Title	Education in Singapore: Development since 1965
Author	Goh, C. B., & Gopinathan, S.
Source	B. Fredriksen & J. P. Tan (Eds.), *An African Exploration of the East Asian Education* (pp. 80-108).
Published by	Washington, DC: The World Bank.

Goh, C. B., & Gopinathan, S. 2008. *Education in Singapore: Development since 1965* © World Bank. http://hdl.handle.net/10986/6424. License: Creative Commons Attribution licence (CC BY 3.0 Unported licence).

Citation: Goh, C. B., & Gopinathan, S. (2008). Education in Singapore: Development since 1965. IN B. Fredriksen & J. P. Tan (Eds.), *An African Exploration of the East Asian Education* (pp. 80-108). Washington, DC: The World Bank.

CHAPTER 3

Education in Singapore: Developments Since 1965

GOH Chor Boon and S. GOPINATHAN

INTRODUCTION

The aftermath of World War II in the Pacific region created severe social and economic dislocations for the people of Singapore. Although the British rulers reclaimed control of the trading port, the halo of British invincibility was totally shattered. The people now clamored for political freedom and economic opportunities. Frequent industrial strikes and unrest forced the closure of many British firms and, subsequently, spurred an exodus of British capital out of Singapore. The population grew from about 960,000 in 1948 to about 1.6 million in 1954, but the colonial administration was slow in reviving the economy and in providing enough jobs. There was high unemployment and an acute shortage of public housing. Many squatter colonies sprouted up throughout the suburban and rural areas. In the 1950s, racial integration did not exist and within the plural society the main ethnic groups considered themselves to be Chinese, Malays, or Indians, rather than Singaporeans. Religious differences, if exploited, could lead to communal trouble, and this became a reality in the infamous Maria Hertogh riots.

Besides the economic and social woes, British colonial policies relating to education, language, and citizenship were responsible for stifling the growth of racial integration and the establishment of a common destiny and identity shared by the people of Singapore. In education, for example, the government did not attempt to regulate and support the number of Chinese schools but, at the same time, encouraged the growth of English-stream schools. The Chinese-educated became an underprivileged group; they had no opportunities for tertiary education nor could they hope to be employed in the civil service. In short, the government failed to recognize the more dynamic and vocal Chinese-educated group. These "gaps" were quickly exploited by the Malayan Communist Party in Singapore and

contributed to a decade of political turbulence in the 1950s.[1] Singapore thus had, at this time, many of the features of a "failed state."

The years 1959 to 1968 represent some of the epochal years in Singapore's modern history. In 1959, the British colony became completely self-governing and in August 1965 Singapore became a sovereign state after separating from Malaysia. Singapore's political leaders were faced with the unenviable task of ensuring the political and economic survival of the small city-state. Colonialism had produced a lopsided economy strongly dependent on entrepôt trade. Increasingly, science and technology became the vital ingredients that dictated a country's level of competitiveness. The overriding priority of the Singapore government in 1965 was to find the quickest and most effective way to develop an industrial economy and to develop its own military capability. To compete as a viable economic entity, the immediate task was to break away from the long dependency on entrepôt trade and embark on an export-oriented industrialization strategy. To do so, the government developed a "developmental state" strategy.

The developmental state ideology propagated the inseparability of economic and political survival. The successful fusion of economic and political survival required the internalization of an entirely new set of social attitudes and beliefs by the people of Singapore. The call was made for the sacrifice of self-interest for the "national interest." In the process of catching up, important policies, especially those in the field of education and manpower development, were speedily implemented. In the late 1960s and 1970s, the state was successful in ensuring that individual survival matched well with the state's ideology of survival.

This chapter highlights key features of the development of education in Singapore over the last 40 years, focusing on how Singapore has been able over this period to develop its education system from a level in the early 1960s quite similar to that of many developing countries, to reach a level comparable to and in some aspects surpass the best member countries of the Organisation for Economic Co-operation and Development (OECD). This analysis is done in the context of the economic and social transformation of Singapore since 1965.

SURVIVAL ECONOMICS, SURVIVAL-DRIVEN EDUCATION, 1965–78

Since the 1950s, industrialization has been widely acknowledged by the procapitalist, independent states of Southeast Asia as the key to survival and economic growth. But the task was not easy as long periods of colonialism had produced unbalanced economic structures that confined the rising indigenous capitalist class to comprador trading activities and limited small-scale manufacturing and processing. The initial response was the adoption of the development strategy strongly recommended by the Argentine economist Raul Prebisch, that is, Import

Substitution Industrialization (ISI), which was aimed at the reduction of dependence on imported goods (Dixon 1991, 152). Essentially, it involves the small-scale production of nondurable consumer goods whose production requirements are compatible with such conditions as abundant unskilled labor and unsophisticated technology that exists in countries without previous industrial experience. High growth rates were indeed experienced by the countries in Southeast Asia, but by the mid-1960s, the limitations and inherent contradictions of the ISI strategy began to be felt. In the case of Singapore, apart from assembling consumer goods, there were few signs of a transition to capital goods production. Manufactured imports were merely replaced by raw materials, capital goods, and components. Pressure for accelerated growth through the development of export markets was emerging from local manufacturing capitalists. The situation was compounded by Singapore's expulsion from Malaysia in 1965. It seriously undermined the ISI strategy by dramatically reducing the size of the domestic market. When the country was part of Malaysia during the years 1963 to 1965, it was able to take advantage of the wide hinterland market to its north. The development strategy adopted by the Singapore leaders gradually shifted toward Export Oriented Industrialization (EOI), which, by the early 1970s, became the "new orthodoxy" strongly advocated by Bela Balassa of the World Bank for economic growth in developing countries.

In the case of Singapore, by the late 1950s, it remained primarily an entrepôt, with 70 percent of its gross domestic product (GDP) derived from these entrepôt activities (Dixon 1991, 158). The country had a small and limited industrial base. The predominant industry was the shipbuilding and repairing industry that was largely in the hands of governmental and public bodies, such as the Singapore Harbour Board and the British Naval Base. The small manufacturing sector consisted mainly of light engineering, assembly of vehicles, marine engineering, printing, and processing (Colony of Singapore 1955). Though employment in the manufacturing sector grew from 22,692 in 1955 to 44,295 in 1961, manufacturing development was slow and stagnated at about 12 percent of GDP in 1960. In the meantime, the postwar baby boom in the early 1950s and the free immigration policy had resulted in an average annual population growth rate of 4.4 percent between 1947 and 1957, and the unemployment rate stood at 5 percent, rising to a high of 9.2 percent in 1966. It was clear to the government that solving the rising unemployment problem was a matter of high priority.

The government became more focused on the need to expand the industrial base, although it still advocated that Singapore must continue to "jealously guard its position as an entrepôt" (*The Malaya Tribune* March 13, 1953). But the task of expanding manufacturing activities for a trading port was not expected to be smooth because of the "dearth of skilled labor in Singapore" (Colony of Singapore

1954).[2] The year 1968 was a watershed in terms of a shift in industrial strategy to more export-oriented manufacturing activities. To support the EOI strategy, and given the lack of natural resources, the development of the country's human resources was of paramount importance for the government. To achieve this end, a task was started to build an education system that would support the development of a literate and technically trained workforce.

While under British colonial rule, education was used as a tool to meet British political interests and to pacify ethnic groups that were political aspirations. In 1965 and after, an intimate link between education and economic development of the small city-state was strongly emphasized. The government took the conventional path in developing new skills and work attitudes to accommodate new economic strategies. While the economics of education was in focus, the role of education in the socialization and nation-building process, especially in terms of developing a Singapore identity, was not forgotten. National integration through a national education system was seen as the key condition for economic survival. To attain these national objectives, the government rightly recognized the necessity to provide every child with at least six years of education from the age of six—without discrimination of race, language, sex, wealth, or status.

Given the multilingual nature of the population, bilingualism inevitably became a key component in Singapore's education system. In 1960, learning a second language was made compulsory in all primary schools, and in 1966, the policy was extended to all secondary schools. The decision on bilingualism was not just for the achievement of social cohesion in a largely plural society (at least, during the early 1960s). The English language was seen as a primary utilitarian tool in Singapore's effort to make the world its marketplace. It was a politically difficult decision, because English, the language of the colonial powers, was met with much hostility. With the increasing demand for English, however, the danger that the young could become deculturized and forget their mother tongues increased. The bilingual policy assured parents that their children would not grow up culturally ignorant. Today, Singapore's bilingual policy is perhaps the most unique of its kind in the world. It is an Eastern-Western Hemisphere model that allows Singaporeans to attain competency in the use of the English language, the language of the so-called West, as well as in the use of the Chinese language (or other indigenous languages, such as Tamil and Malay), the languages of the so-called East. This approach is particularly useful for Singapore's business internalization strategy. The Western concept of bilingualism in schools is based more on a Latin model in which pupils will usually learn, say, German and English or Italian and English.

