

**INTERNATIONAL COMPARATIVE STUDY: THE
AUSTRALIAN CURRICULUM AND THE SINGAPORE
CURRICULUM**

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EXECUTIVE SUMMARY

This document reports on the findings of a study comparing the Australian Curriculum (AC) with the Singapore Curriculum (SC). The study is the third in a series of international comparisons with curricula of high-performing countries and systems; these comparisons are a component of the Curriculum business unit's ongoing program of research, as specified in the Australian Curriculum, Assessment and Reporting Authority (ACARA) 2017–2020 work plan. The comparison studies will contribute to the long-term consideration of international developments in curriculum design and are intended to elicit observations that will inform the next generation of the AC. It is not the purpose of the studies to make judgements regarding the quality or effectiveness of the overall provision of education in any jurisdiction.

The selection of Singapore for this comparative study is based on the key criterion stipulated for the research project. Singaporean students perform consistently well in international assessments, learning in an education system that attracts intense interest from around the world.

Singapore is highly regarded for its innovative approach to learning, centring on 21st century competencies and values-driven education which represent the latest additions following nearly two decades of curriculum initiatives. As is true of Australia, Singapore is an active participant in the Organisation of Economic Cooperation and Development (OECD) Education 2030 Project.

This research project takes place in a climate of increasing international competitiveness regarding student performance in assessment programs such as the Programme for International Student Assessment (PISA), Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading Literacy Study (PIRLS), together with expressions of concern about the capacity of school curricula to prepare students for the post-school world of the 21st century.

Contemporary comparative education research emphasises careful consideration of the local context in which curriculum is developed, rejecting any notion of an easy transfer of design or practice from systems that are judged to produce superior outcomes. A review of the literature relating to comparative education research underpins the methodological approach adopted for these international comparison studies (ACARA, 2017). In this third comparison study, a mixed-methods approach enables a comprehensive picture of the basis for curriculum design in the two jurisdictions. Complementing the demographic and other contextual comparisons, ten small studies reveal the professional judgement of ACARA's Curriculum Specialists in their analysis of the content and expectations of the two curricula. Drawing on Webb's Depth of Knowledge schema (1997; 1999), this work includes careful evaluation of breadth, depth and rigour across learning areas.

This comparative study is based on the *Australian Curriculum Version 8.3* (ACARA, 2016), and the *Singapore Curriculum* in various versions to align with the rotational update

program. The version of the SC used in this study is stated at the beginning of each curriculum comparison subject area.

Comparison of the AC with the SC reveals some commonality in relation to intent and content. Both curricula identify traditional disciplines and 21st century competencies as key elements of learning. In Singapore, an ideological statement, supported by a suite of teaching and learning frameworks, underpins delivery: *Teach Less, Learn More*. This pedagogical directive has no equivalent in the AC, particularly as states and territories carry responsibility for implementation and for decision-making regarding strategies for meeting the needs of their students.

Comparison of the AC and SC reveals variability in relation to breadth, depth and rigour. Findings of interest in this comparative study are as follows:

Flexibility of the curriculum

Singapore's education authorities encourage greater choice and flexibility in education by affording autonomy and resources to schools to enable them to build on their strengths and create 'niches of excellence' (MOE, 2017). One strategy is to provide time for students to focus on core knowledge and skills and to participate in school-based activities, including inquiry-based learning. Notwithstanding the meritocratic principles that characterise the education system, Singapore's practice of streaming students in secondary schools has become more flexible in terms of acceleration and greater mobility between courses.

The flexibility of the AC is demonstrated in ways in which schools, according to jurisdictional and sectoral policies, develop programs that meet the educational needs of their students.

Prescription and volume of content

In developing the necessary knowledge and competencies demanded of a 21st century curriculum, Singapore has reduced the volume of content by one-third. The focus has been less on disciplinary content and more on learning and teaching outcomes; conversely, more emphasis has been accorded to developing creative and thinking skills, problem-solving skills and the learning process that allows students to capitalise on rich opportunities afforded by a new digital age.

The AC is considerably more prescriptive and detailed in relation to disciplinary content, although its three-dimensional design provides flexibility for teachers to adapt their programs for students with diverse interests and needs.

A key finding emerging from ACARA's international comparisons is the perception that any significant reduction in curriculum content may lead to an inevitable loss of intellectual rigour and pedagogical integrity. These studies have identified an apparent tension between the volume of (prescribed) content and the capacity of teachers to deliver a 21st century curriculum in innovative and flexible ways.

Student agency and engagement

The AC states explicitly that the document is written for teachers.

The integration of the 21st century competencies in Singapore's academic curriculum, co-curricula and character and citizen education reinforces the notions and practices associated with a holistic education focused on learning-centred and student-centred approaches to curriculum. Within the syllabuses and on the Ministry of Education (MOE) website, there is a reference to 'we' and 'our,' reflecting Singapore's desire to 'nurture' its students.

Integration of indigenous perspectives

One of the three cross-curriculum priorities of the AC is Aboriginal and Torres Strait Islander Histories and Cultures; the material is taught through the learning areas.

The Singapore education system recognises the importance of meeting the needs of the original inhabitants of the country, the indigenous Malays. Singapore's curriculum contains elements that relate directly or indirectly to content about Malay histories and cultures.

Competency-based learning

The AC is committed to preparing students for life and work in the 21st century, and a set of seven general capabilities is provided to enable this.

Singapore's curriculum identifies 21st Century Competencies (21CC) in each learning area syllabus. These include Civic Literacy, Global Awareness, and Cross-cultural Skills, Critical and Inventive Thinking Skills, Communication, Collaboration and Information Skills. These competencies are more closely aligned to the AC's capabilities of Critical and Creative Thinking, Intercultural Understanding, Ethical Understanding and ICT Capability.

Student diversity

The design of the AC reflects the commitment to equity and diversity stated in the Melbourne Declaration on Educational Goals for Young Australians (2008), with all students, regardless of their background or location, 'entitled to rigorous, relevant and engaging learning programs' that address their cognitive, affective, physical, social and aesthetic needs (ACARA, 2015). The diversity of Australian students is acknowledged in the provision of advice materials guiding teachers in personalising the curriculum.

The Singaporean concept of diversity differs from that of the AC, emphasising choice for students and support for them to develop their special talents 'to go as far as they can' (MOE, 2017). Singapore authorities explain that the different needs of students will be met through "a wide range of school types and educational programmes" (MOE, 2017). With regard to students with special needs, the Ministry of Education arranges places in special education schools. Singapore's Compulsory Education Act 2000 covers all students of primary school age, except for students with disabilities, who are exempted if they are unable to attend due to physical or intellectual impairment.

Plurilingual learning environment

In Singapore, plurilingualism is a feature of the learning environment as a direct consequence of the country's socio-linguistic diversity. English is the medium of instruction in a nation that supports four official languages (English, Mandarin, Malay and Tamil) and mandates the study of Mother Tongue; students benefit from the cognitive demands associated with language acquisition. Singapore's bilingual policy was introduced in 1966 to

encourage the use of English as the common language among diverse ethnic groups and as a means of ensuring the integration of Singapore into the global economy.

Australian educators are encouraged to support students from diverse linguistic and cultural backgrounds, and the AC: L includes both language-specific curricula and frameworks for Aboriginal and Torres Strait Islander languages as well as classical languages. While numerous national and state/territory policies have emphasised the cognitive, literacy, nation-building and career benefits of foreign language acquisition, the provision of high-quality programs remains problematic and the proportion of school leavers studying a foreign language is extremely low.

National assessment and reporting

Australia's national curriculum is complemented by the administration of an annual national assessment program that measures the performance of students in Years 3, 5, 7 and 9 in literacy and numeracy. Sample groups of students are tested in Science Literacy, Information Communication Technology and Civics and Citizenship.

Singapore does not administer standardised tests. Primary students are required to sit the national Primary School Leaving Examination (PSLE), the results of which determine their admission to secondary schools. Secondary students undertake the Singapore-Cambridge GCSE O-Level examinations. Students sit at least six examinations in English, Mother Tongue or Higher Mother Tongue Language, Mathematics, one Science and one Humanities elective.

This comparative study considers the design and content of curricula from a country and a nation state that are arguably more similar than different in their aspirations for their young learners. The detailed analyses of the various learning areas and other dimensions reveal that the two curricula also share the reality that a school curriculum represents just one – albeit critical – element of the learning experience of a student in the 21st century.

1 PROGRAM OF RESEARCH

One highly visible trend in education around the world is the focus on redesigning school curricula to enable students to prepare for work and life in the 21st century.

School authorities and other decision-makers are encouraging innovative review and rethinking of school curricula, with input sought from a wide range of stakeholders, including parent and professional associations, industry and employer bodies and a range of special-interest groups. Amid escalating interest in international comparisons of the performance of education systems over past decades, nations and jurisdictions increasingly aspire to the creation and delivery of curricula that merit the description of ‘world-class’ (Donnelly & Wiltshire, 2014; Denman & Higuchi, 2013; Hebert, 2012; Schleicher, 2009).

In Australia, discussion about curriculum content and design tends to be framed by perceptions of a decline in traditional academic standards both of content and teaching, accompanied by a sense of urgency to address issues of equity, access and diversity.

The AC, now being implemented in its first iteration, has a three-dimensional structure that attracts international interest regarding its capacity to meet the needs of all learners in an increasingly challenging world.

ACARA is undertaking a program of research that considers international trends and developments in curriculum design, including the projects to which Australia contributes, such as the OECD Education 2030 Project and the IBE-UNESCO Global Curriculum Network. The question guiding ACARA’s research is universal: *What should students learn?*

1.1 Background

With specific regard to the AC, ACARA’s strategic directions, endorsed by the COAG Education Council in November 2016, are to:

- provide a world-class curriculum from Foundation to Year 12 in specified learning areas agreed to by Council
- assemble the evidence base required to review, develop and refine curriculum.

ACARA’s quadrennial work plan (2016-17 to 2019-20) approved by Education Council in 2015 includes development of a program of research to review and report on recent developments in international curriculum practice to inform national policy and practice and to improve the AC.

1.2 Methodology

Comparative education research has a lengthy and wide-ranging history. A review of the literature (ACARA, 2017) in the field of international comparison studies reveals a shift in emphasis from large-scale quantitative data analyses to more nuanced qualitative research methods and underpins the methodological choices made in this program of research. For over the past thirty years, two opposing epistemologies have characterised comparative education research, which Epstein (2008, p. 377) names as “the universalism of positivism and the particularism of relativism”. A consensus appears to be building among contemporary researchers that a mixed-methods approach to comparison studies is more

likely to allow “more comprehensive analysis of the external and internal factors that shape policy making and education systems” (Chong & Graham, 2013, p. 2).

This international comparative study uses a mixed-methods research design incorporating philosophical and pedagogical assumptions as well as methods of inquiry. As a methodology, it draws on philosophical assumptions that guide the direction of the collection and analysis of data and the mix of qualitative and quantitative data in a series of studies. It seeks to use quantitative and qualitative approaches in combination to provide a better understanding of the research objectives (Creswell & Plano Clark, 2007, p. 5).

This document comprises smaller studies of comparison between the AC and the SC. These encompass the seven of the eight learning areas identified in the AC. Learning areas applicable to the two curricula were counted in the study, as shown in Table 1.1. For this comparative study, a comparison for The Arts was not undertaken.

Table 1.1 *Subject areas by country*

Australian Curriculum	Singapore Curriculum
English	English Language and Literature
Mathematics	Mathematics
Science	Science
Humanities and Social Sciences (History, Geography, Civics and Citizenship, Economics & Business (Year 10 only))	Commerce, Economics, Geography, History, Social Studies
Design and Technologies Digital Technologies	Computing, Design and Technology, Food and Consumer Education
Health and Physical Education (HPE)	Health Education, Physical Education
Languages (Italian)	Mother Tongue Languages (Malay, Chinese, Tamil)
NOTE: As a point of departure, Singapore offers Character and Citizenship Education (Primary & Secondary), Education and Career Guidance (Secondary), Cyber Wellness (Secondary). Since the AC does not have a comparable knowledge base, a comparative analysis was not attempted.	

A further study was conducted using the AC’s General Capabilities and Singapore’s 21st Century Competences. The AC promotes seven General Capabilities; Singapore’s MOE has identified 21st Century Competencies and Outcomes necessary for living in a globalised world.

The final study considered the AC’s cross-curriculum priority of Aboriginal and Torres Strait Islander Histories and Cultures together with the Orang Laut /Malay Histories and Cultures of Singapore’s curriculum.

ACARA’s Curriculum Specialists undertook the comparisons of the learning areas and other dimensions.

Methodological Tensions and Measurement

Determining curricular breadth and depth is integral to curriculum design and this has been the source of ‘premature polarities’ (Hirsch, 2001). Hirsch also posits that a deep understanding depends on broad knowledge, emphasising that “not just any knowledge will suffice” In determining breadth and depth, a curriculum is likely to privilege one over the other.

The aim of this study is to make comparisons between the AC and the comparison curriculum with respect to breadth, depth and rigour. The study uses a three-level taxonomy to determine curricular breadth and depth, drawing on terminology invoked by the National Emergency Medical Services Education Standards (2009) and Masters (2015).

Calculating Breadth and Depth

Breadth refers to the number or range of topics or content covered in the curriculum. The terms used to describe breadth are *limited*, *fundamental* and *comprehensive*.

Breadth	
Terminology	Explanation
Limited	Elementary, modest, unembellished
Fundamental	Building on basic breadth to expand knowledge
Comprehensive	Comprising multiple items; wide scope; full range

Depth refers to the amount or level of detail about a body of knowledge or topic that can lead to the development of deep understandings of key concepts, principles and knowledge and the ability to apply these understandings to authentic, or ‘real-world’, contexts. The terminology used to describe depth is *limited*, *fundamental* and *challenging*.

Depth	
Terminology	Explanation
Limited	Elementary, rudimentary
Fundamental	A leading or primary principle, which is fundamental to system/body of knowledge; essential part
Challenging	Integrates, interconnects; a composite of knowledge; requires higher-order thinking

Calculating Cognitive Demand

Following the broad acceptance of Bloom’s (1956) work, various attempts at developing schemas to describe cognitive demand in different learning and assessment contexts have included The National Assessment of Educational Progress [NAEP] (2005) frameworks for

assessing mathematical complexity of items based on demand on thinking and Norman Webb's *Depth of Knowledge* (Webb, 1997;1999).

Webb's tool is designed to help teachers create rich environments where all students can learn at a high level. Depth of Knowledge (DoK) categorises tasks according to the complexity of thinking required to successfully complete them.

Level 1: Recall and Reproduction

At this level, a student exerts little cognitive effort beyond recall or memorisation. Typical tasks are: copying, computing, defining, and recognising.

Level 2: Skills and Concepts

At this level, a student makes some decisions about learning. Typical tasks are: comparing, organising, summarising, predicting, and estimating.

Level 3: Strategic Thinking

At this level of complexity, a student uses planning and evidence, justifies choices and thinking is more abstract. Typical tasks involve solving non-routine problems, designing an experiment, or analysing characteristics of a genre.

Level 4: Extended Thinking

This level requires the most complex cognitive effort. A student synthesises information from multiple sources, often over an extended period, or transfers knowledge from one domain to solve problems in another. Examples might include designing a survey and interpreting the results, analysing multiple texts to extract themes, or writing a sophisticated, original text.

It must be noted that:

- levels are *not* considered a progression
- levels are *not* sequential
- levels are *not* developmental.

Webb's (1999) work has been applied mainly to different content areas and test item development in the United States, as well as being used in the determination of alignment between state standards and tests used for purposes of accountability.

Measuring Rigour

For the purposes of this comparison study, an understanding of *rigour* assumes the following:

- standards and expectations are high and known to all students
- assessments are comprehensive and aligned to learning standards
- focus is both on content and higher order activities
- student work is assessed both by the classroom teacher and external experts.

The schema provided in Figure 1.1 draws on Webb's *Depth of Knowledge*. It is designed to provide a common language and shared methodology to make evidence-based and on-balance judgements about the level of rigour in the AC and any comparison curriculum.

With consideration of rating scales used in similar work, the schema employs a three-point scale to measure a curriculum's capacity to:

1. engender in-depth (mastery) learning across the years of schooling in a coherent and sequential manner, and
2. provide opportunities for cognitive and intellectual challenge that moves students into deeper and broader engagement with a learning area.

At *limited, moderate or challenging* levels, a curriculum will reflect:

- content knowledge and skills a student is expected to demonstrate (equivalent to Content Descriptions/Elaborations; Achievement or Learning Standards)
- cognitive demand placed on the student by the curriculum to accomplish tasks (equivalent to Creative and Critical Thinking).

The schema should not be considered a progression. Rather, it is a framework for gauging: (i) a student's depth of understanding of the content, including acquisition of skills aligned to the expectations of a jurisdiction's curriculum, and (ii) the level or variance of cognitive demand placed on a student by the particular curriculum learning area.

Limited	Moderate	Challenging
Relies on memorisation and recall (e.g. recognition of previously learned concepts and principles)	Involves flexibility of thinking and choice in developing skills and concepts (e.g. comparing, applying, classifying, describing, explaining)	Places considerable demand on students' ability to engage in abstract thinking and reasoning (research, planning, analysis, investigation, use of judgement, application of critical, creative and collaborative skills to solve problems and apply solutions to real world issues)
Teacher actions		
Questions to direct or focus attention; shows/tells/demonstrates; provides examples; examines; leads, breaks down (deconstructs); defines	Questions to differentiate, infer, or check conceptual understanding; models; organises/reorganises/explores possible options or connections; provides examples	Questions to probe reasoning and underlying thinking; asks open-ended questions; acts as resource/coach; provides criteria and examples for making judgements and supporting claims; encourages multiple approaches and solutions
Student actions		
Responds, remembers, memorises, restates, absorbs, describes, demonstrates, follows directions, applies routine processes, definitions, procedures	Solves routine problems/tasks involving multiple decision points and concepts; constructs models to show relationships; demonstrates use of conceptual knowledge; compiles and organises; illustrates/explains with examples /models	Uncovers and selects relevant and credible supporting evidence; analyses, critiques, debates, judgements; plans, initiates questions, disputes, argues, tests ideas/solutions; sustains inquiry into topics or deeper problems
Examples of student product		
Show and tell Locate or recall quotes Document information/cite sources Brainstorm related ideas Represent math relationships in words, pictures, or symbols Write complete sentences Fill-in-the-blank tasks Recite math facts, poems, etc	Graphic organiser Mind map Blog entries Timeline Demonstration (e.g. sports) Diary entry (English, Art) Narrative writing Spreadsheet Survey development Science/mathematics logs Venn diagram	Complex graphing Vodcast or podcast Analyse survey results Debate/argue from given perspective, Multiple paragraph essay or extended response, including research and analysis Literary critique, play, book, music or film review, Information report (may be multimodal), Science experiment report (may be multimodal), Storyboard for film/cartoon animation

Source: Hess, K. (2013). *A Guide for Using Webb's Depth of Knowledge with Common Core State Standards*. Common Core Institute.

