able to think in context and are adept in skilful teaching, reflective teaching and innovative teaching (Tan et al. 2012). We want our teachers to be able to reflect on their roles, think systematically about their own practice, draw on theories and research to deepen their understanding and adapt and innovate their teaching in ways that most effectively support student learning (e.g. Cochran-Smith and Lytle 1999; Darling-Hammond 2006a; Labaree 2003; Norlander-Case et al. 1999; Rodgers 2002). In addition, we want them to have the commitment and drive to take responsibility for their own learning and to continuously strive to increase their competencies and better their practice so that they can reach and teach every child (see Fig. 10.1 in Chap. 10 for a simplified conceptual map of how NIE actualises the TE²¹).

In essence, the right-hand side of the framework shows the “relationship” between coursework and practicum, while the left-hand side of the framework outlines the “process” in which pre-service teachers build their understanding of

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teaching and learning with the structure provided by the e-Portfolio (for more details, see Chap. 10).

In this chapter, we will take a closer look at the clinical practice or practicum component of NIE teacher education programmes. We will describe how the NIE's Enhanced Practicum Model is conceptualised in the light of TE²¹. Thereafter, we will highlight the five key tenets that underpin the redesigned practicum model. In conclusion, we will discuss the lessons learnt from the feedback gathered from both pre-service teachers and stakeholders from schools and make suggestions to refine the practicum structure and processes so as to further enhance pre-service teachers' learning during their field experience.

11.2 Practicum as the Spine of Teacher Education Programmes

Of all the different aspects of education, practicum or field experience is by far one of the most agreed upon essential components to have in any teacher education programme (Glickman and Bey 1990; Joyce et al. 1977). It is “the one indisputably essential element in professional education” (Conant 1963, p. 142). In the literature, it is seen as the most prized aspect of teacher preparation (Feiman-Nemser 2001; Haigh and Tuck 1999; Hill and Brodin 2004; Smith and Lev-Ari 2005) and is perceived by pre-service teachers to be the most valuable part of their teacher education programme (Smith and Snoek 1996). It is a period when pre-service teachers are attached to schools to learn how to teach and to experience what it means to be a teacher. It enables pre-service teachers to acquire beginning teaching competencies, crystallise their teaching philosophies, and (trans)form their professional identities. It helps prepare them for the realities of teaching by providing them with a clear understanding of the meaning of their profession and the contexts for schooling.

Although the role of practicum in the learning to teach process is not disputed, it is not without its challenges. Some of the major critiques are the apparent separation of student teaching from other courses, idiosyncratic placement arrangements with little shared understanding between university-based faculty and school-based mentors and selection or preparation of school-based mentors (Darling-Hammond 2006a).

Teacher education programmes, especially those that are university-based, have often been decried for offering disjointed and incoherent courses, focusing too much on theory and having little connection to practice, and lacking a clear shared conception of teaching among faculty (Darling-Hammond and Hammerness 2005). For instance, Hoban (2005) highlighted the issue of fragmentation of knowledge bases in teacher education into independent components such as curriculum, assessment, pedagogy, educational psychology, classroom management and subject knowledge. It is generally assumed that the cumulative effect of such individual

knowledge bases would lead to teacher learning. Such a “mechanistic framework” does not take into consideration the interrelatedness of many elements in the complex setting of a classroom and the students’ prior beliefs (Hoban 2005) and is not designed to develop a holistic view of knowing, doing or understanding (Ginsburg and Clift 1990).

Similarly, Tom (1997) posited that what teachers need is different from the more abstract, systematised and general expert–knowledge teacher educators often present to pre-service teachers. According to Korthagen (2007), this problem is epistemological in nature because it comes from a distinction between practical knowledge and formal knowledge. It is possible, however, to meld both spheres of knowledge together through the pre-service teachers’ personal reflection of their actions and experiences. Such experiences and reflections would then foster the ability to consolidate both thinking and action (Buchmann 1993; Clark and Peterson 1986; Coulter and Wiens 2002; Dunne 1997; Shulman 1998). Strengthening the theory–practice nexus in teacher education programmes would encourage more of such reflexive thinking among pre-service teachers, resulting in a smoother transition for them into schools.

To address the common criticisms, the practicum in NIE is conceptualised as the spine of the teacher education programmes (refer to Fig. 10.1). It provides shape and support to the programmes and helps frame the courses. Just like the arms, legs, chest and head are attached to the spine, the courses are “joined” to practicum. Practicum affects and is affected by every decision made in the courses. It is an integrated component in a systematic and coherent programme, and not just seen as an experience culminating at the end of the teacher preparation programme. No change in practicum can be isolated from how the rest of the courses function, and vice versa. This interdependence of field experience and courses is fundamental to NIE’s mission of developing autonomous thinking teachers by helping them “learn for practice” and “learn from practice”. It is also central to addressing the critique of separation of student teaching from other courses.

In essence, pre-service teachers learn to teach during practicum with the help of graduated practice, purposeful mentoring, Planned and Structured Reflection, and Focused Professional Conversations, which will be elaborated in the next section. However, it does not mean that learning to teach happens only in school classroom in real time (Ball and Cohen 1999). It takes place in NIE for pre-service teachers during coursework through the gathering and incorporation of authentic classroom materials of students’ works, video recordings of school lessons and problem-based scenarios of issues that occur in the classrooms. It happens with the purposeful interweaving of coursework with clinical experiences, as well as an emphasis on reflection, school-based inquiry projects and pedagogical tools that “bring” the classroom into the university. In addition, the linkages between coursework and clinical experience are crystallised by the use of the e-Portfolio, renamed the Professional Practice and Inquiry (PPI) portfolio. The PPI is the “glue” of the programmes (for more details, see Chap. 10). It is the vehicle and “meta”-course that helps pre-service teachers build and revisit central ideas and concepts, as well as integrate and aggregate their learning as they construct their own conceptual map of teaching and learning.

Practicum at NIE takes the form of a shorter period of attachment to schools for School Experience and Teaching Assistantship, and longer attachment with schools for block teaching. The duration for the attachments varies with the different pre-service teacher education programmes, as well as the stages of the initial teacher preparation. In the 1-year Postgraduate Diploma in Education (PGDE) programme, there is only one block teaching. Nonetheless, PGDE pre-service teachers undergo a school attachment, termed the “Enhanced School Experience”, before they start their coursework in NIE. The school attachment, which is structured as an early clinical experience, allows the pre-service teachers to experience first-hand the requirements and demands of teaching in a real-life school setting. These experiences are crucial in helping the novices make sense of the ideas, theories and concepts that are addressed in their subsequent coursework (Darling-Hammond and Hammerness 2005).

11.3 Practicum as a Professional Thinking Activity

The developments in the practicum at NIE over the last decade have been indicative of the changes in the philosophy of teaching. In the 1970s and early 1980s, when teaching was conceived primarily in terms of implementing a range of micro-teaching skills (Turney et al. 1985), the practicum was known as “teaching practice” because pre-service teachers’ time in schools was simply an opportunity to put their university-acquired knowledge into practice (Le Cornu and Ewing 2008). This understanding of teaching stemmed from a *behaviourist orientation* to teaching where the skills relevant to teaching were specifically defined (Zeichner 1983), and where pre-service teachers were assessed on their ability to implement a range of micro-teaching skills (Turney et al. 1985). This orientation to practicum was criticised for the passive recipient stance assigned to the pre-service teacher (Zeichner 1990). Furthermore, this approach to practicum emphasised technical knowledge which is a small part of teachers’ knowledge and not sufficient for the preparation of teachers for the professional role of teaching (Schulz 2005). This type of experience can socialise the pre-service teachers into maintenance of status quo rather than developing a critical inquiry approach in which teaching as a profession is underpinned by lifelong learning (Darling-Hammond 1999).

Although the term “teaching practice” is used in NIE, the practicum model at NIE sees teaching as a complex “professional thinking activity” (Calderhead 1987). Instead of expecting the pre-service teachers to apply technical or scientific rationality, they are seen as active agents who construct and reconstruct their own professional experience (Schön 1983, 1987; Zeichner 1980), practise and reflect on their practice, rethink their assumptions about teaching and learning and act on those new assumptions. The process of practicum is “purposefully analytic” to provide pre-service teachers with a platform for trying ideas, for reflection, for inquiry and for talking about teaching and learning with their peers and their mentors (e.g. Schulz 2005). And the supervisors of practicum “are there to guide

and facilitate reflective practice rather than act as mere critics or judges” (Nolan and Francis 1992, p. 52, as cited in Le Cornu and Ewing 2008, p. 3). They assist pre-service teachers theorise their own accounts of practice and then help them see how they might use these deeper understandings to develop their practice.

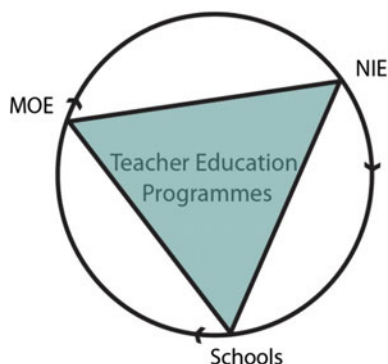
11.3.1 Practicum as a Partnership with Schools

The partnership between schools and universities is crucial in any teacher preparation programme. A well-rounded preparation of teachers is a joint effort between schools and universities, and that the pre-service teachers upon graduation, would be the type of beginning teachers that schools wish to employ. Hence, many teacher education faculties or institutions have established long-term working arrangements in a common enterprise while others are exploring strengthening these linkages. The degree of collaboration that schools are willing to extend to such partnerships, however, can differ between institutions within a country and also across countries. The effectiveness of such partnerships is also an issue that is regularly questioned.

NIE has a robust partnership with the Ministry of Education (MOE) and schools in Singapore. This strong tripartite relationship has been a pivotal component in NIE’s teacher education programmes and is “the envy of other nations” (Darling-Hammond, cited in National Institute of Education 2009, p. 6).

The NIE Enhanced Partnership Model (see Fig. 11.1) has been advocated by NIE to unify the strengths of NIE’s university-based approach with the support and collaboration of MOE and schools. This is to engender and foster strong relationships among the institutions while reinforcing the theory–practice nexus. The current partnership model is one where all parties involved see themselves as partners pursuing a common endeavour of teacher preparation, professional development and joint action research (Wong and Goh 2010). Amidst the different types of partnerships that have been documented (Callahan and Martin 2007; Furlong et al. 1995), the current partnership is one where NIE provides a formal teacher education within an academic setting, which is then complemented by the active support of local schools in providing opportunities in practicum, school attachments and other various collaborations. The partnerships strengthen the link between university-based learning and “real classroom setting” (Tan et al. 2012). It is noteworthy that the model is research-driven and evidence-based. This makes it faster and easier for NIE to address the needs or concerns of schools and practitioners.

Fig. 11.1 Enhanced Partnership Model (National Institute of Education 2009)



11.3.2 Key Tenets Underlying the Enhanced Practicum Model

The NIE Enhanced Practicum Model is built on five key tenets (Liu et al. 2014), many of which are recognised factors that contribute to the success of student teaching and are closely linked to those of cognitive apprenticeships (Darling-Hammond and Hammerness 2005).

- Tenet 1. Practicum is an integrated part of a coherent programme.
- Tenet 2. Practicum provides opportunities for purposeful mentoring from experienced teachers and university supervisors.
- Tenet 3. Practicum allows pre-service teachers to develop their teacher competency through graduated responsibility and opportunities for practice.
- Tenet 4. Practicum is assessed through clearly defined standards that go beyond the demonstration of skills and knowledge.
- Tenet 5. Practicum strives to develop thinking teachers with the use of Planned and Structured Reflection, and Focused Professional Conversations.

11.3.2.1 Tenet 1: Integrated Part of a Coherent Programme

Powerful teacher education programmes share the common feature of having connection and coherence (Darling-Hammond and Hammerness 2005). Hence, it is not surprising that the first tenet of the NIE Enhanced Practicum Model is that practicum must be an integrated component in a coherent initial teacher preparation programme. To achieve coherence and connection in programmes, NIE ensures that there is (i) a shared vision among stakeholders, (ii) a consistent underpinning philosophy, (iii) clear expectations and goals and (iv) a structure for integrating and aggregating learning.

Having a shared vision is antecedent to programme coherence, and the attainment of conceptual or philosophical coherence is achieved through the various

shared vision practices carried out such as task force meetings, conversations with staff at MOE headquarters and conversations with school staff members among others. During the process of formulating TE²¹, a substantial amount of time was spent by the NIE staff on in-depth conversations before a consensus on fundamental concepts, such as our notion of a teacher and the nature of teaching and learning, was eventually reached. At the heart, NIE sees a teacher not just as a “teacher of the subject but more importantly a teacher of the learner and a preserver and custodian of the values of society” (Tan et al. 2012, p. 6). NIE endeavours to nurture thinking teachers who possess a deep understanding of twenty-first-century learners, and the will and skill to engage and develop them holistically and in meaningful ways. We want our teachers to have a strong content knowledge that is grounded in real-world affairs and current issues that matter to humanity. We want them to have within their repertoire a wide range of pedagogical methods that will meet the needs of different learners. In this era of relentless change, our children will solve problems that require multifaceted solutions, encounter issues that test their values and face challenges that are not documented in manuals and textbooks. They need to have a deep love for learning, a curious and inquisitive mind to ask questions and find connections, and a deep sense of responsibility to the community and the environment (Tan et al. 2012). As such, we are mindful that learning must be anchored on why we learn, how to learn and how to extend and create knowledge in greater measure than merely what to learn, while teaching must be anchored in who we teach and must involve designing of the learning environment, facilitating of the learning process (Tan 2003, 2012) and shaping and moulding character and values than merely disseminating information.

The vision is communicated to and shared with both faculty members as well as adjunct supervisors. The vision is also shared with schools and MOE since they are partners in the tripartite relationship in the development of teachers. The schools, in particular, play a key role in mentoring our pre-service teachers during practicum, and developing the beginning teachers after their graduation from NIE. Also importantly, the vision is shared with pre-service teachers at the onset of the programme when they are starting to develop their initial conceptions of teaching and learning. This same consistent common vision is reinforced in their coursework and during clinical experience as they develop a deeper understanding of what it means to be a teacher.

A shared vision has to be underpinned by a common philosophy and guided by clear expectations and goals. In NIE, the Values³, Skills and Knowledge Model (V³SK; for more details, see Chaps. 2 and 4) guides the design, delivery and enhancement of all NIE programmes and courses including the field experience. The V³SK Model focuses on three value paradigms: (i) learner-centred; (ii) teacher identity; and (iii) service to the profession and community. Learner-centredness places the learner at the centremost of teachers’ work, while teacher identity outlines the attributes that define “teacher personhood” such as the quest for learning, an enquiring nature, professionalism and passion. Service to the profession and the community outlines the commitment of teachers to their profession through active collaborations with fellow teachers and the constant attempt to be better

practitioners with a view of benefitting the community and the larger society as a whole. Finally, the skills and knowledge in the V³SK Framework refer to key skills and knowledge competencies that a teacher requires to meet the needs of twenty-first-century learners. The NIE's Graduand Teacher Competencies (GTCs) Framework (for more details, see Chap. 2) outlines the lists of twenty-first-century skills and a set of professional standards, benchmarks and goals for NIE graduands. The GTCs include three performance dimensions—professional practice, leadership and management and personal effectiveness. It is interwoven into the programmes and courses in NIE and is also used in coursework assessment and clinical work. On the one hand, the GTCs provide mentors a useful developmental framework to work with, while on the other hand GTCs serve as a scaffold that aids in the growth and development of pre-service teachers by providing them with a common guideline to aspire and work towards.

Finally, the PPI course and e-Portfolio were introduced with the aim of integrating courses across programmes (for more details, see Chap. 10). It serves as a vehicle and “meta”-course to aid pre-service teachers in re-examining core ideas and concepts time and again, a notion reminisce of what Bruner termed a “spiral curriculum”, so as to encourage integrated and aggregated learning. It provides pre-service teachers with a platform that affords ongoing opportunities for them to reflect and converse about their growing understanding of what constitutes good teaching (Mansvelder-Longayroux et al. 2007; Wolf and Dietz 1998; Wray 2007), articulate and refine their teaching philosophy and document what they know and are able to do as teachers (Mansvelder-Longayroux et al. 2007; Tanner et al. 2000).

The pre-service teachers begin to explore the role of the teacher and the nature of teaching and learning right from the beginning of their programme, after having undergone the Enhanced School Experience prior to their coursework in NIE. This period is also when they begin to map out their initial teaching philosophy. What this exercise does is to enable them to grasp the “big picture”, such that they are able to see for themselves how the theories and courses are all interrelated, in the same time as they strive towards becoming thinking teachers and professional leaders. Using the structure provided by the e-Portfolio, the pre-service teachers establish their conceptual frameworks of their journey throughout the programme. In particular, they focus on how they all “fit together” as they learn for teaching and learn from teaching (Darling-Hammond and Bransford 2005). The pre-service teachers are then required to give a formal presentation, with the use of their e-Portfolio to present the conceptual maps of their learning on at least two occasions: (i) to their school coordinating mentors (SCMs) at the start of their practicum in the schools to formally articulate and share with the mentors their teaching philosophy, beliefs and learning experience, (ii) to their SCMs at the end of their practicum, as a consolidation of what they have learnt during the course of their practicum. The SCMs are senior teachers who are appointed by the school principal to assist the pre-service teachers with the in-school practicum and the pre-service teacher mentoring scheme. Their role is to oversee the work of the cooperating teachers (CTs) and pre-service teachers, to ensure that the standards of mentoring and assessment are consistent within the school (Wong and Goh 2009).

The following is a comment from one of our graduates:

Prior to presenting my e-Portfolio, there was quite a bit I had to go through in order to articulate my thoughts and feelings about my teaching philosophy, my values and beliefs. I guess the issue was that I'd often thought about these things but they stayed in my head because there was hardly any reason to explicitly express them in writing or other forms of media...allowed me to express myself more clearly, not only to others, but also to myself. And the process of arriving got me thinking more about my own position as an educator.

11.3.2.2 Tenet 2: Purposeful Mentoring

Greater involvement of schools in initial teacher preparation benefits pre-service teachers by helping them gain “practical classroom knowledge” (Maynard and Furlong 1993) and at the same time lead to “teacher-centred knowledge creation” (Hargreaves 1998). Lengthening the period of placement and intertwining campus classes with School Experience are some ways to achieve that. While a longer period of placement is commonly perceived as a way to strengthen the link between theory and practice, “increased practice alone does not always lead to analysis, reflection and growth on the part of novice teachers” (McIntyre et al. 1996, p. 171). The nature of support given during the practicum period is crucial in helping pre-service teachers make sense and learn from their experiences (Darling-Hammond and Bransford 2005). For this reason, NIE Enhanced Practicum Model focuses on both the (i) mentor preparation and (ii) mentoring process.

NIE wants our pre-service teachers to develop a positive attitude towards teaching, and a strong commitment to their students and their profession. To this end, it means that there must be purposeful mentoring to help pre-service teachers learn from good teachers and improve their teaching competencies while building their conceptual map of learning and teaching. During practicum, pre-service teachers receive mentoring from experienced teachers, also known as CTs, through modelling, co-planning, systematic observations, repeated opportunities for practice and frequent feedback. In addition, they also receive supplementary guidance and feedback from their SCMs through structured reflections and professional conversations. Their university-based supervisors are also on hand to advise them through focused supervision, systematic observations and giving regular feedback. It is hoped that aided by such firm and consistent support and guidance from CTs, SCMs and university supervisors, the pre-service teachers will learn, adapt and acquire the necessary values, skills and knowledge to become effective teachers in this new twenty-first-century education landscape.

[Good classroom teachers] may not know how to make their thinking visible, explain the principles behind their practice, or break down complex teaching moves into components understandable to a beginner. Nor do they necessarily know how to design an individualised curriculum for learning to teach that is tailored to the specific strengths and vulnerabilities of a particular novice in a specific context. (Feiman-Nemser 2003, p. 29)

However, the process of learning to become a mentor is a conscious process of induction into a teaching context and does not emerge naturally and simply even if one is a good teacher to children (Orland 2001). Effective mentors must be able to observe keenly and communicate at pertinent times. They have to monitor closely a pre-service teacher's immediate needs and broader concerns; know when and how to draw out a pre-service teacher's thoughts; and when to provide relevant and concrete advice. They must also be able to articulate explicitly their implicit understanding of their own practice gained throughout the years and at the same time, reflect on the nature and adequacy of those understandings. In addition, they need to treat pre-service teachers as colleagues and as teachers, working together with them to create syllabus and plan lessons as well as care for them beyond a student-teacher relationship. This is essential in encouraging and affirming the pre-service teachers' progress and growth as they slowly begin to develop their teaching pedagogy, identity and see themselves as teachers, rather than as pre-service teachers (Darling-Hammond 2006b; Feiman-Nemser 2003; Pungur 2007). Apart from having the skills and dispositions, mentors have to know clearly the goals of the experience, for it is a crucial factor that will affect how successful the practicum turns out to be (Collins et al. 1991). The clinical experience that pre-service teachers undergo is hence shaped to a large extent by the efforts taken by an institute in the selection and preparation of CTs and SCMs (Darling-Hammond 2006a). Bearing these considerations in mind, NIE has a framework of *mentor preparation* that engages SCMs, CTs and NIE supervisors through orientation, workshops, learning forums, focused group discussions and ongoing interactions (see Chap. 10 for details).

Contrary to the popular saying, practice does not always make perfect. Even with good mentors, there must be a structure and process in place for *purposeful mentoring*. The provision of *continuous formative feedback* is at the heart of NIE's practicum model. The feedback can come from NIE supervisors, CTs or SCMs. For every lesson observation conducted by CTs or NIE supervisors, there is a three-stage lesson observation cycle—Stage 1: pre-observation conference; Stage 2: lesson observation; and Stage 3: feedback conference. The primary aim of the pre-observation conference is to help the pre-service teachers prepare and plan the lesson that is to be observed. CTs or NIE supervisors will work closely with the pre-service teachers and suggest modifications where necessary. At Stage 2, during the lesson observation, CTs or NIE supervisors assume the role of an unobtrusive data-gatherer while the pre-service teacher conducts his or her lesson. CTs or NIE supervisors will use the Assessment of Performance in Teaching (APT) form to guide the recording of observations. “Clinically”, the APT form is an observation instrument that can be used to provide the pre-service teacher with an objective and accurate account of the lesson under observation. It also provides a basis for discussion in the post-lesson conference. The data gathered during the lesson observation will highlight to the pre-service teacher his or her strengths and areas for improvement. After the lesson observation, CTs or NIE supervisors will provide feedback to the pre-service teachers about the performance and progress in teaching and help the pre-service teachers make sense of the practice and learn from the

experience. The main focus is on how the teaching decisions in the classroom have enabled or undermined student learning. The same feedback cycle is then repeated for the second and subsequent lesson observations throughout the pre-service teachers' practicum. It is important to note that at the pre- and post-observation conferences, CTs and NIE supervisors seek to help pre-service teachers reflect and inquire into their own teaching practice, not instruct pre-service teachers to implement prescribed teaching strategies in a micro-teaching manner.

Mentors are crucial in making practicum a beneficial experience for the pre-service teachers. Here are some comments from our pre-service teachers on their mentors:

[S]hared with me invaluable lessons and advice on the roles and responsibilities of an Art Teacher in Secondary School...the importance of teaching art through scaffolding, making real world connection and exposing students to various mediums and techniques.

[B]een an exemplary role model for me as I observe the way she conducts her lesson, performs her duties as a form teacher and how to plan for lessons. She has been relentless in the sharing and imparting of knowledge in the area of writing lesson plans, producing of teaching resources and strategies in classroom teaching.

[M]y mentor, for inviting me into her classroom and allowing me to observe her practices. She even took special pains to set aside some time after each lesson to give me feedback on my lessons as well as some tips for classroom management. This has helped me reflect on my practices and prepared me for my formal observations.

11.3.2.3 Tenet 3: Graduated Responsibility and Opportunities for Practice

Repeated opportunities have to be provided to pre-service teachers in the course of their practicum experience so that they are able to grow and develop their competencies in teaching. Effective and powerful learning, however, does not emerge merely from a teacher's experience to survive his/her clinical experience (Britzman 1991). Good clinical programmes adopt a structured approach that allows pre-service teachers to assume graduated and greater responsibilities in independent teaching over a period of time (Darling-Hammond 2006a). This provides the time needed and creates the space for the mentors to help their pre-service teachers shape and refine their practice by incrementally expanding their responsibilities of teaching in the classroom. Gradually, pre-service teachers develop a greater sense of ownership of and gain more confidence in their planning, teaching and evaluation of their own teaching. The concept of graduated responsibility is clearly articulated in the Stanford Teacher Education Programme (STEP): "Graduated responsibility supports the professional growth of teacher candidates by combining long term experience in a clinical setting, incremental expansion of the candidate's teaching role, and individualised support from a cooperating teacher and a supervisor" (Stanford Teacher Education Programme 2012, p. 36).

In the 4-year degree programme at NIE, for instance, pre-service teachers are attached to schools for different periods of times each year. In the first year, the pre-service teachers are attached to schools for School Experience, where they spend time in a primary school and in a secondary school. The purpose of the school experience is to expose the pre-service teachers to the wide range of students, as well as attain teaching and learning experiences. During these attachments, the pre-service teachers are not required to teach. They must, however, collect observational data on elements of classroom organisation and management and talk to their CTs to learn more about their decision-making processes in areas such as planning, managing, communicating, instructing and evaluation. Thereafter, the observational data and information gathered are used during coursework when the pre-service teachers return to NIE.

The pre-service teachers are posted out to schools for their Teaching Assistantship in the second year. In the period of their Teaching Assistantship, the pre-service teachers are given opportunities to observe how their CTs and other experienced teachers teach and manage their classes, which is then followed by a stint of assisted teaching. The pre-service teachers also gain much practical experience through helping their CTs plan lessons, prepare resources and manage pupils. They are, at the same time, required to reflect and pen down their experiences. In an attempt to develop teachers with a global perspective of teaching and learning, selected pre-service teachers can opt to do their Teaching Assistantship overseas in countries such as Denmark, Finland, New Zealand, Sweden, Switzerland, Taiwan and USA. The structure and mentoring process of the Teaching Assistantship are the same as in NIE, but are administered with the help of our partner universities.

In the third year, the pre-service teachers are attached to schools for their Teaching Practice 1. This period of attachment is to help pre-service teachers acquire beginning teaching competencies to teach independently. The pre-service teachers begin by observing their CTs, before proceeding to help their CTs plan lessons, prepare resources, manage pupils, and assisting their CTs in guided teaching. They eventually move on to teaching whole lessons. Guided teaching takes on a gradual progression of practice, from teaching of lesson segments, to co-teaching or paired-teaching with their CTs and finally to independent teaching of the whole lesson. The progression of guided teaching will vary among pre-service teachers depending on the individuals' level of confidence and progress. In the final year, the pre-service teachers will be out in schools for a longer block of Teaching Practice 2. After an initial period of observation of the classes that they will be teaching, the pre-service teachers will then take over some of their lessons or part of the lessons, before assuming full classroom teaching and management responsibilities by teaching complete lessons to intact classes.

For the 1-year PGDE programmes, the range of graduated responsibility as mentioned above is condensed in a block practicum. The pre-service teachers, nevertheless, are closely mentored, and they go through a period of observation, co-planning and co-teaching, before they are allowed to assume full responsibility for their classes.