The years 1959 to 1965 were significant, even epochal, in the history of Singapore's education transformation. In May 1959, Singapore was given self-government status, and a Five-Year Plan (1961–65) to boost the education standards

of the people was implemented. The priority was to provide universal free primary education. The plan consisted of three main features:

- Equal treatment for the four streams of education—Malay, Chinese, Tamil, and English
- The establishment of Malay as the national language of the new state
- Emphasis on the study of mathematics, science, and technical subjects

The philosophy behind these aims "[c]onserved equal opportunity for all citizens, established the means of maintaining unity in diversity and instituted a program for training a new generation for the needs of a forward-looking, modern, industrial and technological society" (Ministry of Education 1966).[3] Today, this philosophy, broadly speaking, stays intact. Although the government continued to provide for vernacular education, a major consequence of the transformation of the Singaporean economy from 1959 onward was the consistently strong tendency for parents to enroll their children in the English language schools. In 1959, only 47 percent of children entering primary grade one were in the English stream, and 46 percent were in Chinese schools. Twenty years later (in 1979), the English stream enrolled 91 percent of all children in primary grade one with only 9 percent in the Chinese stream and a negligible number in the Tamil and Malay language streams. This dramatic shift was brought about by the free choice of pragmatic parents in response to the nation's drive toward high value-added industrialization and to an economy where the language of business is English.

Primary education was freely made available to all. In 1962, out of a population of 1.7 million, the student population stood at nearly 400,000. This led to a period of rapid construction of schools. Under British rule, government English schools and missionary English schools had good buildings. In mainly the rural areas, however, vernacular schools, built and supported by private organizations or individuals, were made of wood. Beginning in 1959, the responsibility of building all new functional schools was passed on to the Ministry of Education.

Primary and secondary education enrollment rose from 320,977 in 1959 to a peak of 530,079 in 1968. Table 3.1 shows enrollment since 1959. The early 1970s saw a decline in primary enrollment because of successful family planning strategies implemented by the government. By 1965, a total of 83 new school buildings were completed—at about the rate of one school a month for seven years. The accelerated building program matched the demand of the primary-school population by 1964. Even with this program, however, it became necessary for school buildings to be used by two sets of children, that is, double sessions were held, to accommodate the rapid increase in enrollment. In the words of Ong Pang Boon, the then minister for education, "The people of Singapore are becoming so education conscious that we have achieved universal primary education without making it compulsory . . . and once admitted, they [the children] are assured of a

Table 3.1 Pupil Enrollment in Primary and Secondary Schools

Year	Primary	Secondary
1959	272,254	48,723
1960	290,576	59,314
1961	307,981	67,857
1962	324,697	72,308
1963	341,620	84,425
1964	353,622	99,592
1965	362,672	114,736
1966	370,899	132,088
1967	373,437	144,448
1968	379,828	150,251
1972	354,936	161,371

Source: Department of Statistics (Singapore), various years.

10-year primary and secondary education finishing at the minimum age of 16" (*Straits Times* September 26, 1965; November 25, 1965). Because of the rapid construction of schools, universal lower-secondary education was achieved as early as 1970. The overall growth in secondary education, from 48,723 in 1959, to 114,736 in 1965, and to 161,371 in 1972 is impressive evidence of the importance attached to education (beyond primary education) that is perceived by parents. From a societal point of view, secondary education was the most profitable investment (Pang Eng Fong 1982, 94–95). The rate of return to society is 18.2 percent for a completed secondary education for males and 17 percent for females. In terms of types of education, an English-stream education had greater monetary payoffs to society than vernacular-stream education.

Although statistics indicated successful outcomes, it was increasingly difficult for the Ministry of Education to meet the intense desire of the people to educate their children. Some obstacles were logistic in nature. The population in most urban areas and in certain rural areas was unevenly distributed. Suitable school sites in the densely populated areas were unavailable. This problem was compounded by the parents' selection and preference for certain schools, such as those with personal affiliation and language stream. Nevertheless, with careful planning, budgeting, and ensuring that there were sufficient teachers, universal primary education was attained by the mid-1960s.

In 1965, the government allocated 28.8 percent of its total budget to education; of this, 59 percent went to primary education, 27 percent went to secondary education, and 14 percent went to higher education (as compared with 65 percent, 20 percent, and 15 percent, respectively, in Japan) (*Straits Times* November 25, 1965). Table 3.2 shows the annual expenditure on education during the years from 1959 to 1967.

Table 3.2 Annual Expenditure on Education, 1959–67

Year	Expenditure on education (S$ millions)	Percent of national expenditure
1959	60.00	23.6
1960	57.10	23.5
1961	65.84	17.1
1962	82.31	23.4
1963	94.64	15.8
1964	103.36	31.7
1965	112.81	28.8
1966	124.08	23.4
1967	135.05	22.8

Source: Department of Statistics (Singapore), various years.

Education in Singapore was financed almost entirely from state revenue. The Ministry of Education made its own estimates of expenditure annually, which were presented to the Ministry of Finance for submission to Parliament for approval. Hence, except for a handful of private schools run by private organizations such as clan associations, schools in Singapore were (and are) public or state-supported schools. In addition to the generous funding from the government, two other strategies were adopted to cater to the rapid expansion of the schooling population: teacher recruitment and the availability of textbooks.[4]

Corresponding to the increase in pupil enrollment, the number of teachers in the teaching service increased rapidly, from 10,590 teachers in 1959, to 16,986 in 1965, and to 19,216 in 1968. These teachers were trained or qualified, and the strategy used to achieve these numbers resorted to large-scale recruitment of teachers-in-training at the then Teachers' Training College. During this period, a part-time teaching program was introduced—training in the morning and teaching in the afternoon and vice versa (depending on the type of program). This was a realistic approach during the years of rapid expansion.

In tune with the government policy of equal treatment for the four language streams of education, the Government Scheme for Loan of Free Textbooks offered assistance to all pupils studying in these four language streams. This was done in accordance with the Textbook for All policy, which stated that no needy children from lower-income families should be denied an education merely because of an inability to purchase textbooks. The free textbooks scheme was administered by the schools, and the books were obtained directly from the Education Publications Bureau (EPB), which was set up by the government in 1967 to produce common and affordable textbooks for all. The rising cost to the government of this form of aid to needy children can be seen from the annual expenditure on free textbooks—rising from S$79,606 in 1959 to S$259,200 in 1965. The textbook ownership-to-student

ratio was close to 1:1 thanks to the low cost of production achieved through a competitive tender system administered by the EPB with private printers. The cost recovery associated with textbook development was not a primary concern, because "Singapore has so far been able to finance its own educational expansion program largely because of the resourcefulness of its people" (*Straits Times* November 25, 1965).

The period of survival-driven education also saw the review and upgrading of technical and vocational education. As early as 1964, the government established secondary vocational schools for the first time, with an enrollment of 4,910 pupils. These pupils did not pass the primary leaving examinations to enter academic secondary schools. The curriculum, aimed to equip pupils for employment in establishments where basic vocational skills are required, consisted largely of vocational subjects, such as woodwork, domestic science, art and crafts, and technical drawing. By 1968, it was becoming increasingly apparent in the Ministry of Finance that the prospective output of technically trained workers produced by the school system would be insufficient to meet the requirements of new industries. It did not require any elaborate process of manpower planning to reach this conclusion. In 1968, out of the 144,000 students in secondary schools, only some 18,000 were enrolled in technical and vocational streams. Accordingly, the government accelerated the plans for the expansion of technical education. A Technical Education Department was set up in the Ministry of Education in June 1968, and from 1969, all male lower-secondary pupils were required to have two years of exposure to technical subjects. Girls were given a choice between technical subjects and home economics.

The Technical Education Department used all available training facilities (located in four newly built vocational institutes) to train skilled workers, such as welders and machinists, to service the shipbuilding, oil refinery, electro-chemical, electro-mechanical, precision engineering, metalworking, and woodworking industries (Clark 1971). From 1970 to 1973, for example, 1,789 trainee welders received formal technical training. Although Singapore succeeded in attracting a wide range of foreign-owned new industries, the industrialization effort benefited immensely from the technical and financial assistance provided by a number of foreign governments and from the United Nations Development Programme aimed at producing industrial skills. Foreign governments who donated machinery and expertise included Japan, Britain, and France. Several vocational training centers were set up as a result of this external support.