Figure 1.1 Webb's Depth of Knowledge

Using this schema, a template was developed to map curricular *breadth*, *depth* and *rigour*, as can be seen in the smaller studies included in this paper, enabling judgements about the seven learning areas and three other dimensions of the comparison curricula.

2 CONTEXTUAL DESCRIPTION AND ANALYSIS

2.1 Preamble

As education systems around the world grapple with the challenge of preparing students for work and life in the 21st century, their efforts have invariably led to consideration of curriculum at the system and/or school level. They have also, according to Fadel (2014), generally resulted in making existing curricula more robust and rigorous rather than redesigning learning in innovative, skills-based ways.

Fadel's (2014) assertion, mirrored in the research underlying the OECD's Education 2030 Project, is that the rapid rise in the rate of global systemic change has created 'an increasingly volatile, uncertain, complex, ambiguous (VUCA) world and thus is significantly more unpredictable'. For students to function successfully in a rapidly changing world, it is now recognised that they will need to be able to 'find solutions to complex social and environmental problems'. It follows that they will need to 'develop higher-order thinking skills, social intelligence, the ability to work with diverse groups of people and a commitment to lifelong learning' according to PricewaterhouseCoopers Consulting (Australia) (2107).

The UNESCO Global Curriculum Network (GCN) project pursues similar lines of investigation into educational developments and practices around the world. A recent discussion paper argues for a new approach to curriculum design (UNESCO, 2017), exploring the view that rethinking and repositioning curriculum in the 21st century demands a global change in basic assumptions. The discussion seeks to redefine curriculum as a multi-modal, multi-dimensional and complex continuum that must take account of a fourth industrial revolution; that is, students are learning in a world that is rapidly shifting from a focus on the acquisition of knowledge to one that is driven by access to and the use of technology to enable the application of knowledge.

In this view, the traditional, triangulated relationship between teaching, learning and assessment represents a limiting and limited proposition. Future curriculum design must be shaped and informed by a proactive objective, where curriculum is 'an agent of change rather than just a reactor to change' (UNESCO, 2017, p. 4).

Australian research supports the notion that a 21st century curriculum should encourage students to prepare for post-school lives that are likely to span a range of occupations, many of which do not yet exist. Such a curriculum, according to Masters (2015), should privilege:

- deep understandings of subject matter and the ability to apply what is learnt
- the ability to communicate and solve problems in teams
- the ability to think critically and to create novel solutions
- flexibility, openness to change and a willingness to learn continually.

Consistent with OECD research on 21st century skills, Masters (2015) posits that an effective school curriculum prioritises depth over breadth of learning.

What is the appropriate balance between breadth and depth? There is evidence that school curricula tend to be 'crowded' with content that teachers are expected to cover. This is a major focus of the OECD Education 2030 Project, as researchers and educators attempt to address the concerns coming from the field regarding the density of content and the temptation among teachers to 'tick off' items they have taught rather than aspire to providing students with deep learning in fewer areas (Masters, 2015). Efforts to provide students with some knowledge about a wide range of topics can lead to what is sometimes referred to as 'mile-wide, inch-deep' curriculum. Although the mastery of factual and procedural knowledge is privileged in disciplines offered in schools around the world, research coming out of the OECD Education 2030 Project advocates a specific set of 'transformative competencies' that help learners to use their knowledge, skills, attitudes and values to navigate a complex world and attain impact and self-growth (OECD, 2017).

Over the last decade, both Australia and the nation of Singapore have engaged in an extensive review of curriculum, involving broad consultation with stakeholders and the engagement of national and international experts. Australia has developed its first truly national curriculum, a three-dimensional model that identifies learning areas and subject disciplines, general capabilities and cross-curriculum priorities.

To help young Singaporeans thrive in a rapidly changing world, Singapore's MOE has identified 21st Century Competencies that aim to strengthen a curriculum containing knowledge and skills underpinned by core values. In designing a future-proof curriculum, the SC is less prescriptive with respect to learning content than its counterparts around the world, including the AC.

2.2 Demographic comparison: Australia and Singapore

...other elements in (Singapore's) success include a clear vision and belief in the centrality of education for students and the nation....and a culture of continuous improvement and future orientation that benchmarks educational practices against the best in the world. (OECD, 2010, p.159)

This section provides broad demographic information to assist in understanding the context of curriculum development in Singapore and Australia. Singapore is not a member state of the Organisation for Economic Cooperation and Development (OECD); consequently, difficulties in locating some comparative statistics have resulted in the analysis being less detailed than other ACARA reports dedicated to comparing education systems.

Singapore's education system attracts interest around the world, especially as its students continue to excel in international assessments. In the 2015 Programme for International Student Assessment (PISA) results, Singapore scored first in all assessment domains: Science, Reading and Mathematics.

In addition to their students' consistent performance above OECD averages in international assessments, Australia and Singapore share other characteristics. Both countries are part of the Asia-Pacific region, located in the southern hemisphere. Both are modern, island nations, operating as parliamentary representative democracies whose structures are based on the Westminster system of government. Both gained sovereignty during the twentieth century, the Australian Constitution Act being passed by the British Parliament in 1901 and

Singapore moving from the status of a self-governing state within the British Empire to independence in 1965. Australia is a federation, comprising six states and two territories, whereas Singapore is a city-state where the President is the constitutional head and the Prime Minister leads the executive government. Australia's head of government is the Prime Minister and the Governor-General acts as the head of state, representing the British monarch.

Education in Singapore is central to prosperity and nationhood and is regarded as the 'engine of human capital' required to drive economic growth (OECD, 2010, p. 159). On this philosophical basis, the MOE has readjusted its approach to curriculum design by reducing syllabus content by 30 per cent and devoting more teaching time to higher-order thinking skills, a strategy that has 'borne fruit' (Davie, 2016). Some posit that more attention could be given to 'curiosity, creativity and leadership' (Nayak, 2016) in spite of the government's implementation of *Thinking Schools, Learning Nation* in 1997, which focused on creativity, and allegedly contributed to Singapore's success in the PISA 2012 assessment of creative problem-solving (Tan, Koh, Chan, Costes-Onishi & Hung, 2017, p. 3)

A distinguishing feature of Singapore's education system, in comparison with other OECD countries, is an integrated scheme of planning for education in collaboration with economic agencies to identify current critical skills shortage and predict future needs. Singapore's government believes that this approach "helps students to move faster into growing sectors, reduces oversupply in areas of declining demand more quickly, and targets public funds more efficiently for post-secondary education" (OECD, 2010, p. 165).

Singapore's education system involves close cooperation between the MOE and the National Institute of Education (NIE) and its schools. The system is highly centralised and responsive to policy implementation and changes. The MOE formulates and implements education policies governing structure, curriculum, pedagogy and assessment. It also oversees the management and development of government-funded schools. The NIE conducts research and advises on pre-service teacher training. The state is the principal provider of education at primary, secondary and tertiary levels although private schools do exist, principally in the form of 'Foreign System Schools' (MOE, 2017a).

In 2015, just under 12,000 students attended a private school in Singapore (MOE, 2016, p. 15), representing less than 3% of the student population. By way of comparison, 35% of Australia's students are enrolled in non-government, fee-paying schools, either Catholic or Independent (ABS, 2017).

The provision of education in Australia is the responsibility of the six states and two territory governments, with funding allocated to all public schools through the eight education departments. A combination of federal and state/territory funding is available to many non-government schools. While it neither runs schools nor employs teaching staff, the Australian Government Department of Education and Training (AGDET) is responsible for developing and executing national policies and programs. It contributes over 50 per cent of total funding to the Catholic sector and almost a third of total funding to the Independent sector.

The AC is published in English and the medium of instruction in Australian schools is English. In Singapore, the four official languages are English, Malay, Mandarin and Tamil (OECD, 2010, p. 161). A policy of bilingualism applies in education: English is the medium of

instruction in all public schools and Chinese, Malay and Tamil Indian students study their Mother Tongue as a second language.

Population

Australia ranks sixth in the world in terms of land mass, and contains a very small, widely dispersed population. It is over 10,000 times the size of Singapore, which occupies just over 700 square kilometres and has one of the highest population density levels in the world at almost 7,800 people per square kilometre. By comparison, per Table 2.1, Australia averages three people per square kilometre.

Census data in Singapore are collected only among the resident population and do not capture statistics relating to citizens living elsewhere. In terms of ethnicity, 74% of the resident population in 2017 is Chinese, 13% Malay, 9% Indian and 3% Other (Statistics Singapore , 2017, p. 14)

Table 2.1 *Key population measures*

Population measures	Australia	Singapore
Population (000s)	24,385.6 ¹	5,612.3 ²
Area (km ²)	7,692,024	719.9
Average people per square kilometre	3.17	7,796 ²
Average annual population growth 2016	1.6% ¹	1.3% ²

Based on and includes information from the following sources:

1 Source: *Australian Bureau of Statistics, Australian Demographic Statistics (3101.0, Dec 2016, released 27 June 2017)*

2 Source: *Department of Statistics Singapore, Population and Land Area, www.singstat.gov.sg/statistics/latest-data#16*

Economy

Australia's Gross Domestic Product (GDP) continues to grow faster than that of Singapore and is well ahead of the OECD average (OECD, 2017a). In relation to income per capita, however, Singapore is marginally better off than Australia, as shown in Table 2.2.

Australia spends 5.6% as a percentage of GDP on education, including tertiary education, which exceeds the OECD average of 5.2%. Singapore's expenditure, at 2.9%, is almost half that of Australia.

Table 2.2 *Key economic measures*

Economic measures	Australia	Singapore
GDP (USD trillion) forecast 2017 ¹	1.344	0.311
GDP (USD) per capita forecast 2017 ¹	\$54,236	\$55,252
% GDP growth projected 2017 ²	3.1%	2.2%
% GDP spent on education (2014)	5.8% ³	2.9% ⁴
- Primary education	1.8%	0.6% ⁵
- Secondary education	2.0%	0.8% ⁵
Average \$ spent per student (USD)	(2014 ⁶)	(2017 est. ⁷)
- Primary education	8,251	8,245 SGD 11,210
- Secondary education	11,023	11,095 SGD 15,086

Based on and includes information from the following sources:

1 Source: *International Monetary Fund, Report for Selected Countries and Subjects, World Economic Outlook Database, October 2016*

2 Source: *International Monetary Fund, World Economic Outlook April 2017, Statistical Appendix, Table A2*

3 Source: *OECD Education at a Glance 2017: OECD Indicators, Table B2.1*

4 Source: *World Bank, Government expenditure on education (2013), total (% of GDP) (The World Bank, 2017)*

5 Source: *Calculations based on Yearbook of Statistics Singapore, 2017 Sections 5.1 and 22.15 (2015 numbers)*

6 Source: *OECD Education at a Glance 2017: OECD Indicators, Table B1.1*

7 Source: *Singapore Government Budget, Ministry of Education 2017: Key Performance Indicators*

Australia and Singapore spend almost the same amount on primary and secondary students (albeit comparing different years in Table 2.2), but overall, Australian expenditure as a percentage of GDP is more than double that of Singapore. In part, this can be attributed to the greater number of school-aged children in Australia. Per Table 2.3, Australia recorded 3.75 million students or around 15.3% of the population, whereas Singapore recorded 425,000 students or around 7.6% of the total population (ACARA, 2015, p. 14) (Statistics Singapore, 2017, p. 282). In other words, compared to Singapore, Australia supports twice the number of school-aged students as a percentage of its overall population,

Indigenous population

In Australia, almost 3% of the population is indigenous, i.e. Aboriginal or Torres Strait Islander. Singaporean reports show that Malay peoples make up around 13.3% of the population (Statistics Singapore, 2017, p. 14). This is a consequence of centuries of migration from Malaysia and Indonesia, but does not reflect the original indigenous Malay people, of whom there were estimated to be fewer than 4,800 in 1826 (Wright & Cartwright, 1907, p. 37).

Literacy amongst the Malay people is reported as higher than the average Singaporean level, with a general literacy rate of 97.1% versus a countrywide average of 95.9%. Further, absolute progress since 1980 in educational indices has been significant, particularly in the secondary and tertiary indices.

University-level attainment for Malays has increased from 5.1% in 2005 to 6.8% in 2015. However, university attainment by Malays is one quarter that of the level of non-Malay attainment (Shantakumar, 2011, pp. 193-7).

In Australia, academic performance demonstrates indigenous disadvantage of over two years of schooling, as measured by international assessment studies such as the Programme for International Student Assessment (PISA).

Teaching

Australia has approximately nine times more students than does Singapore, meaning that the overall provision and structure are proportionately far larger. While the number of students per teacher is similar for both countries in primary education, Singapore reports a ratio of 12.2 students to each teacher in secondary education, which is considerably lower than the ratio of 16 students per teacher recorded in Australia.

Teachers in Singapore may pursue promotion in the context of classroom teaching or with an emphasis on school administration and leadership (MOE, 2017b). In Australia, opportunities for promotion in schools tend to be associated with withdrawal from classroom teaching. Exceptions occur in rural and remote school contexts, and in the non-government sector, where there is more demand for teaching principals.

According to the OECD's Teaching and Learning International Survey (TALIS) as reported in Table 2.3, Singapore teachers spend less time teaching and more time marking than their Australian counterparts (OECD, 2013).

Table 2.3 *Key teaching measures*

Key teaching measures	Australia	Singapore
Number of students (2015)		
- Primary	2,140,571 ¹	239,102 ²
- Secondary	1,610,402 ¹	186,036 ²
Ratio of students to teaching staff		
- Primary education	16 ³	16 ⁴
- Secondary education	16 ³	12.2 ⁴
Average hours per week spent ⁵ :		
- teaching	19	17
- marking	5	9
Average days spent in professional development in previous 12 months ⁵	4	9

Based on and includes information from the following sources:

1 Source: ACARA *National Report on Schooling in Australia, 2015*

2 Source: *Yearbook of Statistics Singapore, 2017, Section 22.1*

3 Source: *OECD Education at a Glance 2016: OECD Indicators, Table D2.2*

4 Source: *data.gov.sg Pupils per Teacher in Primary and Secondary Schools*

5 Source: *Teaching and Learning International Survey (TALIS) 2013, OECD: Country Notes*

Some differences are seen in the average age of principals. Singapore is reported to have the youngest teaching force amongst the TALIS (2013) countries. In Singapore, the average age of school principals is 36 years; in Australia, it is 43. Data collected on secondary school leaders show that Australia has a higher proportion of older principals than both Singapore and the OECD average, as shown in Figure 2.1.

The percentage of female principals, also in relation to secondary schools, is much higher in Singapore, at 52.5%, than the 38.6% found in Australia (OECD, 2016, p. 460).

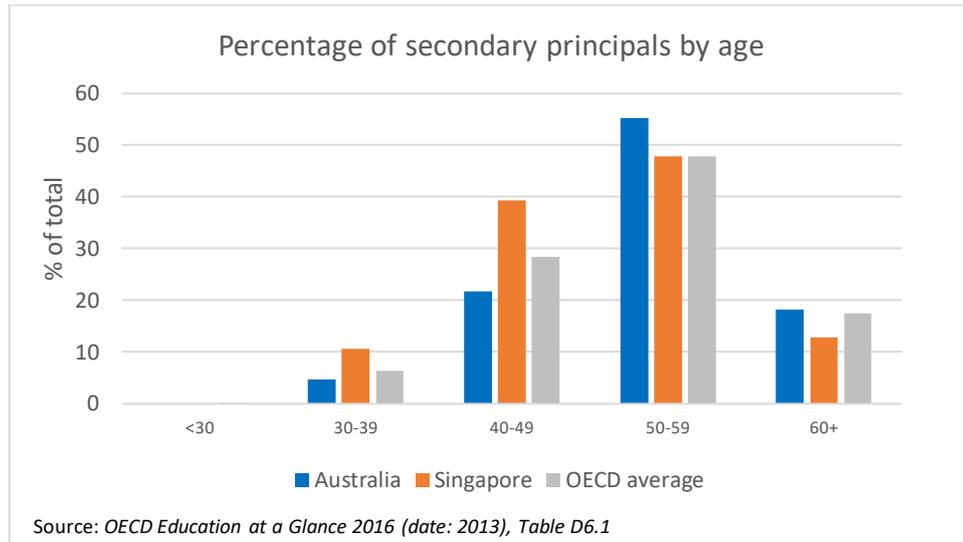


Figure 2.1 Percentage of secondary principals by age

Migration

Population

Singapore and Australia are both countries that benefit from longstanding policies of welcoming migrants. Around 45.4% of Singapore's resident population and 28.5% of Australia's resident population were born overseas (ABS, 2017a; OECD, 2017b; UNO, 2015).

In Australia, per Figure 2.2, the most common country of birth for the overseas-born population is the United Kingdom, followed by New Zealand, China and India.