11.3.2.4 Tenet 4: Clearly Defined Standards Beyond Skills and Knowledge

As mentioned earlier, assessment in practicum is supported by the use of the APT instrument. It is essentially an observation instrument that provides pre-service teachers with a way of diagnosing strengths and weaknesses in classroom teaching, as well as for monitoring progress. It has been designed to be used by NIE supervisors and CTs and can also be used by the pre-service teachers themselves for self-evaluation or peer-evaluation. It plays a major part in lesson conferences and in the supervision cycle generally. It is used as a tool to provide pre-service teachers with a clear and accurate account of their lessons taught under observation and to engage them in a professional discourse of their teaching attempts. With the help of the APT form, pre-service teachers are constantly encouraged to reflect and evaluate what constitutes good teaching in terms of lesson preparation, lesson implementation, feedback and evaluation and classroom management, and to articulate and crystallise the professional attributes and attitudes expected of teachers.

In the NIE Enhanced Practicum Model, learning to teach is more than just the mastery of a list of competencies or teaching techniques. It is about the development of the whole person in terms of knowledge, experiences, beliefs and values (Feiman-Nemser 1983). As such, pre-service teachers are assessed holistically through multiple sources of evidence that include observational data (APT forms from university-based supervisors, school-based mentors, heads of department or school leaders), lesson plans and reflections, as well as samples of student work and feedback given by the pre-service teachers. They are evaluated through clearly defined standards of teaching competencies from lesson preparation and implementation to classroom management and feedback and evaluation, as well as desirable professional attitudes and attributes. The consistent message to the pre-service teachers is that the key focus of their practice must be on student learning and the ways in which the teaching helps to facilitate or impede that learning. For example, the first part of the Summative APT form that is used to guide mentors and supervisors with the final grading focuses on a range of key competencies expected of a thinking teacher who is student-centric and is sensitive to the contexts influencing teaching, such as knowledge of subject matter, ability to cater to learners' diverse needs, ability to arouse and sustain interest, ability to create a secure environment which engenders trust and respect, ability to monitor and address students' understanding and ability to stimulate higher-order thinking. The second part of the form focuses on professional attributes and attitudes based on the TE²¹ underpinning philosophy of V³SK. In essence, pre-service teachers are expected to uphold learner-centred values, for example, by showing care and concern for their students, having high expectations of students, and respecting diversity of students' background. They should demonstrate teacher identity values, for example, by having professional integrity and upholding professionalism. They show their commitment and service to the profession and community, for example, through their initiative and active collaborative work with colleagues in the school.

11.3.2.5 Tenet 5: Developing Thinking Teachers

NIE's vision is to develop thinking teachers and professional leaders. In the NIE Enhanced Practicum Model, we want pre-service teachers to be able to challenge assumptions, formulate their philosophy, work through dilemmas, think pedagogically, investigate problems and construct their own concept of teaching. In order to achieve all these, *Planned and Structured Reflection* and *Focused Professional Conversations* are incorporated into pre-service teachers' field experience.

The importance of reflection is not new to teacher education. According to Cunningham (2001) and Bengtsson (1993), reflection develops self-awareness and knowledge through personal experiences. Reflection encourages teachers to see themselves as autonomous professionals. It encourages them to assume greater responsibilities for their own professional growth through a deepening awareness of their practice, while being embedded within their unique teaching contexts. Reflection is especially useful in bridging the theory–practice gap when it takes place within the context of experience, such as during the practicum, and when done collaboratively with one's peers and supervisors (Russell 2005).

NIE defines reflection as a “deliberate pause to assume an open perspective, to allow for higher level thinking processes” (York-Barr et al. 2001). Advocates of reflective practice subscribe to the use of a structure or framework to guide practitioners through the process of reflection (e.g. Gibbs 1988; York-Barr et al. 2006). NIE's Reflective Practice Model is an adaptation of the Sparks–Langer model (for more details, see Chap. 10; National Institute of Education 2009). It takes into consideration the interaction between teacher's dispositions, practice and professional knowledge and, as such, shows how personal-professional knowledge is built. At the heart of the model is a four-stage cyclical process of what, why, so what and now what that facilitates reflection-in-action and reflection-on-action. The model is used during coursework and practicum to help pre-service teachers make sense of their experiences, as well as to guide them in thinking through their beliefs, assumptions and notions of teaching and learning. The model is also used by the pre-service teachers to examine their practices to gain deeper understanding and improvement after every lesson. In addition, SCMs use the model as a guide to facilitate Focused Professional Conversations.

To a large extent, feedback from SCMs, based on their interactions with the pilot group of pre-service teachers who went through the NIE Enhanced Practicum Model, affirmed that the pre-service teachers benefitted from the “deliberate pause” to reflect. Specifically, the SCMs shared that

The questions framed by the Reflective Practice Model provide a very good structure for the [pre-service teachers] to think more deeply about their actions and behaviours and also about the students' behaviours and responses in the classroom, how these came about – the causes, the implications, the consequences and how a similar situation can be better managed in the future, as well as touching base with the theoretical underpinnings that govern and perhaps help to explain for them. Working through those questions also helped them get in touch with the teaching theories, their knowledge on pedagogies and how these can be applied, i.e., how to put theory into practice.

[I]t really helped them to take stock of the current situation in the school and helped them to rethink about their initial beliefs and adjust them to suit the needs of their pupils – the [pre-service teachers] had to make some drastic changes to their approaches to teaching and to what they had initially planned and even make changes to some of their idealistic initial beliefs.

Apart from the *Planned and Structured Reflection*, *Focused Professional Conversations* were also incorporated in the NIE Enhanced Practicum Model. The purpose of focused conversations is to have a directed dialogue to encourage participants to stay long enough on a topic to work through issues themselves. The facilitator of the conversation would ask questions to elicit responses in order to delve and inquire deeper into the issue (Stanfield 1997). One of the approaches of enabling a more structured kind of conversation is developed by the Institute of Cultural Affairs (ICA). The method helps participants work through issues with the use of a four-stage process with four levels of questioning:

1. The objective level—What is the data?
2. The reflective level—What are the personal reactions?
3. The interpretive level—What are the insights, learning or meanings?
4. The decision level—So what?

Such a structured conversation interjects people's inclination to be selective in the data they think relevant and to jump to foreclosure based on that data.

In the NIE Enhanced Practicum Model, the introduction of Focused Professional Conversations provides a platform for pre-service teachers and their SCMs to engage in professional conversation that is focused so that they can talk about their learning and work through issues encountered during their practice. There are many benefits in engaging in professional conversations. It provides pre-service teachers with the avenue of getting support and guidance from their SCMs in interpreting their experiences and expanding their repertoire. This will facilitate their growth as teachers and reduce the risk of them inferring wrong lessons from their early attempts at teaching. In addition, it provides the platform for the co-construction of knowledge pertaining to teaching and learning. From another perspective, it creates a culture of openness and trust, both of which are essential in sustaining learning communities. It also provides the environment for fostering emotional bonds among pre-service teachers and teacher educators. Lastly, it prepares pre-service teachers for the new work environment in schools where teachers are expected to learn through networking and learning communities.

Currently, pre-service teachers are required to participate in three to four Focused Conversations (FCs) that are facilitated by their SCMs (or other senior teachers) in their schools. During the Focused Professional Conversations, SCMs use the questions in the Reflective Practice Model—What, Why, So What and Now What—to deepen the conversation. They challenge the pre-service teachers' assumptions, question their understanding of theories, help them re-examine their notions of teaching and learning and force them to go to their theoretical base to guide their decisions. As such, the SCMs need to have good facilitation skills to ensure that the conversation remains focused and that they are able to effectively

elicit the thoughts of pre-service teachers. They need to abstain from giving solutions to the pre-service teachers when discussing problem cases or issues. They need to help pre-service teachers co-construct their knowledge by reflecting and thinking together.

Specifically, FC1 is done during the first week of practicum. In the first session, pre-service teachers share their teaching philosophy, their learning journey in NIE, and how their experience have influenced their notions of teaching and learning. Many of our pre-service teachers reflected that the FC1 gave them the opportunity to think deeply about their own beliefs and philosophy of education, and the articulation of their conceptual map of learning helped them consolidate and draw connections between courses. Examples of pre-service teachers' comments are shown below:

The experience of doing Focused Conversation 1 (FC1) forces you to make certain choices – I could not present everything I'd learnt; I had to choose the key things which I think helped me and **shaped my beliefs in education** ... There's a lot of unstructured thinking going on, all these ideas come to you and you absorb them, but you may not have the time to fully form a particular framework to approach issues about education – but with FC1, because I was forced to think about what was – it became the **foundation of my philosophy of education**. That aspect of ourselves as educators became **more anchored, in terms of the beliefs that we held dear and certain things that we wanted to do in the course of our teaching experiences**.... FC1 was a filter for all these issues and ideas that we picked up **over the courses at NIE**.

Having to verbalise **my beliefs** about teaching actually strengthened them and reinforced my **determination** to put them to practice.

[A]llowed me to express myself more clearly, not only to others, but also to myself. And the process of arriving got me thinking more about **my own position as an educator**.

Many SCMs also affirmed that FC1 is a good reflective exercise which helps the pre-service teachers articulate their learning and thereby bridge the theory–practice gap, as seen by the following comments:

[A] good platform for the [pre-service teachers] to reinforce their *raison d'être* to join our profession. I feel it's important to think about why one joins the profession; it's not just about subject mastery, or teaching skills. It's more about the **kind of teacher they aspire to be** and **why and how they are going to get there**. It also gave them the opportunity to reflect on what they've learnt and through their presentations, clarify any misconceptions they might (and usually) have.

[G]ood as [pre-service teachers] were made to **think through and verbalise their reasons for joining the teaching profession** and record their **teaching philosophies and lessons learnt** from their NIE course.

FC2 (or more) takes place in the middle of practicum, and pre-service teachers are asked to bring up an authentic case study or issue they have encountered in their practice. These issues are generally on classroom management or on engaging and motivating students. SCMs shared that they had found the session(s) useful as evidenced by the following comment:

[G]ood opportunities for professional conversation.... The micro-view of each practice discussed conveyed the fundamental idea that **each lesson/practice presents complexities that these young teachers should not take for granted.**

Finally, the last FC (either FC3 or FC4) is carried out in the last week of the practicum. Pre-service teachers are asked to share how their practicum experiences have helped them in developing their teaching competencies and how they have learnt from their practice in general. The following was a quote from one of the SCMs:

[W]as useful as it helped the [pre-service teachers] to be **focused on what they set out to achieve.** It also helped them to **take stock** of what they have learnt about their teaching and themselves during the practicum with reference to the given set of competencies.

On the whole, the SCMs shared that through the series of FCs and through the reflective practice, the pre-service teachers were better prepared for the reality of teaching because they were forced to rethink their goals and beliefs and connect with the reality and challenges in the schools, as evidenced by the following comments:

They had a better **awareness of the challenges of teaching** and were **prepared to face the demands of being a teacher.** They shared on their experiences and realised that there were varied ways to handle different situations based on their dialogues with their CTs and also the staff whom they had interacted with. One of their key takeaways was one size would not fit all. They felt the need to discern the profile of each class and even individual students so as to engage them.

It was a reflective sharing – it helped the [pre-service teachers] to rethink about their initial goals, beliefs and **make adjustments to some of them based on the reality of the situations** they encountered in their classrooms.

In addition, what appears strongly in the SCMs' comments was that FCs had given pre-service teachers a greater sense of ownership of their learning during practicum. The pre-service teachers were able to articulate with confidence and conviction the affirmation of their commitment to be teachers. Some comments of the SCMs are as follows:

There is a **greater sense of ownership** and the [pre-service teachers] feel that they have learnt a lot from the Teaching Practicum and have grown to be better, effective teachers, are able to **articulate with greater confidence and conviction** in their presentations.

This makes them more reflective and can further **ignite their passion** in the teaching profession. Just like one of them mentioned that it confirmed why he is in the teaching profession, quote, "has reaffirmed my decision and filled me with optimism for the future".

Finally, SCMs noted that through FCs, the pre-service teachers were made to review their own strengths and areas for improvement. The sharing was beneficial not only to the pre-service teachers but also to them. SCMs got to know each of the pre-service teachers better and felt better prepared to provide support for them when they report back to the schools as beginning teachers. Some comments of SCMs are as follows:

The sharing enables [pre-service teachers] to reflect more deeply on his professional practice, leadership and management and personal effectiveness so that they can build on their strengths and work on their areas for improvements.

It is useful. It allows us to hear **what problems the [pre-service teachers] have**. Also it allows them to reflect deeply with guiding questions. It allows them to think out loud. It also allows them to review their own strengths and [areas for improvements].

[U]nderstanding better how each has developed and **what support to be given** to them when they report back to us as [beginning teachers]. I also got to identify how I can **integrate** these young teachers with the experienced others through department's [professional development].

11.4 Moving Forward

As seen earlier, qualitative feedback from the pre-service teachers and SCMs has affirmed that many of the initiatives such as the *Planned and Structured Reflections* and *Focused Professional Conversations* have provided opportunities for the pre-service teachers to take ownership of their own learning, experience deep substantive learning and make meaningful connections between their coursework and practicum. Apart from enabling pre-service teachers to develop their practice, the practicum experience has helped them make sense of who they are as teachers and inspire them to greater commitment to their chosen profession. It is noteworthy that the comments given by the SCMs were on the first two cohorts of pre-service teachers who went through the NIE Enhanced Practicum Model, and many of the comments made were based on the SCM's experience of working with pre-service teachers before and after the implementation of the NIE Enhanced Practicum Model.

A quantitative research (Liu and Wang 2011) has found that the pilot 2010 cohort of pre-service teachers under the NIE Enhanced Practicum Model ($N = 854$) had a moderate level of overall perceived competence of their teaching ($M = 3.78$, out of a 5-point scale) at the end of their practicum. Among the teaching processes, they reported a moderate-level perceived competence in terms of lesson preparation, lesson delivery, classroom management and feedback and evaluation ($3.84 \leq M \leq 3.91$, out of a 5-point scale), and a high level of professional attributes and attitudes ($M = 4.21$, out of a 5-point scale; Liu and Wang 2011). In addition, the pre-service teachers agreed largely that their practicum experience made them reflect on the “why” and “how” of teaching ($M = 3.97$, out of a 5-point scale) and was useful in helping them make connections between theory and practice ($M = 3.86$, out of a 5-point scale; Liu 2012). The research was not a comparative study, so it is not possible to comment on the pre-service teachers' perceptions and experience in the old and Enhanced Practicum Model. Nonetheless, the relatively positive results provided NIE with a good basis to continue working on enhancing our pre-service teachers' learning and experience during practicum. More recently, Liu (2016) established that there were significant differences between the pilot 2010

PGDE cohort ($N = 854$) and the 2014 PGDE cohort ($N = 739$) in terms of their perceived competence in lesson planning, lesson delivery, feedback and assessment, and classroom management. Specifically, the 2014 PGDE cohort reported significantly higher levels of perceived competence in lesson planning ($M_{\text{pilot}} = 3.88$, $sd_{\text{pilot}} = 0.47$; $M_{2014} = 4.06$, $sd_{2014} = 0.46$, $p < 0.0005$), lesson delivery ($M_{\text{pilot}} = 3.91$, $sd_{\text{pilot}} = 0.46$; $M_{2014} = 3.96$, $sd_{2014} = 0.45$, $p < 0.05$), feedback and assessment ($M_{\text{pilot}} = 3.87$, $sd_{\text{pilot}} = 0.53$; $M_{2014} = 4.00$, $sd_{2014} = 0.50$, $p < 0.0005$) and classroom management ($M_{\text{pilot}} = 3.84$, $sd_{\text{pilot}} = 0.51$; $M_{2014} = 4.08$, $sd_{2014} = 0.50$, $p < 0.0005$), than their counterparts in the pilot cohort. Liu's (2016) results are encouraging and affirmed that the enhancements to the practicum model were steps in the right direction in our quest to develop a quality teaching force for Singapore. Despite the promising results, there continues to be many challenges, from buy-in from the multiple stakeholders in the practicum programme, which include the NIE supervisors, school-based mentors, school leaders and pre-service teachers, to the capability or competency of mentors; from time resources available to mentors and pre-service teachers to variations of implementation at the ground level (see Liu et al. 2014). For instance, Mutlu (2015) found that pre-service teachers often reported that the way the school mentors taught was not what they learnt from the university faculty. While Kahn (2001) documented that many mentors felt as if they were "out of the loop" and wished to have more knowledge and training from the university. Mtika (2011), on the other hand, observed that the disengagement between pre-service teachers and their mentors who were not formally identified jeopardised the pre-service teachers' learning opportunity during practicum. Taken together, it is apparent that transforming the practicum experience requires all the stakeholders to understand and share NIE's mission of developing thinking teachers, and to subscribe to the tenets of the NIE Enhanced Practicum Model. It will also require more to be done in terms of the selection, preparation and support of mentors. The MOE, schools and faculty members in NIE need to continually work closely together if we are to cultivate confident pre-service teachers who will eventually become skilful and reflective practitioners in schools.

From a broader perspective, it has to be acknowledged that more can be done in our endeavour to prepare teachers for the twenty-first century. One possible improvement would be to incorporate a research component in NIE's initial teacher preparation programmes so that there is a stronger focus on inquiry. The role of inquiry is crucial if the goal of teacher education is to provide teachers with the ability to continue to *learn from teaching*, rather than a contained phase of *learn for teaching* during teacher preparation (Darling-Hammond and Hammerness 2005). In this sense, inquiry should be an integral part of the activity during practicum, teachers should be equipped with research skills and classrooms and schools should be seen as research sites (Cochran-Smith and Lytle 1993). NIE's 4-year degree programmes are currently undergoing a curriculum review and it is envisaged that the new programmes would have a stronger focus on inquiry to better prepare our teachers to be thinking teachers and professional leaders.

Notwithstanding the challenges and future refinements to the programmes, NIE is optimistic in its effort in transforming not only the practicum experience but also

holistically teacher preparation. With the central spine of practicum providing shape and support to the initial preparation programmes, and framing the courses and a “meta”-PPI course providing the “glue” to the programmes, NIE is confident that we are empowering our teachers with a firm knowledge base that will guide and inform them through their practice, while at the same time, we have a practice that will aid them in deepening their understanding of the theories they have learnt (Darling-Hammond 2006a). With the five key tenets of the NIE Enhanced Practicum Model being important cornerstones of good teacher education programmes, we are optimistic that our teachers will experience deep substantive learning and develop the skills and wills to continue to learn and better their practice.

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Chapter 12

Mentoring and School Partnerships

Lay Hoon Jessie Png and Woon-Chia Liu

12.1 Introduction

According to Malvolio in Shakespeare's *Twelfth Night*, "some are born great, some achieve greatness, and some have greatness thrust upon'em" (Shakespeare, trans. 1601–02, 2.5.146–147). Similarly in teaching, some are born to teach, some acquire skills to teach, and others have teaching thrust upon them. Despite the differing views on whether teachers are born, made or are "manufactured" because of circumstances, there is a substantial and growing evidence that teacher education matters for teacher effectiveness (Darling-Hammond 2006a). Good teacher education programmes help teachers develop the necessary knowledge, skills and values for optimal teaching and lay the foundation of lifelong learning. These powerful programmes share many similar features, one of which is that they all have "extensive and intensely supervised clinical work integrated with course work using pedagogies that link theory and practice" (Darling-Hammond 2006b, p. 300). To have "extensive and intensely supervised" teaching practice for the pre-service teachers, the teacher education institute or university needs to ensure that her supervisors are equipped with mentoring skills and that there is "proactive relationships with schools" (p. 300).

In Singapore, the National Institute of Education (NIE) sees the importance of having a strong tripartite relationship between NIE, the Ministry of Education (MOE) and schools in teacher education. The partnership between NIE and schools

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is particularly crucial in the strengthening of the link between theory and practice during initial teacher education. In this partnership, schools “take on a bigger, more active role in practicum, school attachments and other in situ collaborative platforms that facilitate professional development and bridge the gap between campus-based learning and ‘real classroom settings’” (National Institute of Education 2009, p. 41). NIE works with schools to play that active role in practicum and school attachments through school-based mentors, that is the school coordinating mentors (SCMs) and cooperating teachers (CTs; for more details, see Chap. 11). Apart from that, NIE is involved in the preparation of mentors across different levels of the education service. More significantly, NIE was involved in the conceptualisation of the Singapore’s Mentoring Framework for the teaching fraternity, spearheaded by MOE and the Academy of Singapore Teachers (AST). The development of the framework was a crucial step in establishing a common language and an acculturated practice of mentoring across all levels of the Singapore’s education service.

In this chapter, we will take a closer look at mentoring within the NIE’s initial teacher education programmes. Specifically, we will outline the key philosophies and the role of mentors in NIE Enhanced Practicum Model. Thereafter, we will highlight how mentoring is actualised for pre-service teachers, before discussing briefly the NIE–School Partnership.

12.2 Mentoring and the Novice Teachers

The highlight of a pre-service teacher’s learning journey in an institute of education or university is generally the teaching practice stint in school(s). Teaching practice or clinical experience is a time where the pre-service teacher gets to put into practice what he or she has learnt at the institute or university. It is a time when he or she acquires beginning teaching competencies, crystallises his or her teaching philosophy and makes sense of who he or she is as a teacher. It is a time when the “tyres hit the road” and the pre-service teacher finds out how well prepared he or she is for the real world of school. Nonetheless, being placed in a school does not automatically make a pre-service teacher competent. The clinical practice has to be carefully structured and managed, and the pre-service teachers must be guided and mentored for him or her to make sense and learn from his or her experience (Darling-Hammond 2006a; Darling-Hammond and Bransford 2005).

There are different definitions of mentoring depending on the mentor’s role in the process. Podsen and Denmark (2007, p. 10) defined mentoring as “a sustained relationship between a novice and an expert. In a clearly defined teacher-mentoring relationship, the expert provides help, support, and guidance that helps the novice develop the necessary skills to enter or continue on his or her career path”. From a broader perspective, mentoring can be seen as a professional relationship in which

an experienced person assists another in developing specific skills and knowledge that will enhance the less-experienced person's professional, academic and personal growth (Donaldson et al. 2000). There are others who see mentoring as a collegial and equal relationship with the mentee in which the mentor serves as a guide to practical knowledge and as a source of moral support (Awaya et al. 2003).

Many mentoring gurus have also come up with different mentoring models. Within teacher education, Maynard and Furlong (1994) highlighted three: the Apprenticeship Model, the Competency Model and the Reflective Model. In the **Apprenticeship Model**, the assumption is that pre-service teachers learn different teaching strategies by observing and receiving guidance from experienced teachers. Their mentors are role models, and they assist pre-service teachers in gaining techniques and confidence that will help them cope within an existing school situation, without questioning or challenging the status quo (Krull 2005). This seems to be the predominate model adopted by teacher education institutions in the earlier years. Dominguez and Hager (2013) examined the progress of mentoring frameworks over time and similarly deduced that the early stage of mentoring was heavily characterised by such dyadic, hierarchical relationship that is central throughout traditional mentoring research. In the **Competency Model**, pre-service teachers are assumed to teach by putting their teaching skills and strategies into practice. Mentors observe their lessons and provide feedback. Competency Model is assessment in nature and focuses on the ability of pre-service teachers to perform various teaching tasks. In the **Reflective Model**, pre-service teachers learn by reflecting on the different methods of teaching and developing an in-depth comprehension of the learning and teaching processes. Mentors and mentees are co-enquirers. Lesley et al. (2009, as cited in Smith and Avetisian 2011, p. 338) noted that in the Reflective Model, there is "a sense of mutuality in expertise and [an] inquiry-oriented approach towards teaching where the cooperating teacher and the pre-service teacher learn together". This model is akin to the **Laboratory Model** mentioned by Krull (2005), where pre-service teachers receive supervisory assistance by developing habits of inquiry and reflecting on their practice and the context in which it occurs.

However, understanding the real role of mentoring becomes more complicated if we take into consideration the **mission of teacher education**. If the mission of teacher education is to prepare good employees, then mentoring would involve different variations of the apprenticeship and/or Competency Model(s). In comparison, if the mission of teacher education is to prepare thinking teachers and reflective practitioners, then there is a need for greater emphasis on the Reflective Model or Laboratory Model of mentoring (Krull 2005). The models, although ideologically different, all strive to provide mentees with instructional as well as psychological support. Nonetheless, the importance given to the different types of support can be very different in the mentoring process (Krull 2005).

12.3 The NIE Mentoring Model

NIE's Teacher Education for the twenty-first century (TE²¹) Model (for more details, see Chap. 1) aims to prepare autonomous thinking teachers for the twenty-first century. We want our teachers to be able to think in context, and it involves elements of skilful teaching, reflective teaching and innovative teaching (Tan et al. 2012). We strive to develop teachers who have the competencies required of a beginning teacher, yet the will and skill to continue to learn from practice. To achieve our mission, **purposeful mentoring** is one of the key tenets of our Enhanced Practicum Model (for more details, see Chap. 11). Within the Enhanced Practicum Model, pre-service teachers are mentored by university-based supervisors through focused supervision, systematic observations and regular feedback. They are also mentored by school-based mentors, also known as CTs, through modelling, co-planning, systematic observations, repeated opportunities for practice and formative feedback. In addition, they receive guidance and feedback from their SCMs through structured reflections and professional conversations.

12.3.1 The Philosophy

Drawing upon the good work done by many other institutions (e.g. New Teacher Center in the USA), NIE's approach to mentoring is guided by the following philosophy:

- Mentoring is based upon mutual trust and respect and is a relationship between two adults.
- The act of mentoring is an act of teaching and leading.
- The process of mentoring is a process of co-learning and co-enquiring.
- Mentors provide both instructional and psychological support.
- Mentors help pre-service teachers crystallise their teacher identity and contribute to the professionalism of teaching.
- Becoming a mentor is a developmental process.
- Mentoring is seen as a continuum that takes place before, during and after practicum.

12.3.2 The Roles

Mentors can have differing views of their role. Some mentors see their role as being a guide or leader, others see it as being a good listener or friend, yet others see it as being an organiser of experiences for pre-service teachers (Elliott and Calderhead 1994). Kwan and Lopez-Real (2005) found that while mentors regard the role of

provider of feedback as of utmost importance, there had been increasing attention given to roles that are more personal and relational such as that of a counsellor, an equal partner and a critical friend. Zanting et al. (2001) compiled a list of roles which they had gathered from several literature on mentoring. Several of the roles are highlighted below.

1. *A model and instructor of students' teaching*

It is common for pre-service teachers to expect their CTs to be “examples of good practice for student teachers to evaluate and emulate” (Glenn 2006, p. 86). Similarly, some CTs “feel obligated to show student teachers how to teach: ‘I think they’d rather us tell them what to do, because they don’t know. That’s why they’re student teachers and we are the master teachers’” (Anderson 2007, pp. 319–320). This role as a model is the distinctive feature of the Apprenticeship Model as mentioned above. It is important for mentors to be role models, but they should avoid promoting “conventional norms and practices” but instead model “continual reforms of effective practices within their own classrooms and schools” (Cochran-Smith 1991, as cited in Podsen and Denmark 2007, p. 10).

2. *An information source for tips and advice*

In one comparative study reported by Feiman-Nemser (2001), there were mentors who “defined their responsibilities in terms of emotional support and short-term technical assistance. They explained local policies and procedures, shared materials, answered questions and gave advice” (p. 1032). The role of mentors being sources for tips and advice is quite a basic one and is also part of the Apprentice Model.

3. *An “introducer” to the teaching world*

In a research conducted by Zanting et al. (2001), at least 15 out of 30 of the pre-service teachers in their study felt that mentors should enlighten them “about life in the classroom” (p. 76). In short, pre-service teachers think it is necessary for mentors to introduce them to the teaching world.

4. *An evaluator*

Two-thirds of the pre-service teachers in Zanting et al.’s study (2001) expected their mentors to critique their lessons, that is to point out the strong and weak points of their lessons, examine the reasons for the success and failure and suggest ways to make the lessons better. To summarise, the mentor-evaluator should assess the pre-service teacher’s teaching performance. This role would come under Maynard and Furlong’s Competency Model of mentoring.