To keep pace with the rapid developments in technical and vocational education, extensive teacher training and retraining programs were developed, and the Finance Ministry made funds freely available for such purposes. The number of technical teachers increased from 425 in 1968 to 1,950 in 1972. This was by no means an achievement, because the labor market was getting increasingly tight. In

addition to teachers who were specifically trained in technical subjects, academic subject teachers were also encouraged to be retrained as technical subject teachers. In 1968, some 4,000 teachers received training in metalwork, including fitting and sheet metal, woodwork, printing, motor mechanics, radio and television servicing, and electrical fitting and installation. The flexibility inherent in teacher retraining proved to be highly cost-effective in meeting the demand for these technical teachers.

The survival-driven system of education continued into the 1970s with the continual propagation of an industrial-oriented education to produce the manpower needed for industrial development. The Vocational and Industrial Training Board (VITB, the predecessor of the current Institute of Technical Education) was created in 1979 to take in secondary school leavers who were less academically inclined. Vocational training institutes under the VITB offered a wide range of courses, the most popular of which were electrical, electronics, maintenance and repair of motor vehicles, refrigeration, air conditioning, carpentry, masonry, and plumbing.[5] Enrollment at the secondary level continued to grow, rising from about 148,000 in 1969 to 176,000 in 1979. Enrollment in VITB institutes also rose from 2,800 to 14,000 during the same period. By 1976, only a decade after independence, close to 20 percent of the secondary school population was receiving technical education. At the tertiary level, the total intake at Singapore's two main polytechnics at this time—Singapore Polytechnic and Ngee Ann Polytechnic—rose from about 3,500 in 1966 to about 11,000 in 1980. Thus, the decision to promote technical education proved successful, even though it was not initially popular with parents.

Britain's laissez faire policy did not produce systemic changes to the education landscape in colonial Singapore, but the Singapore leaders introduced a flurry of "haphazard changes" (*Straits Times* March 24, 1976). Singapore's planners in education failed to see early enough that the bilingual requirements of the system were not differentiated in terms of pupil ability. Those who failed to make the grade at the Primary School Leaving Examination (PSLE), which was a selection to secondary school, left the system and only some went on to vocational institutions. As a result, the growth in secondary education was slow, with an average of about 70 percent of the leaving primary cohort entering secondary schools. As many as seven different ministers were at the helm of these education changes and, at one stage, Singapore had three education ministers within a span of less than 15 months. No attempt was made to listen to the views of teachers or parents before new policies were implemented. As pointed out by one member of Parliament, "The point is we were so concerned with objects and objectives that we lost sight of the fact that we were dealing with children and people" (*Straits Times* March 24, 1976). A serious communication gap was recognized between the Education Ministry and the schools. This lack of dialogue led to all kinds of

interpretation of policy decisions that, at one point, totaled 78 notifications issued to schools within just nine months. The necessity of establishing channels of regular communication between the Ministry and the schools was an important lesson learned from this experience.

The low status and morale of teachers was also high on the list of complaints. As voiced by the Singapore Teachers' Union, resignation of teachers and principals was consistently high in the early 1970s. In 1973, 379 teachers resigned, or 2.1 percent of the teaching force; in 1974, 350 teachers resigned, or 1.9 percent; and in 1975, the figures were 306 resignations, or 1.7 percent.[6]

The year 1978 was a watershed in Singapore's education development. To support its broad "catching-up" economic strategy, and working on the premise that senior servants and talented bureaucrats should assume major roles in decision making, spearheading changes and managing large government enterprises, the government introduced a technocratic ethos in its education framework. A high-level review committee, led by Dr. Goh Keng Swee (the then deputy prime minister) and his team of systems engineers, reviewed the education system and totally overhauled it. Its report (popularly known as the "Goh Report") brought to light the education doldrums embedded in the system, as reflected in two sets of statistics, those relating to education wastage and to the literacy level of the students. Education wastage, in the form of failure to achieve the expected standards and premature school leaving, for the years 1971 to 1974 was high. Out of 1,000 pupils entering primary grade one, on average, 206 dropped out of school nine years later, without acquiring any useful qualification or skill. It was recommended that those pupils who did not have the ability to proceed satisfactorily in the academic stream would be screened and prepared for vocational careers. In this way, reduced student wastage rates contributed to increases in education access.

The low education standard in the 1970s was reflected in the poor literacy level, which was measured in terms of proficiency in the English language (an average 40 percent pass rate in the Ordinary Level Cambridge Schools Examinations in the 1970s), of those pupils who passed their PSLE and young national servicemen with education levels ranging from no formal education to secondary grade three. This low literacy was despite the fact that the nation's literacy rate increased from 72.7 percent in 1970 to 77.6 percent in 1978 (*Straits Times* August 11, 1978). The low English proficiency resulted in the overall low education standard.[7] Out of 1,000 pupils entering primary grade one, only 440 reached secondary grade four after 10 years and, of this number, only 106 obtained 3 or more "Ordinary" level passes at the Cambridge Schools Examinations.

By the mid-1970s, the adoption of the EOI strategy had enabled the country to enjoy full employment. But it was apparent to the political leaders that to sustain robust growth rates, the people must develop additional competencies in science

and technology. British colonialism did not leave behind a well-planned education system that emphasized the development of technical and vocational skills. The earlier-than-expected British military withdrawal from 1971 also created the pressing need for the supply of skilled labor resources to fill the positions formerly occupied by skilled British workers. The long time lag had made it difficult for the government to introduce measures to quickly close the technological gap. The problem was compounded by the severe shortage of local expertise in the field of science and technology. Such expertise could have contributed to the development of appropriate science and technical education in schools. A study report in 1970 by Dutch economist Albert Winsemius highlighted the deficiency in terms of the shortage of skilled workers, such as engineers, management personnel, and technicians.[8] Whatever limited pool of engineers the country had was largely taken up by the multinational corporations (MNCs) that dominated the fast-expanding manufacturing sector (Goh 1972, 275). The Singapore government had adopted an aggressive open-door policy to attract MNCs and foreign expertise to the small city-state to provide the impetus for an industrial takeoff and to close the technological gap. As explained by Goh Keng Swee, then deputy minister, in his 1970 budget speech, "When foreign corporations bring their expertise, what we experience as a developing nation is a brain-drain in reverse . . . in the long term the scientific know-how and technological processes which we now borrow from abroad must in course of time develop on an indigenous base at our institutions of higher learning" (Parliamentary Debates Singapore March 9, 1970).[9]

Although new government institutions were set up to deal with science and technology policy problems, quite often the measures recommended did not endure for long. Instead, there was a bewildering succession of ad hoc committees, councils, and agencies, each of which sent out different signals and directions. The confusing situation was further reinforced by the existence of a rather-inept Ministry of Science and Technology (set up in 1968), suffering from a shortage of high-level administrators and overseeing a wide range of activities, ranging from coordination of technical education to the promotion of research work.[10] Young Singaporeans had indifferent attitudes toward "blue-collar" jobs. The magnitude of the problem was seen in some shocking 1976 statistics—of the 150,000 clerical and related workers, only 2 percent were work permit holders; but of the 1,600 metal process workers, 46 percent were work permit holders, reaching 56 percent of the 4,700 woodworkers and a staggering 60 percent of the 55,000 building construction workers (*Straits Times* August 9, 1976).[11] Recognizing the backwardness in the development of science and technology in the country, the Singapore government, in the 1980s, adopted development strategies designed to push the economy and society higher up the technological ladder. With this vision, more education changes were introduced to prepare the people for the country's "Second Industrial Revolution" in the 1980s.