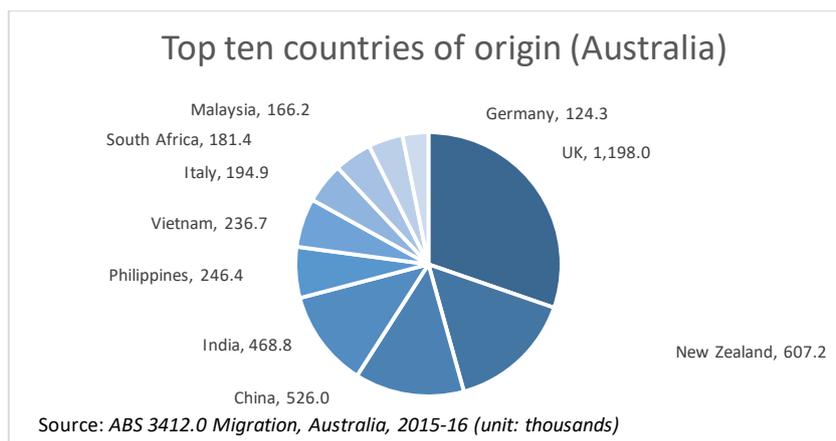
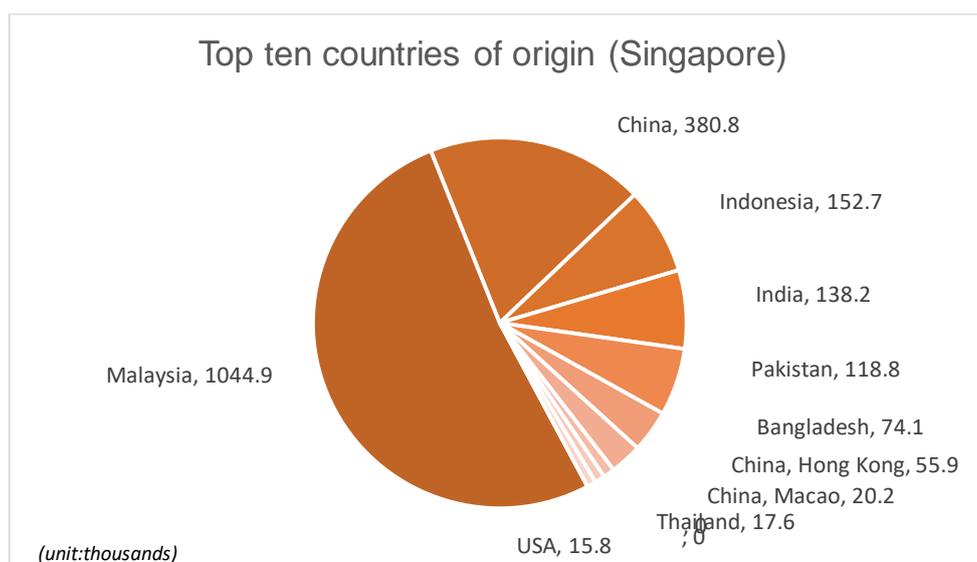


Figure 2.2 Top ten countries of birth (Australia)

Singapore is the major destination for Malaysian immigrants. The top ten countries of origin for Singaporean immigrants are represented in Figure 2.3.



Based on and includes information from the following source:

Source: UN Migration Profiles (2013): Singapore, <https://esa.un.org/migmigprofiles/indicators/files/Singapore.pdf>

Figure 2.3 Top ten countries of origin (Singapore)

Singapore attracts a large percentage of non-residents, comprising foreigners who are working, studying or living in Singapore without permanent residency. In 2016, non-residents made up 30% of the population; this figure has risen from around 20% over the last decade (Statistics Singapore, 2017, p. 11). In 2016, Singapore recorded a 2.5% growth in the non-resident population, versus 0.8% in the resident population.

Skilled migrants or expatriates in Singapore are permitted to bring dependents into the country and many of their children attend international schools: only 4% of international students and 9% of Permanent Residency students attend local government schools (Teng,

2016). Resident school children, however, are only permitted to attend an international school for their secondary schooling; primary-aged school children must attend a Singaporean 'national primary school' (MOE, 2017cx).

Languages

Singapore is a pluralist society, and recognises four official languages: English, Malay, Mandarin and Tamil.

Data collected on the resident population show that 74% of the resident population is Chinese, 13% Malay, 9% Indian and 3% Other (Statistics Singapore , 2017, p. 14). Nonetheless, English is the most-common language spoken at home, followed by Mandarin and Chinese dialects, as shown in Figure 2.4.

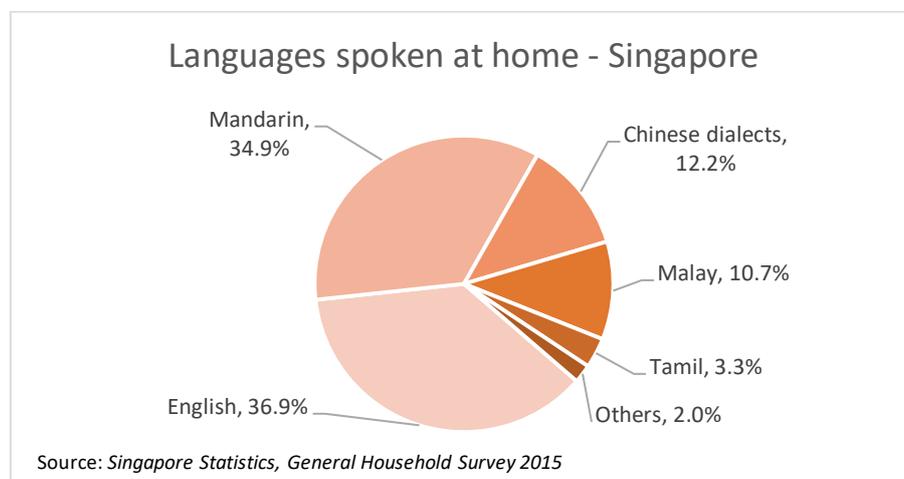


Figure 2.4 Languages spoken at home – Singapore

English is the language of instruction in schools although students are also required to take 'mother tongue' classes in Malay, Mandarin or Tamil, depending on their ethnic background. English is also more likely to be spoken at home where residents are university-educated (Statistics Singapore , 2016, p. 21).

Recent data indicate that 73.2% of Singaporeans are literate in two or more languages, and residents from Malay and Indian ethnic groups are more likely than their Chinese counterparts to be literate in at least two languages (Statistics Singapore , 2016, pp. 15-16).

Notwithstanding its significant socio-cultural diversity, Australia is essentially a monolingual society in which the language of instruction in schools is English and access to foreign language instruction is variable. Around 20% of the Australian population can speak more than one language. According to the 2016 census, the most common languages spoken at home, other than English, are Mandarin, Arabic, Cantonese and Vietnamese (ABS, 2017b). Around 50 Indigenous languages are estimated to be in use, a significant decline from over 250 at the time of first European contact.

The AC provides a framework for Aboriginal and Torres Strait Islander Languages as well as curricula for 16 languages, both classical and modern (ACARA, 2017a).

Singapore’s national curriculum allows for third language acquisition in secondary schools in Mandarin, Malay, Bahasa Indonesian, Arabic, Japanese, French, German and Spanish. Selection criteria apply to the last four (MOE, 2017d).

Educational achievement

The highest rate of educational attainment in Australia is among students completing the upper secondary qualification. This is also the OECD average, but it is not the case in Singapore. Data is available for Singaporean residents in relation to educational attainment. The 2016 data show that attainment at ‘below secondary’ (at 29.3%) was just above university-level attainment (29.1%), as shown in Figure 2.5.

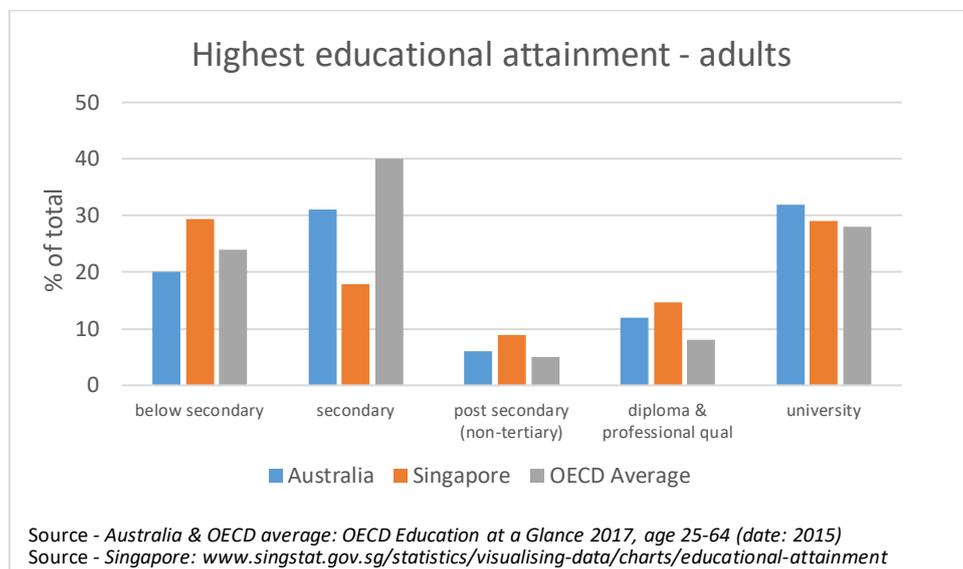


Figure 2.5 *Highest educational attainment in adults*

Residents with ‘below secondary’ education are more likely to be aged 60 years or over; most the university-educated residents are aged 44 or under (Statistics Singapore , 2016), an indication of Singapore’s rising educational levels over recent decades.

Intergenerational mobility in education, which reflects the proportion of the population who have a higher level of education than their parents, is significant both in Australia and Singapore. The use of education to achieve upward mobility is evident in Singapore, where fewer Singaporeans than Australians have parents with tertiary qualifications. In Singapore, 81% of tertiary-qualified adults come from families where both parents held below-tertiary level qualifications (OECD, 2017c, p. 79). This compares to 68% in Australia, suggesting greater upward mobility in recent years in Singapore.

Tertiary education for Singaporeans is often attained overseas; in 2015, only 59% of tertiary-qualified adults were educated in Singapore. Per Figure 2.6, Australia and New Zealand are

grouped together as these countries represent the most popular education destinations for Singapore residents.

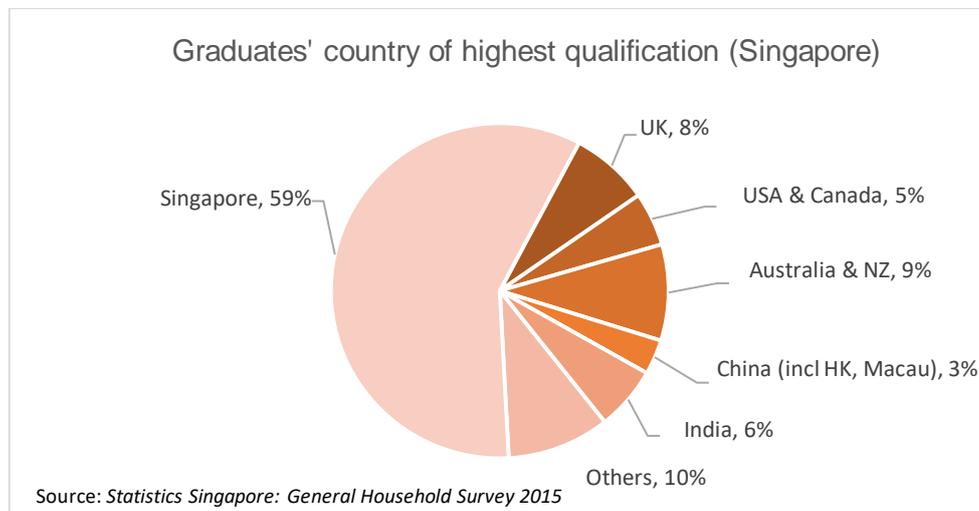


Figure 2.6 Graduates' country of highest qualification (Singapore)

The most common fields for international study by Singaporeans are Engineering, Business and Administration, and Humanities and Social Sciences. This is reflected in Singapore's growing overall interest in tertiary education – both local and international – compared to the OECD average and Australia, as shown in Figure 2.7.

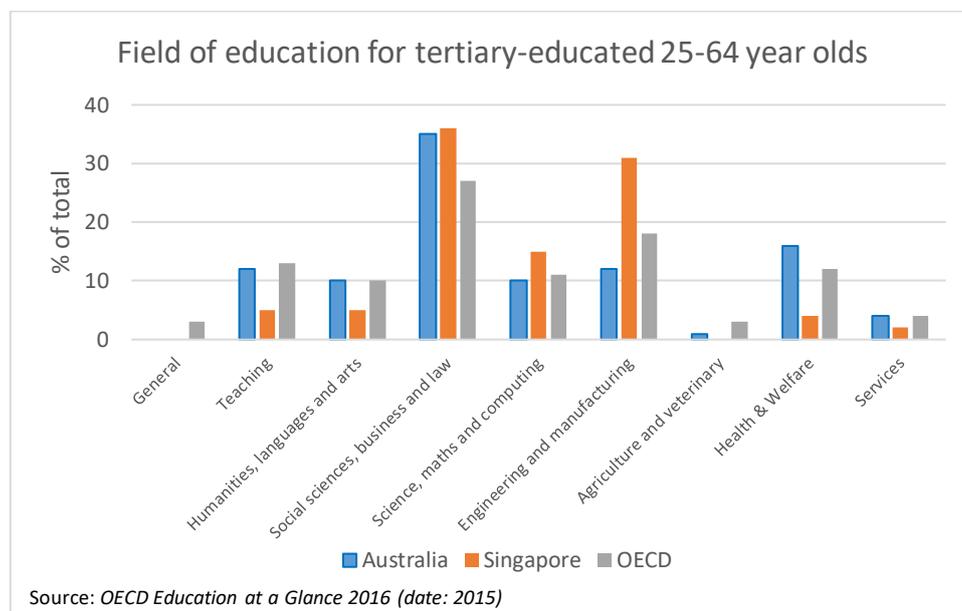


Figure 2.7 Field of education for tertiary-educated adults

Singaporean females were less likely to study Information Technology or Engineering but formed the majority of graduates in most other fields, including the Sciences which contributed 1.3 females for every male (Statistics Singapore , 2016, p. 205). By contrast, in Australia, there are 1.67 males for every female graduate in the Sciences (OECD, 2016, p. 70)

Post-education unemployment

Per Table 2.4, OECD (2016a) data show that unemployment rates for those aged between 25 and 64 in Australia decrease as the educational achievement rises, demonstrating the value of additional qualifications. Singapore’s statistics do not suggest the same relationship (Statistics Singapore, 2016).

Table 2.4 *Unemployment by highest educational attainment*

Educational attainment	Australia ¹	Singapore ²	
Below upper secondary	7.5%	2.4%	Primary or below
		2.6%	Lower secondary
Upper secondary, non-tertiary	4.5%	2.7%	Secondary
		3.0%	Post-secondary, non-tertiary
Tertiary	3.2%	2.9%	Diploma and professional qualifications
		2.8%	Degree

Based on and includes information from the following sources:

1 Source: *OECD Unemployment rates by education level (2016)*: data.oecd.org/unemp/unemployment-rates-by-education-level.htm

2 Source: *Singapore Yearbook of Manpower Statistics, 2016, Table A.10*

Vocational Education

During the 1990s, Singapore undertook to transform vocational (or technical) education through the *Institute for Technical Education*. This reform initiative has attracted around 25% of the post-secondary cohort annually, and is recognised world-wide as a global leader in technical education (OECD, 2010, p. 168).

In Australia, students can enrol in vocational education and training (VET) subjects in the senior secondary years, and can articulate to tertiary institutions. In 2016, approximately four million domestic students were enrolled in VET courses; 9% of students (370,000) were still in secondary school.

Comparative International Performance

The Programme for International Student Assessment (PISA) is designed to provide policy-oriented international indicators of the skills and knowledge of 15-year-old students across OECD member countries. Australia has participated in PISA since it was first introduced in 2000; Singapore has participated since 2009.

In recent years, Singapore has drawn attention as a top-performing country in international assessment. PISA (2015), the sixth cycle, focused on scientific literacy and included mathematical and reading literacy as minor domains. For the first time, PISA 2015 included financial literacy and a collaborative problem-solving assessment for countries that elected to participate in the computer-based delivery. Singapore scored the trifecta in PISA 2015, ranked first in the Science, Reading and Mathematics domains. The OECD subsequently described Singapore's education system as 'extremely rigorous', particularly because of the commitment to ensuring students develop a strong early foundation in the 'core subjects of Mathematics, Science, and literacy in two languages' (OECD, 2010, p. 172).

Singapore stood out as one of only seven countries where at least 80% of 15-year-old students mastered the baseline level of proficiency in all three literacy domains of Science, Reading and Mathematics. The other high achievers were Canada, Estonia, Hong Kong (China), Japan, Macao (China) and Finland (OECD, 2016b, p. 4).

Singapore was also ranked first in the 2015 Trends in International Mathematics and Science Study (TIMSS) which consists of a set of math and science tests given every four years to 10- and 14-year olds around the world,

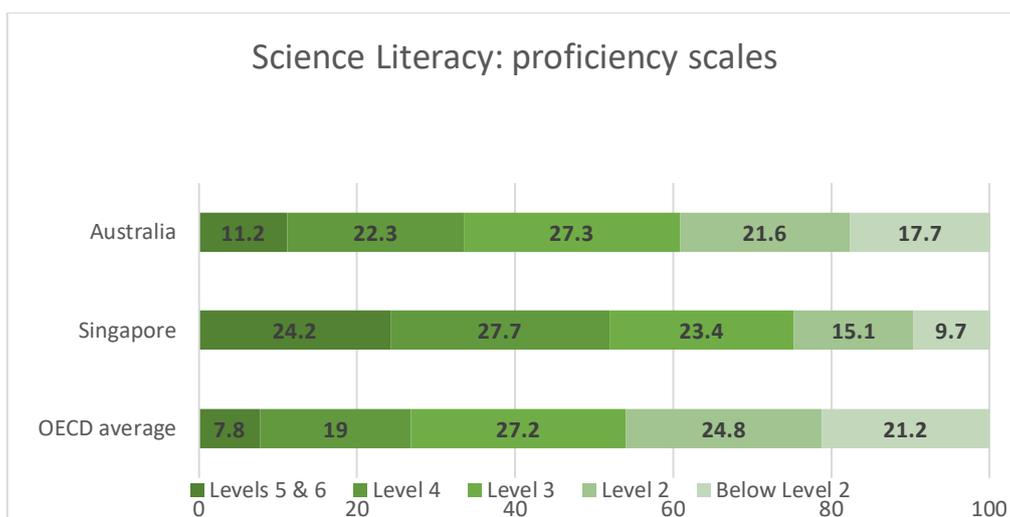
Singapore achieved fourth place in the 2011 Progress in International Reading Literacy Study (PIRLS), compared with Australia's 24th place. Singapore, amongst all participating countries, returned the largest percentage of students (24%) that attained the highest benchmark in Reading, the PIRLS *Advanced International Benchmark*. By comparison, 10% of Australian students in PIRLS attained this benchmark.