5. *A coach or a supporter*

The pre-service teachers in Zanting et al.’s study (2001) also expected their mentors to be coaches. In other studies (Elliott and Calderhead 1994; Jones et al. 1997; Martin 1996), mentors expected themselves to be supportive and having a good relationship with their mentees. To Smith and Avetisian (2011), the main aspect of

the coaching mentorship is the rendering of support to pre-service teachers as they develop their own approaches to teaching rather than relying on the CTs.

6. *A challenger*

A mentor who challenges is one who creates tasks which can prompt differing ideas or critique assumptions. He or she explicitly tries to push the novice teacher forward (Martin 1996), perhaps by getting the teacher to go beyond the replication of over-used teaching practices to theoretically based professional pedagogies (McNamara 1995). Elliot and Calderhead (1995) claimed that challenge is vital for the novice teacher to grow professionally. However, Martin (1996) admonished that there should be a right combination of support and challenge when mentoring novice teachers and that the challenges should be catered to individual novice's capability. This role as a challenger could probably be subsumed under Maynard and Furlong's Reflective Mentoring Model.

7. *A co-enquirer who stimulates pre-service teachers' reflections on their own lessons*

In Maynard and Furlong's Reflective Mentoring Model, pre-service teachers learn by reflecting on the different methods of teaching and developing an in-depth comprehension of the learning and teaching processes. Tomlinson (1995, p. 76) believed that "Helping [helping] to analyse and reflect on teaching is one of the basic functions of mentoring". Zanting et al. (2001, p. 70) found that when mentors "invited their students to think about their teaching, they analysed the lessons themselves, diagnosing their weak points and finding possible solutions". This is when the mentors and mentees are co-enquirers.

8. *A co-learner who grows together with the mentee*

Another role not in Zanting et al.'s list is mentor playing the role of a co-learner who grows with the mentee. The former does not draw a bold line between himself and his mentee(s) but interacts with them as colleagues (Darwin 2000). "[In this kind of climate,] mentoring becomes a collaborative, dynamic, and creative partnerships of coequals, founded on openness, vulnerability, and the ability of both parties to risks with one another beyond their professional roles. Relationships become opportunities for dialogue, and expert and learner become arbitrary delineations" (Darwin 2000, p. 206). In Jaipal's (2009) study on mentors as co-learners, the associate teachers and pre-service teachers shared their expertise and knowledge with each other and co-learned "new knowledge and skills in technology integration" (p. 272).

Pre-service teachers need assistance in a myriad of areas, from planning lessons, handling classroom discipline and motivation issues, catering to differentiated learning and grading students' work to sourcing for teaching resources. Hence, it is not surprising that mentors generally take on the role of instructors and models, or providers, of information, as seen in the comment by an NIE pre-service teacher:

[Our mentor] shared with us strategies for classroom management, how to check for students' understanding and how to be an effective teacher. She was also always willing to lend us a helping hand every time we approached her. (Pre-service Teacher A)

However, at NIE, we want mentoring to go beyond the Apprenticeship Model. Instead of just focusing on developing the mentees' acts and practical skills, we want our mentors to be involved as co-learners and co-enquirers. In line with the Reflective Model or Laboratory Model of mentoring, we want our mentors to work through issues and challenges with their mentees and share their professional knowledge in authentic learning situations where contextually specific knowledge is valued. Hence, we have put in place structures and processes so that mentors can dialogue with pre-service teachers on educational and pedagogical issues, encourage them to go through the four-step reflection process as mentioned in Chap. 10 and help them integrate what they have learnt in NIE with the practical teaching issues that they face.

From another perspective, we believe that a mentor is an important "introducer to the teaching world". We want our teachers to have strong learner-centred values and a clear sense of "self" as they learn about teaching and about themselves as teachers. We want them to be committed to their students and to the profession. Although pre-service teachers have their own beliefs when they start their clinical practice, it is within the context of the experience that they crystallise their teaching philosophy and develop their teacher personhood. During the experience, mentors responsible for guiding them can help them understand their roles so that they become professional leaders who question their own assumptions, accept personal responsibility for their own continuous learning, reflect and think critically about their profession and their practice and inquire and make informed decisions about teaching and the learning needs of their students (e.g. Tan 2012; Tan and Liu 2015; Tan et al. 2012).

The above mentoring roles are shared with SCMs when NIE conducts workshops for them. In a qualitative feedback, pre-service teachers affirmed that school-based mentors took on a myriad of roles from information source, instructor, coach, role model, supporter and challenger to evaluator (Liu 2012). In addition, a quantitative study revealed that school-based mentors modelled, observed, gave feedback on and assessed teaching. They provided pre-service teachers with tips and advice and assisted them with the knowledge, skills and strategies necessary to be successful in the classroom. Importantly, the mentors scaffolded their growth and development as teachers and stimulated their reflections on their lessons (Liu 2012). Likewise, a recent survey of NIE's graduands showed that the school-based mentors have largely embraced their roles. The graduands were appreciative of the help and support they received from their mentors, as seen in the following comment:

Thank you for being supportive of my interests and aspirations. Thank you for inspiring me with your work and for valuing mine. Thank you for seeing something in me and challenging me to attain greater heights by thinking, doing and reflecting more. Thank you, also, for the opportunity to work independently within and outside curriculum, for the freedom in creating and experimenting and finally, for allowing me to take on an active role

in the various school events that occurred during my stay.... Thank you for believing in me, I have gained so much from these 10 weeks because of this trust. (Pre-service Teacher B)

It is particularly heartening that the graduand felt that his or her mentor challenged him or her into “thinking, doing and reflecting more” and gave him or her “the opportunity to work independently within and outside curriculum” and “the freedom in creating and experimenting”.

Feedback from mentors also affirmed that many mentors have moved beyond being an instructor or provider of information to be a co-enquirer and co-learner, as seen in the following comments:

I benefitted from the experience because I had to continually articulate my philosophy on education. This caused me to reflect on my practice and opportunities to progress. It was also rewarding to know I was advancing the participant’s skill set. (Cooperating Teacher A)

I was provoked to look deeper at how or why I do certain things and to perhaps consider “other ways” of doing certain things. (Cooperating Teacher B)

12.3.3 The Preparation

Mentoring goes beyond giving information, providing emotional support and superficial instructional advice to influencing the practice of their mentees in a significant way. However, not all experienced teachers (or supervisors) make good mentors. Even for good teachers, mentoring does not come naturally. They need to consciously pick up mentoring skills and learn the process of inducting their mentees into the world of teaching (Orland 2001).

In addition to having the correct attributes and sufficient teaching experience, mentors need to have the knowledge and skills to do their job well. They must be able to observe and monitor pre-service teachers’ needs and concerns. They must know when to provide relevant and concrete advice, how to challenge their assumptions and when and how to draw out their thoughts. Mentors need to be able to articulate their implicit understanding of their practice and help pre-service teachers make the theory–practice link. In addition, they have to know clearly the goals of the experience, for it is a crucial factor that will affect how successful the practicum turns out to be (Collins et al. 1991). As such, it is important that mentors are carefully selected and properly prepared (Ganser 2002). NIE works closely with school-based mentors and university-based supervisors through orientation, workshops, learning forums, focused group discussions and ongoing interactions to level up their mentoring skills and to ensure that the SCMs, CTs and NIE supervisors share the philosophy of NIE’s teacher education programme and the vision of developing a thinking teacher.

One of the signature events in NIE is the Learning Forum for Teacher-Mentors. It is a one-day conference held every 3 years for mentors of pre-service teachers and/or beginning teachers to share their practices or insights from their research on

mentoring. This forum also gives pre-service teachers an avenue to share with the teaching fraternity their learning journeys during practicum via their teaching and learning e-portfolios. During the sharing sessions, the pre-service teachers are grouped according to their teaching subjects. This allows them to learn from each other. The tutors who taught them are able to see how the pre-service teachers link theory with practice. Because this forum enables teacher educators, serving teachers and pre-service teachers the opportunity to learn from one another, the naming of this event as a “learning forum” is apt.

In addition, NIE conducts regular Mentor Preparation Programmes for SCMs, CTs and NIE supervisors. SCM preparation is meant to help SCMs better understand NIE’s Teacher Education for the twenty-first century Model, one which emphasises on three sets of values, skills and knowledge, and the Graduand Teacher Competencies Framework (for more details, see Chaps. 1, 2, 4 and 15). It also aims to enlighten the SCMs on their roles and the NIE’s practicum structure and processes, as well as to equip them with the necessary tools to conduct the focused conversations (FCs) with pre-service teachers during practicum in the schools. The FCs are platforms for pre-service teachers to link theory with practice. Many school-based mentors are senior teachers who have gone through the senior teacher course, which provided them with an in-depth understanding of what their pre-service teachers are learning in the teacher education programme. The theory–practice link is strengthened when these mentors are able to articulate theoretical understanding of practice that is consistent with what their pre-service teachers have learnt in their courses.

To help SCMs play the role of co-enquirers, they are given hands-on practice on how to lead pre-service teachers to reflect on their lessons by following a Reflective Practice Model adapted from York-Barr et al. (2001; for more details, see Chap. 10). Specific roles pertaining to NIE’s practicum programme are also discussed. SCMs are urged to regard themselves as mentors and not merely as administrators or assessors (National Institute of Education 2012). To assist them in doing that, the language of mentoring, both verbal and non-verbal, is shared with them.

Likewise, mentoring workshops are also conducted for CTs and university-based supervisors. The mentors are also encouraged to discuss their specific roles spelt out in the practicum handbook. For example, in these workshops or sharing sessions, mentors are shown how mentoring language is used. They are given time to practise using it. They also look at video recordings of good teaching and discuss the various aspects of assessing teaching. Mentors tend to mentor according to their assumptions about pre-service teachers’ learning (Zanting et al. 2001). To minimise that from happening, the mentors are encouraged to confront their assumptions and to look at their mentees’ needs and examine how they learn best. The pre-service teachers’ feedback on how they hope to be mentored is shared with the mentors. The latter are also presented with the Reflective Practice Model (for more details, see Chap. 10) and are encouraged to empower the pre-service teachers to reflect on their teaching so that they can be co-inquirers. At the preparation workshop, CTs also have the opportunity to meet with NIE academic staff to discuss

subject-specific content and pedagogy so that the CTs are better equipped in their mentoring.

In essence, NIE's mentor preparation programmes aim to remind all mentors that they should facilitate learning and not make the pre-service teachers into their clones, empower mentees and allow them to come up with their own solutions and not provide the solutions and provide honest feedback so that their mentees will learn and grow.

12.3.4 The Process

In NIE, pre-service teachers are mentored by their mentors through a process of systematic observations, modelling, co-teaching, opportunities for practice and frequent feedback, structured reflections and focused professional conversations. In this section, we will discuss three of the processes.

12.3.4.1 Systematic Observations

During the School Experience, the first of four school attachments in the BA/BSc (Ed) programme, pre-service teachers are posted to a primary school followed by a secondary school. This is to allow pre-service teachers to observe lessons in the primary and secondary classrooms and to expose them to the wide range of pupils and teaching and learning experiences in our schools. The pre-service teachers are required to collect observation data and learn from the teachers and school administrative personnel whom they observe or have discussions with. The information is used by the pre-service teachers for their coursework when they return to NIE. During this stage, the CT is largely the introducer to teaching, an information source and a model of teaching. He/she will help the pre-service teacher formulate his/her conception of teaching and learning by discussing school-related issues, discussing syllabuses/schemes of work and sharing in planning for lesson activities. The CT will also guide the pre-service teacher to systematically observe how he/she perform his/her teaching roles—planning, managing, communicating, instructing and evaluating.

In all the other three attachments, there will always be an initial period of intensive observation and reflection by the pre-service teachers before they embark on co-teaching or take on the responsibility of independent teaching.

12.3.4.2 Opportunities for Practice and Frequent Feedback

Apart from systematic observations, pre-service teachers are given opportunities for practice and frequent feedback so that they can work on important elements of their practice. Feedback can come from NIE supervisors, CTs, SCMs and other

experienced teachers. The provision of frequent formative feedback, that is developmental supervision, is at the centre of NIE Enhanced Practicum Model. For instance, for every lesson observation conducted by the CT or NIE supervisor, there is a three-stage lesson observation cycle.

The main purpose of Stage 1, the **pre-observation conference**, is to help pre-service teachers prepare and plan the lesson for observation. In essence, the CT or NIE supervisor will check that the lesson plan has definite, meaningful goals/objectives, is relevant to the topic/subject, is appropriate for the class/level and is workable in terms of pedagogies or time given. The mentor will discuss with the pre-service teachers their plans and, suggest modifications, only if it is really necessary (e.g. it is against the school rules), and advise the pre-service teacher on problems that might be encountered and how these could be handled. This is to ensure that the pre-service teacher has ownership of his/her lesson plan. During the pre-conference, the mentor will also discuss with the pre-service teacher the points of focus for the lesson to be observed, be it on classroom management, explaining or questioning skills, among other points. An agreement on the aspects to focus on for observation is helpful, especially for the first few observations, as pre-service teachers are less likely to be overwhelmed by the whole experience when they focus on specific areas they want to work on and the mentor, in turn, will be able to provide specific feedback on these particular aspects.

At Stage 2, during the **lesson observation**, the mentor's role is primarily that of an unobtrusive data gatherer while the pre-service teacher teaches. The mentor must refrain from intervening or participating in the pre-service teacher's teaching. Observation includes both the focused and systematic viewing and recording of the pre-service teacher's classroom behaviour. The mentor and the pre-service teacher are partners in a shared inquiry, examining together three related questions: *What is going on in this classroom? What changes might be made to improve learning? What type of observation seems most useful at this point?*

The mentor will use the Assessment of Performance in Teaching (APT) form to guide him or her with the observations (for more details, see Chap. 10). "Clinically", the use of the APT form is to provide the pre-service teacher with an objective and accurate account of the lesson under observation, so as to provide a basis for discussion in post-lesson conferences. The data gathered during lesson observations will show the pre-service teacher's strengths as well as areas for improvement. Repeated observations provide a sound, cumulative description of the pre-service teacher's teaching development over time.

After the lesson observation, the mentor evaluates and provides **feedback** to the pre-service teacher about his or her performance and progress in teaching. The aim is to help the pre-service teacher reflect and inquire into his or her own teaching practice, and not to instruct him or her to implement prescribed teaching strategies in a micro-teaching manner. The mentor guides and supports the pre-service teacher to help him or her make sense of the practice and learn from the experience. The same feedback cycle is repeated for the second and subsequent lesson observations throughout practicum. It is important to emphasise that the focus of the analysis is on *student learning*—and the ways in which the teaching facilitates or impedes that

learning. Overall, the pre-service teachers are assessed holistically through multiple sources of evidence that include observational data (APT forms from university-based supervisors, school-based mentors, heads of department or school leaders), lesson plans, and reflections, as well as samples of student work and feedback given by the pre-service teachers. In this process, the mentor takes on roles that are more akin to a coach, a challenger and to a certain extent is “an evaluator”.

12.3.4.3 Focused Professional Conversations

The aim of FCs is to encourage participants to remain on a topic long enough to work through certain issues themselves. The facilitator generally asks questions to prevent foreclosure based on the use of selective data (Liu et al. 2014; for more details, see Chap. 10).

Currently, SCMs facilitate three FCs for small groups of pre-service teachers attached to their schools during practicum. FC1 is generally conducted during the first couple of days of practicum. Pre-service teachers share what they have learnt from the courses in NIE and how these have influenced their notions of teaching and learning. Most of the pre-service teachers found that the sharing helps them crystallise their teaching philosophies and that the articulation of their conceptual maps helps them consolidate their learning and make connections between courses. FC2 takes place in the middle of practicum. Pre-service teachers are asked to reflect on and share an authentic case study or issue they have encountered in their practice. They are generally on classroom management or motivational issues. Finally, FC3 is done at the last week of the practicum. Pre-service teachers share how their practicum experiences have helped develop their teaching competencies and what they have learnt from their practice. The pre-service teachers extract artefacts from their e-portfolios to support their sharing at FC1 and FC3 (for more details, see Chaps. 11 and 12).

During the focused professional conversations, SCMs use the 4 Wh questions in the Reflective Practice Model—*What, Why, So What and Now What?*—to deepen the conversation (for more details, see Chap. 11). They take on the role of a coach, a challenger, a co-enquirer and/or a co-learner. They prompt the pre-service teachers to examine their understanding of theories, encourage them to revisit their philosophies of teaching and learning and guide them to go to their theoretical base when making their decisions. In other words, they work with the pre-service teachers to co-construct knowledge, discuss their prior beliefs, integrate their personal–professional knowledge and develop their personal stance towards teaching. It is imperative that SCMs have good mentoring skills to ensure that the conversation remains focused and that pre-service teachers make their thinking visible. SCMs need to abstain from giving solutions to the pre-service teachers when discussing problem cases or issues. They need to help pre-service teachers co-construct their knowledge by reflecting and thinking together.

12.4 The NIE–School Partnership

NIE has a strong tripartite relationship with the MOE and schools that is “the envy of other nations” (Darling-Hammond, cited in National Institute of Education 2009, p. 6). The strong relationship, especially between NIE and schools, is vital for the success of her Enhanced Practicum Model and mentoring framework. NIE, like any other university, “provide[s] access to theoretical and academic knowledge based on research and to the synthesis of a broad range of indirect practical experience” (Moran et al. 2012, p. 17). On the other spectrum, schools are providing “situational knowledge of teaching and schooling” (McIntyre 1997, p. 5). This is why NIE works closely with schools via SCMs to discuss “the purposes of student teaching and the type of mentoring needed to achieve these purposes” (Smith and Avetisian 2011, p. 350). Such a “cross-institutional network” helps establish “shared knowledge, practices and discourses for teaching and develop trust across institutions” (Smith and Avetisian 2011, p. 350).

One of the most important contributing factors to the strong partnership between NIE and schools is that all parties see themselves as partners in a common endeavour of teacher preparation, professional development and joint action research (Wong and Goh 2010). Marlow and Nass-Fukal (2000) believed that in successful partnerships, colleagues should regard each other as equals. NIE academic staff work closely with the teacher-mentors in schools. They see the latter and themselves as partners in education. This in turn leads to a trust relationship between the two parties. To build on that trust, NIE invites school mentors to be presenters at the Learning Forum for Teacher-Mentors. As mentioned earlier, the school mentors are invited to share with NIE staff and fellow educators on the mentorship programmes in their respective schools. In the inaugural learning forum, one school mentor commented:

The Learning Forum created a bridge that links the reality to the possibility in teacher education and development. It was a great opportunity and platform for success stories and authentic experiences to be shared among practitioners. (Cooperating Teacher C)

This is in line with what Teitel (1997) and Yendol and Fichtman (2004) deemed as making school partners “feel that they have a voice in the collaboration when their expertise is honoured through opportunities such as...providing guest lectures” (Burton and Greher 2007, p. 16).

In addition, NIE works with schools to ensure that there is a link between “school needs and priorities and pre-service teachers’ skills and interests” (Kruger et al. 2009, p. 10). In particular, NIE works closely with MOE’s Deployment Unit to facilitate the right match of pre-service teachers’ teaching subjects to the schools, which have vacancies for teachers of the subjects concerned. NIE keeps the channel of communication open between her and the schools so as to obtain feedback from the schools regarding their needs and to act upon them where possible.

12.5 Conclusion

At NIE, mentoring is seen as a medium for developing thinking and autonomous teachers who can reflect on their teaching and refine their teaching to meet the needs of twenty-first century learners. NIE's mentoring framework within practicum has spanned beyond the traditional and transitional paradigms, which range from maintaining authoritativeness and apprenticeship to being partners and co-learners during the transfer of skills from mentors to mentees. NIE believes in strengthening her mentorship framework and will continue to help SCMs and CTs sharpen their skills in mentoring pre-service teachers during their practicum as not all experienced teachers make good mentors—they have to be prepared to be mentors (Moran et al. 2012). In addition, mentors “with limited ideas about their role tended to have limited time to mentor. Forced to fit mentoring in around the edges of full-time teaching, they leaned toward ‘fixing novices’ problems rather than treating them as occasions for joint problem-solving or shared inquiry” (Feiman-Nemser 2001, p. 1032).

There is a recognition that NIE needs to continue to enhance her partnership with schools. No pre-service programme is able to equip teachers fully for all the challenges of classroom and school life. For any education system to be successful, it must provide a structure and process for professional development and mentoring of prepared teachers so that these teachers can continue to learn and relearn, adapt and restructure their knowledge, gain new competencies in practice, assume new roles and grow as professionals. Having a strong partnership with MOE is also vital. With NIE, MOE has developed Singapore's Mentoring Framework framework for the teaching fraternity that establishes a common language and an acculturated practice of mentoring across all levels of the education service. AST also leverages this framework to strengthen the culture of collaboration and promote professional excellence among teachers, ensuring that good teaching practices, as well as professional values and ethos, are passed on to and sustained among the young teachers.

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Chapter 13

Building Character and Citizenship Through Service Learning

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13.1 Introduction

Character and citizenship are key goals of a holistic education. The daunting task of building character and citizenship rests with teachers. As early in a teacher’s career, programmes in teacher education can develop teachers to build character and citizenship. To be effective, building character and citizenship needs to start with the teacher. What better way to learn this than by immersing in the community. As the sole teacher education institute in Singapore, the National Institute of Education (NIE) has since 2005 required all student teachers to engage with and learn from the local community via service learning experiences, thus building character and citizenship along the way. Through mandatory local service learning experiences and voluntary international service learning experiences, student teachers learn more about themselves, their strengths and areas for improvement, about working as a team, and about community and community issues.

Singapore has taken the challenge of increasing the number of teachers prepared in service learning by introducing programmes that emphasise on developing quality experiences for all teachers. In 2009, the Ministry of Education (MOE) launched the 21st Century Competencies Framework emphasising the core

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values of Respect, Responsibility, Resilience, Care and Harmony. Concomitant to its goal to be more student-centric and values-driven, MOE laid out competencies in the framework to develop a holistic education centred on values and character development (Heng 2011b). The introduction of service learning to Singapore is corroborated by this initiative especially in the promotion of active citizenry and is upheld as a learning approach where participants “learn to identify the needs of the community, serve the community and reflect their experiences through working with the community to foster an understanding and appreciation of what it involves” (D’Rozario et al. 2012). As a response, NIE initiated a Teacher Education for 21st Century (TE²¹) Model in its endeavour to develop a strong teaching force for the twenty-first century (NIE 2009), where the essential constructs supporting teacher preparation are highlighted: values³, skills and knowledge (V³SK). Service learning is viewed as one of the several approaches designed to fulfil this mission and to provide the kind of experiences necessary to ensure that new teachers understand the three components in the context of schools and communities.

One learning experience in Singapore’s national curriculum is Character and Citizenship Education (CCE) that enhances students’ development as socially responsible citizens through ownership of their contribution to the community. Values in Action (VIA), which is part of this CCE curriculum, takes students on a journey where they develop a deeper understanding of themselves and the impact they can make on the community. As they gain a greater awareness of their identity in the contexts of family, school, community, nation and the world, they invest time and energy to build meaningful relationships with the people around them. As they take ownership of their communities, their values guide them in making responsible choices and effecting positive change.

13.2 Values in Action

In 1997, the Community Involvement Programme (CIP) was introduced to all schools across all levels in Singapore. Its aim was to help build social cohesion and civic responsibility in schools through community engagement by undertaking small-scale projects that provided these opportunities. The goal to strengthen holistic education was re-emphasised by the inaugural Character and Citizenship Education Conference jointly organised by NIE and MOE in November 2010. The theme of the conference, Active and Concerned Citizens, Building Character for Community, summarises MOE’s purpose to support schools in their efforts to nurture values, competencies and dispositions in pupils and enable them to become good persons and responsible citizens (Heng 2011a). It aimed to deepen the conversation on what constitutes character education and citizenship education.

Five years later, MOE announced the reframing of the CIP as VIA to give greater focus to students acquiring values. VIA builds on the strengths of CIP, and encourages students to identify and understand community issues, initiate action

among their peers to make a difference and improve the lives of others (MOE 2012).

A key feature of VIA is that it encourages student ownership over what and how students can contribute to the community. Students are given opportunities to choose how and what to make a difference to. Together with their team members, they make decisions through brainstorming, planning and implementing their VIA projects. Throughout the VIA project, students take ownership of their learning by constantly reflecting on their experiences, the values they have put into practice and how they can continue to contribute meaningfully.

13.2.1 Learning Outcomes of VIA

Students recognise their roles in their families, school, community, nation and the world. As they understand how they can make a positive impact on their daily lives, they exercise social responsibility in their spheres of influence. Students also discover the needs of their communities and the ways they can contribute. They consider how they may use their strengths and resources to make a difference through meaningful contribution to the community.

13.2.2 Ways that Students can Contribute

As students learn about the challenges faced by the community, they consider what kind of help would make the most impact. They may choose to meet the needs of the community in one or more of the following ways:

1. By taking *action*: to improve a situation they care about.
Students engage the community directly to make positive change. Their efforts may include offering practical help, adding a personal touch through meaningful interactions or strengthening relationships through thoughtfully designed projects.
2. By promoting *awareness*: so that others may learn about an important issue or concern in the community. Students may draw attention to a current issue or concern so that the community is better equipped to respond. They may also help others to better understand specific groups in the community.
3. By being an *advocate*: to inspire and influence others to make a difference to something important that they care about. Students may motivate and persuade others to join them in promoting an area of concern in the community. Through speaking, writing or other creative means, they inspire others to join them in making a difference to the community.

Service learning is a teaching and learning approach that schools can adopt for VIA. To employ successful service learning initiatives in schools, it is important for teachers to have a good understanding of the underpinning philosophy of service learning, and experience this aspect of values education in order to help their students undertake meaningful service learning projects (D'Rozario et al. 2012). In this day and age, it is not sufficient for student teachers to just learn knowledge and pedagogical skills, an opportunity through an experiential approach allows them to connect with society, embrace diversity, and develop values and competencies needed to make a positive difference in the classroom.

This chapter highlights two initial teacher education programmes which build positive values, character and citizenship in our student teachers: the Group Endeavours in Service Learning (GESL), where student teachers work with the local community on a joint project; and the Youth Expedition Project (YEP), where student teachers choose to work with international communities on an area of need.

13.3 Literature Review

Character building, service learning and a sense of civic responsibility and citizenship are integral components of a meaningful educational experience for children and young people. Service learning does not produce singular outcomes, but rather tends to be associated with outcomes in multiple youth development areas, including academic, civic, social/emotional and career (Billig et al. 2005). Through voluntary projects and reflections, positive benefits accrue not only to the recipient but also to the giver; in this case, the students themselves. Students need that part of education that connects them with the community outside the confines of the school in order to appreciate what is taking place in society (Goh et al. 2009). Several studies have been conducted to prove this point (Billig and Root 2006; Berkowitz and Bier 2005; Laird and Black 2002). Other studies have shown that service learning can promote civic engagement, responsibility and formation of social capital (e.g., Ammon et al. 2002; Kahne et al. 2002; Yamauchi et al. 2006) and empathy (e.g., Meyer 2003).

Nearly all of these studies qualify their results, though, by stating that only students who engage in high-quality service learning reach the specified outcomes. Typically, high quality was defined as meeting the essential elements of service learning (National Youth Leadership Council 1998). These elements developed during meetings of expert practitioners include the following:

- clear educational goals that require the application of concepts, content and skills from the academic disciplines, and the construction of one's own knowledge;
- service tasks that have clear goals, are designed to meet genuine needs in the school or community and have significant consequences for themselves and others;

- student reflection that takes place before, during and after service, that uses multiple methods to encourage critical thinking, and that is central in the design and fulfilment of curricular objectives;
- multiple methods to acknowledge, celebrate and validate student service work;
- student participation in selecting, designing, implementing and evaluating the service project;
- student participation for all aspects of their service work, including a clear understanding of the task, the skills and information required to complete the task, awareness of safety precautions, and knowledge about and sensitivity to colleague;
- student engagement in tasks that challenge them cognitively and developmentally;
- use of assessment to enhance student learning and to document and evaluate how well students have met content and skills standards;
- formative evaluation of the service effort and its outcomes;
- activities that promote the value of diversity in participants, practice and outcomes; and
- activities that promote communication and interaction with the community and encourage partnerships and collaboration.