SUSTAINABLE DEVELOPMENT THROUGH EFFICIENCY-DRIVEN EDUCATION, 1978–97

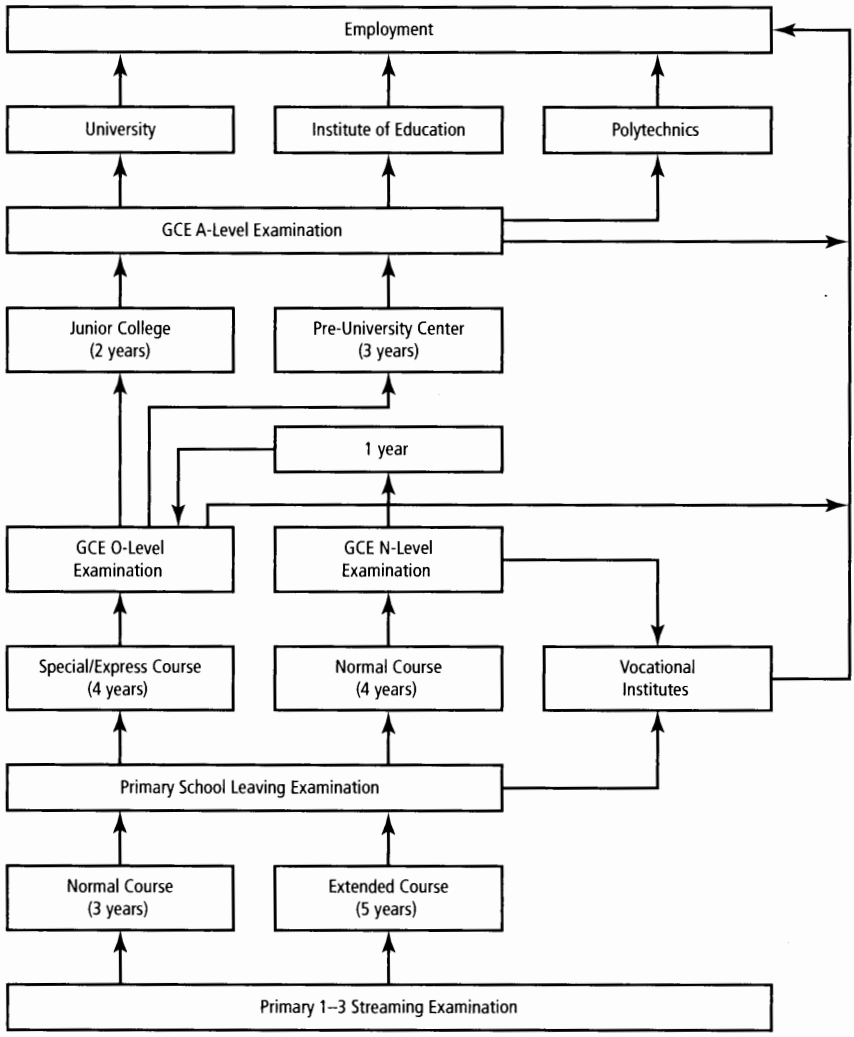
Quite remarkably, by the end of the 1970s, social and economic indicators pointed to a rich and progressive environment in Singapore, which, in the midst of developing countries in the region and elsewhere, was still battling with the problem of poverty. In 1980, after two decades of intensive expansion of the manufacturing sector largely through the aegis of foreign MNCs, the manufacturing sector contribution had risen to 28 percent of GDP, compared with 12 percent in 1960. As countries in Southeast Asia began to compete effectively for foreign investments in low-skilled, labor-intensive industries, Singapore's previous comparative advantage in labor-intensive manufactured products was gradually being eroded.

The response was a shift to a strategy that could accelerate Singapore's transition from a third-tier labor-intensive industrializing country to a second-tier capital-intensive economy. Thus, the Second Industrial Revolution was launched in 1981, accelerating Singapore's transition to a more sophisticated technological base, and thereby taking it out of competition with the lower-wage countries and lessening its reliance on labor expansion for economic growth. The two main strategies of the restructuring program were as follows: (a) a continuation of the policy of attracting MNCs to invest in high-technology operations, and (b) the promotion of science and technology, such as activities in research and development (R&D).[12] To provide a labor force for this stage of industrialization, the government revisited the education system, not only using it as a major vehicle in nation building, but with the state acting as a strategic player through manpower planning, also applying it to the wider process of economic development. The ability of the state to successfully manage education and skill demand, as well as supply, was and continues to be a major source of Singapore's competitive advantage.

After two decades of rapid expansion of education opportunities for all young Singaporeans, during which universal primary and lower-secondary education was achieved, the government now shifted its focus to quality rather than the fulfillment of mere quantitative demands. The emphasis was on upgrading and providing quality education. It was recognized that survival-driven education was structured on the premise that children of different levels of intelligence and learning ability were expected to progress at the same rate. With the pace of teaching geared to the average pupil, the more intelligent students found school to be boring, and those with learning difficulties found it difficult to keep pace.

To support the drive toward sustainable development and reflecting the economic restructuring strategies, education was revamped with an emphasis on efficiency. Aimed at reducing education wastage, a New Education System (NES)

Figure 3.1 The New Education System, 1979



Source: Adapted from Low et al. 1991, figure 4.1.
Note: GCE = General Certificate in Education.

was introduced in January 1979 (see figure 3.1). The NES provided for three streams in both primary and secondary school, to allow pupils to progress at a pace more suited to their abilities. Slower primary pupils were allowed up to eight years to complete primary education, whereas secondary pupils could take up to five years to acquire the General Certificate in Education (GCE) "Ordinary" Level and a further three years for the "Advanced" Level. A new lower-secondary school certificate, the GCE "Normal" was introduced. In manpower terms, the intention

was to reduce attrition and enable each pupil to go as far as possible in school, and thereby achieve the best possible education takeoff for further training and employment.

By the early 1980s the key features of the efficiency-driven education system were in place—a national curriculum with a stress on bilingualism, moral education, and civics; an emphasis on science, mathematics, and technical education; regular student assessment regulated by the Ministry of Education's Research and Testing Division; differentiated curriculum materials tailored to the needs of different streams produced by the Curriculum Development Institute of Singapore; and clear lines of progression to the university, polytechnics, and vocational institutes. By 1984, the education system featured a systematic and year-long professional training program for principals and heads of departments. Primary streaming (at primary grade three) and secondary streaming (at secondary grade two) began in 1979 and 1980, respectively. Taken together, these changes motivated student enrollment and performance by eliminating education dead-ends and enabling each student to advance as far as their interest and ability might take them.

On the whole, the NES saw improvements in terms of academic results. Before implementation of the new system, more than 60 percent of pupils who sat for the PSLE and the O-level examination failed in one or both languages. By 1984, the overall percentage passes of the PSLE in English and a second language were 85.5 and 98.7 percent, respectively. For the O-level English exam, the passing percentage jumped to more than 90 percent. At the same time, high attrition rates at the primary and secondary stages of education declined sharply, as noted in the Goh Report (1978). In 1986, for example, only 3,772 pupils (or less than 1 percent of the total school population below 16 years of age) left school without having at least 10 years of education. The country's success in reducing education wastage provided the city-state with an educated workforce able to cope with the demands of a rapidly expanding economy. As in the previous decades, education in Singapore in the 1980s and beyond, being both a public and merit good, was (and is) heavily subsidized by the government. In 1989, private expenditure on education was only 0.55 percent of GDP (compared with 0.86 percent in 1960) (Low, Toh, and Soon 1991, 135–38).[13]

Within the education system, however, there were still teething problems. The strictly top-down approach in planning, disseminating, and enforcing education changes was a clear reflection of the Singapore government's paternalistic style of rule. In the process, it produced three unhealthy trends.

First, it generated the "yes-man" syndrome and the acceptance of instructions without question. Second, it inculcated an over-reliance on the top leaders for direction. Third, it nurtured a spoon-feeding culture. The end result was an education service that lacked autonomy, initiative, and a general sense of detachment

from the policy makers. Within schools, teachers and children alike were mechanically fed by a bureaucratically designated and rigid curriculum. The double-session system imposed constraints on schools by restricting the availability of its physical facilities and imposing severe inconveniences on teachers. Not surprisingly, even by the mid-1980s, principals and teachers suffered from low morale and lacked the deep commitment to implement effectively the changes demanded by leaders. Teachers had to endure poor social status, ineffective supervision and guidance, and bleak promotion prospects especially for the non-graduate-level teachers.[14]

With the appointment of Dr. Tony Tan Keng Yam as minister of education in 1985, the pressing problems in the education system were tackled with great vigour. The guiding philosophy for Singapore's education system in the 1980s was explicitly expressed by the former banker who answered the call of duty to serve in the Cabinet:

> I would say that our education system in the 1980s should be guided by three considerations: Firstly, preparing the child for work in a Singapore which is rapidly becoming a modern centre for brain services and technological industries. This means that he will need to have a sound knowledge of English. Secondly, equipping him with a sufficient knowledge of his mother tongue so that he will retain a link with his cultural origins. This is the rationale for our policy on bilingualism. Thirdly, inculcating in the child an awareness of the necessity of moral and traditional values so that he will grow up to be a responsible adult, conscious of his obligations to himself, his family, his neighbours and his nation (*Business Times* July 8, 1980).