Performance – Science Literacy

In the 2015 cycle of PISA, Australia ranked 14th in Science literacy. This result represented a statistically significant decrease compared to the prior cycle (OECD, 2016c, p. 5).

In terms of proficiency levels, 24.2% of the Singapore cohort performed at levels Level 5 and 6, three times the OECD average and more than twice the Australian average. This statistic was higher than any other participating country; the second highest was Chinese Taipei at 15.4%.

Level 2 is considered the baseline level of scientific literacy proficiency. Per Figure 2.8, Australia recorded an increase in the number of students *not* attaining Level 2 level over the last three cycles of PISA Science Literacy testing (OECD, 2016b, p. 321).



Based on and includes information from the following source:

Source: OECD. (2016). PISA 2015 results (Volume 1): Excellence and equity in education. Figure 1.2.5 Students' proficiency in Science.

<http://dx.doi.org/10.1787/888933432072>

Figure 2.8 Science Literacy: proficiency scales

Per Table 2.5, both Australia and Singapore showed a large differential between the performance of the top 10% and bottom 10% of students, suggesting lower equity than in other OECD countries. Other countries with a wide spread included New Zealand, France and Israel (Kastberg, Chan & Murray (2016)).

OECD data reveal that students from the two countries, Australia and Singapore, who attended wealthy schools had advantages in four surveyed areas: access to educational resources; exposure to science; school climate; and instructional practices (OECD, 2017e, p. 4). This finding is relevant, considering that Singapore recorded 16.8% of performance variation which may be attributed to students' socio-economic status.

Table 2.5 Performance in Science Literacy (PISA 2015)

Science Literacy	Australia	Singapore	OECD average
Average score	510	556	493
Score difference between 10 th and 90 th percentiles ¹	267	271	247
% of immigrant students in PISA 2015 ²	25%	20.9%	12.5%
% of variation explained by students' socio-economic status ³	11.7%	16.8%	12.9%

Based on and includes information from the following sources:

1 Source: OECD, PISA 2015 Results (Volume 1): Excellence and Equity in Education, Table I.2.3

2 Source: *ibid*, Table I.7.15a

3 Source: *ibid*, Table I.6.17

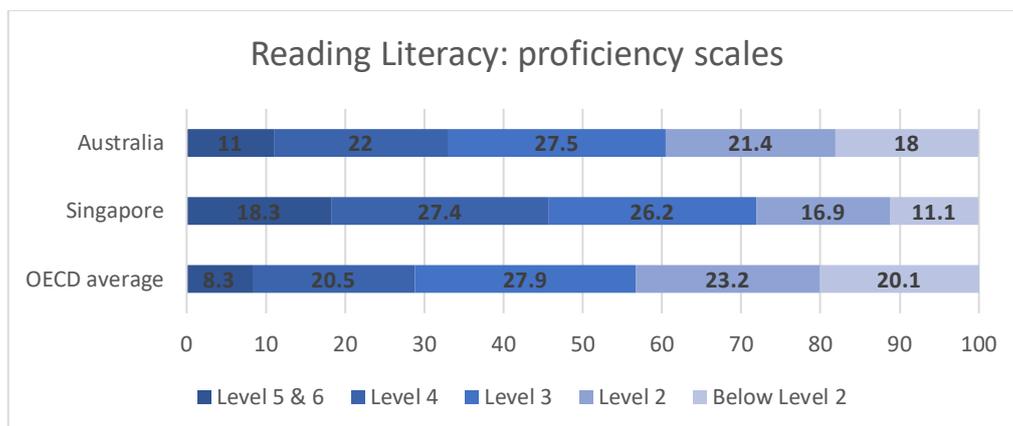
Statistically, there was no difference between the average performance of Australian boys and girls in Science Literacy, although boys performed poorly in the 10th percentile and better in the 90th percentile, demonstrating a greater range of performance than their female peers. Singapore recorded a greater variation of performance, as well as statistically valid evidence of better achievement by boys (OECD, 2016b, p. 328).

In terms of performance over time, Australia lost 17 average points between 2006 and 2015, whereas Singapore gained 14 points between 2009, when it first participated, and 2015. These data contrast with an average OECD loss of 5 points between 2006 and 2015 (OECD, 2016b, p. 324).

Performance – Reading Literacy

For Reading Literacy, Australia ranked 16th compared to Singapore's 1st place. Girls both in Australia and Singapore performed significantly better than boys across the range of performance, viewed at the 10th, 50th and 90th percentiles (OECD, 2016b, p. 384).

In relation to achievement at baseline level 2, Figure 2.9 shows that Australia is close to the OECD average, with just under 82% of its students achieving this level, compared to 80% for the OECD average. Nearly 89% of Singapore's students achieved level 2 proficiency or better in Reading Literacy.



Based on and includes information from the following source:

Source: OECD. (2016). PISA 2015 results (Volume 1): Excellence and equity in education. Figure 1.4.8 Students' proficiency in reading.

<http://dx.doi.org/10.1787/888933432569>

Figure 2.9 Reading Literacy; proficiency scales

Australia's performance in Reading Literacy revealed a large differential between the performance of the top 10% and bottom 10% of students, as demonstrated in Table 2.6, suggesting lower equity than in other OECD countries. Singapore, still above the OECD average, recorded a lower spread of performance than Australia, suggesting greater equity.

Table 2.6 Performance in Reading Literacy (PISA 2015)

Reading Literacy	Australia	Singapore	OECD average
Average	503	535	493
Point difference between 10 th and 90 th percentiles ¹	266	257	249

Based on and includes information from the following source:

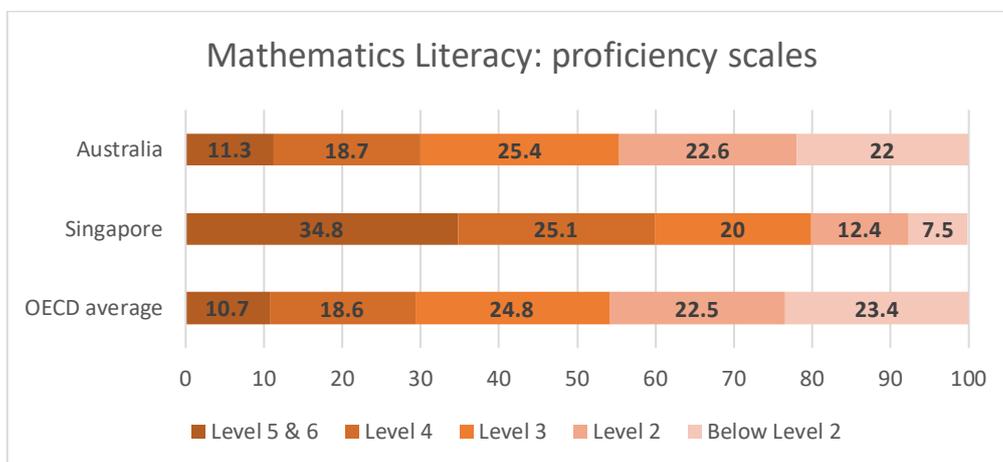
¹ Source: OECD, PISA 2015 Results (Volume 1): Excellence and Equity in Education, Table I.4.3

Performance – Mathematics Literacy

Per Figure 2.10 Singapore ranked 1st compared to Australia's 25th place, that is, three times the number of Singaporean students achieved at the highest proficiency levels in Mathematics Literacy, compared to Australia and the OECD average. While 11.3% of Australian students achieved at the highest proficiency levels of Levels 5 and 6 (above the OECD average of 10.7%), almost 35% of Singaporean students achieved at these levels.

In Mathematics Literacy, Australian girls performed marginally better on average than their male peers at the lower percentiles; boys performed better at the 90th percentile. Singapore recorded the same spread of performance, although the underperformance of boys at the lower percentile (10%) was statistically significant (OECD, 2016b, p. 395).

In Mathematics Literacy, 92.3% of Singapore's students achieved baseline level 2, compared with 78% in Australia and 76.6% across the OECD countries.



Based on and includes information from the following source:

Source: OECD. (2016). PISA 2015 results (Volume 1): Excellence and equity in education. Figure 1.5.8 Students' proficiency in Mathematics.

<http://dx.doi.org/10.1787/888933432665>

Figure 2.10 Mathematics Literacy: proficiency scales

The Australian results show a significant differential between the performance of the top 10% and bottom 10% of students compared with the OECD average, per Table 2.7.

However, although a better result for Australia, Singapore recorded an even higher differential, suggesting lower equity in students' Mathematics Literacy performance compared with other OECD countries.

Table 2.7 Performance in Mathematics Literacy (PISA 2015)

Mathematics Literacy	Australia	Singapore	OECD average
Average	494	564	490
Point difference between 10 th and 90 th percentiles ¹	242	246	232

Comparative performance in PISA - Australia

Per Table 2.8, for Science Literacy, the average indigenous student scored 76 points lower than the average non-indigenous student, which is equivalent to two-and-a-half years of schooling. Further, the average indigenous student scored 71 points lower in Reading Literacy and 70 points lower in Mathematics Literacy, equating to around two-and-a-third years of schooling for both literacies.

Metropolitan students had a distinct advantage over provincial (or rural) students, which was even more pronounced compared to their remote counterparts.

The difference in average performance based on migration status was not as marked. Although Australian-born students appeared to have some advantage over their foreign-born and first-generation counterparts for Science and Reading literacies, they were less successful in Mathematics Literacy.

Difference in performance by gender was only significant in Reading Literacy, where females demonstrated an advantage of one year of schooling over their male peers.

Table 2.8 Score difference in performance in Australia (PISA 2015)

PISA 2015 Scores	Science Literacy ¹	Reading Literacy ¹	Mathematics Literacy ¹
Indigenous students: versus non-Indigenous students	-76 (~2.5 years of schooling)	-71 (~2.3 years of schooling)	-70 (~2.3 years of schooling)
Metropolitan: versus Provincial versus Remote	+26 (~1 year of schooling) +44 (~1.5 years of schooling)	+31 (~1 year of schooling) +46 (~1.5 years of schooling)	+29 (~1 year of schooling) +42 (~1.5 years of schooling)
Australian: versus Foreign-born versus First-generation	+15 (~0.5 years of schooling) +10 (~0.3 years of schooling)	+17 (~0.5 years of schooling) +16 (~0.5 years of schooling)	-6 (statistically similar) -14 (~0.5 years of schooling)
English spoken at home: versus LOTE*	+27 (~1 year of schooling)	+20 (~0.6 years of schooling)	+9 (statistically similar)
Females: versus males	-2 (statistically similar)	+32 (~1 year of schooling)	-6 (statistically similar)

Based on and includes information from the following source:

¹ Source: ACER, PISA 2015: Reporting Australia's results

* LOTE – a Language other than English. This category refers to "language spoken at home most of the time".

2.3 Curriculum design principles and purpose

This section provides further contextual detail regarding the recent curriculum design work undertaken in Australia and Singapore. As revealed in the preceding demographic analysis, the contexts and challenges influencing curriculum decisions in Australia and Singapore are similar in that they include, but are not limited to, addressing students' cultural diversity, interests and abilities. In general, the curriculum design principles adopted in both locations reflect the aim of meeting the needs of a wide range of students with a focus on 21st century skills such as creative and critical thinking, collaboration, communication and problem solving. Both curricula state their intention to produce informed citizens with the knowledge and skills to navigate an increasingly complex world. Both countries espouse flexibility and diversity, although their curricula and/or education system express these notions in differing ways.

2.3.1 Education Policy

The goal of the Singapore government to "recalibrate its education system is a bid to better prepare its students for positive social and professional trajectories in a globalised 21st century world" (Tan, Koh, Chan, Costes-Onishsi & Hung, 2017, p. 15). This position is a response to concern about Singapore's dwindling natural resources and the need for human resources and manpower capability to further its goal of constructing a knowledge-based economy. Customarily, education has been perceived as essential to building both the economy and the nation, as expressed in the statement that the government's ability to "successfully match supply with demand of education and skills is a major source of

Singapore's competitive advantage" (OECD, 2010, p.159).

In contrast to some decentralised education systems that have moved towards centralised systems of education (Hargreaves & Shirley, 2009), Singapore's education system has been described as a 'hybridised centralisation/ decentralisation model' (Ng, 2013), which delivers 'high quality' supported by centralised functions such as strategic directions, curriculum, resources and infrastructure. On the other hand, schools are enabled "to value and respond to diversity, as well as exercise flexibility and innovations in curricula enactments" (Tan, Koh, Chan, Costes-Onishsi & Hung, 2017, p. 16). [Singapore's initial approach to reform anticipated a highly centralised and structured system reinforced by high stakes assessment at the grades 6, 10 and 12 (Tan & Gopinathan, 2000). Its policy originates from the belief that 'degrees of centralisation' are fundamental to Singapore's ability to respond to external challenges and circumstances (Lee & Low, 2013).

Globalisation, changing demographics and technology innovation represent 'driving forces of the future' (MOE, 2017e). Similar to most OECD countries, the government of Singapore is committed to preparing students to "face these challenges and seize opportunities brought about by these forces" (MOE, 2017e). Accordingly, the Ministry has identified 21st century competencies, consistent with skills and competencies promoted by the OECD, to enable young Singaporeans to "capitalise on rich opportunities of the new digital age, while keeping a strong Singapore heartbeat" (MOE, 2017e).

In the wake of criticism that Singaporean students may be wanting in "exercising creative and critical thinking in a flexible manner to solve ill-defined problems," recent PISA (2012, 2016) assessments established that the nation's 15-year-olds "outperformed their international peers on tasks that required flexible and innovative thinking, and the transfer and application of learning to unfamiliar and complex problem contexts" (Tan, Koh, Chan, Costes-Onishsi & Hung, 2017, p. 3).

In two decades (1997–2016), Singapore has successfully navigated a series of 21st century education initiatives and policies that epitomise the country's determination to "nurture a resilient, agile, and productive society" which can prosper in the 21st century (Tan, Koh, Chan, Costes-Onishsi & Hung, 2017, p. 3). Singapore's embrace of 21st century competencies is distinctive. First, it is the product of a longstanding and profound commitment to nation building, energised by national policy statements and initiatives that "communicate a shared philosophy of education and desired student outcomes" towards nurturing and sustaining a vibrant society and vigorous economy for Singapore. Second, it can be argued that a series of curricular, structural and infrastructural reforms have collectively defined a holistic approach to educating students in the 21st century (Tan, Koh, Chan, Costes-Onishsi & Hung, 2017, p. 8).

Like Singapore, Australia has engaged in a period of national and state initiatives in preparing students for 21st century education. The policy plan for Australia's schools is shaped by reforms delivered under the *Quality Schools* package - announced on 2 May 2017 - and the Australian Government's goal to ensure that every student "should have the opportunities they need to be the best they can be" (AGDET, 2017).

To confirm Australia's future prosperity and to remain competitive internationally, the Australian Government is committed to ensuring that all Australian students have access to

a high-quality education. In partnership with states and territories and the non-government sector, the Government is committed to improving outcomes in Australia's schools via a reform mechanism called *Students First*, which details “teacher quality, school autonomy, strengthening the curriculum and engaging parents in education” as the four pillars designed to lift current educational standards (AGDET, 2014).

A robust, relevant and current AC is essential to improving the quality of education for all school students. In particular, high-quality school Science and Mathematics education are considered “critically important for Australia's current and future productivity” (AGDET, 2017a).

2.3.2 The Singapore Curriculum: Structure and design principles

Education in Singapore may be best understood as ‘complex ecology’ wherein change is ‘evolutionary, adaptive, and nonlinear in nature’ (Tan, Koh, Chan, Costes-Onishsi & Hung, 2017, p. 8). To arrive at a position of high-level performance in international testing is indicative of national commitment – policy makers, educators and scholars – and close attention to the relevance of schooling to a rapidly changing globalising world. A series of education policy initiatives, documented below, attest to Singapore's drive towards its goal of maintaining its reputation as a high performing nation.

A major curriculum review in 1997, which led to the launch of the initiative titled Thinking Schools, Learning Nation (TSLN), may be regarded as a turning point for 21st century competencies education directed at preparing young Singaporean students for the future (MOE, 2017g). The TSLN represented a shift from an ‘efficiency-driven’ to an ‘ability-driven paradigm’ (MIA, 1999). It was argued that Singapore's future sustainability and economic growth depended on ‘the ability of Singaporeans to learn’ (Goh & Gopinathan, 2008) and, as such, the transformation of pedagogy and practice in schools was essential to expand learning experiences and better address students' diverse learning needs. The TSLN initiative aimed at enabling students to develop creative and critical thinking skills, underpinned by strategies that encouraged: explicit teaching of creative and critical thinking skills, a reduction of curriculum content, a revision of assessment models and an increased emphasis on process rather than learning and teaching outcomes (Tan, Choo, Kang & Liem, 2017; Tan, 2013).

Subsequent initiatives have included technology as a ‘powerful leverage’ both in acquiring content knowledge and 21st Century Competencies for effective learning. The Masterplan 1 (MP1) for Information Communications Technology (ICT) in Education, launched in 1997, aims to encourage students to develop thinking, learning and communicating skills through using IT (MOE, 2017i).

Consistent with Singapore's drive to foster national cohesion and instill a shared national identity among students, the 1997 National Education Initiative (NEI) addresses Singapore's future challenges as well as its core values of *meritocracy* and *bilingualism* (Mother Tongue).

