SINGAPORE

Singapore, a city-state of approximately 700 km2 in Southeast Asia, has made great strides since it was established as a republic in 1965. In its early years of independence, Singapore was a poor, undeveloped island with a lack of natural resources, high unemployment, rapid population growth, substandard housing and sanitation, and tension among its various ethnic groups.

As a small nation with limited natural resources, human resources have always been the island republic's most precious asset. Today, Singapore is a vibrant global hub of trade, finance and transportation, with a strong and harmonious community of citizens of different ethnicities and religions. Its transformation "from third world to first" in one generation is one of Asia's great success stories (Lee, 2000; OECD, 2010).

Phases in the development of Singapore's education system

The survival-driven phase: 1959 to 1978

During the first years after independence, the government, led by Prime Minister Lee Kuan Yew, focused its efforts on expanding basic education. Schools were built rapidly and teachers were recruited on a large scale. A single national education system was created, replacing schools that had previously catered to individual ethnic groups. This system was bilingual, teaching students English, the national language, and their mother tongue language (Chinese, Malay or Tamil).

The expansion of basic education provided Singapore with a literate and skilled workforce to meet the needs of the shift in its economy from entrepôt trade to export-oriented manufacturing. This was achieved with remarkable success: during the late 1960s, GDP grew an average of 12.7% per year as Singapore attracted foreign manufacturers in search of low-cost and low-skilled labour.

The efficiency-driven phase: 1979 to 1996

Rising competition from other Asian countries looking to attract low-cost manufacturing to their own shores and the 1973 global oil crisis compelled Singapore to move higher up the economic value chain. However, to do so, it had to make considerable changes to its education system, as indicated in a landmark report by Goh Keng Swee, then Minister for Education (1979).

The new model of education included more pathways for students, with the goals of improving the quality of education, reducing dropout rates, and developing the skills required in the new capital- and skill-intensive economy. Students were offered different courses in schools, with differentiated curricula and pedagogical approaches designed to enable more students to progress through secondary schools and post-secondary institutions (Goh and Gopinathan, 2008).

The new education system:

- reduced dropout rates: by 1986, only 6% of students, compared to over 50% in the 1960s, left school with fewer than 10 years of education
- improved the quality of education: the pass rate of O-level English examinations increased from 40% in the 1960s to 90% by 1984, and students in Singapore performed very well in the 1995 Trends in International Mathematics and Science (TIMSS) study.

The quality of vocational education, in particular, was enhanced. The Institute of Technical Education (ITE) was created in 1992 to provide high-quality technical and vocational education. Industries helped develop the Institute with the aim of producing graduates with the industry-relevant skills. Universities and polytechnics were also expanded to train a larger number of scientists and engineers, thereby meeting the demands of a more technologically-driven economy.

Ability-based, aspiration-driven phase: 1997 to 2011

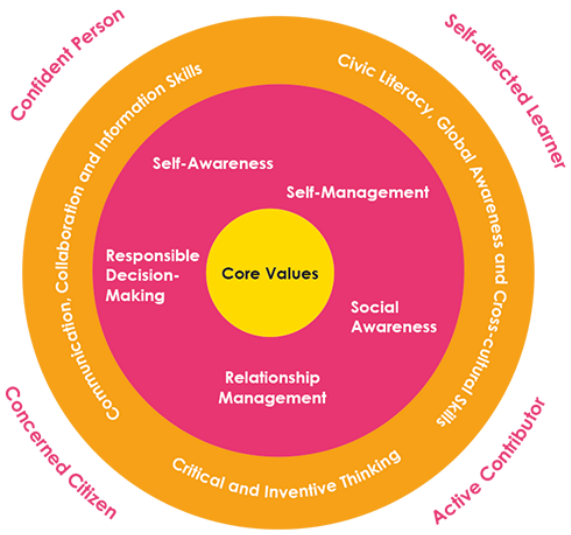
With the emergence of a knowledge-based economy, Singapore has pivoted its economy away from one based on high-skilled manufacturing to one based on high value-creation services and products. To prepare its citizens for navigating this new economic paradigm, Singapore developed a new education philosophy, "Thinking Schools, Learning Nation" (TSLN). Instead of simply imparting knowledge to students, "thinking schools" would develop creative and critical thinking skills and a passion for lifelong learning. Complementing this, the "learning nation" would place education at the heart of the national identity (Lee et al., 2008).

To achieve these goals, Singapore increased flexibility and variety in its school system. The curriculum was reduced to create space for more inquiry-based activities. Common time was created for teachers to collaborate on planning lessons and active learning activities for students. Furthermore, significant investment in information and communications technology (ICT) facilitated new modalities of learning. Schools were organised around clusters of 10 to 14 schools, with greater autonomy and collegial sharing enabling schools to be innovative in their programmes and teaching. All these efforts facilitated the development of a culture of continual improvement, and an open and collaborative school environment (Poon et al., 2016).

Student-centric, values-driven phase: 2012 to present

The momentum generated from the TSLN vision led to the development of a framework for *21st Century Competencies and Student Outcomes* (21CC Framework, see Figure 1). This framework articulates the core competencies and values that will enable the youth of Singapore to thrive in the 21st century (MOE, 2014).

Figure 1. Framework for 21st Century Competencies and Student Outcomes



The 21CC framework guided the development of subject syllabi and instructional materials. Schools also use the framework to design curricular and co-curricular programmes that will help students develop the requisite competencies.