From 1985 to 1991 a series of well-planned education changes were introduced that reduced wastage, increased flexibility within the school system, gave greater autonomy to schools, and provided greater access to higher education. All pupils leaving the primary school system were placed in the appropriate secondary school courses that matched their learning pace, ability, and inclinations. An education program for gifted students was started in 1985, English was made the main medium of instruction in all schools, and a scheme to have all secondary schools move to only a single session was initiated in 1989. Changes were also made to tackle the teacher shortage. In the words of Dr. Tony Tan, "The basic solution to the problem of attracting high-quality people to join the teaching profession is to pay them sufficiently" (*Straits Times* July 8, 1980). In response to these needs, training programs at the then Institute of Education were revamped and full-time training for nongraduate and graduate teacher trainees started in July 1980.

A critical issue that continued to fester was the failure of the education system to inculcate positive values and attitudes toward technical training and blue-collar

jobs. Though much had been done to equip the school leavers with technical and vocational skills and to change attitudes, vocational training was (and is) specifically aimed at providing a form of continual education for the less academically inclined pupils. Before 1992, those who failed their PSLE and the examination at the end of secondary grade two were channelled into vocational institutes. Unlike in the Republic of Korea, where vocational and technical training is held in high esteem, Singapore's system had failed to project the same image. Vocational institutes continued to be perceived as "dumping grounds" or "catch-nets" for those who failed to master the academic rigor curriculum.

As a result, Singapore continued to be severely hampered by shortages of labor at three critical levels—skilled labor, qualified technical and engineering personnel, and management trained in modern techniques. Clearly, it is not an easy task to reconstruct a trading culture into a manufacturing culture, especially one that has strong underpinnings in science and technology. In the first place, education in Singapore has long been historically characterized by a white-collar mentality. In part this characterization is due to its colonial origins and to the high standing the civil service has in Singapore because of its contribution to Singapore and its contribution to Singapore's socioeconomic transformation. The majority of school leavers wished to go to university and obtain academic and professional qualifications. They gravitated toward clerical and administrative posts in the tertiary sector, mainly in insurance, banking, trading, and government service. A useful sociocultural explanation for the continuation of this white-collar mentality is the perception held by many Chinese families that administrative posts were seen as compatible to the scholar class under the Confucian social hierarchy. They command high prestige, prospects, and job security (*Straits Times* April 10, 1968). The white-collar mentality at this time was undesirable and inconsistent with the government's policy to shift toward a science- and technology-competent blue-collar workforce. Unfortunately, some vestiges of this historical legacy remain.

The negative perception of vocational and technical training was tackled seriously by the Singapore government in the late 1980s. As the young continued to show an aversion toward blue-collar jobs, the danger of the country not possessing a sufficient pool of technically skilled local workers became obvious. This scenario prompted a serious warning by Lee Yock Suan, then minister of education, in June 1994: "Singapore will be poorer if everyone aspires to and gets only academic qualifications but nobody knows how to fix a TV set, a machine tool or a process plant. We need a world-class workforce with a wide variety of knowledge of skills to achieve a world-class standard of living" (*Straits Times* June 14, 1994).

Several institutional changes were introduced in the 1990s to enhance the image of technical and vocational education in Singapore. In 1992 the VITB was totally revamped and renamed the Institute of Technical Education (ITE). ITE campuses, with excellent education and sports infrastructure and cutting-edge

technological support, were built in several locations throughout the island. Beginning in 1992, pupils who did not fare well at the end of their primary education were channelled to a new Normal Technical secondary stream before gaining admission to the new postsecondary ITE. The secondary curriculum was restructured to allow the necessary time to master basic skills, especially proficiency in the English language. Scholarships were available for top ITE graduates to pursue diploma courses in the polytechnics (*Straits Times* December 30, 1993).[15] Beginning in August 1994, ITE launched its attachment programs for Secondary Two Normal (Technical) Technical stream students. The objective was to familiarize these students with the state-of-the-art campuses and, more important, to "remove any fears of machinery and tools or hang-ups about blue-collar jobs" (Chiang 1998, 64). Market demand for the well-trained ITE graduate, especially by some 650 participating companies under ITE's apprenticeship scheme, led to a rise of their starting salary, from an average of about S$700 per month in 1994 to about S$1,200 per month in 2005. Many success stories were highlighted in the newspapers that showcased ITE students making it to the polytechnics and eventually acquiring university degrees. In short, although enrollment in these training schools is limited to those who find it difficult to go the academic route, the image of vocational training has greatly improved.

At the tertiary level, in line with the government's effort to enlarge the pool of scientific and technical manpower and its overall economic vision to transform Singapore into a developed nation, total enrollment in local degree and diploma courses increased by more than 200 percent (20,305 students in 1980 to 62,683 students in 1992) (Ministry of Education, various years).[16] Increasing university enrollment, however, does not hide the fact that Singapore was critically short of university graduates to run the economy. In the early 1980s, only 9 percent of annual cohorts of students entered universities or polytechnics (compared with 20 percent in Taiwan (China), and 40 percent in Japan). Rigidities in the education system and, more specifically, in the admission process to the two local universities also prevented the rapid expansion of the graduate population. Admission was (and is) based on the student achieving acceptable A-level results. Further restrictions included enrollment quotas for the various faculties (for example, law and medicine) and the second language requirement.

Although the increasing number of polytechnic and university graduates helped change the profile of the workforce, the government recognized that, to become a technologically advanced city-state, the country needed a sustainable supply of indigenous scientists and engineers. For Singapore to develop its own indigenous technological capabilities, the lion's share of the supply of scientists and engineers had to come from native-born students educated and trained in local universities and polytechnics.[17] In 1990, out of every 10,000 Singapore

Table 3.3 Output of Degrees, 1980–89

Courses	1980–85	1986–89
Arts	3,792	4,542
Science	3,180	4,105
Engineering	2,467	5,005

Source: Calculated from Department of Statistics 1989, tables 15.12 and 15.13.

workers, 114 were engineers by qualification, but only 29 were research scientists and engineers (RSEs).

Concerted efforts, including better employment prospects and higher baseline salaries, were made in the public-private sector to entice young Singaporeans to take up science and engineering disciplines in the universities. These efforts resulted in an increase in the output of science and engineering graduates during the 1980s, as seen in table 3.3.

This increase in the number of graduates in science and engineering was sustained throughout the 1980s. Most significant, the number of engineering graduates doubled between the periods 1980–85 and 1986–89. This was an indication of the success of the government manpower planning "in meeting the needs of the economy for trained personnel at all levels" (Lee 1988, Vol. 50, Col. 1503). The government confirmed that

> [T]he major constraint on the expansion of technical education has been the number of qualified trainees, not the demand for graduates or the availability of places . . . the Engineering faculty at the University, which expanded rapidly, had difficulty in filling its places, and admitted some marginal students, and then suffered high failure rates in its five year examinations . . . (Lee 1988, Vol. 50, Col. 1504).

The shortage of able students studying engineering was compounded by the fact that "[t]he biggest misallocation in our tertiary education is the very low proportion of girls doing engineering" (Lee 1988, Col. 1505). Girls, some of whom outperformed the boys at A-level examinations, were more interested in courses like accountancy and business administration because "they think [that in engineering] they may get their hands dirty" (Lee 1988, Col. 1505).

In terms of the needed research and development manpower, the increase in the number of science and engineering graduates contributed to a steady rise in the pool of RSEs. Results are shown in table 3.4.

It was also in the mid-1980s that Singapore launched its National Information Technology (IT) Plan, which marked its development as a "wired" nation.[18] Although measures were introduced in schools to promote computer literacy, the

Table 3.4 Research Scientists and Engineers (RSEs)

Year	RSEs	Labor force (thousands)	RSEs per 10,000 labor force
1978	818	975	08.4
1981/82	1,193	1,128	10.6
1984/85	2,401	1,188	20.2
1987/88	3,361	1,252	26.8
1990	4,329	1,516	28.6
1991	5,218	1,554	33.6
1992	6,454	1,620	39.8

Source: National Science and Technology Board (Singapore) 1992.

buy-in was slow and it was not until the 1997 IT Master Plan was implemented that concerted efforts were made to pursue this agenda.