A related initiative, first formulated in 1997 and later refined in 2009, is the Desired Outcomes of Education (DOE) which provide “a common purpose for educators, drive our policies and programmes, and allow us to determine how well our education system is doing” (MOE, 2017f). The DOE defines a set of moral, cognitive, physical, social and

aesthetic attributes that students will acquire by the completion of their formal schooling. Essentially, a Singaporean student is to be a confident person, a self-directed learner, an active contributor and a concerned citizen (MOE, 2017f). The DOE is conceived as developmental outcomes for each stage of schooling; altogether there are eight Key Stage Outcomes that explicate the aspirations for young Singaporeans to ‘thrive and achieve success in life as a contributing member of society’ (MOE, 2017f).

The most significant development in Singapore’s quest for 21st century education is the Framework for 21st Century Competencies (21CC) and Student Outcomes, ratified in 2010. The framework expands on earlier emphases on thinking skills with the inclusion of values, emotions and interpersonal skills. The competencies framework underpins ‘holistic education,’ which aims to provide a common core of knowledge and skills reinforced by values that define a person’s character and shape their beliefs, attitudes and actions (MOE, 2017e). Per Figure 2.11, the three concentric circles denote 21st century competencies, social and emotional competencies and core values.

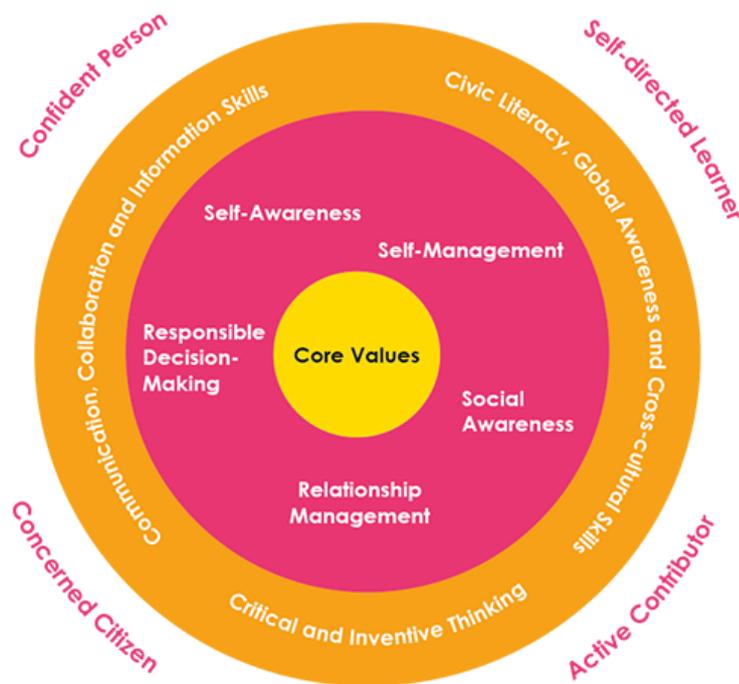


Figure 2.11 Framework for 21st Century Competencies and Student Outcomes

Reproduced from: Ministry of Education, Singapore (<https://www.moe.gov.sg/education/education-system/21st-century-competencies>, August 2017).

Singapore’s framework permeates the academic curriculum, co-curricular activities, character and citizenship education, as well as applied learning programs in high schools. Some researchers posit that this “integration avoids the trap of compartmentalisation and affords the sustainability of the competencies” in Singapore’s education system (Tan, Koh, Chan, Costes-Onishsi & Hung, 2017, p. 7).

Value-centric and needs-based strategies and policies define Singapore education (Tan, Koh, Chan, Costes-Onishsi & Hung, 2017, p. 7). This is exemplified in the Character and

Citizenship Education Framework (2011) – a synthesis of Values Education, Education and Career Guidance and Cyberwellness and Sexuality Education (MOE, 2014). This initiative grew from a groundswell of support in the wider Singapore community (Tan, Koh, Chan, Costes-Onishsi & Hung, 2017, p. 7).

The 21CC framework and values-driven education is indicative of the reach with which Singapore has embraced 21CC in its vision and plans to provide students with holistic education, both in academic and non-academic spheres. In recognition of ways and measures of judging student performance without invoking examinations, educational strategies now focus on the need to “expand the *breadth* (i.e. broad and inclusive approach, broad and holistic education), *depth* (i.e. deep values, deep foundation for learning) and *length* (i.e. lifelong learning, learning for life)” of students’ learning experiences (Tan, Koh, Chan, Costes-Onishsi & Hung, 2017, p. 7).

Alongside Singapore’s focus on students’ development of self-awareness and interpersonal attributes is the realisation of pedagogical change that is embodied in the national mantra of *Teach Less, Learn More*. The MOE is intent on reducing the volume of syllabuses so that students “learn more actively and independently” and have “more space for flexibility in carrying out schools-based activities in the curriculum” (MOE, 2017). Such thinking assumes that 21st century learning requires new pedagogies such as inquiry-based learning, and that these require more time to teach. To support teachers to enact *Teach Less, Learn More* principles, a suite of curriculum and pedagogical frameworks (e.g. PETALS™) and resources has been developed.

Current education structure

Singapore’s education system is managed by the MOE, which carries responsibility for the development and administration of schools receiving government funding as well as holding an advisory and supervisory role for private schools. The Compulsory Education Act (CE) (2000), for which Australia has no national equivalent, introduced Compulsory Education in Singapore in 2003 for all primary school-aged children up to Primary 6 – except for children with disabilities. The two objectives of the CE embody Singapore’s aims and core values in educating its students, specifically:

- A common core of knowledge will provide a strong foundation for further education and training
- A common educational experience will help to build national identity and cohesion (MOE, 2017c).

In Singapore’s education system, students receive six years of primary education and four to five years of secondary education, followed by two years at junior college, polytechnic or the Institute for Technical Education. Primary education comprises a four-year foundation stage during which all students follow a common curriculum that emphasises English, Mother Tongue language and Mathematics. Science is introduced from Primary 3. Other subjects taught in primary school are Civics and moral education, Social Studies, Health, Physical Education, Art and Music (MOE, 2017h).

Students in the express course follow a four-year program culminating in the General

Certificate of Education (GCE) O-level exam. Students in the normal academic course follow a four-year course to GCE N-level and may sit for O-levels in Primary 5. The normal technical program prepares students for technical higher education, jobs or the post-secondary ITE after a four-year program leading to the GCE-N level. Recently, students have been afforded more choice in secondary school, with a wider range of subjects at O-level and elective modules. Students who attain university standing may study in Integrated Programme Schools where they can omit O-levels; this arrangement allows for engagement in broader learning experiences that develop leadership potential and capacity for creative thinking. More horizontal mobility now exists between courses; students who perform well are permitted to transfer between streams (MOE, 2017h).

Curriculum design

Singapore's education system is regarded as exceedingly rigorous. The academic standards set by its Primary School Leaving Examination and O- and A-levels are "as high as anywhere in the world" (OECD, 2013, p. 172). All students receive a strong early foundation in the core subjects of Mathematics, Science, and literacy in two languages.

Singapore's education system is commonly perceived as one that is excessively focused on coverage and mastery of disciplinary content. Moving from a successful education system embedded in knowledge transmission, Singapore is engaged in matching curriculum, pedagogy and assessments to standards that will lead to a greater focus on high-level, complex skills (OECD, 2010). Integral to this goal is the decision to reduce learning content by 30 percent [Personal communication]¹.

The OECD (2011, p. 172) reports that Singapore "does not just establish high standards and then leave it to individual teachers to figure out how to achieve them." Intense focus on curriculum development has produced strong programmes in Mathematics, Science, technical education and languages, as well as a significant investment in well-trained teachers to teach them (OECD, 2011).

Singapore has concentrated on the "universal development of strong Mathematics, Science and technical skills." Having a "solid foundation in Mathematics and Science for all students in the elementary grades seems to be a core part of students' later success" (OECD, 2011, p.168). At primary and secondary levels, Mathematics and Science are compulsory core subjects. Students start Mathematics in Primary 1 and Science from Primary 3 onwards. Students have specialist teachers in Mathematics and Science from upper primary onwards. From upper secondary onwards, a range of specialised Mathematics courses at higher levels is offered.

Singapore's curriculum design is indebted to ideas from other parts of the world. International benchmarking and, more recently, significant funds for research have contributed to enhancing Singapore's unique approach. Singapore's education system

¹ Interview with Mr. Ong Kong Hong, Director, Curriculum Policy Office, Ministry of Education, Singapore, September, 2017

recognises rapid global change and the need for the capacity and inclination to learn and adapt. Singapore fosters a global outlook for teachers, principals and students; all are expected to have 'global awareness and cross-cultural skills' and to be 'future-ready' (OECD, 2011, p. 173).

2.3.3 The Australian Curriculum: Design principles

It is not the purpose of this document to provide a detailed critique of the history and development of the AC. Relevant aspects of the process and the AC's characteristics are provided here for the purpose of this comparison study.

The AC has its origins in a single document, the *Melbourne Declaration on Educational Goals for Young Australians* (2008), which identifies two overarching goals:

- Goal 1: Australian schooling promotes equity and excellence
- Goal 2: All young Australians become:
 - successful learners
 - confident and creative individuals
 - active and informed citizens

In contrast to the island state of Singapore, Australia is a federal system wherein the development and implementation of a national curriculum both depend on a high degree of cooperation from the states and territories, largely because these jurisdictions have legislative responsibility for education. ACARA is responsible for Australia's first national curriculum. ACARA's stated mission is to improve the learning of all young Australians through world-class school curriculum, assessment and reporting.

Eleven propositions have shaped ACARA's development of the AC, with the overarching rationale centered on *quality* and *equity*:

- quality – an Australian Curriculum will contribute to the provision of a world-class education in Australia by setting out the knowledge, understanding and skills needed for life and work in the 21st century and by setting high standards of achievement across the country
- equity – an Australian Curriculum will provide a clear, shared understanding of what young people should be taught and the quality of learning expected of them, regardless of their circumstances, the type of school that they attend or the location of their school. (ACARA, 2017b)

The Shape of the Australian Curriculum (v 4.0, 2012) underwrites the purpose of the AC:

- to improve the 'quality, equity and transparency of Australia's education system'. [Quality is defined as 'knowledge, understanding and skills needed for life and work in the 21st century.' Equity is defined as 'a clear, shared understanding of what young people should be taught and the quality of learning expected'.]

- to address the ‘intellectual, personal, social and educational needs of young Australians’ within the context of a changing global environment so that they can function as ‘successful learners’, ‘confident and creative individuals’ and ‘active and informed citizens’. (AGDET, 2014, p. 65)

The AC is presented as a progression of learning from Foundation to Year 10, with a range of subjects available for study in the senior secondary years (Years 11 and 12).

Among the eleven propositions that inform the design of the AC, item (i) explicitly states that:

The primary audience for the Australian Curriculum is teachers. The curriculum is concise and expressed in plain language while preserving a complexity appropriate for professional practitioners. Consistency in terms of language and broad structure supports teachers in planning within and across learning areas. (ACARA, 2017c)

Numerous other propositions also point to the teacher as the primary consumer and interpreter of the AC. Teachers and schools are expected to make decisions about the delivery of the AC, including the allocation of time and other resources as appropriate to their local context, and they are responsible for all pedagogical and other considerations that will meet the needs of their students.

Students are identified in the achievement standards, specifically in relation to the expectations set for them by the AC at the various stages of schooling. The AC recognises the entitlement of each student to knowledge, understanding and skills that provide a foundation for successful and lifelong learning and participation in the Australian community.

Unlike Singapore’s suite of syllabuses supported by pedagogical and curriculum frameworks for nurturing 21st century learning, the AC is distinctive in its multi-dimensional design. As Figure 2.12 shows, the three dimensions of disciplinary knowledge, skills and understanding, general capabilities and cross-curriculum priorities appear to be accorded equal weight. The eight learning areas comprise an extensive collection of content descriptions, elaborations and achievement standards. The general capabilities and cross-curriculum priorities are taught through each of the learning areas, as teachers consider appropriate.

The three dimensions of the Australian Curriculum



Figure 2.12 The Australian Curriculum 'cube'

The three dimensions of the Australian Curriculum, ACARA (2017), from <https://www.australiancurriculum.edu.au/f-10-curriculum/structure/>

3 COMPARISON STUDY

3.1 Purpose

As part of the commitment to monitoring international developments in curriculum design, a key component of ACARA's program of research involves comparison of the AC with high-performing school systems and countries.

3.2 Method

This comparative study is based on the *Australian Curriculum Version 8.3 (ACARA, 2016)*, and the *Singapore Curriculum* in various versions to align with the rotational update program. The version of the SC used in this study is stated at the beginning of each curriculum comparison subject area.

ACARA's Curriculum Specialists conducted a detailed comparison of their learning areas during the first half of 2017. The AC is comprised of eight learning areas from Foundation to Year 10. The comparison points for all learning areas were determined at **Years 2, 6 and 10**. In some learning areas, it was not possible to make a completely straightforward comparison or judgement.

In addition to comparisons of the discrete learning areas, a comparative analysis was undertaken of the AC's General Capabilities and the SC's Core Competencies. A further comparison was made between the Aboriginal and Torres Strait Islander Histories and Cultures cross-curriculum priority in the AC and the Orang Laut /Malay Histories and Cultures of the SC.

The detailed analyses of these curriculum components are provided in their original **templates in the body of this document**.

3.3 Data collection and analysis

ACARA's Curriculum Specialists conducted a comparative analysis of the SC and the AC across Years 2, 6 and 10, using measurements of breadth, depth and rigour to make a determination on a three-point scale.

For this analysis, the following understandings of breadth, depth and rigour were applied:

- **Breadth** refers to the range or amount of content or topics (predominantly factual and procedural knowledge) covered in the curriculum. This is often referred to as 'coverage'.
- **Depth** refers to the detail or amount of knowledge that leads to the development of deep understandings of key concepts, principles and knowledge and the ability to apply these understandings to real-life contexts.
- **Rigour** is defined as the cognitive demand required for students to engage in higher-order learning.

Some variation in presentation is seen in the templates as differences in the provision and sequence of learning areas are addressed.

The findings were categorised and analysed by learning area and year (AC) /grade (SC).

3.4 Findings

Evaluation of the AC reveals a high degree of consistency across the learning/subject areas and year levels in terms of breadth. Some variability was found in the SC. Both curricula display greater variability in relation to depth and rigour.

While the structures of the AC (F-10) and the SC (Primary 1-6; Secondary 1-4) differ, the breadth, depth and rigour are comparable. As Table 3.7 shows, there is no curriculum for some student groupings. For example, the Science syllabus does not commence until Primary 3.

The following section details findings by subject and year/grade with respect to breadth, depth and rigour. It draws on evidence, gathered and analysed by the Curriculum Specialists, and located in Section 3.6 of this document.

Breadth

On balance, the analysis by the Curriculum Specialists shows that the AC and the SC vary in breadth of coverage. Across the AC, there is considerable breadth for all subjects at Years 2, 6, and 10, based on evidence that each learning area consists of quite dense and lengthy content descriptions supported by detailed elaborations, and each includes a range of subject-specific topics deemed age-appropriate.

The expectations of the AC: HASS, for example, are achieved through the combined agency of four subject areas, which are all regarded as *comprehensive*. The following excerpt is drawn from the comparative analysis:

The concepts and skills of Australian Curriculum: History (AC: H), Australian Curriculum: Geography (AC: G), Australian Curriculum: Civics and Citizenship (AC: CC), and Australian Curriculum: Economics and Business (AC: EB) in Year 10 allow learners to build upon experiences from each of these specific subject areas in Years 7, 8 and 9. Each subject has its own collection of overarching concepts, inquiry questions, inquiry skills, knowledge and understanding, with associated elaborations to support teaching and learning.

This is to be compared with the Singapore equivalent, which produces consistently *fundamental* breadth across the three points of comparison, maintaining some commonality with the AC. For example, Secondary 3 and Secondary 4 students undertake a mandatory two-year course in Social Studies and sit for a final examination in this subject. For these learners, Social Studies (SC: SS) is organised into four strands. Three issues are explored over the two years of the course, with each issue containing its own inquiry focus. Notably, the aim of the SC: SS is to explore “societal issues that have been shaping Singapore society and the world” (MOE, 2016, p.5). The following excerpt is drawn from the comparative analysis:

For students in Secondary 3 and Secondary 4, the expectations of the Singapore Curriculum are deemed to be **fundamental** in relation to breadth of coverage. The skills and values of Singapore Curriculum: Social Studies (SC: SS) are replicated in each of the three topics, while the knowledge outcomes, key concepts and key

understandings are drawn only from the geo-political context of 21st century Singapore.

For Singapore, few subject areas are accorded *comprehensive* with respect to breadth across both primary and secondary grades, with the exception of Mother Tongue languages, which is notably conceived as a strength of the SC. For students in Secondary Grade 4, the expectations of the SC: MT, Malay are considered *comprehensive* in relation to content coverage. In this learning area, “The elements of language learning are prescribed in detail, with emphasis given to all aspects of grammatical acquisition, systems of language, vocabulary, idioms and proverbs.” Notably, the end of Secondary, Grade 4 represents 10 years of learning a second language in addition to the language of instruction, English, and ‘ensures a developmental sequence’ of learning from Primary Grades 1-6.

Depth

The comparative study reveals variability in depth across the AC and the SC. As shown in Table 3.1, considerable depth is accorded to most subjects across the AC, particularly in the secondary years.

Across the AC, there is a high degree of consistency among subjects described as *challenging*, including English at Years 2, 6 and 10, and Mathematics at Years, 2, 6 and 10 (see Table 3.1). For Singapore, in the early years and primary grades, there is evidence of significant depth. This pattern seems to dissipate in the secondary years. However, Mother Tongue languages continue to exhibit higher order learning across Primary 1-Secondary 4.