13.3.1 Promoting Character Development

At the core of positive selfhood is the inherent aspiration of becoming a mature individual of good character when reaching adulthood. Yet how does one define maturity? One way to conceptualise this process is by considering one's growth and development within the framework of life goals. What is the role of service learning in this area?

Service learning and character development seem to be the embodiment of good youth development based primarily on principles of experiential learning. According to Shumer (2009), many service learning programmes engage youth with adults and children in ways that provide real responsibility and real opportunity to make meaningful contributions to society. Students engaged in service learning develop both a strong sense of responsibility as well as a clear understanding of the value of integrity and trust. Evaluative studies of typical service learning programmes have shown that they nurture a sense of responsibility and personal integrity. A 1997 Brandeis study in the USA revealed that middle school and high school students who participated in service learning programmes described themselves as not only more aware of important issues in their home, school, community and state, but that they also felt encouraged to act more responsibly (Anderson 1998). Similarly, in a 1994 Vanderbilt study in Tennessee, students expressed to researchers that they had a better sense of belonging in the community because of their service learning programme. Further, the students felt that they

were more capable of taking the other person's viewpoint and perspective as a result of their service work (Anderson 1998).

Students have indicated how successful service learning programmes are in the development of character in young people. According to a study by Hodgkinson et al. (1992), over half of the top responses by the students were character benefits when asked what they felt were the most important benefits of their service learning programme. Students who participated in service learning character education programmes had significantly less diminution in value attainment, which suggests that service learning may help students retain their character assets as they mature (Furco and Root 2010). In essence, these studies suggest that service learning does in fact aid students in developing empathy and the ability to care for others. Educational researchers have also found that those students receive tremendous benefit from service learning programmes. As one researcher commented:

Advocates of youth service also agree that, while involvement in community projects is beneficial to all, students with poor academic performance, discipline problems, and low self-esteem gain the most (from service learning). By taking responsibility for a social cause or caring for someone else, these students internalise a different self-image: they learn that they can produce change and can be problem solvers. (Schervish et al. 1995, p. 145)

Students will be challenged in terms of attitudes and habits through the service component. Compassion and empathy will naturally emerge as a result of the task at hand. Learning compassion for others in our society is certainly an area of challenge for many of the students who engage in service learning. For example, young men and women who do not recognise the value of what they have at home are often confronted personally when working with the less fortunate. Along with the attitudes and concepts, emotions and feelings are also being challenged.

Students have the opportunity to recognise the contributions that they can make to their community and so feel valuable as a result of their service. Self-esteem and self-efficacy are experienced in most service programmes. Contribution to the community is therefore another natural outcome of service learning. Having performed an act of service for the sake of one's community creates a bond or sense of belonging. For children and teens, a sense of belonging is a big plus because it is high on their needs. In addition, students have the chance to look at possible careers when they engage in various service projects. For example, secondary school students who might be considering a career in teaching would be able to assess that area more fully as they tutor children.

13.3.2 Nurturing a Sense of Civic Responsibility and Citizenship

According to Sax (2004), citizenship has three attitudinal and behavioural aspects: (1) commitment to social activism, (2) sense of empowerment and (3) community involvement. For the first aspect, citizenship means participating in community

action programmes, helping others who are in difficulty, influencing social values, and influencing the political structure. The second connotes the level of feeling about how much an individual can bring changes in society. The third implies engagement in voluntary work or community service. Similarly, McLaughlin (2000) shared the three elements of citizenship as “social and moral responsibility, community involvement, and political literacy”. Both underscore the importance of feeling responsible, being active and taking part in serving the community voluntarily.

Civic responsibility through volunteerism is also fostered through service learning. Those students who engage in service learning will develop awareness that individuals working together in a society can make a difference in the community’s life. Once youth and adolescents recognise this fact, the probability that they will continue in community service throughout their life is increased. Most students who participate in a service learning programme have usually chosen to continue performing some form of volunteer work after their initial programme (Bak 2012). In addition, students also become more active in the general life of their neighbourhood and city due to the awareness gained from their service learning programme. The outcomes sought for young people from civic learning are comprehensive, and service learning has been documented to improve the very same areas, including specific knowledge and skills, feelings of efficacy and belonging, the development of moral character, and the ability to effectively interact and problem-solve in increasingly diverse communities (Bak 2012).

Barber (1998) sees education for citizenship and service learning in schools and higher education as a key factor in maintaining civic virtue and civic participation. In a number of influential articles and books, Barber has advocated education for active citizenship through service learning. Service learning can also help develop the capacity building for democratic citizenship within civil society (Annette 1999). Boston (1997) argued that service learning provides an experiential way of understanding abstract moral thinking and provides learning opportunities to build character.

Hamilton and Zeldin (1987) assessed the effects of community-engaged experiences on students’ attitudes towards government and students’ overall civic knowledge and skills. Blozis et al. (2002) conducted a study of middle and high school students in several communities in Northern Illinois and reported that service learning, coupled with other approaches, can be an effective intervention strategy for increasing students’ understanding of their roles and responsibilities as citizens and their sensitivity to diverse cultures.

The use of service learning explicitly to meet CCE outcomes appeared to have increased over time. In 2002, only three projects funded by the US Department of Education featured service learning (Billig et al. 2008). Five years later, that number has substantially increased, with more than half of the grantees using service learning as one of their primary character education approaches. By engaging in service learning, students had opportunities to think more deeply about social problems, thus possibly prompting them to see their place in the world.

Today, many educational institutions use service learning as a tool to enhance education programmes, community life and to foster civic responsibility among their students. Service learning in teacher education provides an opportunity for bonding among the community of learners, namely the teacher educators, the student teachers, and the youth and children that they are reaching out to (D'Rozario et al. 2012). According to Stanton (1990, p. 67), service learning is “an expression of values—which determines the purpose, nature and process of social and educational exchange between learners (students) and the people they serve, and between experiential education programs and the community organisations with which they work”. In essence, service learning integrates learning, student voice, high-quality service, civic responsibility, collaboration, reflection and evaluation (Tan and D'Rozario 2009). The learners who participate in service learning projects become responsible citizens and agents of social change. These outcomes are also emphasised when conducting overseas expedition projects. According to Lee and Tay-Koay (2009a, b), a unique combination of intrinsic motivation and concentration are two components of experience hypothesised to occur during overseas community service. In response to environment challenges and opportunities, coping and adaptation potentialities are developed (Jew et al. 1999). Successful adaptation or coping may result in positive outcomes such as improved personal competence and civic attitudes (Bringle and Duffy 1998).

Two good examples of application of these theoretical principles are found in GESL and YEP at NIE. At the core of these two programmes is the learning outcome that student teachers learn and work in group environments. Here, they have a chance to model leadership, develop values of engagement, create curriculum through deep endeavour, develop activities that are meaningful to them and to the context of the experience, provide for social learning and personal learning simultaneously, and contribute to society (Shumer et al. 2010).

13.4 Group Endeavours in Service Learning (GESL)

The Group Endeavours in Service Learning is an experiential learning experience for all NIE student teachers done in collaboration with local schools and organisations, both government and non-government. GESL aims to help student teachers be ready to lead VIA service learning initiatives when they are full-fledged teachers in schools. GESL also aims to develop character, social-emotional competencies and positive values. The desired outcomes for student teachers have been articulated as care and concern for all, collaboration, sharing and team spirit, desire for continual learning, excellence and innovation, commitment and dedication to the teaching profession, and respect for diversity.

GESL's key objectives are to provide a medium for student teachers to (1) understand themselves, (2) understand others, (3) develop effective team skills, (4) develop and exercise situational leadership skills, (5) encourage innovation and creativity, (6) understand community needs better, (7) develop project management

skills, (8) experience service learning which they may apply in school and (9) link curriculum learning to service learning experiences, and vice versa.

Student teachers work in groups of 16–20 to plan, implement and review service learning with a community of their choosing. Each GESL group is structured with one academic staff mentor, two leaders, two facilitators, a secretary and two safety officers. Other members in the group are encouraged to pick up roles that align with their competencies and contribute to the group. Preparation is provided to staff mentors, group leaders and facilitators. The preparation provides them with the knowledge in service learning, understanding of the experiential learning cycle and basic facilitation skills to ensure that there is group and individual learning from the experience. A celebratory sharing with the NIE community called Service Learning Day will cap their experience at the end of 9 months.

GESL is a pedagogy in developing values, skills and knowledge of student teachers underpinned by NIE's V³SK Model and MOE's 21st Century Competencies and Student Outcomes Framework (see Fig. 13.1). The experience provides an opportunity for them to understand themselves and reach out to the community. It is envisaged that attributes such as the ability to foster care for the community, a respect for diversity, a strong collaborative spirit and a deep commitment to the profession can be honed. Specific skills developed through service

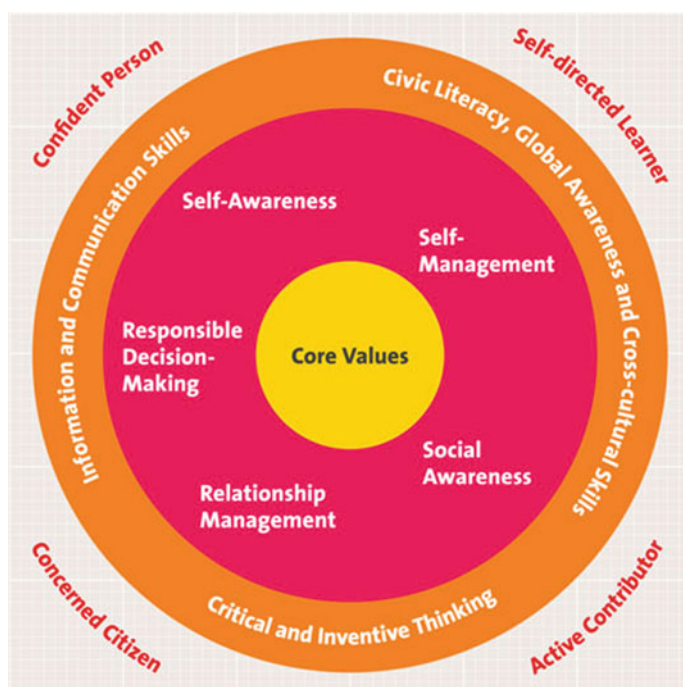


Fig. 13.1 21st Century Competencies and Student Outcomes Framework (MOE 2010). *Source* Ministry of Education, Singapore (2016)

learning include reflective skills, pedagogical skills, communication skills, facilitative skills, and social and emotional intelligence. Areas of knowledge developed through service learning experiences include gains in knowledge of self, one's pupils, the community, subject content and multicultural literacy.

13.4.1 Essentials of Service Learning

Six essential components of service learning are recognised in GESL as follows:

- i. Reciprocity
- ii. Meaningful service
- iii. Community voice
- iv. Student teacher voice
- v. Reflection
- vi. Academic connections

These essentials serve as guiding principles for designing high-quality service learning which benefits both student teachers and the community.

Reciprocity

Through GESL, student teachers learn from the community. The community becomes our teacher. Student teachers also serve the community and, hence, there is mutuality in our relationship with us learning from the community and us serving them. Reciprocity helps to ensure respectful partnerships between student teachers and the community creating mutual respect, improving relationships, and enhancing healthy communication.

Reflection

When student teachers design, plan and implement their project, reflecting on the process helps them learn. Regular reflection encourages an ongoing thinking process. When student teachers reflect, they are able to make sense of their service learning experience and link recent experiences with past experiences. The reflection process involves seeking commonalities, differences and interrelations among the important elements of mental schema. Student teachers use journaling or group discussions after their practical experiences to reflect upon their process.

Meaningful Service

When planning for their GESL project, student teachers are advised to plan for activities that they find useful and helpful. The activities can be something that they acquire from reading or observing. These activities should do good to benefit both the student teachers and the community, to not only achieving the minimum standard but also doing something they perceive as relevant and of value. These activities should not encourage dependency. It should promote self-reliance and

sustainability, which can help the student teachers make sense of what they experience.

Community Voice

Service learning is approached with the notion that the community knows best. Before the project is conceived, students have to find out from the community what their needs are, by carrying out a needs assessment. This is essential as there are often discrepancies between our perceptions and the actual needs of the community. Students should hear the community out, learn from them, be open to their opinions and gather as much information as possible from a wide variety of people with different perspectives.

Student Teacher Voice

When this essential is incorporated into the service learning process, student teachers are encouraged to explore, discuss and make informed choices, lending their voices to the cause they believe in. Planning follows student teacher discussions with free sharing of views, findings from their research and evaluative comments. This helps develop a sense of ownership for the project. It gives the students space to appreciate and time to comprehend and decide on how they would like to serve and learn, rather than being told what to do.

Academic Connections

The last essential of GESL is that it should facilitate links to the academic curriculum at NIE. Curriculum is defined broadly as what students learn in NIE classrooms. This type of connection normally focuses on the core courses such as math, science, the language subjects and social studies. How does service learning inform the teaching of these subjects, and vice versa? Is there something learnt from GESL which may be applied to the psychology of teaching and learning? Did one use IT skills learnt at NIE to facilitate service learning? However, service learning can also easily be linked with other non-core courses such as computer IT and psychology.

13.4.2 Developmental Assessment of GESL

Student teachers are assessed on their contribution to their group and service learning process. The group's staff mentor observes the group and its members and documents their progress. Evaluation procedures were adapted from MOE's (2001) Project Work for Secondary School Evaluation. The four areas of focus for evaluation are as follows: knowledge application (group—process and product), communication (group presentation), collaboration (group/teamwork) and independent learning (individual).

Each student teacher is also required to submit an individual project reflection paper, and the group will submit an end-of-project reflection which is used to assist

assessment on both the individual and group level. The specific areas of individual assessment include the following:

- i. Have a positive attitude towards learning.
- ii. Have a positive attitude towards servicing the community.
- iii. Have leadership abilities.
- iv. Are able to do project management.
- v. Set high standards in your work.
- vi. Do your fair share of the work.
- vii. Share your ideas and views with your group.
- viii. Are willing to consider the opinions of others, even if you do not agree with them.
- ix. Are accepting of others in your group.
- x. Understand and accept your own strengths and weaknesses.

Upon the completion of the GESL project, the student teacher receives a GESL transcript. The GESL transcript documents the overall evaluation of the group and an individual assessment of the individual.

A formal evaluation of GESL was conducted by Professor Shumer of the University of Minnesota in March 2009. The purpose of this evaluation was to gain an understanding of how well GESL had been conceptualised and implemented, and how effective it had been in developing learner-centred values, a positive teacher identity and a better understanding of our community and its needs. Information was gathered from a variety of sources: documents outlining GESL objectives and procedures, student projects and focus group discussions with all stakeholders (student peer facilitators, teacher educators, community agencies, NIE staff facilitators and others involved in related programmes such as YEP, the international service learning initiative of Singapore's National Youth Council).

The evaluation process by Professor Shumer identified three key throughputs:

1. Impactful Group Experience

The greatest impact of GESL was in the project itself—the power of the experience and how meaningful it was to the participants. The participants also felt they learnt how to function in a group and as a group—they learnt group skills—managing time, setting goals and working towards a common purpose.

2. Personal Growth

Participants said they developed interpersonal skills as GESL increased their personal ability to work within a group structure. Developing patience, the ability to resolve conflict, and manage and execute plans had been cited as important outcomes. The ability to work collaboratively with community agencies was another important outcome cited.

3. Awareness of Community and Student Issues

Student teachers became aware of community problems, such as environmental issues, and student characteristics of students with special needs.

Shumer (2009) recommended that NIE needs to explore the possibility of reducing the group size from 20 to 24 members to ten in order to maximise active group discussions. He further suggested that groups be arranged by thematic areas of common interest because it is a powerful factor in sustaining their interest and involvement.

As part of the evaluation of the GESL experience, student teachers are asked to report what they have gained from GESL. A compilation of twenty GESL stories into *Journeys of the Heart* in 2010 revealed many meaningful outcomes, supporting findings reported by Shumer (2009).

The student teachers reported that they had learnt how to work together as a team despite their diverse backgrounds and viewpoints. Challenges were surmounted through give and take, creativity and innovativeness, and working together towards a common goal. The need to band together in order to achieve success in their quest required the student teachers to set aside differences. In addition, they encouraged each other with affirmations and support. These are relationship management skills so necessary in developing lasting interpersonal relationships in the workplace and in personal life.

With a common goal, constraints became opportunities to learn new skills. This is seen in the following reflection from, “The Green Generation Concert: Youth in Conservation” in *Journeys of the Heart* (Bastion and D’Rozario 2010a, p. 71):

Instead of being stumbling blocks, the occasional challenges, such as the limitations in time, resources and manpower, strengthened the team’s creativity and flexibility in finding efficient solutions.

The following reflection from “Chek-Mates at Chek Jawa” from *Journeys of the Heart* also highlights life skills gained through GESL:

I think GESL has been a fabulous, meaningful learning experience for all of us. I have learnt valuable organisational skills, to work with a variety of people. I have gained insight into how a project of such scale should be planned and carried out. (p. 9)

Student teachers reported that GESL helped them develop insight into community and social issues, and acknowledged that their role as teachers included that of being concerned citizens and active contributors. Reminded of their social responsibility in creating and maintaining harmony among all, this student teacher from Project Shine stated:

A GESL project like this is a must for teachers to remind us we are part of society, to remember the importance of cooperation and harmony with all, and to realise we have a role as teachers in carving out the future, while influencing the present. (p. 23)

Summed up, GESL seemed to have paved the way for the development of a more socially responsible citizen:

The GESL project created a meaningful platform for student teachers to be involved in the community. GESL takes a baby step in creating a less self-centred Singaporean community. (p. 9)

GESL seemed to have developed insight into a part of society student teachers did not have much knowledge about or experienced before as seen in the following student teacher reflections:

I was previously biased about foreign workers but the project gave me a clearer picture of their life in a foreign country. (p. 52)

“Chek-Mates at Chek Jawa” was an eye-opener about out threatened native wild habitats and the wildlife that live in these fragile ecosystems:

This experience has definitely made us appreciate the beauty of nature and in understanding our roles in protecting it despite all difficulties. Hopefully our project could count as among the efforts to save Chek Jawa from being swallowed up by economic progress. These may be once in a lifetime kind of experiences. We might never have touched a starfish or even seen a hermit crab. If we were so “deprived” what more our children and their children should these locations go extinct? I believe that all of us will look at nature differently now and appreciate the fragility of these wonderful creatures. (p. 9)

Student teachers expressed that GESL helped them grow into more confident persons. Appreciating this journey into self-discovery, one student teacher reflected:

It is a special gift to be able to teach and communicate with children with special needs, and we don't claim to have it, but this GESL project has definitely shown us what we are capable of. We are now more versatile in reaching out to children with differing mental and intellectual abilities. (p. 23)

GESL has been described by a student teacher as a valuable journey into the self:

This GESL project is the most important thing I've done in my life so far. To start with, I was extremely sceptical about this service learning project. But now I hate to think of myself as before, ignorant of community work, living in a vacuum of self-service, rather than service to others. (p. 31)

GESL had been a reward in itself, a learning journey which came with dedication, commitment and developing firm friendships.

Seeing the project through has provided us with enriching learning experiences, an unshakable camaraderie, demanding from us commitment, teamwork, determination and dedicated leadership. (p. 71)

Student teachers gained insights into their role as a teacher and a good citizen through learning from their partner organisations experiences which developed new perspectives:

I used to think our primary job scope is to cover the syllabus and ensure students are well equipped with correct values and beliefs. But now I've learnt we should always try to empower students with alternative classroom learning experiences. A teacher should not only look at academic development, but also character building. (p. 49)

Student teachers expressed learning gratefulness and an appreciation of their own lives:

I have gained awareness of the dire situation which lower income families are in. This makes me more appreciative of what I have at home. I am now also more determined to help out with such families. I have definitely become more appreciative of I have after my experience in GESL. (p. 13)

It was touching seeing how the elderly could be so absorbed by just simple games and handicrafts. There was a kind of peace about them that made us feel comforted, a strange thing, can't explain it. (p. 40)

Besides local service learning projects, student teachers have been given the opportunity to opt for taking service learning overseas since 2002. They may do this by participating in YEP administered by the National Youth Council and organised at an institute level at NIE by the students themselves through the NIE Service Learning Club.

YEP are service learning projects carried out in international settings. At NIE, these began in 2002. Since then, 41 groups with approximately 650 student teachers have embarked on YEP. Projects have many different foci including infrastructure upgrading, sharing pedagogies with teachers teaching lessons to kids, and environmental projects such as starting environmental education and waste management projects.

A collection of 34 stories of international service learning projects from 2002 to 2009 are captured in the 2010 publication called *Tracks, Treks and Trails: Ventures and Adventures Abroad in the Spirit of Service Learning* (Bastion and D'Rozario 2010b). A review of these stories provided interesting insights into what the student teachers gained from an international service learning experience.

Student teachers developed insights into humanity and expressed their experiences of gratefulness, humility and respect:

Have you ever received a gift from a child? Given from the heart, their eyes are earnest and full of trust and love, because they appreciate you and think of you as someone wonderful. That's how they made us feel. (p. 27)

The trip taught me to see that the human spirit has no colour, no status, no language. We could not speak each other's language, yet the chemistry and sincerity was amazing, we somehow could communicate with each other and become friends too. (p. 74)

Many teams have found that money is undoubtedly important. We have to feed mouths before we feed hearts. But at Lepcha, with Ms Keepu as beacon, it is all about heart. The children were never grasping, greedy or demanding. They were scrupulously honest, respectful, and always appreciative. It seemed what was most important was care, interaction, people just showing them love. Ms Keepu accomplishes all this as a one-woman show. Service learning teams felt honoured to be by her side, even if just for a short stint, to help in her efforts. (p. 19)

Student teachers expressed that international service learning projects helped them to learn to be better people and to develop character. The students admitted that the service learning experience had changed some of their misconceptions about less privileged groups in society and dislodged some of the complacency that might result from a lifestyle deprived of adversity, thereby making them into better citizens:

We went there to make a difference to their lives, but they have opened our hearts and taken residence there, so now it's us who are different. We hope, too, we're better people for having been at Lepcha Cottage and with them. (p. 27)

We went to Sikkim thinking solely about what we could do for them, never thinking about what they would do for us. They've done more for us, because they've overhauled our ideas and beliefs about disadvantaged groups. Got rid of our complacent arrogance, made better people out of us, with characters, we hope they are proud to have had a part in our "upbringing" or "education". (p. 40)

The service learning experience has helped to instil a sense of hope among the students that they can make a positive difference in the community and that their efforts do matter. This in turn has brought about a change in attitude towards community service and altruistic behaviours:

...now I'm going to ensure I continue with community service and play a more active role in making this world a better place. (p. 31)

International service learning projects required a group to work together as a team within and with host organisations developing group skills, interpersonal relationship skills and project management skills, all necessary life skills for effective living. The students were exposed to the culture of the host country in a manner that is different from traditional tourism. Specifically, they found themselves immersed in both the strengths as well as the challenges of the host culture in a way that is not typical of "accidentally chancing upon it".

We learnt to look out for each other, and to take comfort in the safe and warm feeling of being looked after. We came to accept each other, all our idiosyncrasies, characteristics. We stuck together to overcome many obstacles, cementing even more our already strengthening ties. (p. 60)

We learnt the vital importance of planning for what we hope will happen, what we hope won't happen. Throughout it all, teamwork and solidarity keeps everything running, even when things look like they may be falling apart, its teamwork that heals and seals. (p. 74)

There were many occasions that student teachers found themselves in positions where they had to think on their feet, get out of their comfort zone, be flexible and adaptable in order to be successful in their endeavours overseas. The students grasped the art of being able to think spontaneously, depending on the needs of the situation, and often to come up with solutions, which could be very different from conventional approaches. In that sense, their ability for divergent thinking was enhanced. The students also learnt to proceed on a lesson with a plan in mind and also a readiness to be flexible to adapt appropriately if the need arose:

The challenges were there, and although surmountable, still needed handling, with whatever experience we had, which wasn't much. But this I guess is the whole point of service learning. You get pushed out of your confined comfort zone into situations you would not encounter back home, and then you find you can actually do amazing things. (p. 47)

The hands on nature of our project gave us experience of how to manage students, conduct a class, and get over language barriers. All these we learnt from NIE, and it was fulfilling seeing how realistic our courses have been. (p. 16)

YEP also helped student teachers develop insight into social and community issues:

We got thinking about our own water situation, scarcity of resources. KCC showed us we do need to be more environmentally aware, and take concrete actions, so environmental education and awareness is not just a fad or trend. (p. 60)

Being out of their comfort zone in an unknown land and foreign culture helped the students develop close friendships among themselves. Several of the documents accounts revealed that these intimate interpersonal ties have been a pillar of support in their lives even after returning back home. By working in communities that lacked learning resources, the students learnt that education was not about being equipped with extravagant classroom facilities. Rather, the evidence of education lay in the concern that individuals show for each other, their knowledge and awareness of their cultural values and the genuineness with which they express themselves. For those who explored areas that had been previously excluded from community work, there was a feeling of optimism that the tracks which had been laid down would be followed up by other teams in the future.

13.5 Discussion and Conclusion

The reflections highlighted in this chapter indicate that GESL and YEP programmes are effective in inculcating the elements of character and citizenship among student teachers. The activities comprising environmental awareness, helping the less privileged, teaching kids, assisting foreign workers, among others, enabled student teachers to look into the “self” then to the community. This can be related to what Goh et al. (2009, p. 1) referred to as “connecting with the community outside of their immediate surroundings”. Consistent with the goals of holistic education, service learning through GESL and YEP promoted character development and nurtured a sense of civic responsibility and citizenship among student teachers, who learnt and developed skills necessary as they embarked on their teaching career. Student teachers practised interpersonal skills in their group meetings. They learnt to plan and acquire reflective skills necessary to establish an impactful service learning project. The overseas service learning programme (YEP) provided an opportunity for the student teachers to think out-of-the-box and learn from experiencing unfamiliar environments. The challenge of service learning projects required groups and individuals to seek innovative approaches and created the need to think beyond traditional classroom learning.

13.5.1 New Initiatives and Future Directions

As schools play a nurturing role in the development of students, teachers have the responsibility to be aware of their professional commitments with regard to CCE:

What roles do teachers play in the character and citizenship development of students? What are the relevant attitudes, knowledge and skills that teachers should possess to enable them to contribute meaningfully to the character and citizenship development of their students in schools?

In addition to GESL and the Meranti Project,¹ a new CCE syllabus has been offered as part of NIE's pre-service programmes to better prepare beginning teachers in the teaching and learning of CCE implemented in both primary and secondary schools since 2014. The offering of CCE in pre-service programmes highlights the fact that teachers have a powerful impact on the hearts and minds of their students, who often see them, as well as other significant adults in their lives, as role models. CCE at NIE is a compulsory 1 Academic Unit (AU) course within the Education Studies core course structure. This course enables pre-service teachers to learn about current MOE policy on CCE curriculum, character development, the roles and responsibilities of citizenship and key approaches and pedagogies to teach the subject (MOE 2014). CCE at NIE now includes GESL which also carries 1 AU course credit for the first time since 2005.