TOWARD A KNOWLEDGE-BASED ECONOMY THROUGH ABILITY-DRIVEN EDUCATION, 1997–PRESENT

By 1995, the efficiency-driven education model was producing positive outcomes. Singapore's youth performed exceptionally well in international mathematics and science tests (TIMSS 1995, 1999). The 1995 research study involved schools in 41 countries. It compared scores of 13 year olds in mathematics and science tests. The international average score was 500. Singapore was first with 643, followed by Korea, Japan, and Hong Kong (China). This feat was again achieved in 2003. Although some have credited Asian values as the success factors for this achievement, the policy of streaming students according to academic abilities in Singapore at both primary and secondary levels helped teachers to better respond to the learning requirements of their students. The pupils benefited from major changes to the mathematics syllabus in 1990 and to the teaching of science since 1985 (when a greater emphasis was placed on thinking skills and understanding concepts, rather than rote mastery of content). The attrition rate for secondary schools decreased significantly from 19 percent in 1980 to 3.5 percent in 1999.

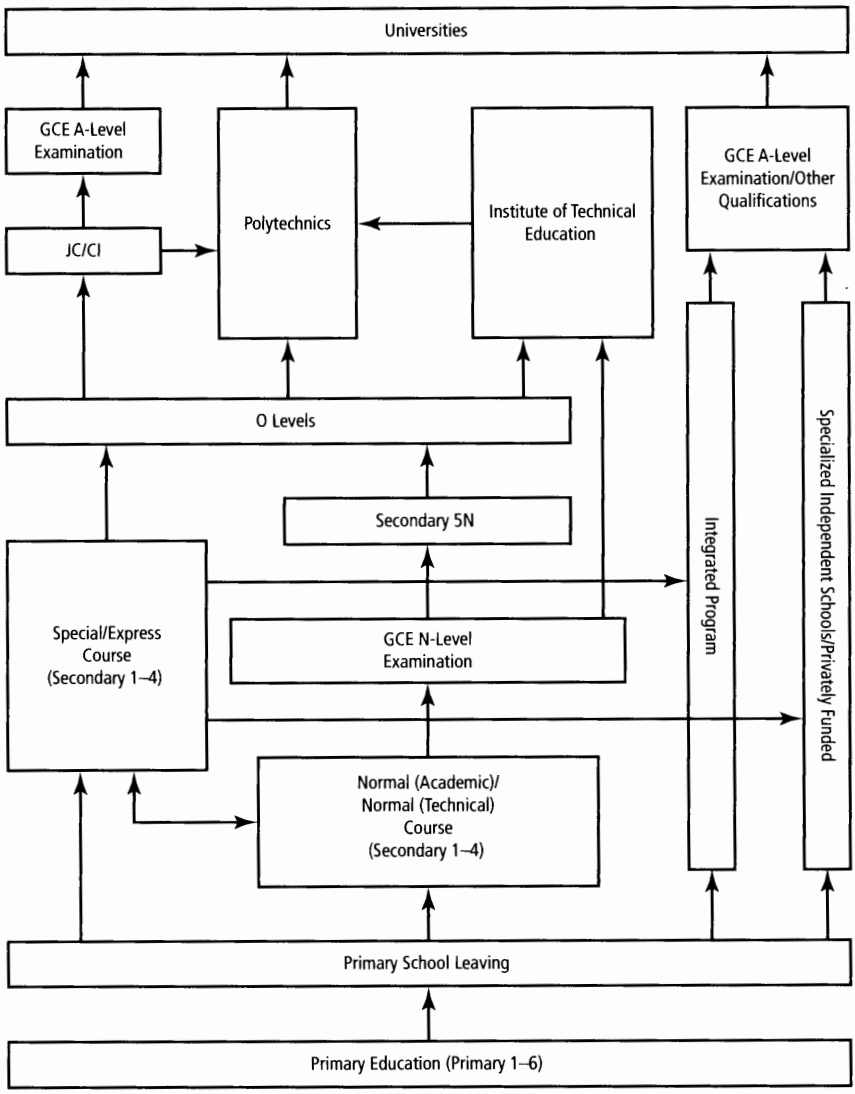
Globalization, powered in part by rapid technological advances, has redefined the competitive framework of nations. In the new economy, national wealth is increasingly determined by discovery and application of new and marketable ideas. The transition to a knowledge-based economy (KBE) shifts the emphasis of value away from traditional factors of production and industrial production toward the use of knowledge in innovation and creativity. For Singapore and Singaporeans, the faster the country's economy changes, the harder it is for the citizens to be confident of their skills and employability. In short, the new economy carries a steep price—more frenzied lives, less security, more economic and social

stratification, and the loss of time and energy for family, friendships, community, and self. These trends required Singapore's education system and structure to be redefined and realigned to meet the challenges of the new century. Stakeholders, especially the parents and the community at large, were now actively engaged. Singapore and its education system now entered into an ability-driven phase to meet the demands of the KBE.

The major education milestone of the 1990s was a shift in the country's strategic paradigm—from that of an efficiency-driven education to an ability-driven one. Initiated in June 1997, the new paradigm encapsulated the "Thinking Schools, Learning Nation" (TSLN) vision.[19] The vision of TSLN hinges on the premise that, devoid of natural resources, the future sustainability and wealth of Singapore depends on the capacity of its people to learn—and to learn continuously throughout their lives. The decision to make a radical shift toward ability-driven education in the late 1990s was timely and imperative. Undoubtedly, for nations to survive and prosper in the twenty-first century, the quality of education would be a critical success factor and would differentiate the wealth of nations. Singapore's leaders learned much from the examples of the United States, Britain, and Japan. Although the Americans were (and are) unsurpassed in producing highly creative and entrepreneurial individuals, serious concerns remain about the low average levels of literacy (including technological literacy) and numeracy among young Americans. Similar trends were also evident in the United Kingdom. The Japanese acknowledged the limitations of their mass-oriented school system, with its government-controlled curriculum. They, too, had begun to refine their education system, from primary to postgraduate education, to sustain the country's standing as one of the most innovative and competitive nations in the world. Like Japan, Singapore seeks to keep the best of the old in the education system while forcing needed changes.

Ability-driven education was designed to give all youth a well-rounded 10 years of general education, including six years of compulsory education at the primary level, during which time they could participate in a variety of programs according to their differences in ability (see figure 3.2). The school system continues to feature a national curriculum, with major national examinations administered at the end of the primary, secondary, and junior college years. The ability-driven education model provides greater flexibility and choice. Upon leaving primary school, the young Singaporean now has a range of education tracks that cater to different strengths and interests. For example, brighter students can apply to join the Integrated Programme—a new component in the education system. It spans secondary and junior education without the intermediate O-level examination at the end of secondary school. For students with different abilities the Academic and Technical tracks provide a mixture of academic and technology-based subjects. The streams are no longer rigid barriers, and opportunities exist for lateral

Figure 3.2 Ability-Driven Education System, 2007



Source: Adapted from Ministry of Education (Singapore) 2006.
Note: GCE = General Certificate in Education; JC/CI = Junior colleges/centralized institute.

transfer. Schools have the flexibility to offer options that match student interests and closer teaching-learning opportunities with links to polytechnics and the ITE. Schools have been encouraged to build on niche strengths in nonacademic areas, for example, sports and performing arts.

A flexible and responsive education structure that better caters to diverse abilities is now in place. The overall objective is to motivate Singaporeans to continually

acquire new knowledge, learn new skills, gain higher levels of technological literacy, and develop a spirit of innovation, enterprise, and risk-taking, without losing their moral bearings or their commitment to the community and nation (Gopinathan 1999).[20] To achieve a "quantum improvement" in Singapore's whole process of education, several major initiatives were launched, including revamping career paths for teachers, teaching creative thinking, introducing collaborative learning strategies, stressing national (or citizenship) education, making better use of new technologies in teaching and learning, and giving schools more resources and greater autonomy.

Schools are strongly encouraged to take ownership of the curriculum and cocurricular activities to better respond to student talents and abilities and to develop custom programs that meet student aptitudes and skills. These specialized programs now include music and art elective programs and specially designed physical education and Chinese language classes. As discussed, vocational training under the ITE was given a strong boost. Government recurrent expenditure on technical and vocational education per student increased from S$4,883 in 1991 to S$8,018 in 2004. Infrastructure, facilities, and technical equipment are consistently upgraded to ensure that they match industrial needs.[21]

These structural changes and education initiatives were matched with changes in education funding. During the last two decades or so, several new moves related to the financing of education were created by the Ministry of Education. The first was the government committing itself to increasing spending on education from 4 to 5 percent of the GDP, if the need arose. In 1991, an innovative program, known as the *Edusave Scheme*, was announced that enabled grants to be given to each child between 6 and 16 years old to meet specified education expenses, such as expenses for education visits to other countries, enrichment programs outside the formal school curriculum, and so on. The *Edusave* financial provision thus incorporates an element of choice in the use of funds, serving to customize the use of education facilities according to needs. The scheme ensures equity in education provision among different ethnic groups. An endowment fund was established with a capital sum of S$1 billion to be topped up yearly up to S$5 billion. Government recurrent expenditure on education per student increased from S$2,013 per primary student in 1991 to S$3,541 in 2005 and S$2,843 per secondary student in 1991 to S$5,390 in 2005 (Ministry of Education 2005, 49).