Each school in Singapore offers a range of learning experiences to develop students holistically. Through co-curricular programmes and outdoor education, students can develop their interest and talent in music, arts and sports, and hone their leadership skills and social and emotional competencies. In addition, every student participates in Values-in-Action programmes that help to build a sense of social responsibility towards their community (MOE, 2016a).

Teachers are the pillars of Singapore's education system and the Ministry encourages them to be at their professional best. After initial pre-service training at the National Institute of Education (NIE), teachers are expected to continue to build their capabilities as teaching professionals through various in-service opportunities. The culture of dedication, collaborative learning and professional excellence is expected to be further strengthened by teacher academies, language institutes and professional learning communities.

Structure of the current education system

All children start primary school education at age 7. This is a compulsory six-year course designed to give them a strong educational foundation. It aims to develop language and numeracy skills, build character and nurture sound values and good habits. At the end of Primary 6, students take the Primary School Leaving Examination (PSLE), which assesses their suitability for secondary education and places them in a secondary school course that matches their learning pace, ability and inclinations. Students can also seek admission to a secondary school based on their diverse strengths and interests in areas such as art and sports through the Direct School Admission exercise (MOE, 2016a).

At the lower secondary levels (grades 7 and 8), students experience a broad-based education in the languages, the humanities and the arts, mathematics and sciences, design and technology, physical education as well as character and citizenship education. At grades 9 and 10, all students learn two

languages, social studies and mathematics, and select from a wide range of elective subjects and programmes (MOE, 2016b).

Almost all students proceed to one of the following post-secondary education institutions:

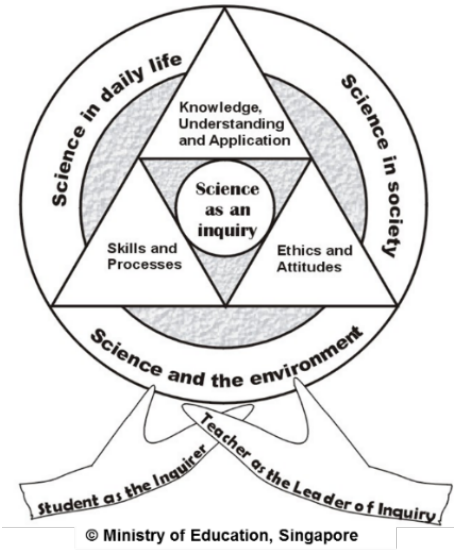
- **Junior Colleges/Centralised Institutes**, which offer an academic pre-university course
- **Polytechnics**, which offer three-year, practice-oriented diploma courses that equip students with industry-relevant skills (while most of the polytechnic graduates progress to work, a proportion of them move on to university education)
- **the Institute of Technical Education (ITE)**, which offers a broad-based, multidisciplinary curriculum including engineering, technical, business and service skills
- **Arts Institutions** for students interested in the creative arts.

About 30% of each cohort enrol in government-funded, autonomous, local universities. The university landscape continues to diversify with the establishment of new institutions, including those with different specialisations (e.g. Singapore University of Technology and Design) and different approaches to tertiary education (e.g. the Yale-NUS Liberal Arts College).

Science education in Singapore

The Singapore Science Curriculum Framework (Figure 2) is centred on the spirit of scientific enquiry and is based on three domains essential to the practice of science: knowledge, understanding and application; skills and processes; and ethics and attitudes (MOE, 2012; MOE, 2013). The curriculum aims to help students value the pursuit of science and appreciate the important role it plays in daily life and society.

Figure 2. Singapore Science Curriculum Framework



The primary and lower secondary science syllabi are designed around themes that students can relate to in their daily experiences and on common natural phenomena (Chee et al., 2016). The five themes at the primary level are diversity, cycles, energy, interactions and systems. The lower secondary science curriculum includes an additional theme on models, with science continuing to be taught as a way of exploring the physical and natural world. At the upper secondary levels, students start to specialise in science subjects like biology, chemistry and physics, and may take one, two or three of them.

A wide range of enrichment programmes complement the formal curriculum at both the school and national fronts. Science fairs, competitions, learning trails, camps, workshops, and attachments to research institutes serve to engage and inspire students across all levels of learning. At the national level, MOE works closely with partners such as the Agency for Science, Technology and Research (A*STAR), institutes of higher learning, industries and the Singapore Science Centre, to design programmes for both the general student population (at all levels) and those with deeper interests and talents in science. Examples of some such programmes include:

- The A*STAR Talent Search (ATS), a competition for student science projects, where participants must proceed through three rounds of judging. The aim is to stimulate a lifelong passion for science and scientific enquiry and to encourage top students, aged 15 to 21, to strive for excellence. Students are mentored by a professor at an A*STAR institute or Singaporean university, and the Chief Judge of the ATS is always a Nobel Prize laureate.
- CRADLΣ, a network of scientists, educators and support staff who facilitate hands-on, interactive invention by both lending equipment to schools and by holding workshops for secondary students at their prototyping lab at Science Centre Singapore. The aim is that students see the practical applications of school science and mathematics and think of science as fun. CRADLΣ also runs professional development workshops for teachers.
- The International Science Drama Competition, which aims to use drama to present scientific content. Although originally aimed at primary school students, it is now also open to the public.

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