The NIE programmes of GESL and YEP have helped student teachers develop insight into their strengths and areas for future growth, opened their eyes to social and community issues and needs, and given them the confidence that they can certainly make a difference in people's lives, and in the social and natural environment, both in local and international contexts. Through GESL and YEP, student teachers have developed insight into a part of society they had previously not had a glimpse of, and hence, now have a better appreciation of community, local and global. Service learning has built in student teachers a much better awareness of what their role as teacher and responsible citizen involves. Positive values of humility, gratefulness and respect were markedly developed during international service learning sojourns. Student teachers expressed that international service learning projects helped them become better people and that they had developed character via the experience. Service learning certainly built team skills and an ability to think on one's feet, an ability to be adaptable, life skills so needed to be an effective teacher. Many expressed developing toughness in spirit, a resilience they will need to be effective teachers of the future. All in all, GESL and YEP have developed good character and engendered civic responsibility in our student teachers, and are set to continue to do just that.

¹The Meranti Project is a personal and professional development programme specially customized for student teachers. Through informal dialogue sessions with veteran teachers, it gives student teachers the opportunity to listen first-hand experiences of teachers and the perspectives of student learners. The programme also makes use of open sharing sessions and ingenious games to help the student teachers experience the core competencies of social-emotional learning, to share their personal aspirations with their peers and to express their opinions in an open and creative environment.

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Chapter 14

NIE Learning Space: Physical and Virtual Learning Environment

Shanti Divaharan, Philip Wong and Ashley Tan

14.1 Introduction

Education in the twenty-first century should focus on the holistic development of the child. It should prepare the child to invent the future and not just merely survive the changing landscape. Hence, teaching should be a blend between the process of transmission of knowledge and building of new knowledge. Teaching must involve guiding and facilitating inquiry and discovery, as well as shaping and moulding the character and values of the learners.

With the advent of twenty-first century, there is an increasing demand on education for the development of the new range of skills and new range of literacies to meet the outcomes of effective teaching and learning in the classrooms of today. Consequently, there is a need for teacher educators to prepare teachers to design learning that will provide opportunities for their students to develop twenty-first-century skills. In the National Institute of Education (NIE), the focus has been on both the physical and virtual learning environments. The design of the physical learning space has to support teacher educators to provide opportunities for student teachers to experience a repertoire of pedagogical approaches. The physical space needs to be supported through technology-mediated tools to provide for expanded and enhanced learning opportunities.

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14.2 Physical Classroom Environment

Acquisition of only content knowledge will not be sufficient for students to meet the demands of the future working force. Instead, students should be taught and exposed to pedagogies that will help them to develop the much de rigueur twenty-first-century skills. This is only possible if our student teachers are exposed to and are able to experience the repertoire of pedagogies so that they are able to design lessons to provide opportunities for their students to become knowledge creators (UNESCO 2013). Student teachers in NIE should be provided with rich and meaningful learning experiences so that they are able to make sense of their current practices and have the competencies to explore new ways of meaningful engagement of their students in schools.

When NIE moved into its new campus in the year 2000, each tutorial room was furnished with individual chairs and attached writing platforms. The classroom layout was front facing, with the lecturer's desk positioned at the front and centre of the room. This conventional classroom design facilitated a didactic approach to teaching. As such, the main mode of teaching and learning approach in NIE was the lecture-centred approach with a resulting passive learning among student teachers. Such a classroom design did not lend itself to support innovative pedagogical practices among faculty.

To support social construction of knowledge and thereby collaborative learning among the student teachers, NIE completely redesigned its tutorial rooms to facilitate the adoption of pedagogies aimed at promoting twenty-first-century skills. The remodelling initiative of NIE tutorial rooms into "Collaborative Classrooms", as it was termed, began in the late 2009 with a pilot project comprising six classrooms. The end of 2012 witnessed the transformation of all 68 ground-level classrooms into Collaborative Classrooms. Given the design of the Collaborative Classrooms (Fig. 14.1), NIE faculty is able to provide opportunities for their student teachers to harness the affordances of technology to learn. Technology tools were used in these classrooms as an information resource, a visualisation tool, a data management tool and a cognitive tool.

Placing the learner at the centre of all pedagogical approaches, the classrooms were remodelled to support collaborative learning mediated by technological tools to enhance the learning experience and outcome. The following table lists the design features of NIE's Collaborative Classrooms and the rationale for incorporating them (Table 14.1).

As part of the pilot project, a sample group of NIE faculty members were surveyed to comprehend how they felt the remodelling of the classrooms supported their pedagogical approaches and its effect on student learning. There were 29 positive comments from the faculty (eight faculty members did not use the facilities as they were using the classroom for service learning meetings). Faculty members reported that the environment was conducive for group work and discussions. It helped in Computer-Supported Collaborative Learning (CSCL) that has an



Fig. 14.1 One variation of the Collaborative Classroom at NIE (*Source* NIE)

emphasis on the individual accountability and a positive interdependence. The advantages of using technology within the classroom are the ease and effectiveness of coordination and monitoring the learning process. They also liked the idea of projecting student teacher's screen onto the group's LCD TVs and also to broadcast to the whole class for presentation. The environment encouraged faculty to expand different pedagogies, and there were more reports of collaborative strategies, such as group work, project-based learning, problem-based learning and more sharing among student teachers.

Despite the positive and encouraging response from the sample group of users about the Collaborative Classrooms, it is important to note that physical changes and new technological affordances in the classrooms will not suffice in promoting student-centred or collaborative strategies. The Collaborative Classrooms were designed to facilitate or encourage various instructional strategies, including didactic approaches. The objective is to have a blend of both didactic and learner-centred approaches where the learning experiences could be further enhanced by leveraging technological tools. It is important to recognise the adage that "teachers tend to teach the way they were taught" (Brown 2003) and to address faculty mindsets in order to help them expand their teaching strategies beyond being the "sage on the stage" (traditional teachers or lecturers) to being a "guide on the side" (effective facilitators). To create a holistic conducive learning environment, various other initiatives were undertaken by NIE.

Table 14.1 Design features of NIE Collaborative Classrooms and their rationale

Pedagogical principles	Design features	Rationale
Promoting collaboration among student teachers during sessions	Collaborative table with student teachers sitting in groups of four or five	This set-up puts student teachers in groups instead of individual chairs and encourages them to face each other
Promoting interpersonal communication through collaborative learning and group sharing	Each group of learners can use a wall-mounted 42-in. LCD TV Writing surfaces on all walls extending beyond the normal frontal position	By projecting a shared workspace onto a bigger screen, participants are able to view their work at the same time. This assists in shared knowledge creation This facilitates dialogue among student teachers by allowing them to record alternative views, notes or diagrams on the writing surfaces. These ideas can be captured by taking a photograph with a mobile device and used for future reference
Promoting ICT use by student teachers	Wireless Internet access Each table is equipped with multiple power points to enable students to recharge their laptops	The wireless Internet connection allows students to access the Learning Management System (LMS) or other online platforms and resources. For example, they may access their course materials, upload documents to the online repository and discuss in online forums As each tutorial session may last two to three hours, it is necessary to provide a power supply
Providing a conducive environment for learning	Colourful environment to promote learning with matching furniture and wall colours. Overall, eight colour schemes were used. To reduce cost, old furniture was recycled with new fittings	The various colour schemes give the rooms' character. The rooms are inviting and vibrant, and the intention was to encourage a sense of exploration and play

14.2.1 Library Space

To accommodate the learning experiences of the student teachers in NIE, the focus in the library redesign initiative was to transform the library building into flexible learning spaces, including an interactive learning environment, that meet the needs of twenty-first-century users. One of the objectives of the redesign was to cater to the student teachers' needs of accessing information anytime, anywhere with ease and using technology as an information tool together with print materials in the library. In the year 2011, with the TE²¹ Model (for more details, see Chap. 1) as a guide, measures were put in place to transform the "library place" into "library space". This transformation aimed at making the NIE library and its resources more accessible to faculty and students, as a space, wherever and whenever they wanted. It was envisioned to be an intangible space, a blend of both the physical and the virtual environments, available to members at their fingertips. It is to serve as a one-stop virtual library that extends beyond the physical library walls into the user space. These spaces are supported by the latest trends in ICT and pedagogy and are designed to meet the user-specific needs such as collaborative learning, independent research, archives, showcases and galleries, to name a few. The Learning Pods, Learning Hub Lounge, Research Commons and SMART Room with a sound proof environment that supports state-of-the-art audiovisual and projection systems are some of the excellent innovations within the library to facilitate collaboration, group work, creativity and interpersonal communicative skills.

An additional transformation within the NIE library is the introduction of Makerspace which is defined as a community centre with tools. This is a new collaboration between NIE library and NIE's Translation and Development Unit (TDU). The aim of the Makerspace is to provide an avenue to encourage our NIE community to:

- embrace the spirit of experimentation, innovation and creativity, and
- learn how emerging technologies can bring their creations to life.

The Makerspace is equipped with a state-of-the-art 3D printer that allows users to perform rapid prototyping of their design ideas and projects. Besides the ability to print professional quality 3D artefacts, the 3D printer is also environmentally friendly as the filament used for printing 3D objects is a form of renewable bioplastic (polylactic acid or PLA) derived from plants. This innovative effort emphasises the ability of ICT to be used as a visualisation and cognitive tool to improve learners' creativity and higher order thinking.

To further enhance the learning experience of the learners and to provide opportunities to develop relevant twenty-first-century competencies, NIE expanded the integration of digital technology in pedagogy in the form of virtual classroom environment. The use of technology as a virtual platform enables the institution to meet the need of new knowledge creation among the learners and equip them to develop the competencies to be successful in the rapidly changing economic and technological environments.

Some notable ways in which the technology supported the pedagogy in NIE to achieve effective learning outcomes and encourage enhanced learning experiences can be seen in the following endeavours. Digital technologies act as a driver that exerts the pressure for change by demanding new set of skills and also provide opportunities for transforming pedagogy. Technologies are viewed as the enablers that can be adapted in the education for enhancing effective learning. This transformation requires new forms of teacher education and professional development (Garrison and Anderson 2003). Realising the potential of ICT as an enabler in education, NIE, the sole teacher education institute in Singapore, together with the Ministry of Education (MOE), undertook the journey of developing ICT competencies of teachers during initial teacher preparation programmes and professional development of teachers. The key focus of NIE has been the pedagogical dimension of ICT use. NIE needed to and continues to develop ICT pedagogical skills and knowledge for student teachers and at the same time reflect on and improve the pedagogical practices with the use of ICT (Divaharan et al. 2011).

14.3 History of ICT in Singapore and Role of NIE

Reflecting on NIE's journey of use of ICT, three significant milestones are of notable mention. The first milestone (2000–2003) focused on the development of technological skills (Galagan 1999; Rogers 2000). NIE developed ICT course in the early 2000 and focused on developing ICT competencies in teachers to enable them to develop into competent designers of ICT integrated lessons. A Learning Management System (LMS) was used as a medium to communicate and deliver course materials to student teachers. The student teachers were expected to demonstrate their competencies through the design of computer-based lesson (CBL) as part of their assignment.

The second milestone (2004–2009) was focused on designing technology-integrated lessons. During this period, the prevalent ICT teaching approaches were focused on learner at the centre of all activities designed. The course adopted the attributes of meaningful learning which included active learning, constructive, reflective, cooperative, collaborative, authentic and intentional learning (Jonassen et al. 2008). LMS continued to be used as a medium to communicate and deliver course materials to student teachers.

The third milestone (2010–current) focuses on leveraging the affordances of technology tools for knowledge creation. Research has shown that the learning opportunities involving co-construction and deep engagement by learners pay enormous dividends in terms of improved learning outcomes. It is, thus, important to instil independent lifelong learning skills in student teachers to improve learning outcomes. The main goal is to foster in learners the competencies of self-directed learning (Tan et al. 2011) and collaborative learning (Chai et al. 2011) through the effective use of ICT. Concurrently, the plan aims to develop learners to be discerning and responsible ICT users. Among the enablers is the capacity for the

teachers to plan and deliver ICT-enriched learning experiences for students to become self-directed and collaborative learners, as well as to become discerning and responsible users of ICT (MOE 2011).

These approaches can promote self-directed learning among students and encourage faculty to move away from the traditional direct teaching approach. However, to adopt these approaches, the institution must support faculty by encouraging the use of ICT as an enabler to meet pedagogical objectives. In NIE, the V³SK Model (for more details, see Chap. 4) requires teacher education to go beyond the acquisition of knowledge and skills. The model emphasises the beliefs and values of being a teacher. NIE aims to develop the twenty-first-century competencies in their teachers and develop the passion for lifelong learning in the teachers. To achieve this goal, NIE underwent a review of its teacher education programme and developed the TE²¹ Model and curriculum (NIE 2009). One component of the TE21 initiative was to have an extended pedagogical repertoire so that student teachers were exposed to approaches that promote twenty-first-century competencies. Several enablers were implemented as part of TE²¹, and these included changing the physical environment of NIE's classrooms, introducing the virtual environment to provide continuous and anytime and anywhere learning experience and promoting blended learning, encouraging ground-up initiatives such as Flipped Classroom and mobile learning.

14.4 Flipped Classrooms

The Flipped Classroom challenges the conventional order of teaching and learning as the objective of flipped teaching is to ensure that curriculum time can be effectively utilised to actively engage students in learning rather than focusing on didactic teaching. Flipped teaching entails the change of mindsets rather than simply relying on the technology alone. It entails a change in mindset about the curriculum—what constitutes a “lesson”, what students and teachers do during out-of-classroom time and in face-to-face meetings, what content is to be taught and learnt, what is the sequence of learning activities, what is the scope of a lesson, what are the appropriate pedagogies to deliver the content and what are some learning strategies students can use. In other words, flipped teaching does not refer to a set of teaching strategies but a curricular platform embodying a broader set of curricular considerations aimed at increasing student active participation in their education (Teo et al. 2014).

The Flipped Classroom provides teachers with greater flexibility over classroom time as students have the time to engage in lesson content at a deeper level. This is, at times, achieved by having student teachers use technology to complete rudimentary study of basic concepts (i.e. through online lectures) ahead of time, so that they will be ready for deeper learning during the class. Hence, the fundamental difference in the traditional and flipped teaching models is in terms of the epistemological beliefs about students, teachers and learning.

Strayer (2012) defined flipped teaching as a specific type of blended-learning design that uses technology to move lectures outside the classroom and uses learning activities to move practice with concepts inside the classroom. More commonly, flipped teaching is frequently defined as a strategy with the purpose of reallocating students' learning time to provide extended curricular platforms for non-teacher-directed learning to take place outside the classroom. Some NIE Academic Groups who have adopted the Flipped Classroom approach are the Learning Sciences and Technologies (LST) Academic Group (AG) and Natural Sciences and Science Education (NSSE) Academic Group. In the LST AG, a segment of the core module, ICT for meaningful learning, has been designed to enable student teachers to learn the essential core concepts and associated technological tools at beyond class time. When they return to class, student teachers are required to work in their teams to apply what they have learnt to the design of a lesson. In-class sessions are focused on discussions, clarification of ideas, idea generation as a team and designing of lessons. The tutors' role changes to that of a facilitator who stretches the potential of the various teams in applying what they have learnt. The NSSE AG also uses flipped teaching for making the laboratory experiences meaningful to the student teachers. Prior to the class, the laboratory content videos are released to the students via the NIE mVideo app. Students are required to watch them and ponder on the questions pertaining to the laboratory experiment. This is followed by some pre-laboratory discussions to provide opportunities for clarification and for deeper learning. The student teachers then proceed to the laboratory session. During the session, there will be no further briefing and they commence the laboratory practical. The tutor observes the student teachers in the laboratory closely and highlights their errors so they may address it immediately. This approach does not inhibit student teachers' learning. Rather, it helps facilitate their continued learning despite a flipped learning approach.

14.4.1 Blended Learning in Collaborative Classrooms

Professional development sessions for faculty members on the use of Collaborative Classrooms have been organised by the Centre for e-Learning (CeL), a subunit of the Office of Teacher Education (OTE) at NIE. Examples of such sessions include the semestral Blended Learning in Collaborative Classrooms (BLCC) series and faculty sharing sessions, as well as ad hoc road shows and demonstrations in the Collaborative Classrooms to AGs. The BLCC sessions include instructional strategies such as station-based learning, jigsaw methods and gallery walks with QR codes. Faculty members who had used the Collaborative Classrooms were encouraged to share their experiences and strategies, while technical staff demonstrated the affordances of the new environment.

One approach to changing faculty mindsets was to highlight the fact that student teachers were no longer facing the front and were instead facing each other. Student teachers could also be multitasking as they had access to the Internet via Wifi for

their laptops or mobile devices. In such sessions, faculty members were encouraged to rethink the design of their tutorials and how they should be engaging and managing such new age learners and taking advantage of the student teachers' ability to multitask.

14.4.2 Introduction of Mobile Applications to Enhance Learning Experiences

People increasingly rely on their mobile devices to access digital information in the workplace, in commerce, during leisure activities or at home. Revolution in the technological arena has led to significant improvements in the efficiency of school administrative processes such as scheduling classes, managing budgets, tracking students and monitoring security, which have all been automated and immeasurably strengthened—though there is often more to be done. Even if technology has not yet dramatically changed the day-to-day practice of teaching and learning, it has certainly facilitated improved practices by bringing better teachers to more students, creating virtual communities of teachers and learners and providing real-time assessment. The ease of accessibility and widespread use of smartphone has made it possible to leverage technology to expand the learning experiences of the learners (Yoo 2008). NIE has adapted these technological advances for the advantage of strengthening the pedagogical approaches and developing the passion of lifelong learning in students. NIE developed and launched various mobile applications to extend students learning beyond the classroom walls. Parallel to the development of Collaborative Classrooms in NIE, CeL launched a mobile learning initiative by collaborating with innovative faculty members to create Web and mobile apps. One such application is mGeo application for Geography students.

14.4.3 NIE mGeo

NIE mGeo was officially launched in February 2012. NIE mGeo is an app that promotes location-aware learning. Users can save geographical location information, data, photographs, and videos onto a map that can be shared with others. This application can be assessed anytime and anywhere, and does not need Internet connection all the time (Chatterjea 2012).

The student teachers can take pictures during the field experience from their phone without Internet connection, and after the field experience, they can go to the place where they can access the Internet and connect to the server to upload and tag the data for the collaboration and sharing of the data. The reason why mobile phones are used instead of pens and paper because of the ease of creating and

sharing of the data and the application, and its data can be used both at NIE, schools or anywhere where the synchronous data needs to be validated.

It can be summarised that the use of the application made the following tasks possible:

1. Collaborative data set development and data sharing;
2. Exposure to authentic field conditions and field analysis within the available limited curriculum time;
3. Collection of only a small set of data in the short given time, yet the ability to access a large data set developed by others, during data analysis; and
4. Data representation on maps for a visual understanding of the given issues.

Thus, NIE mGeo not only facilitated field data recording, but also allowed the use of the collective data sets to be tabulated and mapped to perform analysis of findings during the post-field session. The NIE mGeo app has been used widely by Geography student teachers. The appeal of the app has spread to schools who have been actively using the app with their Geography students.

14.4.4 Well Said

The Well Said application has been developed for learning Standard English Pronunciations produced by a local model. The features of this app are as follows:

- Play and hear each symbol of the International Phonetic Alphabet.
- Videos and animation of speech organ movements for correct pronunciation.
- Enable front camera view other users and comment on the pronunciation of words and sentences.

This application is a diagnostic tool, which can be used to provide feedback that is essential for spoken language teaching. The most influential factor that motivates students to continue using and improving their craft is the ability to share their voice recordings in social media networks and to receive feedback from peers and tutors. The app has been used by NIE's English Language and Literature AG in some of their modules.

14.4.5 iRespond ED

iRespondED is a customised Web application that is a mobile-friendly extension to blackboard. It is a better alternative to clickers as learners can use the mobile devices they already own instead of a separate single-use device. iRespondED facilitates instructor–student interaction before and during a class. It has two main

features, iAsk and iVote. iRespondED was collaborative project by CeL and NIE's Computer Service Centre (CSC). The key features are as follows:

- iAsk allows learners to post questions on a bulletin board;
- iVote allows instructors to set up poll questions (multiple-choice questions, true/false and yes/no) to collect responses from learners;
- Poll results are updated real time and presented visually in charts;
- Guest access for polls and posts; and
- Every poll generates a unique shortened URL (using bit.ly) and QR code for quick access; and
- All responses and results are captured in the history section so that users can search the records based on date and poll type.

The iRespondEd has been used widely in didactic and lecture-style teaching approaches by faculty members and their students. It has helped to facilitate interactive learning in mass lectures and to encourage student teacher participation in a lecture-style setting.

14.5 Transformation in the Learning Modes in NIE

The Collaborative Classrooms and the changes in pedagogy that are nurtured within them are recognition of the importance of teacher educators modelling twenty-first-century teaching competencies. They also illustrate a strategic move to leverage opportunities for informal learning.

The Learning in Informal and Formal Environments (LIFE) Center (2005) revealed that over a modern lifespan, a person learns about 20% of the time from formal environments and 80% of the time from informal ones. This is sometimes referred to as the 20:80 rule (Stevens et al. 2005).

The colourful Collaborative Classrooms provide an air of informality that promotes more open, social and arguably more natural forms of learning. These technology-enabled rooms further enhance the effective learning that takes place in these classrooms. The mobile and flipped learning strategies extend the classroom to the personal and social spaces of learners and provide opportunities for more authentic and meaningful learning.

Collectively, these strategies fade the walls of classrooms so that learners no longer rely on one faculty member as a source of knowledge and experience. They can learn beyond those walls or reach through them to connect with other more knowledgeable sources and the plethora of resources online.

The availability of a repertoire of tools, changes in the physical learning environment and changes in the approach of the faculty have impacted the way student teachers function. They are active learners who discuss and post their ideas. The use of the collaborative seating arrangement has encouraged peer sharing and peer learning. Tutorials are now less didactic and more interactive with tutors becoming

facilitators of learning. Tutorials are now more “noisy” with productive discussions taking place, active interactions between tutors and student teachers as well as among student teachers. The use of technology in a face-to-face tutorial has become seamless.

As student teachers do this in NIE, faculty members gradually learn to adapt and to teach less in the traditional sense and facilitate learning in a way that connects with their learners. The NIE faculty, thus, models strategies for student teacher to emulate downstream in Singapore classrooms.

14.5.1 Looking to the Future

Spaces are themselves agents for change. Changed spaces will change practice (JISC 2004). Space—whether physical or virtual—can have an impact on learning (Oblinger 2006). It can bring people together; it can encourage exploration, collaboration and discussion. The learning space design, according to Oblinger (2006), is very much guided by three facets: changes in the students, information technology and our understanding of learning. These facets are what caused the most pedagogical changes and, in order for teachers to take advantage of these changes, teaching spaces must be able to utilise new technologies and have classrooms that are flexible enough to accommodate different teaching styles.

The classroom of the future is a space, both physical and pedagogical, in flux. The physical spaces which make up the classroom, the educational technologies we use, and the teaching pedagogy we subscribe to are not static. As educators, it is critical for use to continue learning about what the classroom of the future will look like.

Aspden and Helm (2004) asserted that an appropriate blended-learning environment, combining virtual learning with new kinds of physical space, can restore the human moment in the education process (Bleed 2001). Strong relationships built on contact and connection between students and the various elements of their learning experience are an important part of the education process. While access to information is an important part of learning, intellectual development is largely achieved through active engagement and interaction with others (Garrison and Anderson 2003; Palloff and Pratt 1999). Chickering and Gamson’s (1987) “Seven principles for good practice in undergraduate education” highlight the importance of encouraging contact and cooperation between staff and students, principles that are as important in the online as well as the on-campus environment.

14.6 Conclusion

NIE aspires to ensure that spaces within it are responsive to the learning paradigm, with the nuances of function, flexibility and aesthetics necessary to bring the built environment and the educational environment into a harmonious relationship. It is

incumbent to continue to scan the horizon for future trends (Oblinger 2006) that could impact the education enterprise in ensuring that it remains a strong, resilient and vibrant teacher education institute for future generations.

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Chapter 15

Teacher Learning and Development Across the Continuum: Pre-service to In-Service

Pak Tee Ng and Ee-Ling Low

15.1 Introduction

Educational reform movements around the world are setting ambitious goals for student learning, and major developments in classroom practices largely rely on teachers who need support and guidance (Ball and Cohen 1999; Fullan and Miles 1992). If schools are to produce more powerful learning for students, more powerful learning opportunities must be offered to teachers (Feiman-Nemser 2001). Unless teachers have access to serious and sustained learning opportunities at every stage of their career, they will be unlikely to teach in ways that meet the demanding new standards for student learning or participate in the solution of educational problems (Ball and Cohen 1999). This realisation has led educational scholars and policymakers to demand professional development opportunities for teachers—opportunities that will help them enhance their knowledge and develop new instructional practices (Borko 2009). Furthermore, there is a growing understanding that in order to achieve the professionalisation of the workforce that is desired, teacher learning should be structured over the phases of a career-long continuum (Day and Saunders 2006; Day and Gu 2010; OECD 2005; Schleicher 2012). Timperley et al. (2007) argued that teaching is a complex and theoretically informed activity and so we have to recognise this in the continuum of teacher education.

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The idea of teacher education as a continuum and the focus on career-long teacher education has now become one of the key policy (Barber and Mourshed 2007; Mourshed et al. 2010). The contemporary policy interest in the continuum of teacher education is based on an assumption that the formulation of policy and the design of teacher preparation and continuing professional development optimally takes into account the whole spectrum of teacher learning, that is teachers' opportunities to learn from their own prior schooling and throughout their own teaching careers (Schwille and Dembele 2007, p. 29).

In 2011, the Teaching Council Ireland (2011) published its *Policy on the Continuum of Teacher Education* in which it defined the continuum as "the formal and informal educational and developmental activities in which teachers engage, as lifelong learners, during their teaching career. It encompasses initial teacher education, induction, early and continuing professional development (CPD) and, indeed, late career support" (p. 5).

Teacher learning "is usefully understood as a process of increasing participation in the practice of teaching, and through this participation, a process of becoming knowledgeable in and about teaching" (Adler 2000, p. 37). Learning occurs inside classrooms, school communities, conversations with colleagues and professional development courses or workshops (Borko 2009). Hargreaves (2003) argued that teachers in a knowledge society need opportunities to become knowledgeable, inquiry-oriented professionals attentive to problems of practice and resourceful in identifying means of gathering appropriate evidence in order to foster a culture of knowledge generation and sharing in schools.

Reshaping teacher education and teachers' professional learning to reflect and provide for teachers' career-long development can also promote and foster accomplishment. In this construction, developing accomplishment occurs as the practitioner progresses in teaching and is a process that must start early and sustained over a teacher's career and that reflects depth and quality in practice rather than simply the accumulation of experience (McMahon et al. 2013). For Feiman-Nemser (2001), the specifics of teaching and learning in professional development provide grounding for inquiry-oriented conversation and classroom experimentation. Opportunities for teacher learning are situated in the tasks of teaching—enacting instruction, assessing student understanding, reflecting on teaching—and in samples of student work.

Modern views of professional development characterise professional learning not as a short-term intervention, but as a long-term process extending from pre-service education at university to in-service professional development in schools (Ball and Cohen 1999; Feiman-Nemser 2001; Putnam and Borko 2000). Professional development refers to the actual learning opportunities which teachers engage in. It calls for ongoing study and problem-solving among teachers in the service of dual agenda—promoting more powerful student learning and transforming schools (Lieberman 1995). In order to teach in new and challenging ways,

teachers need to rethink their pedagogy, their conception of subject matter and their role in curriculum development (Feiman-Nemser 2001). Similarly, Shulman (1986) stressed the value of pedagogical content knowledge in most of his scholarly work.

The next sections will highlight some of the professional development programmes offered to Singapore teachers, from pre-service to in-service.