At the teacher-training level, Singapore is perhaps one of the few countries in the world that provides a generous employment package to retain teachers and maintain a high-quality teaching force. Besides remunerations that are compatible with (or even better than) beginning lawyers, engineers, and medical doctors in the government service, all teachers are entitled to fully subsidized 100 hours of professional training per teacher per year. In this way, teachers are given in-service opportunities to maintain and increase their "intellectual capital," while the country

benefits in terms of a teaching cadre whose training does not become obsolete. A *Connect Plan* was also introduced that provided a monetary reward for teachers who stayed in service after a certain number of years. In the spirit of lifelong education, school leaders and teachers are encouraged to take sabbatical leave to acquire new knowledge and skills—and not necessarily in an education institution but in other sectors, such as the hospitality industry.

It was also during this period that information and communication technology (ICT) "took off" in Singapore's schools and tertiary institutions. In the first Master Plan of 1997, the underlying rationale was that ICT could be integrated in the "thinking curriculum" to motivate students to be creative and independent learners. Funding of S$2 billion (for the period 1997–2002) was set aside to introduce ICT in the schools and to have pupils spend 30 percent of curriculum time learning with, or through, computers. Principals were given the funds to equip the schools, pupils, and teachers with the necessary infrastructure and training programs. The Second Master Plan continued this rationale of adopting ICT as a key enabler in making student-centered learning and assessment a reality, and in helping to reach the objectives of ability-driven education and the vision of TSLN. The Second Master Plan adopts a systematic and holistic approach by integrating all the key components in the education system—curriculum, assessment, pedagogy, professional training, and culture.

CONCLUSION

As in OECD countries, Singapore enters what Robert Reich describes as the "Age of Terrific Deal," where choices are almost limitless and it is easy to switch to something better (Reich 2001, 13). Social and economic forces are exerting strongly on education change, the outcomes of which, in turn, affect every aspect of the Singapore society. Pragmatic Singaporeans are becoming better educated and well traveled. But income disparities are widening. As the stakes in getting a good education continue to rise and with meritocracy consistently emphasized in the Singapore society, wealthier and more ambitious parents aggressively resort to "school sorting" and seek the best education they can afford for their children. At the other end of the spectrum are families who are socially and economically disadvantaged and likely to have children who form the bulk of school dropouts.

In the years ahead, the Singapore government will be constantly planning and reviewing education policies and changes that are aimed to achieve the following:

- Prepare young Singaporeans for the KBE and, in the process, sustain Singapore's world competitiveness standing.
- Strengthen national identity, values, and social cohesion and, in the process, sustain Singapore's society regardless of race, language, or religion.

The task at hand is not just to deal directly with pupils, teachers, and schools. More significant, a proactive approach toward engaging parents and the community as "Partners in Education" will be adopted.

Education provides the city-state of Singapore the strong fundamentals it needs to sustain competitiveness. With no natural resources to exploit, the development of the country's manpower resources through a sound and robust education system is crucial. Singapore's case study has shown that strong political leadership and will has guided overall education development and has produced a structure and system that is relevant and responsive to the ever-changing economic and social landscape. Singapore inherited a colonial legacy of a fragmented education system consisting of English and vernacular schools. In the 1950s and 1960s, in the midst of social and political turbulence (largely arising from ethnic tension), the government adopted measures to do away with vernacular schools. Without any natural resources, it recognized the importance of education and the urgent need for a national system of running schools. Singapore wasted no time in devising policies to integrate the various ethnic races.

The Singapore government invests heavily in education, especially at the secondary level, and in the lifelong training of its labor force. Besides defense, the education sector receives the largest share (about 4 percent) of the GDP each year. The overall objective is to sustain the nation's world economic competitiveness. A key learning point is that, as in constructing a house, it is essential to build a strong foundation before adding the whole structure. Singapore developed its primary and secondary education base before expanding its vocational and technical education and tertiary sectors. And when the "quantity" component was being worked on, attention was also given to the "quality" aspect. Many developing countries, including the African nations, may not follow the same path as Singapore (or OECD countries in general), nor will they go through the same stages of development. Basic lessons from the Singapore experience, however, can be relevant to policy makers in education in developing countries.

Singapore's education since 1965 exemplifies the general rule that the development of widespread basic education is necessary, though not sufficient, for sustaining economic growth. During the early phases of growth (in the 1960s and early 1970s), the government's priority was to create jobs so that the people and the country could survive. It attempted to quickly expand accessibility to primary education for all Singaporeans. This effort would at least create a young labor force with basic education to support the labor-intensive factories provided for by largely foreign companies. Additionally, rapid construction of schools would also provide employment opportunities. Once the drive toward universal primary education had been embraced to meet the surging demand for education, the target was quickly achieved through rapid construction of schools and training of teachers. Resources, including free textbooks to those who could not afford them, and

funds were fully supplied by the government. The government ensured that a sufficient number of secondary schools could cater to the increased size of primary cohorts. Up to the late 1970s, however, education wastage was high and, although the attainment of universal primary and secondary education was achieved, the quality of education was highly uneven and unsatisfactory in parts. On the economic front, the labor shortage was severe, productivity of the Singapore worker was low, and largely as a consequence of being heavily dependent on MNCs for technology, the indigenous technology base was poorly developed. Urgent measures were taken by the education planners to upgrade the quality of the education system and to reduce education wastage in the 1980s. At the tertiary level, a substantial expansion of engineering and technical enrollment was achieved.

The rising education level of the populace was crucial for the Singapore economy as it made the transition from a labor-intensive strategy to a high value added, technology-intensive industrial strategy in the 1990s. Singapore's economic strategy for the new millennium hinges strongly on raising the technological literacy of its people. This can be achieved largely through the education system. Besides its emphasis on science, mathematics, and computer education, technical and vocational education forms a core component of Singapore's education system. Although it has its fair share of problems, the government persisted in modernizing and uplifting the status of technical and vocational training. Today, Singapore's ITE plays a vital role in preparing young Singaporeans with the technical knowledge and skills they need to service a wide range of industries. This bias toward a technical rather than a purely academic stream of learning is important for Singapore as a global city. The majority of the workforce has to be technically proficient to sustain the manufacturing and services sector.

The new economic paradigm of the new century has led to sweeping reforms of the education system, such as the initiatives to instill innovation, problem-solving skills, creativity, and entrepreneurship in young Singaporeans, while at the same time, maintaining a strong emphasis on content mastery and good values. The school curriculum is constantly revisited and revised, whenever necessary, to ensure its appropriateness in the context of Singapore's overall economic and social development. Emphasis was placed on literacy, numeracy, bilingualism, science and mathematics, the arts, and moral education. Schools were encouraged to be innovative, take greater ownership of their programs and resources, and be more accountable to all stakeholders. This is a significant departure from the top-down approach taken by the Ministry of Education for several decades. School leaders and teachers are trained to respond to change and to initiate change. This "top-down support for ground-up initiatives" approach encourages schools to make decisions and exercise greater autonomy. With greater autonomy comes greater accountability. Education planners in developing countries should recognize that teachers and principals are the key to the successful transformation of

school governance and pedagogy. They are the ones who will nurture and train tomorrow's workforce. Singapore's teachers and principals enjoy high status recognition, ample opportunities for professional development, good career advancement, and employment packages.

One sacrosanct feature of Singapore's education structure is bilingualism. It was crucial for the government to introduce a main language of instruction (in this case, the English language) throughout the education system. During the early years after independence, English had been portrayed by the Chinese educated as colonial and thus antinational. Indeed, there were strong and violent protests. However, measures were in place to ensure that the mother-tongue languages (Chinese, Tamil, and Malay) were preserved and taught as second languages. Hence, bilingualism became a main component of Singapore's education once the city-state gained full independence in 1965. The use of English as the medium of instruction allows young Singaporeans to meet the challenges of the global economy, but the mother tongue is also important as a cultural ballast and as a way to inculcate Asian values.