Table 3.1 *Subjects by Depth: Challenging*

Year/Grade	Australian Curriculum	Singapore Curriculum
2/Primary 3	English Mathematics The Arts Technologies Health and Physical Education Languages (Italian)	English Language and Literature Mathematics Physical and Health Education Mother Tongue Languages
6/Primary 6	English Mathematics The Arts Technologies Health and Physical Education Languages (Italian)	English Language and Literature Mathematics Science Physical and Health Education Mother Tongue Languages
10/Secondary 4	English Mathematics Science The Arts Technologies Health and Physical Education Languages (Italian)	English Language and Literature Science Mother Tongue Languages

Variation is observed in the AC: Science, with a determination of *limited* depth at Year 6. Evidence for this determination is cited from the comparative analysis:

The expectations of the AC: Science (Year 6) are *limited* with respect to the depth of coverage of knowledge and skills encountered in the curriculum. The problem relates to the uncertainty about which scientific concepts are the intended focus of teaching and learning and the depth to which they are likely to be explored.

This is to be compared with Science (Primary 6). At Primary 6 level, the expectations of the SC: Science (Standard) are considered *challenging* with respect to depth of coverage; those of the Foundation stream are considered *moderate*.

The content descriptions both in Standard and Foundation streams detail information about the types of investigations students are expected to perform and the depth of conceptual understanding that is to be gained as a result. Most of these descriptions indicate a moderate degree of depth.

As Table 3.2 shows, few subjects are accorded *fundamental* across Years 6 and 10 for the AC. Unlike Singapore, there is a concentration of subjects in the early years of the AC, thereby underlining a disconcerting trend. On the other hand, by the end of Secondary 4, there is a concentration of subjects registering *fundamental* in depth. Notably, Social Studies registers as a concern across both curricula, and at all levels.

Table 3.2 *Subjects by Depth: Fundamental*

Year/Grade	Australian Curriculum	Singapore Curriculum
2/Primary 3	Science History and Social Studies Health and Physical Education Technologies	Social Studies
6/Primary 6	History and Social Studies	Social Studies
10/Secondary 4	Science History and Social Studies	Social Studies Physical Education and Health Design and Technology Food and Consumer Education

Rigour

As this comparative analysis confirms, debates about curricular provisions frequently relate to rigour. There is a tendency to perceive a flexible structure or curriculum as having no intellectual ‘grunt’, or inevitably being less rigorous. Consistent with other studies, this study contends that a flexible curriculum derives its strength from pedagogy and teacher expertise. As a rule of thumb, it may be difficult to ascribe a high degree of rigour if there is less discipline-specific content to consider.

This study locates variability of rigour across both curricula, particularly at the Secondary 4/Year 10 level. As Table 3.3 shows, the AC English and Mathematics and their equivalent are deemed to have a high degree of rigour across the primary and secondary years. At Year 10, however, the AC Science is assessed as *moderate*, in contrast to its Singapore equivalent, which is deemed as having a highly rigorous curriculum.

As Table 3.4 shows, across Years 6 and 10, lesser determinations are ascribed to Science, HASS and PE. This finding is consistent with determinations accorded to depth. However, what may be of interest in relation to the AC are those subjects that are deemed *fundamental* in the primary and middle years of schooling and, in particular, those subjects that aspire to give students the skills and technologies necessary to be successful at school as well as to prepare them for life and work beyond school.

Table 3.3 *Subjects by Rigour: Challenging*

Year/Grade	Australian Curriculum	Singapore Curriculum
2/Primary 3	English Maths The Arts Languages (Italian)	English Language Mathematics
6/Primary 6	English Maths Technologies	English Language Mathematics Mother Tongue Languages
10/Secondary 4	The Arts English Humanities and Social Sciences Technologies Health and Physical Education Languages (Italian)	English Language Mathematics Mother Tongue Languages Science

Table 3.4 *Subjects by Rigour: Moderate*

Year/Grade	Australian Curriculum	Singapore Curriculum
2/Primary 3	Science Humanities and Social Sciences Technologies Health and Physical Education	Social Studies Physical Education Health Education Food Sciences
6/Primary 3	Science Humanities and Social Sciences Health and Physical Education	Science Social Studies Physical Education Health Education Food Sciences
10/Secondary 4	Science	Social Studies Physical Education Design and Technology Food and Consumer Education

General Capabilities and Cross-Curriculum Perspectives

In addition to comparison of the discrete learning areas, a comparative analysis was also undertaken of the General Capabilities (GC) and the 21st Century Competencies (21CC). The AC promotes seven General Capabilities. Singapore identifies three areas that define 21st Century Competencies. While an exact match is not evident between the two curricula, as shown in Table 3.5, it is possible to determine how, and to what degree, the AC and the SC intend students to master the skills that they will require for participation in their post-school world. The two curricula are comparable in breadth, depth and rigour, although implementation differs markedly.

A noteworthy observation is the consistency of assessment applied to the 21st Century Competences and the General Capabilities. For example, at comparison points for Years 2 and 6, and the Singapore equivalent, the assessment for breadth and depth is *fundamental*, and *moderate* for rigour. At Year 10/Secondary 4, an assessment of high-level rigour is ascribed to the GC and the 21CC.

Table 3.5 *General Capabilities matched with the 21st Century Competencies*

General Capabilities	21 st Century Competencies
Personal and Social Capability	No equivalent
Critical and Creative Thinking Capability	Critical and Inventive Thinking
Literacy	Communication, Collaboration, and Information Skills
Numeracy	No equivalent
ICT Capability	As above
Intercultural Understanding	Civic Literacy, Global Awareness and Cross Cultural Studies
Ethical Understanding	No equivalent

Additionally, comparison of the AC and the SC includes consideration of indigenous learning and culture. The AC's cross-curriculum priority, Aboriginal and Torres Strait Islander Histories and Cultures, finds its counterpart in Singapore's Orang Laut/Malay History and Culture. On balance, Singapore's commitment to indigenous learning and cultural understanding is reflected in an overall promising assessment, in contrast to the AC, for which breadth and depth were judged *limited*, and rigour was deemed to be *moderate*.

	2			6			10		
	B	D	R	B	D	R	B	D	R
English	Green	Green	Green	Green	Green	Green	Green	Green	Green
Mathematics	Green	Green	Green	Green	Green	Green	Green	Green	Green
Science	Green	Yellow	Blue	Green	Orange	Blue	Green	Green	Blue
History and Social Studies	Green	Yellow	Blue	Green	Yellow	Blue	Green	Yellow	Green
Health and Physical Education	Green	Yellow	Blue	Green	Green	Blue	Green	Green	Green
Languages	No curriculum			Green	Green	Green	Green	Green	Green
Technologies	Green	Yellow	Blue	Green	Green	Green	Green	Green	Green
The Arts	Green	Green	Green	Green	Green	Green	Green	Green	Green
General Capabilities	Green	Yellow	Blue	Green	Yellow	Blue	Green	Green	Green
Aboriginal and Torres Strait Islander Histories and Cultures							Orange	Orange	Blue

Figure 3.1 Australian Curriculum by subject and student grouping

	3			6			10		
	B	D	R	B	D	R	B	D	R
English Language and Literature									
Mathematics									
Science (Standard P5-6) (Foundation P5-6)	No curriculum								
Social Studies									
Physical Education									
Health Education							No curriculum		
Food Sciences	No curriculum								
Mother Tongue Languages									
Design and Technology	No curriculum								
Food & Consumer Education	No curriculum								
Art and Music									
21 st Century Competencies									
Orang Laut/Malay History and Culture									

Figure 3.2 Singapore Curriculum by subject and student grouping

Breadth		Depth		Rigour	
	Comprehensive		Challenging		Challenging
	Fundamental		Fundamental		Moderate
	Limited		Limited		Limited

Legend: Criteria applied

3.5 Discussion

The balance between breadth and depth is central to curriculum design, with recent research suggesting that in a 21st century curriculum depth should be prioritised over breadth (Masters, 2015). For some time, there has been concern that providing students with some knowledge about a range of topics can lead to a *mile-wide, inch-deep* curriculum.

Contrary to perceptions that Singapore's education system is excessively focused on coverage and mastery of disciplinary content, this comparative study demonstrates a departure from knowledge transmission to reflection on what constitutes knowledge and skills for a 21st century curriculum, with the potential to match curriculum, pedagogy and assessment to standards that will lead to an increased focus on high order, complex skills.

The SC aspires to a broad range of knowledge and skills, underpinned by knowledge, attitudes and values:

- knowledge that is largely discipline-based and intended to promote deeper understanding and broader application through the use of the 21st Century Competencies
- attitudes and values at personal, local, societal and global levels, including human values that are linked to nationhood.

A distinctive feature of Singapore's education system is a departure from one-size-fits-all to one currently founded on *diversity* and *flexibility* (MOE, 2017). Within the contemporary Singaporean context, and informed by latest research and developments, the curriculum offers multiple pathways that enable young Singaporeans to access prime opportunities to excel and progress 'as far as they can' (MOE, 2017).

Ongoing debate about curriculum design indicates that the claim of 'less is more' may not yet be universally accepted as a worthy principle of curriculum design. This comparative study, for example, uncovers a content-heavy and prescriptive AC distinguished by disciplinary knowledge, skills and understandings. Across and within the subject areas, the content descriptions and elaborations are quite detailed, supported by the General Capabilities and cross-curriculum priorities that are developed throughout each subject area. The SC is underpinned by a set of core values that are at the heart of the 21st Century Competencies framework, specifically designed to promote and 'nurture' a holistic education experience for future-ready students.

This comparative study also reveals the growing significance of 21st century learning skills, which are generally embedded in the elaborations and/or reinforced in the General Capabilities (AC) and enshrined in Singapore's Framework for 21st Century Competencies. Whereas the AC achievement standards detail what students are expected to do as a consequence of subject-specific teaching, the SC promotes critical and inquiry-based learning and problem-based learning in fostering independent learning and collaboration in students. As a pedagogical document, the SC aspires to engage students in a process of deep learning driven by the 21st Century Competencies framework, enabled by a deliberate preference to reduce content coverage.

Methodologically, this comparative study employs a document-to-document analysis. According to this study, the AC attempts to strike a balance of depth and breadth, and a focus on rigour, which is more pronounced as students approach year 10, as represented in Figure 3.6. In its documentation, the AC aspires to "rigorous, in-depth study, preferring depth to breadth wherever a choice needs to be made, with consideration also being given to the overall teaching and learning time available" (ACARA, 2012, p. 10). In its language and format, it provides detailed descriptions of what students should learn and the quality of learning expected of them as they move through their schooling. Teachers use professional knowledge that is reflective of local and state contexts, taking into consideration the diverse nature of the student population (ACARA, 2016).

This study proffers the notion that breadth and depth are equally important for high-quality curriculum. The study reinforces the obvious conclusion that both, or any, curricula depend on teacher expertise to engage students in rigorous and deep learning that builds knowledge and skills to equip them for their future lives. Nevertheless, consistent with other high performing countries, it does invite

consideration of the curriculum as a pedagogical document and the place of pedagogy in designing future-focused learning for students.

While this comparison study suggests that, in general, the AC has greater breadth and depth, both the AC and the SC exhibit high-order rigorous learning, especially in relation to top-tier subjects such as English, Mathematics and Science in the secondary school. It is also noteworthy that Singapore, which has trimmed its curriculum by 30% in recent years, observes a delayed start in the study of Science and Design and Technology, for example, see Figure 3.7).

3.6 Curriculum comparison templates by learning area / subject / dimension

a) English

Comparative Curricula

Australian Curriculum: English	Version 8.3, 2016
Singapore Curriculum: English Language	Primary and Secondary, Express / Normal (Academic) Syllabus, 2010

Introduction

Australia is a linguistically and culturally diverse country, with participation in many aspects of Australian life dependent on effective communication in Standard Australian English. The AC: E aims to develop students' knowledge and skill in using Standard Australian English to equip them to participate effectively in education and the workplace. The English curriculum expects students to respond to and create increasingly complex and sophisticated texts across a growing range of contexts with accuracy, fluency and purpose. Simultaneously, they should be appreciating, enjoying and using the English language in all its variations. In Australian schools, all students study the English curriculum from Foundation to Year 10 with suitable adjustments made to accommodate the needs of all learners.

Singapore expects students to learn both English and their Mother Tongue, with English being the medium of instruction as well as a subject of study. The English language curriculum in Singapore's schools aims to develop the language competency of all pupils while ensuring the most able students reach the highest international standards.

Students are expected to attain foundational English skills, particularly in grammar, spelling and basic pronunciation, to enable them to use English in everyday situations and for functional purposes, such as giving directions, information or instructions and making requests.

Both curricula emphasise levels of proficiency in English that enable participation in society and the economy and the capacity to manage its use as the language of instruction. Both regard English as a foundational discipline of learning that underpins all other learning areas and supports the development of communication and critical thinking skills, which are seen as vital for success both in education and roles in adult life. Singapore and Australia acknowledge the cultural and language diversity of the student population whilst operating from the premise that proficiency in English is necessary for the advancement of their societies and to support an international outlook.

Both curricula encourage understanding of how texts work to achieve their purpose. Through content statements such as 'compare texts including media texts that represent ideas and events in different ways, explaining the effects of the different approaches' the AC: E indicates the way students will learn. The Singapore English Language Syllabus (2010) is more specific in describing how the curriculum will be implemented through statements such as:

Stimulate imagination, generate and/or gather ideas appropriate to the writing and representing tasks and topics, using learner strategies (e.g. illustrating, drawing and

free writing using visuals and realia as stimuli and asking questions about the topic and context and brainstorming and describing personal feelings, past experiences/events, points of view and ideas.

Year/Grade Level

Australian Curriculum: Year 2

Singapore Curriculum: Primary 2

Learning Area/Subject

Australian Curriculum: English (AC: E)

Singapore Curriculum: English Language (SC: EL)

Expectations: Knowledge and Skills

Learning in the AC: E at Year 2 level builds on concepts, skills and processes developed in earlier years. The strand and sub-strand organisers support the recursive nature of English learning while the content descriptions describe the knowledge, skills and understandings for Year 2. The content descriptions are supported by elaborations which provide suggested learning experiences for the content descriptions; these vary in their specificity and breadth of coverage. The Achievement Standard conceptualises the learning from the content descriptions and indicates the quality of learning, in the recursive aspects of the curriculum, that students should typically demonstrate by the end of Year 2. They are often dependent on the accompanying work samples to provide a line of sight to the content descriptions and a meaningful picture of the expected standard. For example, from the Year 2 Achievement Standard, ‘students make connections between texts by comparing content’ or ‘they listen for particular purposes’ are statements that could apply to any year level and are only meaningful when contextualised by the student work samples and content descriptions. Through study of the AC: E, Year 2 students read texts and monitor for literal and implied meaning and self-correct using a range of decoding and comprehension skills. They create spoken and written texts to express ideas or relate experiences using some topic-specific vocabulary, and developing understanding of grammar, spelling and vocabulary.

The Singapore syllabus identifies word identification skills essential for early literacy and formal word study from Primary 1. Word identification skills cover several components, including phonemic awareness, decoding through phonics and the recognition of words. These skills will help pupils make meaning, which is the ultimate aim of reading.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

For students in Year 2, the expectations of the AC: E are **comprehensive** in relation to breadth of coverage. The three strands of Language, Literature and Literacy form an integrated framework of disciplinary knowledge, understanding and skills. Multiple content descriptions enable students to experience comprehensive coverage of the receptive and productive modes of listening, speaking, reading, writing, creating and viewing; there are eighteen descriptions in Language, seven in Literature and eleven in Literacy. Comprehensive coverage of the modes is supported by 90 elaborations of the Content Descriptions. Year 2 teachers can access additional suggestions designed to help students understand, develop and demonstrate the relationship between language and texts, including knowledge of phonics, vocabulary, spelling and punctuation, expression of ideas and examination of literature.

SC – Breadth

Breadth: Comprehensive

The SC: EL Primary 2 covers students' language development in a **comprehensive** manner by organising language learning into six key areas: Listening and Viewing, Reading and Viewing, Speaking and Representing, Writing and Representing, Grammar and Vocabulary. Each of these organisers contains 17 broad outcomes, which are targets of student achievement and have applicability in all year levels in the primary school. Listed under the Outcomes are statements identifying the skills, strategies, attitudes and behaviours that provide detailed and explicit information about what students need to know to achieve expected learning outcomes. For example, at the completion of Primary 2, students will have an elementary understanding of typical structure and organisational features of some types of texts. Their understanding of text structure continues as a developmental theme throughout the curriculum, and teachers must be aware of the specific aspects to be introduced or extended in Primary 2 by considering the detail embedded in the statements and the reference to the number of years featured in each statement.

The Primary 2 syllabus explicitly and systematically introduces grammar and vocabulary in the context of listening, reading, viewing, speaking, writing and representing. Contexts, selected by schools and teachers, are used to model and scaffold the introduction of new concepts such as the introduction of a type of textual structure or learning to identify the main idea in a text. The curriculum is organised to ensure breadth of coverage both for receptive and productive modes of the syllabus, and to clearly represent the place of learning grammar and vocabulary within the contexts of the three modes of English language learning.

AC – Depth

Depth: Challenging

For students in Year 2, the expectations of the AC: E are **challenging** in relation to depth of coverage. In the AC: E, learning is structured so that students initially acquire knowledge about specific aspects of English such as grammar, spelling and syntax and then apply this

knowledge both to understand and create their own texts. The depth of learning occurs when knowledge is classified, transferred and applied in a range of contexts. Understanding context is a central concept in the English curriculum, which continues to expand and develop across year levels. In Year 2, students are introduced to the concept of 'context' and are required to apply their elementary understanding of context to recognise how meaning can be influenced in texts. This expectation extends their thinking beyond superficial levels of understanding and encourages them to develop a deeper appreciation of the construction of text.

The curriculum content develops the students' capacity to interpret and use language features, forms, conventions and text structures in imaginative, informative and persuasive texts. As students interpret a range of texts, they are consciously selecting and applying skills and knowledge to deepen their understanding not only of the ideas or message in a text but also of the author's craft. The content clearly states that students are expected to learn to draw inferences, compare and contrast ideas and explain conclusions and preferences they have drawn. Students are expected to engage deeply with all aspects of the text, particularly in the case of multimodal texts, to synthesise the various identified features. In Year 2, instructional texts selected by teachers are critical to deepening learning about text structures and language in use.