15.2 The Student Teacher's Learning Journey at NIE

The entry of a student teacher into NIE marks the start of a journey of teacher education and development that continues throughout the rest of the individual's career. NIE's programmes are designed to better link theory and practice as well as to develop the individual into an effective and mindful educator. The following sections give a better understanding of how NIE benefits the education system.

15.2.1 Philosophy of Pre-service Education

The underpinning philosophy of teacher education at NIE is the belief that teaching is a calling and that good teachers are called to groom future generations of Singaporeans through a unity of purpose in their personal aspirations, beliefs and competencies (Tan et al. 2012). It is the belief that teachers should be the people with the vision and passion to mould future generations and not just in academic achievements. Teachers are also expected to inculcate in their students a sense of responsibility to the community and environment, and a love for learning and knowledge across disciplines. To do this, teachers themselves need to develop their professional competencies and practices through their own creative learning processes. With this in mind, NIE developed its Teacher Education Model for the twenty-first century (TE²¹; see Chap. 1 for details), which is firmly anchored in values (Lee and Low 2014). The TE²¹ model is intended to enhance key elements of teacher education in areas such as curriculum, desired outcomes for teachers and academic pathways. Ultimately, the strength of NIE's teacher preparation programmes lies in the strong integration between content and pedagogical preparation, whose design is backed by evidence-based research.

15.2.2 Key Components of the Pre-service Programme

The initial teacher preparation programmes offered at NIE include undergraduate and diploma programmes, as well as postgraduate diploma in education programmes. In addition, NIE goes into teacher education with the philosophy that

values can be caught and taught (Lee and Low 2014). Both the formal curriculum and experiential learning platforms such as service learning through the Group Endeavours in Service Learning (GESL; see Chap. 13 for details) are avenues where values can be taught.

Changes in pedagogy and assessment have also been made at NIE to develop thinking teachers who are effective instructors and facilitators of learning. In terms of pedagogy, ownership of learning was intentionally transferred from the teacher to the learner. For instance, real-life, school-based scenarios are sometimes used in discussions, and student teachers are asked to consider the solutions for the different scenarios. The student teachers become the active problem-solvers while the lecturers act as the mediating coaches. The curriculum also includes practical problem-based scenarios of classroom cases and challenges to ensure that student teachers get a realistic feel of the realities in the schools.

15.2.3 Fostering Closer Theory–Practice Linkages

To pre-empt issues that might arise when the realities of teaching in the classroom are vastly different from the general knowledge and skills lecturers impart to student teachers, NIE works to foster closer linkages between theory and practice. Teaching in today's times is a complex activity and teachers need more than the abstract, conceptual theories teacher educators tend to impart in the classroom. Practical preparation becomes increasingly important today (Tan et al. 2012). At NIE, theory and practice come together when student teachers are taught to reflect on their own action and experiences, and to document and articulate their own learning and growth. There is a strong emphasis on inquiry-based and experiential learning (Tan et al. 2012), and NIE works closely with MOE and the schools to provide student teachers with the necessary teaching experiences. The strong tripartite partnership gives student teachers the opportunity for school-based practicum postings that allow them to translate theoretical knowledge in teaching and learning to practical application in the classroom.

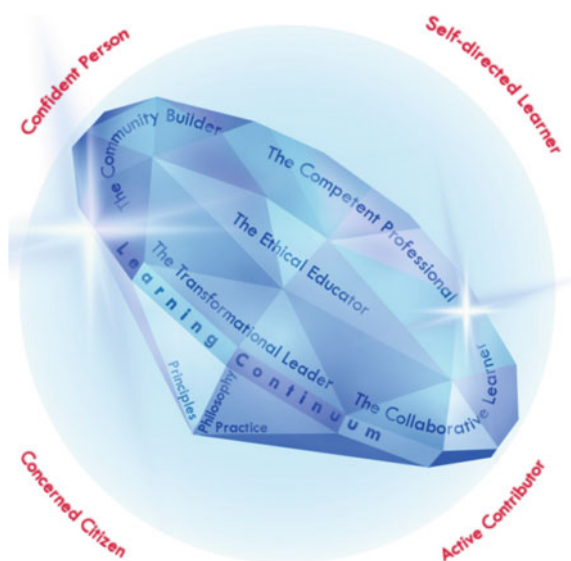
This theory–practice linkage is further enhanced through a series of innovative approaches such as a mentorship model for the practicum, use of real-life case methods for discussions, and use of authentic assessment such as the portfolio evaluation (NIE 2014e). For instance, for pre-service teachers, practicum preparation has been expanded in scope, and schools are more engaged in supporting these student teachers. The practicum component focuses on the development of the student teachers as practitioners, incorporating aspects such as conversations with teacher mentors and reflections with supervisors. Courses and practicum experiences include problem-based learning projects, and authentic assessments. This mentorship model is again further expanded when the student teachers enter the workforce as beginning teachers (see Sect. 15.3.2 Support for Beginning Teachers for details).

15.3 Teacher Professional Development

15.3.1 Teacher Growth Model

The Teacher Growth Model (TGM) was crafted as a professional development model that is used to encourage teachers to pursue continual learning and growth throughout their career as teachers (MOE 2012). It allows teachers to take ownership of their own learning and development. They can plan their own learning that is relevant to their own knowledge and skills, and to meet their own learning needs. The TGM Learning Continuum is organised according to five teacher outcomes: the ethical educator; the competent professional, the collaborative learner, the transformational leader, and the community builder (MOE 2012). Under each teacher outcome are the skills and competencies required for growth and development so that teachers can achieve the all five outcomes. Learning and development occurs in a variety of modes, such as courses, mentoring, e-learning, learning journeys, reflective practice and research-based practice. It is interesting to note that five teacher outcomes are encased in the same four citizen characteristics desired for students in the twenty-first century Competencies and Student Outcomes framework (MOE 2016). The TGM provides the basic model for a teacher's career, and its development from the twenty-first century Competencies and Student Outcomes framework ensures its alignment with all other models and frameworks used by MOE and NIE (Fig. 15.1).

Fig. 15.1 Teacher growth model (MOE 2012). *Source* Ministry of Education, Singapore (2016)



15.3.2 Support for Beginning Teachers

Once the student teachers complete their pre-service education and leave NIE, they are considered equipped with the basic theories and practical skills to teach. However, this may not necessarily mean that beginning teachers will be effective immediately. To ensure that beginning teachers are able to function effectively in the classroom, they attend the two-year Beginning Teachers' Induction Programme (BTIP) provided by the Academy of Singapore Teachers (AST) designed to induct them into the teaching fraternity and provide them with a support structure for their well-being (AST, n.d.). The BTIP includes school-based mentoring where beginning teachers are mentored and coached by senior teachers in the school they are posted. These are senior teachers with many years of experience who have been prepared by NIE on how to mentor and coach the beginning teachers (MOE 2006; NIE 2012). They are specially selected as Instructional Mentors (IMs) and they undergo professional learning sessions so that they have the necessary knowledge, skills and attributes to serve as mentors to the beginning teachers (AST, n.d.).

As part of the BTIP, beginning teachers also attend further courses in classroom management, counselling, parent relations, reflective practices, and assessments offered by AST (AST, n.d.). At the same time, these beginning teachers are given more time and space to learn on the job, benefit from mentorship, and hone their craft (MOE 2014). In other words, these two years of induction can be seen as an “extended practicum” and how these beginning teachers perform is used to determine their fit and suitability for confirmation in the teaching service. All in all, the early years in the teaching force are both well supported and closely evaluated.

15.3.3 Teacher Professional Growth and Development

All teachers are given the opportunity to pursue professional development throughout their careers. Teachers are entitled to a substantial number of hours of professional development each year (Centre on International Education Benchmarking 2014; Stewart 2010). There is a wide range of courses, conferences, and seminars that teachers can choose to attend. Teachers are given the option to take professional development leave and sabbaticals to upgrade their skills. Teachers are also given stipends every year to spend on professional development that will improve them professionally. Teachers can also take partially funded professional development leave that allow for part-time or full-time study or work in an international school or in a business enterprise so that they can better understand the application of their content knowledge to the real world (Sclafani and Lim 2008).

In schools, during their non-teaching hours, teachers can use the time to work with other teachers to carry out lesson preparations, observe others' teaching, or engage in professional discussions and meetings with colleagues from their school

or their cluster. Teachers are also provided monetary resources under the learning and development scheme to enable them to invest in activities or tools that would aid their professional development.

The *Thinking Schools, Learning Nation* (TSLN) initiative was introduced in 1997 during which Singapore carried out education reforms in its curriculum, assessment, and teaching in order to develop a creative- and critical-thinking culture in schools (Goh 1997). Concurrently, schools have made effort to create an inquiry culture among teachers by getting them to conduct action research on their teaching and to actively revise their teaching strategies in response to what they learn. NIE and MOE both have been preparing teachers to undertake action research projects in the classroom so that they can examine teaching and learning problems, and find solutions that can be disseminated to others. Every school has a group of senior and master teachers who are tasked to lead the coaching and development of the teachers in each school so as to instil in the teachers the concept of school-based learning.

Among Singapore's many investments in teacher professional learning is the Teachers' Network, established in 1998 by MOE as part of the TSLN initiative (MOE 1998). The Teachers' Network has since evolved into the Academy of Singapore Teachers (AST) and was started to spearhead the professional development of Singapore teachers. It would be the home of the teaching profession and help catalyse the building of teacher capacity. Their mission is to build "a teacher-led culture of professional excellence centred on the holistic development of the child" (AST 2014). To achieve this, platforms for teacher leaders to lead in professional learning were created via subject chapters, interest-based networked learning communities, role-based networked learning communities, and professional learning communities. The aim is for the teaching community as a whole to collectively upgrade the professional expertise of fellow teachers. Its programmes include learning circles, teacher-led workshops, conferences, and a well-being programme, as well as a website and publication series for sharing knowledge.

A learning circle comprises a small group of teachers with a facilitator who work together to identify and solve common problems using discussions and action research. Programmes are run by professional development officers to develop the whole school on the key processes of reflection, dialogue, and action research. Typically, a more extended programme is also run to prepare teachers as learning-circle facilitators and mentor facilitators in the field. The role of the facilitator is important in encouraging the teachers to act as co-learners and critical colleagues so that fellow teachers feel safe in sharing their assumptions and personal theories, experimenting with new ideas and practices, and sharing their successes and problems. Through the discussions of the issues and brainstorming of possible solutions, teachers learn to work together in teams, develop a sense of collegiality, and learn to be reflective practitioners. These learning circles also allow teachers to feel that they are producing knowledge and solutions through their research and study.

There are also teacher-led workshops which give teachers the opportunity to share their ideas and work with their colleagues and exchange opinions and constructive criticisms. Each workshop is jointly planned with a professional development officer to ensure that everyone will be a co-learner in the workshop. The

teachers who are sharing first prepare an outline of their workshop; then, the professional development officer helps them to surface their tacit knowledge and assumptions and prepares them in facilitation so that they are able to effectively share and discuss the challenges they face in the classroom. The entire process takes time and effort, but almost all teacher presenters have acknowledged that it leads to them grow professionally.

Professional development in schools is also explicitly designed to enable teachers to implement national curriculum and, in particular, the changes and new emphases on critical and creative thinking and formative assessment. With the changes, teachers have to use a variety of formative assessment modes such as classroom observations, oral communication, written assignments, and practical tasks.

To support teachers in implementing these new initiatives, MOE has produced guidelines and assessment rubrics for use in the classroom as well as provided development avenues for the schools. For example, SAIL (Strategies for Active and Independent Learning) was developed to support more learner-centred project work in classrooms. Additionally, MOE has developed assessment guides for use in primary and lower secondary mathematics, and incorporated resources, tools, and ideas for mathematical investigations, journal writing, self-assessment, and portfolio assessment in the guides.

Besides establishing AST, MOE has also set up a Centre for Teaching and Learning Excellence in a collaboration with NIE and Yusof Ishak Secondary School where teacher professional development is set in an authentic context and pedagogies can be implemented in actual classroom settings (AST, n.d.). MOE has also worked in partnership with NIE to give teachers the opportunity to obtain higher professional certification, such as their postgraduate degrees. Incentive schemes to further their studies are provided to teachers; for instance, teachers who intend to pursue their Masters can apply for a MOE sponsorship under the Enhanced Professional Development Continuum Model (NIE 2014f) and are able to opt for part-time teaching. On NIE's part, it offers a wide range of postgraduate programmes (both master's and doctorate) to cater to the interests and needs to potential students.

An example is the Master of Arts in Educational Management (MAEM) programme (NIE 2014a) which is designed for educational leaders to deepen their theoretical knowledge and achieve a knowledge–practice nexus in the area of educational management. It equips candidates with the necessary knowledge, skills, and capability to lead their organisations effectively at a time of rapid change. Topics covered in the MAEM include key issues in education policy and strategic management as well as theory and practice of teachers' professional learning and organisational learning and development.

A more recent programme is the Master of Arts in Leadership and Educational Change (MALEC) programme (NIE 2014b). Launched in 2012 and jointly taught by NIE and Teachers College, Columbia University, New York, the programme represents an educational innovation achieved by collaboration between two internationally renowned teacher education institutions. Designed for a new generation of educational leaders for Singapore, the Asia–Pacific region and the larger

international community, the programme provides opportunities to build new cross-national learning communities and fraternities that will benefit from both local and global perspectives. International candidates may appreciate the advantage of pursuing a higher degree in an Asian context delivered by two leading educational institutions. Key topics covered in the programme include globalisation, educational change and pedagogical reform; curriculum theory, history, and issues; and curriculum improvement and school improvement. Participants also have to carry out an Integrative Study Project. This is a culminating assignment and serves as a “think” piece with a focus on problem representation and understanding the multifaceted contexts of the problem of inquiry, the development of insights based on observations of practice and reflections from experience.

15.3.4 Teacher Career Development

MOE puts in significant measures to chart the teachers’ career development, with school principals, cluster superintendents, and MOE senior management all paying attention to teachers’ abilities and tapping on those with potential for promotions to higher positions of responsibility and for a variety of leadership roles.

At the MOE headquarters, more leadership and specialist positions will also be created as part of the Ministry’s efforts to expand organisational capabilities and deepen expertise in the education domain. Together, these positions will increase the advancement pathways for teachers and their career development. In conjunction with this, the TEACH framework was developed in 2011 by MOE (2011). It is used by educators for their professional growth and development as they work to deepen their teaching expertise and achieve their career aspirations. The framework comprises educational supports for learning and advancement and opportunities for new roles and flexible job structures.

15.3.5 Career Tracks for Teachers

The performance of teachers is evaluated annually and used to establish the performance bonus, set by the principal for each teacher, as well as to flag out struggling teachers for additional assistance or potential dismissal. A number of successful teachers are also identified through the performance evaluation process for potential promotions. All teachers are given a choice of three career and development tracks in which they can choose from: the teaching track, the leadership track, and the specialist track. When reviewing teachers for promotion or progression along each of the three career tracks, their performance evaluations in the preceding 3 years are taken into consideration. There is also the flexibility of lateral movements across the three career tracks.

As teachers are selected and promoted to more senior positions in one of the three career tracks, they receive MOE-funded courses of study conducted by NIE—sometimes while they are still teaching and other times while taking a sabbatical. Teachers who take on higher levels of responsibility, such as head of department or principal in the leadership track, will eventually be promoted to a higher pay scale that is commensurate with their new roles and responsibilities. Similarly, a teacher in the teaching track has the opportunity to progress to a promotional grade, and pay scale equivalent to that of a school principal if he or she reaches the master teacher level, while a specialist can progress to as high a promotional grade as that of a director on the specialist track.

Advancement Along the Teaching Track

Teachers in the teaching track are groomed to achieve teaching excellence in the classroom. To advance within the teaching track, a teacher must meet accreditation standards for the positions. These standards are assessed through a professional portfolio, which includes the following:

- a personal statement on taking up the higher appointment
- evidence indicating the attainment of each accreditation standard
- supporting data to substantiate the evidence (e.g. lesson plans, and presentations).

The accreditation standards used here build on the evaluation criteria used to evaluate teaching (holistic development of pupils through quality learning, pastoral care and well-being, and co-curricular activities), with progressively broader criteria at each career level. The standards include professional expertise in developing students holistically, collaboration and networking with community and parents, and professional development (MOE 2001).

To equip officers for leadership roles in the teaching track, NIE develops teacher leaders through a suite of three programmes called Teacher Leaders' Programme. Teacher Leaders Programme 1 (TLP1) is a 10-week full-time programme designed for senior teachers; where by the end of the course, participants will resume duties in school and pilot their group research project. After six months, the participants return to NIE to present their project. Teacher Leaders Programme 2 (TLP2) is a 10-week full-time programme designed for lead teachers and includes an overseas learning component. Teacher Leaders Programme 3 (TLP3) is designed for master teachers and more information will be provided when it is launched (NIE 2014c). These programmes aim to build expertise and capability of teacher leaders in areas of teacher leadership, curricula, pedagogical, and innovation. Participants are also challenged to act on real-ground issues through action research and engaging in evidence-directed change.

In 2006, the MOE created in every school, the position of a school staff developer (SSD) whose role was to support school improvement and the professional development of school staff. These SSDs are also provided with professional development of their own, including an induction programme, the Management and

Leadership in Schools (MLS) programme conducted at NIE, a bridging course, learning journeys, and networking sessions.

Advancement Along the Specialist Track

Teachers on the specialist track are developed to be experts in curriculum and instructional design, educational psychology and guidance, educational testing and measurement, and research and statistics. Through the specialist track, MOE aims to develop a strong team of officers with deep knowledge and skills in areas such as curriculum, planning, educational programmes, and educational technology. Support is also given to these specialists so that they may pursue advanced graduate study (such as Masters and doctorate degrees) in said fields. These specialists are also assigned to work in clusters that help guide policy and practice for curriculum and assessment, educational psychology and guidance, and educational research and measurement.

Advancement Along the Leadership Track

Teachers on the leadership track are groomed to take on leadership positions in schools and at MOE headquarters. Schools are expected to identify and groom school leaders as leadership is seen as a key enabler for strong schools. On the leadership track, these potentials progress from teacher to subject head, head of department, vice-principal, and then principal.

To cater to the development of school middle leaders, MLS programme was launched in July 2007. This is a full-time 17-week in-service programme that is anchored on a social constructivist framework where collaborative learning is the centre of knowledge creation (Ng 2008). MLS provides learning opportunities within structured activities and facilitated interactions. A major part of the programme is the curriculum project where groups of participants are tasked to design a realistic and innovative curriculum package for a local school (NIE 2014d).

To cater to the development of school leaders, a six-month full-time Leaders in Education Programme (LEP) was launched in 2001. It receives about 30–40 participants per cohort who are evaluated on their good performance and potential for school leadership after passing a series of situational tests and interviews conducted by MOE. Participants receive full salary during their programme at the NIE, and their fees are fully borne by MOE as well. Participants also have the opportunity to visit other countries and learn about their educational systems and structures.

LEP helps to shape the leadership qualities of school leaders and to prepare them to deal with the complexities of leading educational reform in school. An example of how the LEP helps to develop participants to deal with the complexities of school leadership is found in the Creative Action Project (CAP). CAP is a major undertaking by each LEP participant in an attachment school. In the attachment school, the LEP participants have to envisage what the school will be like in 10–15 years' time, describe the major facets of this future school, and work with the principal and staff members of the school to implement a component of the future school that is currently feasible and desirable. CAP challenges participants to exercise their leadership in strategically and systematically addressing change

management issues in an unfamiliar school with no comforting sense of certainty (Ng 2013). In addition, every participant is mentored by an experienced principal through their LEP journey.

Beyond LEP, school leaders also have opportunities to continue their professional development, including international study programmes and master's and doctoral degrees (CIEB 2014). New principals are further given in-service professional development on governance, human resource, financial, and media management. MOE decides on the placement of principals in schools by matching them to schools according to their strengths and the profile and needs of the school.

15.4 Evaluation of Teacher Professional Development Programmes at NIE

To continue to improve programme quality, MOE conducts regular surveys to gather feedback from teachers. The relevant findings concerning in-service professional development are taken up by both MOE and NIE for continual improvement.

NIE conducts its own evaluation of the pre-service courses and gathers feedback from the beginning teachers on the effectiveness of these courses in teacher preparation. The information is used to make programme improvements. The Office of Strategic Planning and Academic Quality (SPAQ) looks into the academic quality of all of the institution's programmes by gathering evidence-based feedback through student teachers' satisfaction surveys of their learning experiences while at the NIE, graduate preparedness for teaching in schools, and stakeholders' feedback on those graduates' sufficiency of preparation for the requirements of the workplace. The data collected is used to make continual improvements to courses and programmes to meet the needs of the educational sector. The variety of tools used by SPAQ includes the Programme Evaluation Survey, which is conducted with every graduating cohort, the Graduate Preparedness Survey, and the Stakeholder Survey, which are used to assess the quality of teaching and learning at critical points of the teacher development process.

With the extensive data collected through these evaluation tools, adjustments and improvements can be made regularly based on direct feedback received from the teachers and stakeholders. For instance, in a recent Graduate Preparedness Survey of beginning teachers with about 2 years of teaching experience, the majority of them listed "mentoring" as the most useful source of support for them as they started their teaching career. This is a good indication that the STEM programme has been effective in integrating beginning teachers into the school. This feedback provides MOE with the impetus to continue to strengthen and grow the STEM programme.

However, the current evaluation tools still take a piecemeal approach towards evaluation as the tools are administered separately and the findings reported independently. NIE is in the process of moving towards a more holistic evaluation process that can integrate all existing evaluation tools to provide a more complete picture of the performance of its teacher training programmes and the readiness of its graduates for teaching.

15.5 Conclusion

This chapter shows the professional development of Singapore's teaching workforce from pre-service to in-service. MOE, NIE, and schools are committed to helping teachers flourish whether they are either on the teaching, leading, or specialist tracks. It is a development that supported by the close and unique tripartite partnership of MOE, NIE, and schools. Underpinned by various frameworks at each stage of their career life cycle, teachers are well guided, well developed, and well suited to the demands and needs of the education system.

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Chapter 16

Quality Assurance in Teacher Education in Singapore

Maureen Frances Neihart and Lee Ling

16.1 Literature Review

Promoting teacher quality is fundamental to improving student achievement; therefore, managing quality in teacher education programmes has become critical to improving student outcomes (Chong and Ho 2009; Cochran-Smith 2000; Darling-Hammond 2000, 2006; OECD 2005). Meeting the demand for high-quality teachers means ensuring quality in teacher education. There is now robust evidence to demonstrate that quality in teacher preparation directly impacts the quality of student outcomes (Darling-Hammond et al. 2010; Darling-Hammond et al. 2013). As a result, there is a growing interest in methods to assess and improve quality in teacher education.

It is clear that evaluations of teacher education programmes should be well conceptualised and incorporate multiple sources of data, including authentic performance assessments (Darling-Hammond 2006; Harris and Sass 2011; Pechione and Chung 2006). Typical procedures include the collection of perceptual data from student teachers and their supervisors regarding their competencies and attitudes both during teacher education and after they have begun practice, as well as objective data from student assessments during teacher education courses, on practicum, and on licensing examinations (Cochran-Smith 2000; Darling-Hammond 2006; Hudson et al. 2011; OECD 2005). For example, in the USA, the federal Higher Education Act requires that schools of education be

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evaluated on the basis of their graduates' performance on state licensing tests, and internationally, most accrediting bodies now require institutions to provide evidence of student outcomes on each of their accrediting standards (Darling-Hammond 2006).

Harris and Sass (2011) reported evidence on the effects of preservice teacher education on teacher productivity in Florida where data is available that makes it possible to link student achievement with the classroom teacher and his or her preservice education. They concluded, "There is no evidence that either pre-service (undergraduate) preparation or the scholastic aptitude of teachers influences their ability to increase student achievement" (p. 1).

Harris and Sass (2011) attempted in their large-scale evaluation to address two common shortcomings of evaluations of teaching quality and effectiveness (Aaronson et al. 2007; Betts et al. 2003). The first shortcoming is the use of gross measures like content specialisation or teacher education programme rather than specific modules, and the second is the lack of control for the pre-education ability level of the student teachers. Relying on broad measures like assigned programmes or content focus means that admission criteria for the programme could be determinative of outcomes rather than the teacher education experience itself. Similarly, without controls for the pre-admission ability level of student teachers, it is difficult to know the contribution that ability makes to teacher education outcomes.

Harris and Sass (2011) estimated the effects of precollege ability (using college examination scores) on a sample of about a million math and reading students in grades K–12 and their teachers in Florida. Their analysis revealed "little or no evidence of the efficacy of advanced degrees for teachers" (p. 30). They recommended that teacher education programmes might strengthen the positive impact of teachers on student achievement "by placing somewhat greater emphasis on content knowledge, including that which is pedagogically oriented" (p. 29). They further found that teachers' college entrance examination scores were not associated with teachers' productivity as measured by student achievement scores.

During the past decade, progress has been made specifically on the development of standards-based performance assessment systems that can be used to evaluate teacher education programmes' effectiveness in preparing teachers to meet standards for professional practice. In the USA, California and Connecticut are two states that have successfully implemented such a system for teacher credentialing (Pecheone and Chung 2006).

In California, a consortium of 15 universities developed a validated authentic assessment (TPA) to measure student teachers' competencies against professional standards of practice (Pecheone and Chung (2006). TPA includes four discrete performance tasks called teaching events (TEs) that use data from multiple sources (e.g. lesson plans, student work samples, video clips, and student reflections) on each of the four aspects of teaching: planning, pedagogy, assessment, and reflection (Pecheone and Chung (2006). Each TE provides evidence from *actual teaching practice* to assess student teachers' abilities to integrate their knowledge and skills in making pedagogical decisions and to promote their reflection on their practice.

In contrast to Harris and Sass' (2011) findings, a longitudinal study of the predictive validity of California's performance assessment (Darling-Hammond et al. 2013) demonstrated that student teachers' scores significantly predicted their later teaching effectiveness as measured by their students' achievement gains in English and mathematics. Subscales of the assessment which contributed to predicting later effectiveness included planning, assessment, and academic language development in English language arts (ELA) and assessment and reflection in mathematics. It was also observed that student teachers perceived they learnt the most from the authentic assessment when they felt well supported by their programme in both learning to teach and completing the assessment process. Hence, while there is mounting evidence that teacher preparation makes a meaningful difference in student outcomes, the challenges to evaluating this impact remain significant.

16.2 Background on Quality Management at the National Institute of Education

The National Institute of Education (NIE) was established in 1991 to raise the academic levels of teachers and provide more education research and a broader range of postgraduate programmes. Teacher education at NIE responds in tandem with the constantly changing national and global landscapes. For example, as the country matured from a developing nation to a developed one in the 1980s, the education system shifted from an efficiency focus to an ability focus, "to develop knowledge workers who are able to cope intelligently with the complexities of the new century" (Gopinathan 2010, p. 130). This shift radically altered expectations for Singapore teachers. The decision to move towards learning environments is characterised by flexibility, innovation, and creativity called for stronger local research processes to provide robust data that could inform not only policy and practice, but also teacher education and development (Chong and Low 2010; Gopinathan 2010).

The Office of Academic Quality Management (OAQM) was established at NIE in 2009 to "provide evidence that NIE's programmes and procedures are accountable, effective, and add value in a way that is relevant to meeting current and future needs" (Chong and Low 2010, p. 144). Its goal is to build a culture of continual self-improvement and professional self-accountability for academic excellence at NIE. OAQM is an internal, independent office that gathers evidence about the impact or effectiveness of NIE's programmes, courses, and processes. It relies on a variety of evaluation methodologies to ensure that the data collected is of good quality and that it is reported in a manner that increases the likelihood that programme leaders and management will use it to improve effectiveness. NIE is able to conduct large-scale analyses of data on initial teacher preparation in Singapore because it is the sole teacher education institute in a country of more than

5 million people. OAQM has since been reorganised as the Office of Strategic Planning and Academic Quality (SPAQ) and retains its initial intent while adding the important portfolio of strategic planning with an evidence base to support this work.