Many developing countries have learned and some have attempted to transfer aspects of Singapore's education model into their respective systems. In the case of Singapore, however, behind the mechanisms and processes of education change is the force that drives them all—the political leadership of Singapore. The few that were entrusted by the populace at the time of independence to lead the small island city-state proved to be equal to the challenge of establishing stability, having both the capacity to make sound social and macroeconomic policies and the political will to make changes. Education was (and is) seen as the key to a good life and, since the early years after independence, the political leadership worked hard to provide education for all. Singaporeans recognized the importance of a good education in order to enjoy economic independence and good standards of living. It must be reiterated, however, that this drive toward attaining good education is sustainable because the nation possesses the economic and social environment that would allow its citizens to reap the full benefits of their investments in education pursuits. For Singapore, the human resources are seen as the most fundamental element in the nation-building process, and, as such, education and training are at the heart of the nation's wider economic plans. For developing countries, this is perhaps one of the most significant challenges in the new millennium.

NOTES

1. In the 1950s, frequent clashes and demonstrations against the government were held by Communist-infiltrated trade unions and Chinese schools. The British soon decided that the best political weapon against the Communist insurgency would be to grant national independence to Singapore. This would deprive the Communists of their role as champions

of antifreedom movements and, hence, the justification for insurrection against the government. Therefore, the stage was set for the first democratic election of a self-governing Singapore in May 1959. The People's Action Party, under the leadership of Lee Kuan Yew, won convincingly. Lee became the first prime minister and, at the same time, the state flag and national anthem "Majulah Singapura" were inaugurated. About four years later, in September 1963, Singapore became part of Malaysia. But political differences soon reached an intolerable level. On August 9, 1965, under the leadership of Lee Kuan Yew, the island of Singapore was formally separated from Malaysia and became a sovereign, democratic, and independent city-state.

2. The Colony of Singapore's Report of the Industrial Resources Study Groups, appears in Andrew Gilmour's Official Letters, 1931–1956. Andrew Gilmour was the Chief Planning Officer in Singapore during the 1950s.

3. The Malays were (and are) considered to be the indigenous people living in Singapore at the time when the British founded Singapore in 1819. Hence, the Malay language became Singapore's national language. Singapore's national anthem is sung in the Malay language.

4. Readers may wonder how the various investments in school construction, teacher recruitment, and free textbooks were made under an education budget that was consistently 20 to 25 percent of the government's budget. The explanation lies in Singapore's steadily rising economic growth rate during this period, which enabled a fairly constant slice of a growing budgetary pie to steadily increase in size.

5. Vocational training and employer-based training constituted the twin strategies of skill-level manpower development. In this respect, the Skills Development Fund (SDF), administered by the Economic Development Board, was an invaluable source of funding for companies to promote employer-based training. This training includes custom training to meet production, restructuring, and specific development needs, undertaken directly by employers as a part of their investment in manpower resources. The SDF worked closely with VITB to promote vocational skill-level training and awarded grants to employers to sponsor (up to 90 percent) employees for VITB's skill courses and apprentices.

6. Objectively, the resignation rates of 1.7 to 2.2 percent for this period were not particularly high. The rates today remain more or less in the same range as they were in the 1970s.

7. Since the 1950s, more and more parents have sent their children to English-stream schools. In 1960, 49 percent of all students were registered for the English stream, and by 1970, it reached 66 percent. In 1982, the figure went up to 90 percent. The reason behind this trend was an economic one. Singapore's economy was inextricably tied to the outside world, particularly industrial nations where the international language for business and trade is English. Moreover, all MNCs (where employment was highly sought) in Singapore used the English language.

8. Dr. Albert Winsemius was the leader of a United Nations Industry Survey Mission to Singapore in 1961. The Winsemius Report, as it became known, convinced the Singapore leaders that the traditional dependence on entrepôt trade would not ensure the future economic survival of the small nation.

9. These statements reflected the optimism of a young but fast-developing nation. In fact, Goh's comments made in 1970 raised several significant, closely related issues concerning Singapore's quest for technological excellence in the 1980s and 1990s—including the transfer and diffusion of technology and skill from the MNCs, the lack of a critical mass,

the brain-drain of local expertise, the weak university-industry link, the lack of a well-planned science and technology policy, and the painfully slow development of research and development in Singapore's indigenous firms. Compared with the newly industrializing countries in East Asia and Japan, Singapore in the 1970s suffered from low labor productivity. Between 1973 and 1978, "real productivity growth in Singapore averaged about 3 percent per annum, compared to an average of 7 percent for Hong Kong, Taiwan and South Korea" (Goh 1978).

These labor-intensive industries do not require professional scientists or engineers; they only need to have experienced foremen or plant supervisors and imported managers. Even within the larger MNCs, transfer and diffusion of technology and skill was rare. See also the "Speech by the Minister of Trade and Industry" quoted in Lim Joo-Jock (1980, 279).

10. Eventually, on April 1, 1981, 12 years after it was formed, the Ministry was dissolved. As explained by Goh Chok Tong (the former prime minister and now Singapore's senior minister), "the defunct Ministry of Science and Technology had only a budget of $100,000 to disburse as research grants. . . . We did not have a research and development policy until now [1991], because research and development was not critical to our economic growth strategy in the last decade" (*Straits Times* February 18, 1981).

11. In Singapore's context, a work permit is a work pass issued to a skilled or unskilled foreigner earning a certain maximum monthly salary to work in Singapore. Currently, the monthly basic salary stands at not more than S$1,800.

12. The impact of an expanding manufacturing base through foreign enterprises on the general managerial and technical skill levels of the workforce was not easily seen. Local industrial establishments in Singapore during this period were characterized by their small size, low capital input, and simple use of technology. In 1969, 70 percent of manufacturing enterprises employed 10 to 39 workers, whereas only 10 percent had more than 100 to 300 workers. Although foreign investors were quick to take advantage of Singapore's open-door policy and the many incentives offered by the government, they were also rational in their technological choice and organization of work. Besides other factors, the small domestic market and the scarcity of local managerial and technical know-how and expertise imposed a limit to the size of the foreign firm. Therefore, apart from the shipbuilding and repairing industry and the chemical-petroleum industry, industrial firms in Singapore were largely labor-intensive, low-wage, and low-productivity enterprises, requiring the mere repetition of simple operations along the assembly and production line.

13. In view of Singapore's growing economy during the 1980s, the declining share represented by private contributions does not necessarily imply a reduction in the absolute levels of private contributions.

14. In Singapore's context, "nongraduate teachers" are trained teachers who do not possess university degrees. Teachers who have a bachelor's degree are "graduate" teachers.

15. Each year, about 400 out of the 3,500 ITE graduates join the polytechnics for a diploma course. For a comprehensive understanding of the development of technical education in Singapore, see Chiang (1998).

16. As a matter of comparison with some OECD countries, the Netherlands's enrollment in the higher education sector increased by 13 percent from 1980 to 1988; in Japan, university undergraduate enrollment rose by about 9 percent between 1978 and 1989; and in Norway, the corresponding figure was 10 percent between 1979 and 1986. The main reason for increased enrollment is the stronger presence of women within the student population (see OECD 1992, 137).

17. This important prerequisite for technological self-reliance was mentioned by Hayashi in his analysis of Japan's experience in absorbing foreign technology.

> Foreign engineers and technologists can and should play only a supplementary role . . . in spite of the diachronic, trans-cultural nature of technology, it cannot function independently of the society and culture in which it is expected to function. Only members of that society can make the best use of a technology. In other words, only native engineers can adapt a foreign technology to their country's climate and history, can intermediate, stabilize, disseminate, and finally, root it firmly in their country (see Hayashi 1990).

18. This visionary initiative is described in: Koh, Thiam Seng, and Sai Choo Koh. 2008. "Digital Skills and Education: Singapore's ICT Master Planning for the School Sector." In *Toward a Better Future: Education and Training for Economic Development in Singapore since 1965*, ed. Lee, Sing Kong, Goh Chor Boon, Birger Fredriksen, and Jee Peng Tan. Washington, DC: World Bank.

19. The TSLN concept or vision was launched by then-Prime Minister Goh Chok Tong on June 2, 1997 (see also Sharpe and Gopinathan 2002). Although the paradigm shift is timed at 1997, rethinking the merits of the efficiency-driven system actually began in the mid-1980s. The *Towards Excellence in Schools* report of 1987 led to the first decentralization moves and the establishment of independent and later autonomous schools.

20. In line with these changes, the National Institute of Education (NIE) reviewed its teacher-training curriculum to meet the objectives of TSLN. NIE ensured that its pre-service training curriculum and professional development programs would stay relevant and responsive. One key factor for its successful role is the close and strong tripartite relationship between the Ministry of Education, schools, and the institution.

21. Many African countries have infrastructure and equipment for technical and vocational training that, for the most part, are obsolete and inadequate to cater to the needs of industries. The problem is compounded by the high costs of importing new equipment.