SC – Depth

Depth: Challenging

The Primary 2 syllabus requires students to engage in language learning that is **challenging** at the cognitive and affective levels. They are expected to use language in diverse and complex ways that could only be achieved with deep understanding and knowledge of how a language works as a system. Although the curriculum is prescriptive and dense, the content is selected and organised to support the students' gaining deep understanding of the fundamental principles of language use. Students may be explicitly taught particular discrete skills, for example, recognition of how texts are structured or retelling a sequence of events, but there is a strong emphasis, through the outcomes, on the application of these skills. The outcomes also expect students to apply critical and creative thinking to knowledge about texts, for example. Understanding and comprehension are core to the reading outcomes. The writing outcomes are underpinned by skills and strategies that support/scaffold students' capacity to master functional or mechanical aspects of writing. Aspects such as spelling and penmanship are stepped out in fine detail for teachers, and it is clear that these are to be taught with a view to providing strong foundations for students to be able to generate, develop and express ideas. Deep learning of vocabulary is implicit in the curriculum as students are expected to know and use a broad range of strategies to extend their vocabularies and to understand word origins and how words function in different contexts.

After three years of schooling, students are expected to be able to use sources such as a thesaurus to support their vocabulary development and to have gained a range of skills which they can use to build and enrich their vocabularies. Students are expected to undertake close and critical reading of texts to develop understandings about characters, identify points of view represented in texts and to make comparisons within and between

texts. These curriculum outcomes are indicative of the deep knowledge and understanding embedded in the early years of schooling.

AC – Rigour

Rigour: Challenging

The recursive structure and nature of the AC: E are the main reasons for evaluating its level of rigour as **challenging**. In Year 2, much of the curriculum is built around understanding how aspects of the language function in different contexts and purposes, rather than simply knowing and being able to identify language forms and features. The emphasis in the achievement standard for Year 2 is on the discriminating use of knowledge and skills to support meaning, as students are either using texts or developing texts. The expectations of accuracy in language use by the end of Year 2 are very rigorous. At this stage, students are also expected to be more independent in their language choices and to demonstrate that they can transfer learning to a range of contexts. Much of the content both in the Literature and Literacy strands requires students to use a range of skills in appropriate sequence to demonstrate their understanding. Students are often required to source and formulate ideas, articulate these ideas, modify them in response to the reaction of others and finally defend their choices. Invoking a range both of higher and lower order thinking skills involves rigorous learning.

SC – Rigour

Rigour: Challenging

The level of rigour in Singapore's English syllabus is considered **challenging** by virtue of the expectation that students manage and challenge their own learning. In the early years, the curriculum embeds foundational skills in the six designated areas of language learning. Most of the components, described as skills, strategies, attitudes and behaviours, are developmental and continue across all the years of learning. For example, 'distinguish cause and effect' begins in Primary 1 and continues to develop with increasing sophistication and complexity across all the years of primary school. Some of the constrained skills – mastered in the short term for specific application – and strategies are introduced, reinforced and completed by the time the students move into the middle primary years. These include most phonemic awareness and phonics skills, and some early handwriting skills and personalised responses to text where little more than unsubstantiated opinions is expected. At Primary 2 level, these represent less than 20% of the entire curriculum and are included as support skills to broader outcomes which are more extensive and rigorous. For example, learning simple spelling strategies could be regarded as quite superficial but the curriculum views these as important to support the more rigorous outcome of developing and expressing ideas coherently and cohesively in writing and representing for a variety of purposes, audiences, contexts and cultures.

Authentic rigorous learning is evident across all five areas of the syllabus, with a strong emphasis on application, rather than knowledge, of skills and strategies. Expectations such as 'identify language or content that is appropriate (inappropriate) to a particular audience or context' or 'pose critical questions based on what is read or viewed' (MOE, 2010) demonstrate that students need to be able to strategically activate skills and knowledge to

achieve curriculum outcomes. At this exit point, rigour is evident as students learn skills and strategies and then are expected to select and apply these in a range of contexts.

Comparative Analysis

Both curricula are explicit about the need to establish strong foundations in literacy during the first three years of schooling and for these to be learned through the English curriculum. They present similar expectations of what students should be able to do after two to three years of instruction in English, though the Singaporean syllabus is much more prescriptive and detailed in the way that the learning of micro-skills is organised. Both curricula have a similar scope of language knowledge and skills, although Singapore places more definitive demands on the learning of specific language components in a set order and there is much greater detail in the SC. For example, for Year 2 Reading and Viewing, the AC: E includes seven content statements found either in the Literature or Literacy strands. The SC: EL includes eight specific reading outcomes that closely parallel the AC but these are further detailed for teachers through the hundreds of statements which organise reading skills strategies, attitudes and behaviours under numerous subheadings. This extensive, fine-grained description of what students will know, understand and produce ensures breadth of coverage but leaves less scope for teachers to adapt and modify the curriculum to meet the needs of their students.

Oral communication (listening and speaking) and *learning to read and view* are highly valued in both curricula in the early years of schooling. Students are expected to refine and develop their oral communications skills so they can engage confidently with broader audiences on more complex topics.

The recursive nature of learning English is well represented in both curricula with an expectation that teachers will have a strong understanding of the developmental continuum of learning in such key areas as comprehending and composing texts. Although the layout and organisers of the two curricula are different, there are very strong parallels in the expectations of development of skills, knowledge and understanding. The content statements in some aspects of the AC: E lend themselves to more investigative and open-ended styles of learning, particularly in the approach to literature study. The SC: EL reveals more traditional expectations of the study of literature, such as identifying and analysing the literary techniques used by authors. The AC: E also expects students to understand character and events; in addition, it opens up literature study to include exploration of the concept of 'entertaining' a reader. Both curricula state that students should be challenged to investigate language and be risk takers in their use of language. At the Year 2 level, the design of the AC: E facilitates this approach more effectively.

Year/Grade Level

Australian Curriculum: Year 6

Singapore Curriculum: Primary 6

Learning Area/Subject

Australian Curriculum: English (AC: E)

Singapore Curriculum: English Language (SC: EL)

Expectations: Knowledge and Skills

Learning in the AC: E at Year 6 level builds on concepts, skills and processes developed in earlier years. The strand and sub-strand organisers support the recursive nature of English learning while the content descriptions detail the knowledge, skills and understandings at Year 6 level. The content descriptions are supported by elaborations which suggest learning experiences for the content descriptions, although these vary both in the specificity and breadth of coverage they offer. The Achievement Standard conceptualises the learning from the content descriptions and indicates the quality of learning, in the recursive aspects of the curriculum such as reading and comprehending texts that students should typically demonstrate by the end of Year 6. Throughout the AC: E the General Capabilities are tagged to content descriptions. Literacy is tagged to every content description in Year 6 with Critical and Creative thinking linked to a number of the content descriptions, reflecting the increasing demands on students to analyse a wide range of texts, and to evaluate the worth and validity of texts for particular purposes. Students are expected to work with a broad range of texts including various types of media texts and to develop their understanding of how texts are influenced by context, purpose and audience.

The SC for Primary school is organised around six key areas of language learning: Listening and Viewing, Reading and Viewing, Speaking and Representing, Writing and Representing, Grammar and Vocabulary. It strongly emphasises foundational language and communicational skills, particularly oral and written communication. Viewing and Representing are also included as organisers of the curriculum. Students are required to access, evaluate and create texts in a variety of digital and multimodal forms, forming an important aspect of the Grade 6 syllabus. Listed under each language area are the Learning Outcomes which are the expected attainment targets to be achieved as a result of teacher instruction for the various Areas of Language Learning. Since literacy is a strong component of the GCE tests at the end of primary schooling, literacy-based learning statements form the bulk of the Year 6 curriculum. Grammar and Vocabulary operate as independent strands of the curriculum, a point of contrast with the AC: E where grammar and vocabulary are embedded components of the Language strand. The Singapore MOE advises schools on texts, particularly textbooks, that can be used to implement the curriculum whereas the AC: E provides general guidance about choice of texts for Year 6 students; it does not recommend texts.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

For students in Year 6, the expectations of the AC: E are regarded as **comprehensive** in relation to breadth of coverage. By the end of Year 6, students understand and create a range of multimodal texts for clearly defined purposes and investigate and evaluate a range of texts which enable them to expand their knowledge and form opinions on a range of real-world and imaginary topics. There are twelve content descriptions in the Language strand, fewer than in Year 2, reflecting the expectation that this cohort will have control over a broad range of decoding, spelling and grammatical skills but will continue to develop their understanding of text structure, more complex sentence structures and language features. In the Literature strand, seven content descriptions describe how students' skills in appreciating, responding to, analysing and creating literary texts build throughout the primary years. These content statements follow a developmental path as students expand and deepen their understanding of the structure, features, devices and purposes of literary texts and use this expanded knowledge to create their own texts. Eleven Literacy content descriptions describe how students should apply the increasingly sophisticated knowledge from the Language strand to listen to, read, comprehend and create texts using both conventional and digital tools.

SC – Breadth

Breadth: Comprehensive

The SC: EL is extensive and **comprehensive** in its expectations of what students should be able to do in Primary 6. The SC is organised under the six broad areas of language development: Listening and Viewing, Reading and Viewing, Speaking and Representing, Writing and Representing, Grammar and Vocabulary. Listed under each of these areas are the outcomes which are the expected achievement targets. These areas and outcomes cover the full breadth of English language learning and particularly support language instruction that equips students with the literacy skills they need to access other learning areas. Teachers are encouraged to focus on the areas and outcomes that best support the learning needs of their students. The detail and specificity provided by the skill, strategy, attitude and behaviour statements, which elaborate on the outcomes, support teachers to not only ensure the full breadth of language learning is covered, but also to guide teachers to systematically and comprehensively teach all the aspects of an outcome.

By Primary 6, students have developed a range of critical listening and viewing skills. Listed under each language area are the Learning Outcomes which are the expected attainment targets to be achieved as a result of teacher instruction for the various Areas of Language Learning. As well, Primary 6 students have further developed their knowledge of, and skills in, writing and are able to compose a range of well-structured texts with ideas drawn from learning content as well as imaginative and descriptive texts. They are able to use a range of writing techniques such as varying sentence length and using figurative language to create effect or achieve precision in their texts. Through systematic instruction they will have control over a range of grammatical features such as abstract nouns and relative pronouns identifying features. Their breadth of knowledge and understanding of English grammar are considered expansive for their level of schooling.

AC – Depth

Depth: Challenging

The AC: E for Year 6 teaches students to communicate for a range of purposes in a range of modes and forms. It also emphasises the deep thinking that occurs when students engage with or create texts; therefore, it is regarded as **challenging**. The curriculum makes it clear that knowledge about language provides critical underpinning to meta-cognition, enabling students to make informed choices as they speak, listen, read and write. It develops students' knowledge and understanding of grammar, text structure and language features to support them to make appropriate choices when applying this knowledge to their own writing or when comprehending increasingly complex texts. Students are required to understand and use the forms and features of language with precision and relevance and to transfer knowledge to new and less familiar contexts, reflecting learning at a deeper level.

While students are expected to read a broad range of literature, the emphasis is on engaging deeply with texts by identifying themes and issues, recognising points of view and justifying interpretations by referring to their own knowledge, values and experiences. A key theme of the Year 6 curriculum is the use of language to persuade. Literature is studied not only for its aesthetic qualities and its language features but also for its role in both contemporary and historical contexts and in shaping and reflecting culture, extending students' understanding of the role of literature in culture. The Year 6 English curriculum supports deep learning as it requires students to use multiple strategies to understand, evaluate and create texts and to process layers of meaning to conceptualise ideas from texts.

SC – Depth

Depth: Challenging

The expectations of the SC: EL for Year 6 are evaluated as **challenging**. This determination is based on the rich knowledge of language students acquire, their strong and purposeful grounding in fundamental skills, the emphasis on contextualised communication and meaning making and the expectations of the deep and comprehensive knowledge of language that students are expected to understand and apply. Students undertake extensive study of a variety of print and non-print texts to provide authentic contexts for incorporating the development of information, media and visual literacy skills in all modes. Students are expected to develop spoken and written texts for creative, personal, academic and functional purposes by using language in a sustained manner to communicate complex ideas with increasing proficiency and inventiveness. The curriculum continues its strong emphasis on continuous development of inferential comprehension and, increasingly, students are expected to apply their wide knowledge of vocabulary and use learnt grammar, spelling and punctuation accurately and appropriately to write more sustained texts. Deep reading and listening are required to debate and justify ideas with reasons and to explore, negotiate, evaluate and build on the ideas of others and select the appropriate register for effective communication. The curriculum specifically states that Year 6 students will investigate abstract ideas, compare and contrast and use a variety of cues to understand the intended purpose of different texts. By Year 6, students will explore key messages and points of view conveyed in a range of poems and demonstrate their understanding of the interplay of texts

and images in texts. To engage in these rich investigations of text, students will need to have deep knowledge of language and a broad array of thinking skills to apply their knowledge.

AC – Rigour

Rigour: Challenging

The AC: E at Year 6 is considered **challenging** in its expectation that students will study and create texts that demonstrate high standards of accuracy in features such as spelling and grammar as well as deep understanding of key ideas and topics. Students are expected to produce texts that reflect understanding of increasingly complex concepts. Rigour in the curriculum is derived from the way these learning processes challenge students' thinking in interesting and provocative ways. This occurs because the curriculum demands a sophisticated understanding and application of fundamental ideas where knowledge is taught to support students to confront and evaluate ideas and problems and to seek deeper and richer understandings.

The AC expects students to speak, listen, read and write to manage the general demands of the curriculum across all learning areas, not only in subject English. In Year 6, students focus on comprehending, processing and analysing both the content of a wide range of texts and the authorial strategies and techniques used in different types of texts.

SC – Rigour

Rigour: Challenging

The SC: EL at Primary 6 is considered to be **challenging** in its level of rigour. It requires students to independently make careful and well-reasoned decisions about how they use and evaluate language. There are significant opportunities for intellectual rigour in the Primary 6 program of study where students adapt how they apply their knowledge and understanding of the grammar, structure and vocabulary to a range of texts and learning activities. Daggett's (2014) framework for rigorous learning includes the application of learned knowledge to the real world and unpredictable situations, and the ability to evaluate, synthesise and adapt ideas and knowledge at the highest level of operating with rigour. In Primary 6, this is demonstrated through such aspects of the curriculum since there is an expectation that students will compare and contrast concepts, not just information or opinions, and that they will self-monitor the language choices they make.

Primary 6 students are expected to use a well-developed battery of skills and knowledge about English to explain, describe or innovate upon texts read or viewed. The Primary 6 curriculum specifically states that, in implementing the outcomes, teachers facilitate and enable the application of knowledge and adopt a *discovery* approach to understanding language through guided questioning. Students are expected to analyse and explain how the themes are developed in a text and to demonstrate awareness that the writer's development of themes represents a particular view or comment on life.

Comparative Analysis

Both the SC: EL for Primary 6 and the AC: E for Year 6 assume that students will attain a strong grounding in knowledge and use of language. The expectations of language skills

and knowledge are similar, although the SC describes skills and knowledge in very fine-grained detail. For example, pronoun knowledge is broken down into eight different statements to be mastered by the end of Primary 6. In contrast, the AC: E focuses on correct pronoun usage as part of broader conceptual understanding of text cohesion. Both curricula emphasise correct usage in aspects of English such as spelling and grammar but the Singapore syllabus demands students have detailed knowledge and are able to use metalanguage, particularly in the naming and describing of grammatical features. The use of critical and creative thinking to analyse and evaluate texts and identify implied messages as well as to focus on concepts and ideas are central themes in both curricula. The AC describes these in more general content descriptions such as 'interpret and analyse information and ideas, comparing content from a variety of textual sources' and relies on the elaborations to provide further detail. On the other hand, the SC: EL includes more than a dozen statements about responding to texts where critical and creative thinking would be required, including 'explain whether predictions about content are acceptable' and 'draw conclusions from writers' view point', which provide greater specificity for teachers but limit students' opportunities to construct their own knowledge and understanding.

Both curricula expect students at this stage of schooling to have a rich and expanding vocabulary as well as a deepening appreciation of, and personal connection with, the English language, particularly through text. In both countries, literary texts are studied for their literary qualities and as a tool for developing empathy. The AC does not provide as much detail about the types of vocabulary students should learn, but it does specify use of evaluative language. Singapore has more than twenty vocabulary statements grouped as 'metalanguage,' 'learner strategies' and 'using appropriate vocabulary', giving vocabulary a more prominent role in the SC: EL than is evident in the AC. The explicit teaching of vocabulary includes the expectation that students recognise and talk about the effect of vocabulary usage in different types of texts.

Year/Grade Level

Australian Curriculum: Year 10

Singapore Curriculum: Secondary 4

Learning Area/Subject

Australian Curriculum: English (AC: E)

Singapore Curriculum: English Language (SC: EL)

Expectations: Knowledge and Skills

Secondary students in Singapore study English in the Express/ Normal (Academic) course leading up to final GCE exams at the end of Secondary 4. All students complete the four-year secondary course in preparation for the final exam but the curriculum also accommodates students studying a fifth year to enable them to take 'O' level exams. English includes Express and Normal curriculums and does not include a technical stream. This course is fully integrated with the primary school curriculum and continues the same aims and approaches. The curriculum is structured around the same six key areas of language learning but the secondary components of each area are divided from the primary.

The secondary curriculum maintains the development of the six key areas of language learning grouped under the three overarching organisers of ‘receptive’, ‘productive’ and ‘knowledge about language’. The secondary curriculum focuses on the application of knowledge and skills and the amplification of knowledge learned in the earlier years. In the final year, students expand their knowledge and understanding of five outcomes which begin in the primary years and continue through the secondary years. These outcomes include values and attitudes, and capture substantial ‘chunks’ of learning. These outcomes are complemented with nine new secondary specific outcomes in reading, speaking and listening and writing and representing. The cognitive and attitudinal requirements of the curriculum are quite rigorous; by the end of secondary school, students are expected to have extensive experience in constructing their own understanding of language through an appreciation of purposes and contexts.

For Year 10 students, the AC: E continues to develop knowledge and understanding in the three interrelated strands of Language, Literature and Literacy through listening, reading, viewing, speaking, writing and creating. As in Singapore, the learning builds on and strengthens concepts, skills and processes developed in earlier years.