The tripartite relationship between local schools, the Ministry of Education (MOE), and NIE offers unique challenges and advantages for quality assurance practices in teacher education in Singapore (for more detail, see Chaps. 1 and 2). A key advantage is also the key challenge: achieving a rapid, aligned response. There is a demand for relentless self-improvement. As a small nation with no natural resources, Singapore is reliant on its human capital to meet the transformative challenges characteristic of knowledge-based economies (Dimmock and Goh 2012). As change takes place rapidly in schools in order to equip citizens with twenty-first-century skills, there is a concurrent need for teacher education to respond with a research-based approach. Achieving well-coordinated, research-based reforms rapidly requires close interactions between schools, MOE, and NIE. It also demands highly efficient mobilisation of resources to evaluate the impact, quality, and effectiveness of teacher education programmes and teachers. Rapid responsiveness and adaptability are required to match the pace of curricular and structural changes in teacher preparation programmes.

As a result, unlike many other developed countries, there is a strong coordination in Singapore among the different elements of teacher preparation and development (Hudson et al. 2010). The influence of change flows in multiple directions, necessitating nimble responses in all directions. NIE works closely with MOE to prepare educators along two stages of development: their initial preparation and their ongoing professional development. Each level has multiple stages. For example, newly enrolled student teachers move through three stages, from *emerging awareness* of essential foundations for teaching to a *developing capacity* to apply what they have learnt to finally *actualising their learning* into professional practice during their first three years of teaching. Experienced teachers, in contrast, move through three different stages from first reflecting and refining their practice, to impacting professional practice in their schools and, finally, to self-analysis of their capacity to impact educational outcomes (Chong and Ho 2009). Our aim at NIE is to evaluate academic quality at each of these stages.

16.2.1 Quality Assurance Framework at NIE

The framework for quality assurance at NIE emerged from a 2005 review of its initial teacher preparation programmes (Chong and Ho 2009). The overarching framework addresses the essential components of the programmes, from admission quality of applicants and programme delivery to pedagogical content and skills. Stufflebeam's CIPP model was selected as the framework to systematically guide NIE's quality assurance processes (Stufflebeam and Shinkfield 2007). Figure 16.1 illustrates how this model is applied at NIE.

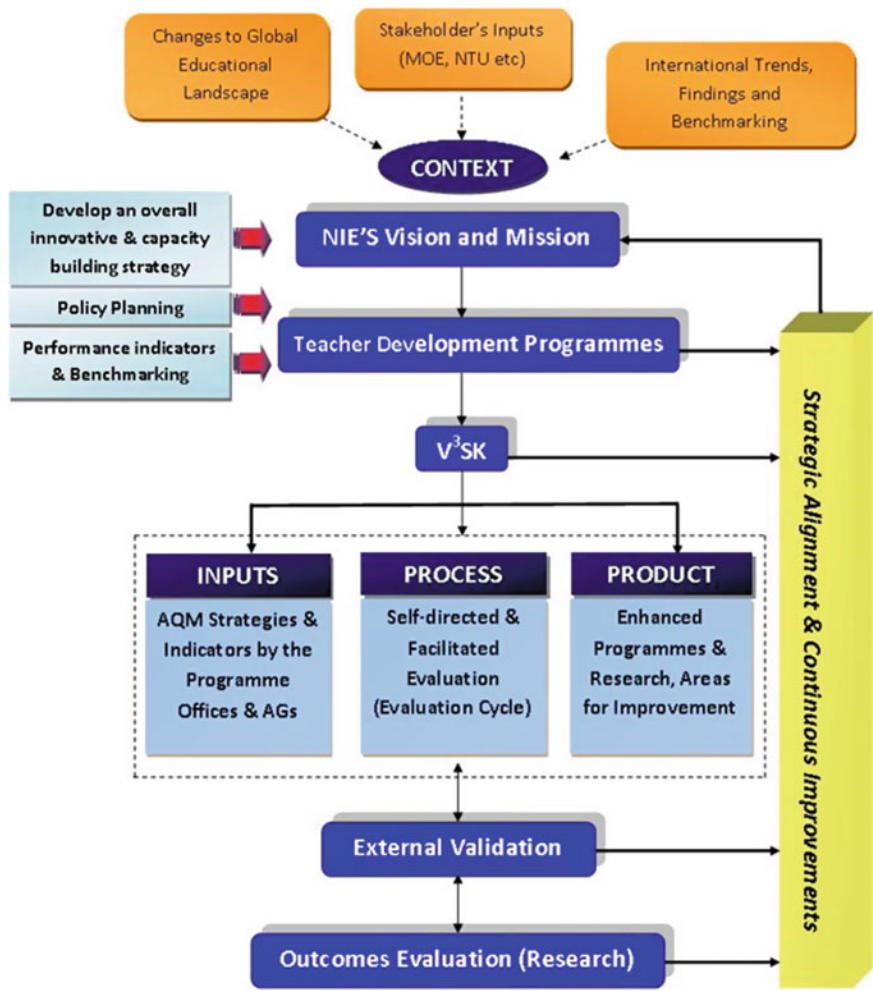


Fig. 16.1 Quality management framework

The model addresses four components: context, inputs, processes, and products. At NIE, inputs come from both the programme offices and the academic groups (i.e. academic departments) because together they are responsible for the content, structure, and delivery of specific programmes. One example of *inputs* is the admissions data that is collected and analysed to determine enrolment trends and the profiles of our student teachers and to make comparisons across programmes and cohorts. Our *processes* are the procedures used to evaluate the quality of our programmes. These include academic group audits, surveys of students, graduates, stakeholders, and faculty, semi-structured and focus group interviews, and quantitative analyses of various kinds of admissions, graduation, and alumni data. We

determine evaluation procedures according to the goals and objectives of specific programmes as well as best practices for evaluation methodologies. *Products* are the outcomes of our evaluation studies. In addition to these four components, we also consider critical variables external to NIE such as international trends in education, benchmark indicators, and changes to the educational landscape nationally and globally.

16.2.2 *Quality in Initial Teacher Preparation*

NIE has three key initial teacher preparation (ITP) programmes: the 4-year bachelors of arts/science in education programme (BA/BSC), the 2-year diploma in education (DipEd), and the 1-year postgraduate degree in education (PGDE). Each of these programmes builds specific knowledge and skills for student teachers with different backgrounds to teach at the primary or secondary level. In striving for academic quality, OAQM developed a series of processes and tools to assess the quality of teaching and learning at four different phases of student teachers' professional development.

The *Emerging* phase occurs when student teachers join NIE. During this phase, student teachers begin to construct an awareness of the basic theoretical foundations of teaching and learning. The *Developing* phase defines the learning process that begins towards the end of student teachers' initial teacher education. During this phase, student teachers should be able to understand and apply what they have learnt into practice. The *Actualising* phase describes beginning teachers' first 3 years of professional practice. Beginning teachers are expected to be able to actualise their learning into professional practice. During the *Evaluating* phase, stakeholders (i.e. principals, vice-principals, head of departments, and experienced teachers in schools) observe beginning teachers' competencies and form perceptions of their preparedness to teach in schools. The first three phases describe the expected professional growth of a student teacher through his/her ITP journey, while *Evaluating* highlights the importance of validating beginning teachers' preparedness to teach in school.

OAQM designed three tools to capture student teachers' learning outcomes, values, and beliefs along their learning and teaching journey. The development of the tools was guided by a literature review of global practices regarding the domains and constructs that contribute to readiness and quality in teaching and learning in ITP. The tools are the Mid-Programme Experience Survey (MPE), the End-of-Programme Evaluation Survey (PE), and the Graduate Preparedness Survey (GPS). Figure 16.2 illustrates the OAQM evaluation tools and processes across the ITP curriculum.

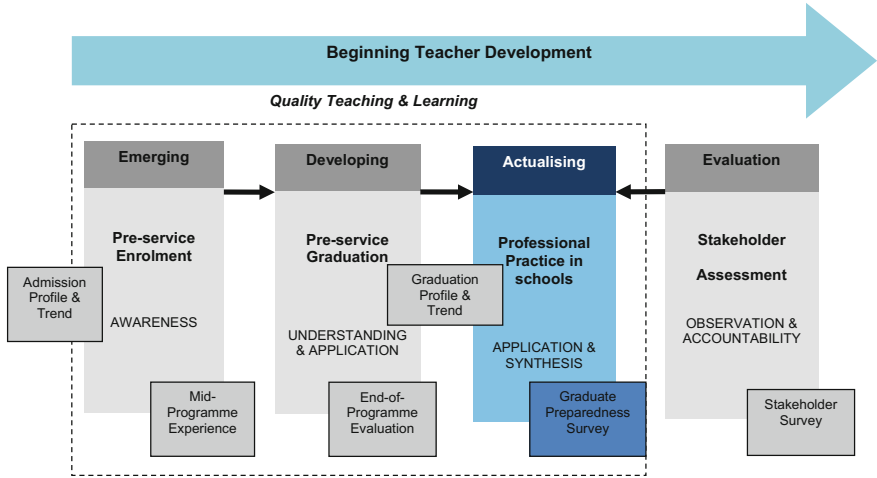


Fig. 16.2 Evaluation framework—tools across ITP curriculum (NIE 2011, p. 9)

MPE collects data from student teachers in the four-year BA/BSc programmes after their second year of teacher education in NIE. It assesses student teachers' academic learning outcomes, values, and beliefs, and their level of satisfaction within the programme in terms of the quality of their learning experiences (Goh, 2011). PE provides periodic feedback to NIE about the overall perceived performance across all its ITP programmes, inclusive of BA/BSc, DipEd, and PGDE. It measures graduates' readiness going into a teaching profession, their values and beliefs, and their overall experiences in NIE.

GPS collects data on beginning teachers' perceived teaching and learning competencies after they have completed their teacher education years. The evaluation at this phase measures beginning teachers' ability to actualise and transfer what they have learnt into practice.

The Stakeholder Survey (SS) measures the perceptions of beginning teachers' supervisors regarding their effectiveness as a teacher as well as about the perceived effectiveness of NIE's programmes. It serves as a tool for triangulating beginning teachers' perceptions of their skills and knowledge. It is the last stage of the quality management process that assesses the quality of teaching and learning processes across the ITP programmes (NIE 2011).

Although these tools are administrated at different phases of ITP and serve slightly different tasks, some domains and constructs are coherent and items within the same domain or constructs were mapped. This integration of SS, GPS, PE, and MPE provides useful reference points to calibrate the professional growth across different tools (NIE 2011). In the next section, we focus on the GPS and SS to illustrate how these instruments are designed and how data is collected and then used to improve quality of initial teacher preparation at NIE.

16.3 Graduate Preparedness Survey (GPS) and Stakeholder Survey (SS)

The major aim of GPS is to collect the level of preparedness perceived by beginning teachers (1–3 years of teaching experience) in their early teaching practices. It addresses beginning teachers' own perceptions about their preparedness to teach and elicits their feedback regarding their schools' induction processes and support. It also obtains beginning teachers' perceptions about their preparation at NIE and their feedback about how the programme could be improved.

The SS is closely aligned with the GPS and PE tools. It seeks supervisors' (i.e. experienced teachers, head of departments, vice-principals, and principals) observations concerning beginning teachers' readiness for teaching and their professional code of conduct. A secondary aim is to understand the support structure and challenges schools face in scaffolding beginning teachers during their first few years of teaching. As the data collected via SS was triangulated with specific beginning teachers' response from the GPS, items in SS are carefully mapped with items in GPS (NIE 2011).

The GPS contains 5 domains, 23 subscales, and 79 items, while the SS contains 4 domains, 13 subscales, and 41 items. Out of those 41 items, 38 were mapped from GPS and 3 items were unique to the SS. The SS also has six open-ended questions that collect qualitative responses from stakeholders. Below, we describe the domains and subscales of the GPS and SS.

1. Skills and Knowledge indicate the translation of the skills and knowledge learnt in the classroom to empirical practices. It includes six subscales for both GPS and the SS. *Lesson Preparation* focuses on the knowledge base of the curriculum materials and resources available to support teaching. *Information and Communications Technology* (ICT) highlights the importance of employing advanced ICT skills that are embedded in the twenty-first century to meet the multiliteracy needs of the society. *Classroom Strategies* stresses the curriculum and pedagogical strategies in bridging content knowledge and teaching practice. *Classroom Management* centres on appropriate behaviour management strategies to control the learning environment. *Assessment and Feedback* addresses the "assessment for learning" needed to support pupils' learning. Finally, *Critical Thinking* focuses on the skills needed to provide opportunities for students to engage in higher-level thinking.
2. Professional Identity encompasses vision and motivation. The Teachers' Vision of Lead, Care and Inspire that was launched by MOE (Chong and Ho 2009) guides the creation of three subscales. *Leadership* refers to the school leadership teachers can offer beyond their teaching expertise to share their knowledge to support school improvement. *Care and Commitment* deals with the belief that all the pupils are capable of learning. *Inspiring Others* addresses the demonstration of positive values about teaching and learning and of a positive influence on those whom teachers work with. These subscales appeared in both GPS

and SS. Motivational studies guided the other three subscales which are unique to GPS. *Intrinsic Motivation* involves their individual sense of psychological satisfaction from their teaching experience. *Extrinsic Motivation* refers to external factors of a teaching profession such as salary and working conditions, among others. *Altruistic Motivation* focuses on the impact of the beginning teacher's contribution to the society.

3. Professionalism defines the areas of professional attitudes that are not directly related to classroom practices. It includes two subscales. *Communication* emphasises the soft skills required for a teacher to maintain an open and effective communication with various stakeholders within the education context. *Professional Development* stresses the ability to reflect and continuously learn. Both subscales of this domain were measured in GPS and SS.
4. School Support surveys the supports available in the school for beginning teachers' early experiences. In GPS, it includes one overall subscale and four specific subscales. *Induction* refers to the ways new teachers are inducted into the school system and supported through their first years in professional practice. *Mentoring* focuses on coaching, facilitating, counselling, and networking by mentors. *Professional Development* concentrates on the availability of professional development via in-service education, and *Sense of Belonging* highlights the positive relationships between schools and beginning teachers. In SS, only the *Induction* subscale was mirrored.
5. Learning and Social Environment is a domain unique to GPS. It includes two specific subscales that measure beginning teachers' ITP experiences in NIE. The two subscales are *Quality of Teaching*, which addresses NIE lecturers' delivery of knowledge, and *Physical and Social Environment*, which emphasises the resources and community support student teachers had experienced in NIE. The *Overall* subscale includes a series of general statements enquiring about the overall experiences student teachers had in NIE.

There is also an overall scale for GPS and SS, respectively. Each contains three general statements to capture either the beginning teacher's attitudes towards the teaching profession or the stakeholder's general impression towards the beginning teacher.

All items except for those in the Induction subscale of *School Support* in the SS were measured dichotomously (i.e. "yes" or "no"). All other quantitative items used a 5-point Likert-type scale. *Skills and Knowledge* was measured on levels of confidence. Beginning teachers were asked to rate their level of confidence on a series of statements pertaining to professional teaching practices in GPS, whereas their supervisors were asked to rate the assigned beginning teacher's level of confidence on mirrored items in SS. *Professional Identity* was measured on level of importance in GPS where beginning teachers were asked to rate how important various items were to their professional identity. *Professional Identity* in SS, along with all other items, was measured on level of agreement. Table 16.1 provides a summary of items for each domain and demonstrates how the items were measured as well as how they are mirrored from GPS to SS.

Table 16.1 Sample items for each domain in GPS and SS

Survey measurement	Sample item
<i>Skills and Knowledge Lesson Preparation</i>	
GPS confidence	Having taught in schools for some time, please rate your level of confidence on the following statements pertaining to professional teaching practices I understand the concepts and principles of my teaching subjects
SS confidence	Please rate the beginning teachers' level of confidence on the following statements pertaining to professional teaching practices The beginning teachers are able to... Deliver the concepts and principles of their teaching subjects
<i>School Support Induction</i>	
GPS agreement	Considering your current school and teaching role, to what extent do you agree with each of the following statements? The induction processes in my school helped me understand the professional matters in school
SS dichotomous	There are induction processes and structures in place to help beginning teachers understand the professional matters in school
<i>Professional Identity Care</i>	
GPS importance	Please rate the following statements about the role of a teacher in terms of its importance to you I value my pupils' thoughts, ideas and opinions
SS agreement	To what extent do you agree with the following statements about the beginning teachers in your school? The beginning teachers... Value pupils' thoughts, ideas and opinions
<i>Professionalism Communication</i>	
GPS agreement	To what extent do you agree with the following statements about the development of your professional knowledge and professional relationships? I am able to communicate effectively with parents and stakeholders
SS agreement	To what extent do you agree with each of the following statements about the assigned beginning teacher? The assigned beginning teacher ... Communicates effectively with parents and stakeholders
<i>Learning and Social Environment Quality of Teaching</i>	
GPS agreement	Please reflect on your NIE experience as a student teacher. To what extent do you agree with each of the following statements about the learning and social environment in NIE? My lecturers provided constructive feedback to improve my teaching and learning
<i>Final Section</i>	
GPS agreement	Reflecting on your overall teaching experience, both within and outside the classroom, to what extent do you agree with each of the following statements? If I could start all over again, I would still choose teaching as my profession ^a

(continued)

Table 16.1 (continued)

Survey measurement	Sample item
SS agreement	To what extent do you agree with each of the following statements about the beginning teachers in your school? The beginning teachers ... Are able to cope with their roles and responsibilities as a beginning teacher ^a

Bold indicates the general question of the section

^aIndicates there is no respective mapping item at the other survey

SS also includes six open-ended questions. One question in the Induction section asked how the respondent’s school supported the beginning teacher through the school’s structured mentoring programme and asked them to list specific samples. The other five open-ended questions appear at the end of the survey. They ask respondents to list challenges the school faced in supporting the beginning teacher, strengths they observed in the beginning teacher, areas the beginning teacher needed to improve, and areas the NIE teacher education programmes needed to improve in. Respondents are also invited to share other comments and feedback. This qualitative data is essential because it helps us to verify the quantitative results and aids us in better understanding the school context and the beginning teachers’ early development. The integration of all three tools provides robust, relevant data that helps us understand the quality of beginning teachers’ preparation at NIE.

Details of the psychometric development, administration, and analysis of these two tools are available online as technical reports (NIE 2011, 2012) on our Website. In 2011, the findings of the 2010 SS and GPS tools were triangulated for meaningful interpretation and used to make improvements to NIE’s ITP programmes. In the next section, we highlight some of the major findings regarding the attributes, processes, learning, and experiences that strengthen the links between teacher education and practice, and in the subsequent section, we discuss how these were used by various authorities to strengthen our ITP programmes.

16.3.1 Findings of the Graduate Preparedness and Stakeholder Surveys

An email invitation of participating GPS was distributed to all beginning teachers (less than 3 years of teaching experience) who had graduated from NIE. Among these 5589 beginning teachers, a stratified random sampling method was performed to generate a sample of beginning teachers whose respective supervisors would be invited to complete SS. Email invitations were then sent to the respective principals of 346 beginning teachers. Principals had the option of responding directly or appointing a representative to respond on their behalf.

After data cleaning, 257 responses were retained for data analysis in SS. The response rate was 74.3%. Respondents included principals, vice-principals, head of departments, subject heads, level heads, and senior teachers. More than half of all respondents had been in their positions for more than 3 years, and the numbers from primary and secondary schools were proportionate (NIE 2011).

Results indicated that the top six challenges schools faced in supporting beginning teachers were lack of time for beginning teachers and their supervisors, a shortage of experienced teachers available to mentor, managing beginning teachers' "culture shock" over the discrepancy between their practicum classroom experience and the realities of their own classroom, difficulties in matching beginning teachers' abilities and interests with the needs and demands of their school, managing the gap between beginning teachers' behaviours and classroom management skills and the demands of the classroom, and difficulties ensuring that the structured mentoring programme in the school addressed the developmental needs of the beginning teachers.

Overall, the greatest challenge was clearly lack of time. A great number of beginning teachers enter Singapore schools every year, and the experienced personnel available to supervise them are already heavily loaded with teaching, supervision, and administrative responsibilities. Most schools reported that they use a mentor or buddy scheme to support beginning teachers. Assigning a mentor or buddy was the top choice for supporting beginning teachers by a ratio of almost 2–1. However, results indicated that most schools do not provide this support regularly over a period of time and few reported they had the logistical or structural supports in place for effective mentoring. In other words, schools seemed to have the knowledge and desire to mentor beginning teachers effectively but not the means.

GPS obtained 3353 valid responses from invited beginning teachers. The response rate was 60%. More than 1100 of these had about 1 year of teaching experience, and more than another 1100 had approximately 3 years of teaching experience. Results were analysed as a whole as well as by programme group.

We observed diverging views regarding first-year teachers' ability to cope with the demands of teaching when we compared results of GPS and SS in 2010. School supervisors perceived beginning teachers to be coping satisfactorily, but beginning teachers did not see themselves balancing the realities with their aspirations and expectations as well. This divergence offered several suggestions. First, it suggested that beginning teachers were not coping as well as people thought. Second, it may have reflected the natural developmental process of learning to balance roles and responsibilities that is common in the first couple of years of teaching. Learning to develop the skills, habits, and mindsets needed for success as a teacher happens over time with experience. Building teachers' confidence in the initial years is critical for retention and for student achievement. Therefore, the findings highlighted a potential focus of concern because many teachers leave the teaching profession during their initial years due to discouragement.

Another useful finding was that beginning teachers with the least amount of teaching preparation (PGDE programme) reported lower self-efficacy than those who had had more preparation. This finding was consistent with the research literature (e.g. Darling-Hammond 2000). This group also reported less confidence regarding their ability to balance their aspirations with the realities of teaching. This led us to explore ways that such teachers could be better supported during their early years of teaching.

16.4 Closing the Loop to Enhance Quality

Results of the analyses were shared over a period of several months with four groups: senior management of MOE and NIE, the Academy of Singapore Teachers (AST), and the Office of Teacher Education (OTE) at NIE. Not surprisingly, interest in the findings differed slightly among groups. For example, MOE's senior management was more interested in the results of SS because they reflected the schools' assessment of beginning teachers' competencies and provided some valuable insights into actual mentoring practices taking place in the schools. AST was particularly interested in the implications of the findings for recruitment and retention strategies while OTE focused on implications for strengthening various components of ITP programmes.

As a result of the subsequent discussions about the data, several changes were implemented to improve programming and support for beginning teachers. For example, NIE conducted a pedagogical audit during a curriculum review to identify, scale up, and monitor best pedagogical practices among faculty. OTE also launched two initiatives to improve beginning teachers' competencies in assessment and feedback. The first was to equip student teachers with assessment literacy skills, and the second was to ensure that relevant faculty model assessment for learning. Instruction of assessment skills was strengthened within the educational psychology modules through curriculum and pedagogical changes, and courses were provided to the faculty who would be teaching it. Revisions were also made to a course focused on teaching diverse learners to better equip primary and secondary teachers with classroom management skills. Finally, two steps were taken to improve the theory–practice link even further during practicum. First, an e-Portfolio component (for more detail, see Chap. 10) was introduced for the upper secondary beginning teachers and continues to be expanded in phases as research data about its impact is analysed (Koh et al. 2013). Second, the mentorship during practicum was strengthened through the use of *structured conversations* to help student teachers reflect upon their experience and discuss it with their supervisor.

AST also identified several steps it would take to improve its support for beginning teachers. These included reducing the workload for three senior teachers by 20% in each school so that they could be available for mentoring, expanding, and strengthening professional learning communities (PLCs) in the schools, providing skills preparation for mentors to enhance their mentoring skills, and

reminding schools to adhere to guidelines established for beginning teachers' workload. Human resources at MOE pledged to further examine its recruitment and retention strategies.

16.4.1 Authentic Assessment Data

While the comprehensive survey tools described above provide useful information for improving the quality of initial teacher preparation at NIE, we recognise that the data is limited because it is perceptual data. There is a need to collect more performance data and to conduct experimental studies, when possible, in order to have more robust data regarding our teacher education programmes. Therefore, in addition to these large, comprehensive scale studies conducted annually to collect perceptual data about graduates' teaching competencies, researchers at NIE have begun to conduct smaller, more focused studies to collect authentic performance data regarding the impact of new pedagogies or innovations in teacher education (Chua et al. 2015a, b; Koh et al. 2013).

For example, in the last few years, NIE has been testing ways to use technology and online platforms to support and enhance teaching and learning in its ITP programmes. Specifically, it has been using a blended learning approach with problem-based learning (PBL) for its educational psychology modules and also very recently implemented an e-Portfolio to support students in their learning journey. PBL is a pedagogical approach that uses authentic problems and a process of collecting, connecting, and communication information (Tan 2003). Various teams of NIE researchers have been investigating the effects of these technological approaches (e.g. Chua 2013; Chua et al. 2015a, b; Koh et al. 2013).

Chua (2013) assessed the impact and effectiveness of Web-based PBL for educational psychology. PBL has been the signature pedagogy in educational psychology at NIE for many years, but it is only recently that NIE has been evaluating Web-based approaches for PBL. Chua (2013) compared results of a traditional PBL (tPBL) environment and an Internet-supported PBL environment (ePBL) with a sample of preservice teachers and investigated effects of the platforms on preservice teachers' efficacies, learning strategies, and motivational orientation.

ePBL provides online question prompts designed to structure student teachers' reflections on their PBL experience. Reflection encourages higher-order thinking skills, metacognition, and self-regulated learning (Chua et al. 2015). Similarly, *e-prompts* at each stage of the PBL process facilitates student's problem-solving. Online collaboration is supported with online tools and templates.

Results demonstrated that while both platforms were effective in enhancing teaching efficacy, motivational orientations of the students, and their learning strategies, the traditional approach yielded more adaptive effects. It was also noted that certain key PBL processes had mediating roles for different outcomes. The study served to identify the key components of PBL that are predictive of various

outcomes. Chua and her colleagues wisely pointed out that “educators need to understand that technology is a tool to support their pedagogical approaches to engage and motivate their learners...they must be mindful on how the introduction of technology may influence the teaching of the subject content and how the associated learning outcomes will vary based on the technology and pedagogy being used”. Findings from the studies were used to modify the delivery of PBL in the educational psychology curriculum and to recommend scaling ePBL to even larger cohorts of learners.

Koh et al. (2013) conducted an evaluation study to collect student teachers’ perceptions of an e-Portfolio’s effectiveness as a learning tool and to assess whether it enhanced their self-regulation and motivation to learn. Many countries are using a portfolio to improve the quality of students’ learning and to demonstrate their achievement of established standards. It is widely believed that building a personal e-Portfolio promotes greater ownership of learning. Some authorities have been cautious about e-Portfolios, however, arguing that the benefits of the technology can be undermined by its time and effort demands. Specifically, Koh and her colleagues wanted to understand student teacher’s motivation regarding the use of the e-Portfolio and the extent to which student teachers thought the e-Portfolio platform was effective in user-friendliness, efficiency, and user satisfaction.

There were 326 student teachers who were enrolled in NIE’s PGDE programme and they were provided with technical support and guidance on how to use an open access Google site to build and revise an e-Portfolio to document their learning and teaching practices. A 27-item Likert scale survey was administered to evaluate student teachers’ experience with the platform and its processes.

Overall, results indicated that student teachers did not indicate strong support for the portfolio as a learning and teaching tool. It appeared that platform usability influenced students’ motivation to use the e-Portfolio because a strong, significant correlation was observed between autonomous motivation and efficiency and user satisfaction, and a moderate and significant correlation between autonomous regulation and user-friendliness. The investigators recommended that future evaluation uses a qualitative approach to identify specific aspects of platform usability that promote high motivation to use the e-Portfolio.

16.5 The Future of Quality Management in Teacher Education in Singapore

The findings from NIE’s quality management efforts suggest several implications for teacher training programme enhancement and student teacher learning. First, it is important to recognise that changes in teacher education are influenced by the larger shifting landscape of higher education worldwide. The investment in technology and innovation to grow economically, the ever-increasing demand for a

highly skilled workforce, and the rising expectations for accountability shape our expectations and efforts for teacher training.

It is clear that an increasing emphasis on authentic performance assessments for beginning teachers will be needed going forward. Triangulated survey results are a good starting point for understanding teacher training outcomes, but they are insufficient in themselves to adequately critique our key processes and methods. Mobile platforms could be a promising platform for collecting authentic performance data in real time in the not too distant future. Mobile platforms could also help address the challenges schools face in supporting and mentoring beginning teachers. It seems unlikely given Singapore's small size and its limited resources that it will be possible to adequately support and equip beginning teachers without leveraging on technology to extend the reach and wisdom of more experienced mentors. However, investment in innovation and technology in teacher education will need to be closely paired with a critical evaluation of the impact of such technologies on pedagogy and learning.

There is an expectation throughout the education system in Singapore that policy and school developments must be based on empirical evidence (Gopinathan and Hung 2010). This means that evaluation efforts must be informed by the needs, characteristics, and contexts of Singapore's constantly changing economic and sociopolitical characteristics. NIE's quality management processes will become increasingly important and subject to greater scrutiny as we pursue our strategic vision to establish NIE's teacher education programmes as one of the leaders in teacher education globally. External reviews will also be required to validate that NIE's processes and practices are aligned with global standards of quality in teacher education. As our quality management processes develop, a significant challenge we will face will be to fit programme evaluation into systematic evaluation of the institution as a whole (Chong and Ho 2009).

Also, since mounting evidence suggests that authentic assessments better evaluate instructional practice and provide powerful learning opportunities for student teachers (Pechione and Chung 2006), we anticipate that NIE will expand its use of such assessments, especially those that are digitally supported or based, as sources of valuable information regarding strengths and weaknesses for programme improvement.

Quality management is about much more than developing contextually relevant measurement tools to collect data about specific programmes. We are also establishing comprehensive guidelines for comprehensive and systematic evaluations and developing new tools. Beginning in the fall of 2013, the ITP programme evaluation will be further strengthened with an additional new survey tool that will be administered to NIE beginning teacher faculty to capture their perspectives on the quality of incoming students three months after they have begun their teacher education.

We will need to be mindful of the shifting dynamics between and among programmes, departments, and the institution as a whole. Establishing a quality culture at NIE will require a shift in the organisation's norms, modifications in some of the processes within departments and programme offices, and changes in the mindsets

and work habits of its individual community members. We are confident that our strong tripartite relationship in education will continue to achieve rapid implementation of teacher preparation processes and programmes that have a strong, contextualised evidence base. New directions in Academic Quality Management have already been taken under SPAQ. It will be interesting to track what changes have occurred in a subsequent publication.

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Chapter 17

Riding Towards the Future

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17.1 Introduction

Singapore saw a signification milestone in 2015 as it celebrated its 50th anniversary of independence. When it gained its sovereignty in 1965, Singapore was a poor, small island with few natural resources and a lot of problems. Today, the once backwater underdeveloped economy is now a world economy and an education leader. The transformation was not a one-shot deal. With tenacity, foresight and political will, Singapore has been able to raise its education level that matches the best systems in the world, accomplishing significant improvements at each stage of its journey. Singapore's education is premised on an "impact perspective", which is reflected in the following four aspects (Tan 2012). First, besides a high cognisance on reform and innovation, there is also an elevated awareness of the outcomes that are strategic to change, at the macro-level and micro-level that involve key stakeholders and partners. Examples of some of these policies and programmes include (i) ability-based reform, (ii) language and bilingual policies, (iii) emphasis on Mathematics and Sciences, (iv) quality thinking schools and (v) holistic and diversity education landscape. Second, Singapore has a holistic approach to

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education and it looks at issues from a bigger perspective and understands the principle of multifactor impact. Third, Singapore recognises the importance of international research and evidence. Fourth, with regard to policy, design and implementation, the strength in the Singapore education system stems from the clarity of communication and the consciousness to continuously develop capacity.

According to Hargreaves and Shirley (2009), Singapore is able to gather stakeholders towards an inspiring and inclusive vision. At the broadest level, Singapore education has been dominated by a concept of a nation of thinking and committed citizens capable of meeting the challenges of the future (Gopinathan 1999; MOE 2008). From an ability-based and aspiration-driven education system, it has evolved to one that is student-centred and values-driven. To realise this, then Education Minister Swee Keat Heng at the 2011 Work Plan Seminar stressed the importance of “strongly supporting teachers in their journey of professional-led excellence as they are the forefront in a student-centric education” (Heng 2011).

Teachers play an important role in building a nation by bringing out the best in every child. Founding Director of the Institute of Education (now known as NIE) Dr Ruth Wong (as cited in Wong 2013) believed this and once said that the teacher stands between a child’s hope and a child’s fulfilment. As one of the main focuses, Singapore is strengthening a culture of learning among the teaching force, developing a culture of teachers growing teachers, and in the process, nurturing a pipeline of teacher leaders who are accomplished in their profession and able to lead fellow educators. This has also been recognised by other countries and experts.

17.2 Championing the Teaching Profession

It was only in twentieth century when teachers started receiving teacher preparation, which consisted of one or two years at a normal school or teacher’s college. Afterwards, they would be employed in a local school, where they would adhere to the strict rules and regulations that monitored their behaviour within and even outside school. Today, teachers strive to be professionals with expert knowledge concerning instruction, content and assessment in their particular fields. They are no longer restricted by imposed external rules but are governed by internal good morals and values of the teaching profession. Often, they participate in decision-making about work procedures and conditions. In many cases, they are forging stronger links with school administrators, university researchers, government officials and the communities they serve. Continuous upgrading of skills through professional development is also mandatory these days and teachers are encouraged to attend in-service education.

The question of whether or not teaching is a true profession has been debated for many years. What is a profession? For Wright (1951), a profession “is a self-selected, self-disciplined group of individuals who hold themselves up to the public as possessing a special skill derived from education and training and who are prepared to exercise that skill primarily in the interests of others” (p. 748). Although

writing on the nursing field, Dahnke and Dreher's (2011) definition of a professional is valid across disciplines. They view that a professional practice discipline has the following characteristics:

1. a recognised role and work product highly valued by society;
2. a legitimate claim to certain boundaries in the field;
3. a distinct body of knowledge that is both practical and theoretical;
4. a critical mass of knowledge generators *within the domain of the formal field*;
5. regulations and standards for membership that includes rigorous educational preparation;
6. a formal organisation of the community of practitioners and scholars;
7. an emphasis on the interpersonal aspects of the role and work; and
8. a highly developed code of ethics and behaviour (p. 15).

Such characteristics have been affirmed through the works of Corwin (1965) and Ornstein et al. (2014) who applied them to the teaching profession. They noted that a full profession is described by the following:

1. a sense of public service, a lifetime commitment to career;
2. a defined body of knowledge and skills beyond that grasped by laypeople;
3. a lengthy period of specialised education;
4. control over licensing standards and/or entry requirements;
5. autonomy in making decisions about selected spheres of work;
6. an acceptance of responsibility for judgments made and acts performed related to services rendered, a set of performance standards;
7. a self-governing organisation composed of members of the profession;
8. professional associations and/or elite groups to provide recognition for individual achievements;
9. a code of ethics to help clarify ambiguous matters or doubtful points related to services rendered; and
10. high prestige and economic standing.

Tan (2003) noted that moving beyond compensation and salaries, we need to see teacher professionalism and development flourish in creative ways. Beyond results and accountability, teachers must be viewed as proactive problem-solvers and researchers, who are empowered to solve the complex issues of school and managing the associated boundaries. One of the primary roles of teacher education institutes is to be seen as champions of the teaching profession and to give the profession a stronger voice in terms of the kind of education and competencies needed in the twenty-first century. Furthermore, teacher education institutes must have its research genesis in schools rather than just from a theoretical perspective of academia, which means that education research must inform and impact the system. In this regard, NIE positions itself as a voice of the teaching profession in both teaching and education research.

17.3 Innovation in Teacher Education

In recent years, there has been constant expression about twenty-first-century thinking, and the need for twenty-first-century teacher education to foster that thinking. In this regard, teacher education institutions need to add value and create learning environments that encourage self-motivation and independence (Tan 2012). In response, NIE aims to build solid foundations and to innovate policies and programmes to achieve excellence in education. Winning programmes mean a win–win situation for the teachers, students and society. Sahlberg (2006) said that in every education system, children deserve to have a curriculum that is varied, complex, challenging and deep. Education must have the ultimate aim to foster the creation of individuals with a greater capacity for creativity and higher levels of thinking skills (Tan 2003).

This book looked at Singapore's evolution and innovation of teacher education in the twenty-first century. Each of the chapters covered teacher education reforms in Singapore, specifically on the experience in conceptualising and implementing the TE²¹ Model, which includes curriculum improvements that align to the new competencies and values development that re-envision teacher professionalism and calling; pedagogical changes that emphasise self-directed inquiry and technology-enabled learning; and a theory–practice nexus that strengthens and enhances teaching practices through school partnerships and mentoring. Chapters 2–4 talked about teacher education policy and the values that underpin it in Singapore while highlighting teacher education programmes and recruitment procedures. Chapter 5 presented a framework that provides an anchor to the innovative pedagogical approaches currently being used at NIE. In Chap. 6, Lim and Huan highlighted the rationale and purpose of the Education Studies modules in the pre-service teacher education. Chapters 7–9 shared how teaching Mathematics, Science and Geography have changed and how NIE is innovating ways to better prepare teachers. Chapters 10–12 talked about the mentoring and practicum experience in schools. Chapter 13 discussed service learning while Chap. 14 examined the change of learning spaces and the use of technology in twenty-first-century classrooms. Chapters 15 and 16 talked about professional development and quality assurance in teacher education, respectively.

In the light of the twenty-first-century challenges, pre-service teacher education in NIE ensures that what it teaches reflects how it impacts society. This was the main point driven when NIE's TE²¹ Model was launched in 2009, which underscores the importance of values. Along with technological development come constant challenges to the socio-politico-economic dimensions, and it is a set of good values that provide an anchor of stability. A values-driven teacher education programme reflected in the V³SK Model provides the underlying context for teachers to be effective in their role of moulding the learner to maximise his/her potential and to have a strong sense of rootedness to the community and nation. Provided in the next section is the forward-looking NIE 2017 Strategic Roadmap.

17.4 Strategic Roadmap: Towards 2017

At his first address as the new Director of NIE, Professor Oon Seng Tan said, “a great institution is characterised by its people, history and by its future orientation” (Tan 2014). To materialise this, he laid down the strategic directions, key goals and anchoring values the Institute is embarking on for the near-to-medium term. Known as the “NIE Moving Forward: Towards 2017”, the Strategic Roadmap will serve as a compass to guide NIE in its next phase of strategic development in achieving its vision to be an Institute of Distinction. Graphically designed as a ship, the 2017 Strategic Roadmap (see Fig. 17.1) illustrates the important message that education is a journey, not a destination. At the base of the ship sits a stable anchor encapsulating the essential values (professionalism, collegiality, integrity, appreciating diversity and embracing change) and culture (responsiveness, relevance and rigour). These core values and culture will drive NIE’s corporate culture and help realise its strategic goals.

Growing the knowledge capital, forging and enhancing key partnerships, and building institutional capacity and corporate professionalism are the three major

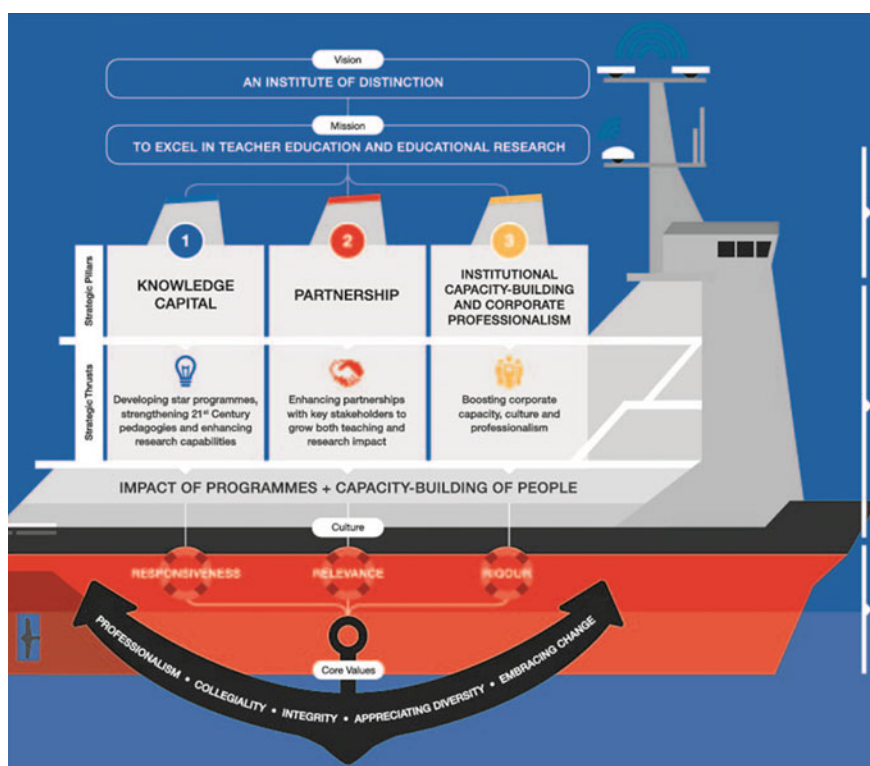


Fig. 17.1 NIE 2017 Strategic Roadmap (NIE 2014)

strategic pillars that NIE will strive towards the next lap of growth. To achieve the aim of being a thought leader in teacher education, NIE intends to further enhance research capacity and seek to develop a distinctive suite of signature programmes built on key strengths. More weight will be placed on translating research outcomes into pedagogical and programmatic enhancements. At the same time, new programmes and initiatives will be developed by forging and furthering relationships with the parent university Nanyang Technological University (NTU), the Ministry of Education (MOE), schools, and global and regional partners. Resources will also be dedicated to boosting NIE's constitutional capacity while building a collegial and professional corporate culture. The pillars cascade down into three corresponding strategic thrusts that will guide the planning and implementation of key NIE initiatives for the next few years. The following will explain each of the three strategic thrust and how it will enhance NIE's impact on Singapore's education system.

17.4.1 Knowledge Capital

As the premier teacher education institute in Singapore, NIE aims to become a thought leader in teacher education and education research globally as well. The first strategic thrust is growing knowledge capital by developing a distinctive suite of signature programmes, strengthening twenty-first-century pedagogies and enhancing research capabilities. All three initiatives will support and align with one another to build up NIE as a premier knowledge leader in teacher education and related disciplines.

(A) Developing a Distinctive Suite of Signature Programmes

NIE aims to develop a distinctive suite of quality signature programmes that will embody a holistic approach to teacher education. These programmes will, in essence, be multidisciplinary, research- and evidence-informed, robust in disciplinary and pedagogical rigour, infused with global perspectives and strong industry skills, and values-based for all-round character development. By blending and balancing academic rigour with industrial relevance, these programmes will elevate NIE's standing as a thought leader and knowledge/brain trust in education and education-related disciplines.

i. Building a Premier NTU-NIE Teaching Scholars Programme

In 2014, NIE launched the NTU-NIE Teaching Scholars Programme (NTU-NIE TSP), which is a new addition to NTU's suite of premier scholars' programmes. It is especially designed to develop a core group of high-calibre and deeply passionate teachers with intellectual rigour, strong leadership qualities and global perspectives with a keen desire to make significant contributions to education. Teaching scholars will be offered a wide range of education-related local and overseas immersion opportunities. They will be given an opportunity to engage with a close community of exceptionally

motivated and talented academics and educators. They can benefit from a multidisciplinary curriculum at NTU via access to the University Scholars Programme (USP)¹ and may select electives and minors at other NTU colleges to complement the NIE core curriculum and general education programmes. Participation in both disciplinary and education research at NIE offers teaching scholars the opportunity to present their findings at local and international conferences and seminars. (Further information can be found in the section below on “Enhancing NTU-NIE Synergy”.)

ii. **Enhancing Pre-service Degree Curriculum**

The Office of Teacher Education and NIE’s Academic Groups are enhancing the design and delivery of the four year Bachelor of Arts/Science in Education programmes to offer a more robust and flexible curriculum, providing student teachers a chance to deepen their content and pedagogical mastery. With the enhanced curriculum, student teachers are able to embark on both content and educational research, as well as participate in conferences, overseas practicum and semester exchanges. The enhanced degree programmes, incorporating features of the NTU-NIE TSP, will also help hone leadership skills and build character through experiential learning via local and overseas service learning initiatives.

iii. **Strengthening Continuous Professional Education and Graduate Student Research**

The Office of Graduate Studies and Professional Learning will continue to strengthen its in-service and master’s degree programmes to meet the changing needs of twenty-first-century educators and education leaders in sectors as diverse as early childhood, school and adult education. Courses in these programmes will provide evidence-based learning that is rigorous and contextualised. These courses will tap on the expertise of the NIE faculty as well as that of renowned international academics and educators to provide students and participants with a combination of local and international perspectives. NIE remains deeply committed to enhancing learning experiences of higher degree research students in the Doctor of Philosophy (PhD) and Doctor in Education (EdD) programmes through quality supervision and mentoring of young researchers, relevant research and academic learning support, and strong networks within and beyond the Institute.

¹The USP is an interdisciplinary programme that provides an intellectually stimulating environment for the best undergraduate students in NTU. The undergraduate programme is academically rigorous and supplements the scholars’ core curriculum with a comprehensive and diversified selection of modules—ranging from religions of the world and moral philosophy to astronomy and quantitative reasoning. Beyond the classroom, scholar-led initiatives, seminars by distinguished professors and Nobel Laureates, and overseas programmes allow the scholars to hone their leadership, creativity and critical thinking skills. See <http://scholars.ntu.edu.sg/Pages/default.aspx> for more information.

The new Master of Arts in Professional Education (MAPE) is a specially designed higher degree programme that aims to have significant impact on the education sector by helping to boost the professional competencies and skills of a key group of educators—in-service teachers, school staff developers and continuing education instructors. A primary objective of this new programme is to develop highly qualified mentors for other teaching professionals.

(B) *Strengthening Twenty-First-Century Pedagogies: A New NIE Teaching and Learning Framework*

NIE is developing an institute-wide teaching and learning framework that is anchored to the vision of providing a learner-centric twenty-first-century learning experience, which will be experiential, participative, inquiry-based, interconnected and collaborative. It will allow NIE to leverage the latest ICT and pedagogical innovations to deliver quality pre-service teacher education, higher degree and professional development programmes and courses to meet the needs of a new generation of learners.

Under this new framework, teaching and learning will take on an approach that is borderless, seamless, personalised, multimodal and anytime-and-anywhere. Students can look forward to a technology-mediated learning space to engage and participate freely and with ease, regardless of location. Support will be given to boost e-learning as well as to equip faculty with the requisite skills to conduct teaching using the latest digital tools and technologies for the purpose of enhancing student learning outcomes. A task force has been set up to further articulate this framework and to drive pedagogical innovations, especially in the areas of self-directed and collaborative learning. NIE's higher degree, professional development and leadership programmes have also begun to include new modalities to facilitate e-learning and distance learning.

(C) *Enhancing Research Capabilities*

NIE will continue to enhance its research capacity, particularly in key strategic areas to maintain the current standing as one of the world's thought leaders in teacher education and education-related disciplines. This will include investing resources in the development and mentorship of young and talented researchers and greater support for research initiatives that have an impact on programmatic and pedagogical enhancements both within NIE and in schools. By strengthening the linkage between research findings and programmatic and pedagogical enhancements, NIE will be able to further impact the education system through the delivery of evidence- and research-informed pedagogies and programmes to raise the competencies and capabilities of teachers systematically.

17.4.2 Partnerships

The second strategic thrust is to enhance partnerships with key stakeholders including NTU, MOE and schools, and more new and exciting programmes will be delivered through forging and deepening these collaborations. By establishing and nurturing meaningful partnerships with key stakeholders, NIE will be able to boost impact in both teacher education and education research.

(A) *Cultivating and Enriching Strategic Partnerships and Initiatives with Institutes of Higher Learning Systems (IHLS)*

i. **Enhancing NTU-NIE Synergy**

As an autonomous institute within NTU, NIE is responsible for preserving the quality and rigour of its staff and programmes within the general academic and administrative framework of the university. NIE strives to bolster its influence locally and internationally, eventually progressing towards even greater strategic, academic and operational alignment and synergy with NTU. Likewise, the Institute seeks to play a vital role in enriching teaching and pedagogical excellence in the parent university. Furthermore, NIE will also contribute to cross-disciplinary research and teaching initiatives with other NTU schools, institutes, faculty and students. One of the ways to realise this is for the teaching scholars in the NTU-NIE TSP, for example, to take courses in NTU's other premier scholars' programmes as well as opt to work with both NTU's and NIE's eminent professors on disciplinary-specific research projects. NTU scholars can also choose to take education-related electives at NIE or work with NIE professors on education-related and pedagogy-related research.

ii. **Building and Extending Strategic Collaborations with Renowned International IHLS**

This is especially important to enable NIE to provide global perspectives and exchange and immersion opportunities for students across the spectrum—from initial teacher preparation, to higher degrees, to teacher professional development. These partnerships will ensure that we are able to maintain our competitive edge and distinctiveness and allow us to broaden our reach and amplify the impact on the global education fraternity. It is therefore important for NIE to keep abreast with global education trends, cultivate new strategic partnerships and joint higher degree and executive programmes with other renowned IHLs. In this regard, NIE will continue to identify and develop meaningful strategic collaborations and deepen existing tie-ups with reputable international partners, institutions and organisations.

(B) *Deepening Collaborations with MOE, MOE Academies and Schools*

i. **Strengthening Collaborations with MOE and MOE Academies**

A key success factor allowing Singapore to become one of the world's top-performing education systems is the close partnership and alignment among NIE, MOE and schools. MOE is responsible for policy formulation, while NIE is responsible not just for translating these policies in the design and

delivery of programmes, but also for providing research evidence to help shape future policies. Schools also translate education policies into practice by enacting them within the curriculum and via the teaching and learning process. Furthermore, schools work in close partnership with NIE in terms of providing the sites for clinical/practical/field school experience and where beginning teachers grow to become professional teachers. Going forward, NIE will continue to deepen these collaborations with MOE and its academies, such as the Academy of Singapore Teachers (AST). The aim is to raise the professional competencies of Singapore's educators through delivering more relevant and impactful executive and professional development programmes for both in-service teachers and school leaders. This interaction will allow the whole system to be levelled up.

ii. **Enhancing Impact of Education Research in Schools**

NIE will scale up efforts to enhance the alignment between research work and the pedagogical innovations and enhancements made in the schools. NIE academic staff members are encouraged to proactively contribute to Singapore schools, particularly in building school capacity around areas that include developing new pedagogies, implementing experiential learning modes and conducting action research. The end goal of such partnerships is to enhance the learning outcomes of students in our school system.

17.4.3 Institutional Capacity Building and Corporate Professionalism

The third strategic thrust is boosting corporate capacity, culture and professionalism. For NIE to successfully deliver on the first two strategic thrusts, it is imperative that it has the proper foundations and support structures in place. If growing knowledge capital represents nurturing the brains of the Institute and the nation, and building partnerships represents extending limbs to be closer to key stakeholder, then the third strategic thrust represents caring and nurturing the heart of the Institute—developing NIE staff members and building the right corporate culture to enhance impact in the face of volatile future ahead.

(A) Moving Towards a More Holistic and Meaning Rewards Culture

NIE is taking steps towards developing a more holistic and balanced rewards system. This includes adopting a more concerned and tailored approach to academic staff appraisal. Focus will be moved away from the accumulation of points and towards greater affirmation and reward for good citizenry, impact and contribution to NIE, NTU, MOE and schools. Appraisal criteria will be aligned more closely with the NIE context and contributions to teaching, research and service to NIE, NTU or MOE will be better recognised.

(B) Developing Professional Competency and Corporate Efficiency

Building staff capabilities is an integral part of ensuring NIE's continuous growth and progressive journey towards becoming an Institute of Distinction. Besides the academic faculty, the management and corporate support teams also play critical roles in ensuring that NIE will achieve its goals. To retain and nurture NIE's prized human capital, a talent development framework has been put in place to identify and groom academic and administrative staff members with high potential to take on key management roles. Efforts dedicated to staff capacity building are being enhanced to boost overall corporate efficiency and professional service competency across all levels. In addition, enhancing the strategic and efficient use of resources, from human capital to finances to infrastructure, is also looked into.

(C) Building a Professional and Collegial Corporate Culture

As NIE moves forward, it will strive to build a more collegial and collaborative professional work culture. Within this culture of professionalism, every individual must be willing to take ownership of their responsibilities and have the dedication to see things through for the overall benefit of the Institute. Everyone will be encouraged to go the extra mile beyond the call of duty and avoid a silo/individualistic mentality. The eventual goal is to boost staff engagement levels such that the slogan, every staff an ambassador, can become a reality and all programmes and services can be delivered with exceptional quality, dedication, NIE-wide teamwork and commitment.

17.5 Future Directions

Singapore has always practised a forward-looking and integrated planning system. This is most especially evident in putting high value in education as a fundamental factor to economic development and national cohesion. It has consistently been an impressive performer in international evaluation systems such as the Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) for several years now—Singapore has been on the radar of other countries. In a reciprocal gesture, Singapore likewise shares the interest of studying the education policies of other countries to improve its own system. In the age of information, the search for “what works?” continues.

Indeed, there is high expectation that teacher education must also evolve to live up to the changing needs of future learners. At the basic level, the highlights of Singapore education and teacher education are demonstrated by the interaction of its policies and educational initiatives, including high-quality and rigorous teacher education research. The emphasis of NIE on growing knowledge capital, partnerships and institutional capacity are explored through multidisciplinary research that looks at the educators, students and society. Additionally, researches show that in teacher education there is an increasing demand for critical inquiry, the use of

technology and professional development (Kelly 2013, p. 168). Guided by research, vision and strong leadership, Singapore is already looking into these emerging issues.

17.6 Conclusion

Teachers need to help students gain both an understanding of existing information and generate better ways of using that information. To do this well, teachers need to have strong content and pedagogical knowledge and must make thinking visible among their students, as well as facilitate learning in an integrated approach by teaching students how to access, evaluate, synthesise information and contribute to the generation of knowledge. Teachers also need to be adept in using new tools such as digital technologies to facilitate learning and teaching. Furthermore, the need to function in an increasingly globalised world requires teachers to have literacy of various cultures and languages. As understanding and respecting diversity is an important element for teachers, opportunities for overseas and local service learning serve as a platform to expand teachers' multicultural literacy.

NIE provides ample teaching and learning opportunities through its initial teacher preparation and professional development programmes. These programmes employ innovative pedagogies that integrate the use of technologies, inquiry-based and problem-based approaches, and higher-order thinking skills that ultimately help our student teachers develop the essential values, skills and knowledge needed to function effectively in the twenty-first-century classroom.

This book is meant for scholars, researchers, policymakers, teacher educators, teachers and anyone interested in finding out the latest thinking and philosophy behind Singapore's unique Teacher Education Model for the Twenty-First Century and beyond. It is envisaged that the learning points from this can be contextualised appropriately to its application to suit other education systems and jurisdictions.

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