The AC seeks to improve Year 10 students’ knowledge and understanding of language so that they can comprehend and create a comprehensive range of imaginative, informative and persuasive texts, in different forms and using various technologies. The influence of culture and perspective on language is a key theme in the Year 10 curriculum. The skills and knowledge developed in the curriculum are drawn together through the critical analysis of text, intended as a lens through which students consider their society and culture and those of others.

The AC: E Year 10 reveals a shift away from the development of core literacy skills towards study of literature for its intrinsic, aesthetic value as well as for its contribution to understanding human behaviour, cultures and global philosophical and real world dilemmas. This change in emphasis from the primary years reflects the expectation that students will already have mastery over most essential literacy skills such as spelling, punctuation and paragraphing. The view is that, by the middle secondary years, the curriculum should concentrate on the study of English as a discrete academic discipline and not simply an area of study that is responsible for equipping students with literacy skills.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

The extent of content covered in the Year 10 curriculum is considered **comprehensive**. By the end of Year 10, students understand and create a range of multimodal texts for clearly defined purposes and they investigate and evaluate a range of texts which enable them to

expand their knowledge and form opinions on a range of real world and imaginary topics. In Year 10, there are twelve content descriptions in the Language strand, with most of these building on knowledge and understandings from previous years. The number of content descriptions in the Literature strand has expanded to ten, reflecting the increased emphasis on analysing, appreciating and critiquing literature in the secondary curriculum. These content statements follow a developmental path throughout the primary years, as students broaden and deepen their understanding of the structure, features, devices and purposes of literary texts and use this expanded knowledge to create their own texts. There are eleven Literacy content descriptions which describe how students apply the increasingly sophisticated skills from the Language strand to listen to, read, comprehend and create texts, using both conventional and digital tools.

SC – Breadth

Breadth: Comprehensive

As the syllabus addresses essentially the same content from the early years through to the final year of compulsory education, the breadth of the Singaporean syllabus remains unchanged and may be considered **comprehensive**. By the final year of compulsory secondary education, students studying English language will have well developed a broad range of content knowledge in all aspects of English and a comprehensive range of skills and experiences in the application of knowledge both to school and broader world contexts. The secondary curriculum focuses on the application of knowledge and skills and the amplification of knowledge learned in the earlier years. In the final year, students will expand their knowledge and understanding of five outcomes which begin in the primary years and continue through the secondary years. These include outcomes which cover values and attitudes such as ‘develop a positive disposition by listening and viewing attentively for a sustained period, with empathy and respect, and by indicating response appropriately’ and outcomes which capture substantial ‘chunks’ of learning such as ‘produce a variety of texts for creative and personal expression and for academic and functional purposes, using an appropriate tone and register’. These outcomes are complemented with nine new secondary specific outcomes in reading, speaking and listening and writing and representing, although most of these follow a clear developmental pathway from the prior primary outcomes, for example ‘develop greater awareness of the features of spoken language, including awareness of the differences between spoken and written forms of the language’. In addition to extending critical listening and viewing skills learned across most year levels, at the completion of Secondary 4, students will be able to evaluate the logic and soundness of arguments and the validity of an argument based on the given evidence and the lines of reasoning presented. In text production, the additional new content, which is not part of a developmental sequence, is limited to a summary of the points of a discussion when facilitating group dialogues, and making hypothetical statements as part of the rhetoric in argumentation. Although well-defined within themselves, these expectations do add to the overall breadth of the curriculum.

AC – Depth

Depth: Challenging

The depth of the AC: E is deemed to be **challenging**, based on the rich core content that is considered foundational to a strong secondary curriculum. Year 10 students build on the knowledge and skills developed in previous years and deepen and expand conceptual understandings about language and literature. By Year 10, the curriculum requires students to analyse and critique a range of literary, media and digital texts that provide insights into society, culture and politics. This is achieved through deep knowledge of structures, forms and devices. Students are expected to create a range of texts including digital texts that use hybrid structures to affect and influence the reader. They investigate and create texts, explore rich and diverse themes both from the real and imagined worlds and demonstrate deep knowledge of specialised topics. By Year 10, students are expected to analyse complex English concepts such as *intertextuality* and *voice* involving the application of deep, specialised knowledge.

SC – Depth

Depth: Challenging

As students complete the SC: EL syllabus, they are constantly expanding and deepening their knowledge of the rules, conventions, systems and patterns of English. They should have gained extensive and deep understanding both of the cognitive and affective domains of language used for a range of purposes and across a range of contexts. The syllabus provides students with numerous opportunities to connect the knowledge and understanding gained at each year level with new learning at the following year level, through their own thought processes and through interactions with others and the environment. Such opportunities allow students to build on and refine a schema as a basis for understanding new ideas and information. The depth of learning is reflected in the key outcomes which focus on students' use of language for a broad range of purposes and audiences, as well as on an understanding of the influence of culture and context on language. In the expectation that they will 'use appropriate skills, strategies and language to convey and construct meaning during interactions', Secondary 4 learners are to develop deep and thorough knowledge of language on which to draw in order to write their own sophisticated texts. The depth presented in the curriculum documents is dependent upon teachers' capacity to cement knowledge and application. For these reasons, the curriculum may be considered **challenging**.

AC – Rigour

Rigour: Challenging

The level of rigour expected in the AC is evident in the expectation that students produce a broad range of sustained texts that develop well-reasoned arguments and respond to counter-arguments. Students create texts about challenging academic concepts or issues from multiple perspectives, including different cultural perspectives that tend to focus on themes and issues from the Asia-Pacific region. In the AC, at this level, there is an expectation that students' written texts will be expansive and complex, and that they will have an impact on the reader. Students demonstrate critical understanding of themes and

issues presented in texts that include high levels of abstraction. They develop an understanding of the ways in which contemporary media may represent complex social and political issues. Drawing on this evidence, the curriculum can be deemed demanding and **challenging**.

SC – Rigour

Rigour: Challenging

The rigour expected of students completing secondary school is seen in the ways in which they are expected to work with increasingly complex knowledge about the forms and functions of language. Close attention is paid to the acquisition of detailed knowledge in the SC: EL but there is also a clear emphasis on students' understanding and ability to apply knowledge and skills. The cognitive and even attitudinal requirements of the curriculum are rigorous as there is an expectation that, by the end of secondary school, students will have extensive experience in constructing their own understanding of language through the lens of understanding purposes and contexts. The Singaporean syllabus expects students to integrate new knowledge into conceptual understanding rather than simply acquiring linear knowledge of particular aspects of language. Although students continue to learn more about the functions and features of language in their final year, the curriculum highlights working with knowledge and retrieving, selecting and adapting knowledge to meet the demands of learning expectations such as 'identifying the purpose, audience, context and culture, and setting goals for speaking and/or representing.' A preference for concepts over facts is further supported by the increasing demand for students to understand and use language in real-world contexts. Statements such as 'record the particulars of an incident and/or explain how and why it happened' demonstrate how students are expected to know about, apply, explain and justify their use of language. For all of the above reasons, the curriculum at this level can be considered **challenging**.

Comparative Analysis

The AC: E and the SC: EL differ in their design but the aims and intent of the two curricula are similar, particularly their expectations of what students will know, understand and be able to do with the English language by the time they complete the compulsory years of schooling. The need for teachers to organise language learning into receptive and productive modes is evident in the AC: E Achievement Standards, whereas the Singaporean syllabus gives greater guidance, organising the key aspects of English into the two modes. Both curricula emphasise an integrated, rather than compartmentalised or hierarchical, approach to teaching across the domains or strands of English. Singapore authorities organise learning into broad outcomes which are unpacked into skills and strategies, and this supports teachers to design lessons. However, the inclusion of most strategies across multiple year levels, often beginning in early primary and continuing through to late secondary years, relies on teachers having a deep understanding of the developmental pathway for each skill and a knowledge of each student's progression along that pathway. In choosing not to align outcomes and skills with year levels, Singapore facilitates language teaching and learning in a developmental style, but this approach also risks repetition or learning pitched at the incorrect level for students.

Both curricula place extensive demands on students to produce a range of written and multimodal texts, and both maintain a focus on spoken language in students' cognitive, social and academic development. Spoken language continues to underpin the development of reading and writing; students are expected to use oral language competently and confidently for a variety of purposes. Each curriculum places significant emphasis on using persuasive and evaluative language. For example, the AC: E expects that students can 'explain different viewpoints, attitudes and perspectives through the development of cohesive and logical arguments'. Similarly, the SC: EL expects that students will be 'evaluating the validity of an argument based on the given evidence and the lines of reasoning presented'.

Both curricula require students to read a wide range of challenging texts. Neither curriculum is prescriptive about text selection, but both promote both book and multimodal text selections from authentic print and non-print sources which include many models of good English and reflect national, cultural values. Students are expected to read whole books, read and interpret a range of digital and multimodal texts to read in depth for pleasure and to obtain information. Both curricula expect that students will continue to develop competency in writing for a variety of purposes and audiences across a range of contexts, applying their increasing knowledge of vocabulary and grammar. Opportunities for teachers to enhance pupils' vocabulary arise naturally from their reading and writing.

Both curricula are built on the expectation that, by the conclusion of compulsory schooling, students are independent writers with control over essential grammar, spelling and punctuation. Both curricula are centred on writing techniques that allow students to craft and refine their writing for very particular purposes. By Year 10, for example, Australian students should be able to construct sustained texts that address challenging and complex issues. Their writing should reflect an emerging personal style, use of appropriate structure and the deliberate choice of language and literary devices to suit the purpose.

b) Mathematics

Comparative Curricula

Australian Curriculum: Mathematics	Version 8.3, 2016
Singapore Curriculum: Mathematics	Primary Mathematics P1-5 Syllabus, 2012
Singapore Curriculum: Mathematics	Primary 6 Mathematics Syllabus, 2007
Singapore Curriculum: Mathematics	Mathematics O-Level S3-4 and Additional Mathematics S3-4, 2012

Year/Grade Level

Australian Curriculum: Year 2
Singapore Curriculum: Primary 3

Learning Area/Subject

Australian Curriculum: Mathematics (AC: M)
Singapore Curriculum: Mathematics (SC: M)

Expectations: Knowledge and Skills

Primary education in Singapore comprises a four-year common Mathematics syllabus for all students and either a P 5-6 Standards Mathematics syllabus that builds on the learning that has occurred in P 1-4 or a P 5-6 Foundation Mathematics syllabus, which revisits some of the important concepts and skills learnt in the previous years. Although there is no assumed knowledge for students who begin the primary Mathematics syllabus, “basic pre-numeracy skills such as matching, sorting and comparing are necessary in providing a good grounding for students to begin learning at Primary 1” (MOE, 2012, p.10). These pre-numeracy skills are taught and developed in the AC: M at Foundation level, as found in ‘Sort and classify familiar objects and explain the basis for these classifications. Copy, continue and create patterns with objects and drawings’ (ACMNA028) and ‘Compare, order and make correspondences between collections, initially to 20, and explain reasoning’ (ACMNA005). By contrast, Singaporean students are assumed to have mastered these foundation skills prior to formal schooling.

The overarching goal of the AC: M is to provide relevant 21st century learning by equipping students with the capacity to think, solve problems and respond to challenges. The inclusion of the proficiencies of *understanding*, *fluency*, *problem-solving* and *reasoning* in the curriculum enable students to respond to familiar and unfamiliar situations by employing mathematical strategies to make informed decisions and solve problems efficiently. The proficiencies define the range and nature of those expected actions in relation to the content descriptions. They are an integral part of Mathematics content across the three content strands: Number and Algebra, Measurement and Geometry, and Statistics and Probability. They reinforce the significance of working mathematically within the content and describe how the content is explored or developed, provide the language to build in the developmental aspects of the learning of Mathematics and are intended to underpin pedagogy in Year 2.

At this year level:

- **understanding** includes connecting number calculations with counting sequences, partitioning and combining numbers flexibly and identifying and describing the relationship between addition and subtraction and between multiplication and division
- **fluency** includes readily counting numbers in sequences, using informal units iteratively to compare measurements, using the language of chance to describe outcomes of familiar chance events and describing and comparing time durations
- **problem-solving** includes formulating problems from authentic situations, making models and using number sentences that represent problem situations, and matching transformations with their original shape
- **reasoning** includes using known facts to derive strategies for unfamiliar calculations, comparing and contrasting related models of operations and creating and interpreting simple representations of data.

The AC: M specifies the content descriptions to be taught. The AC: M incorporates content across the three strands of Number and Algebra, Measurement and Geometry and Statistics and Probability. Elaborations are aligned to each content description but are not mandatory for teachers to teach. The elaborations support teachers to clarify the content and offer suggested teaching strategies. Teachers are encouraged to add their own elaborations. By the end of Year 2, students count to and from 1000 and recognise increasing and decreasing number sequences. They perform simple addition and subtraction calculations using a range of strategies and represent multiplication and division by grouping into sets. Year 2 students learn to divide collections and shapes into halves, quarters and eighths and associate collections of Australian coins with their value. Students learn to identify the missing element in a number sequence and order shapes and objects using informal units. They are required to tell time to the quarter-hour and use a calendar to identify the date and the months included in seasons. They draw two-dimensional shapes, recognise the features of three-dimensional objects, explain the effects of one-step transformations and interpret simple maps of familiar locations. Year 2 students describe outcomes for everyday events and collect, organise and represent data to make simple inferences and make sense of collected information.

Key ideas in the AC: M are embedded in the four mathematical proficiency strands - *understanding, fluency, problem-solving* and *reasoning*. These constitute the areas to be developed from Foundation to Year 10. The proficiencies underpin the learning of Mathematics, examples of which are described at the beginning of the year in a year level statement. The AC: M mandates the content descriptions to be taught. Teachers may use elaborations to exemplify the curriculum content; they are not a mandatory feature.

The AC: M incorporates the General Capabilities (GC) that constitute one dimension of the AC, specifying the contribution Mathematics makes to the development of 21st century knowledge, skills, behaviours and dispositions. The GCs comprise Literacy, Numeracy, Information and Communication Technology (ICT), Critical and Creative Thinking, Intercultural Understanding and Personal and Social Capacity; each are identified by appropriate icons in the content descriptions and elaborations. The three Cross-Curriculum Priorities in the AC: Aboriginal and Torres Strait Islander Histories and Cultures, Asia and Australia's Engagement with Asia and Sustainability are also referenced in some of the elaborations for AC: M Year 2.

For example, the content description titled *Group, partition and rearrange collections up to 1000 in hundreds, tens and ones to facilitate more efficient counting* in the Number and Algebra content area illustrates this with the elaboration of ‘demonstrating and using models such as linking blocks, sticks in bundles, place-value blocks and Aboriginal bead strings and explaining reasoning’ (ACMNA028). This also involves Literacy, Numeracy, Critical and Creative Thinking and Intercultural Understanding.

The overarching goal of the SC: M is to ensure that students achieve a level of mastery to serve their varied future needs and capabilities. The broader aims and proficiencies include the acquisition and application of mathematical concepts and skills, the development of the ability to solve problems by the application of metacognitive skills and the development of positive attitudes to Mathematics. For Primary 3 learners, the SC: M details the content to be taught and the learning experiences to be employed, both to meet the content and broader curriculum goals.

The SC: M Primary 3 incorporates content across the broad strands of Number and Algebra, Measurement and Geometry, and Statistics. By the end of Primary 3, students can work with numbers to 10 000, including increasing and decreasing number sequences. They add and subtract four-digit numbers and know their multiplication and division facts for 6, 7, 8 and 9 (having learnt 2, 5 and 10 in Primary 2). They are introduced to the concepts of quotient and remainder via sharing and apply their skills to problem-solving. They can compare and add and subtract related fractions with denominators up to 12. Students add and subtract money in decimal notation and apply their skills to problem-solving. Students can measure length, area, mass and volume using the appropriate metric units (mm, cm, km; g, kg; ml, l). They can carry out simple conversions of units of length, area and volume. They can measure time in hours and minutes and use the terms *past* and *to* the hour and calculate elapsed time between two times on a clock. Students can find the perimeter and area of simple and compound geometric figures involving squares and rectangles. They can identify and distinguish right, acute and obtuse angles and can construct parallel and perpendicular lines using set-squares and protractors. Students can read and interpret data from bar graphs and construct bar graphs to present data they have gathered to solve problems.

The detailed learning experiences in the SC: M Primary 3 syllabus contribute directly to two of the three 21st Century Competencies mandated by Singapore education authorities. These competencies are Critical and Inventive Thinking, and Information and Communication Skills. For example, in the Statistics strand, students work in pairs and larger groups, gathering data, using spreadsheets, and communicate by writing reports.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

The AC: M covers a diverse number of topics indicative of the nature of this learning area. The concepts and skills of AC: M allow learners to build on the previous learning in Foundation and Year 1 as they continue to develop their number and spatial skills and their ability to interpret data. In terms of breadth of coverage, the expectations of the AC are considered to be **comprehensive**. There are 25 content descriptions across the three strands of Number and Algebra, Measurement and Geometry and Statistics and Probability. Under these strands, the content is further organised into the following threads:

Number and Algebra

- Number and place value (7 content descriptions)
- Fractions and decimals (1 content description)
- Money and financial Mathematics (1 content description)
- Patterns and algebra (2 content descriptions)

Measurement and Geometry

- Using units of measurement (5 content descriptions)
- Shape (2 content descriptions)
- Location and transformation (3 content descriptions)

Statistics and Probability

- Chance (1 content description)
- Data representation (3 content descriptions).

As denoted in Table 3.6, there are also 42 elaborations which, although not mandatory, offer teachers some insight into how the content can be presented to students. These elaborations provide examples and teaching points to develop a common understanding of the expectation of what is to be taught. There are one or more elaborations aligned to each content description.

Table 3.6 *Frequency of dimensions in AC, Year 2*

Year 2	Mathematics
Content descriptions	25
Elaborations	42
General capabilities	5
Cross-curriculum priorities	3

SC – Breadth

Breadth: Comprehensive

The SC: M content is organised along three similar strands to those of the AC: Number and Algebra, Measurement and Geometry, and Statistics. The SC: M Primary 3 is considered to be **comprehensive** in terms of breadth of coverage. As per Table 3.7, there are 42 content

descriptions across the three strands, within which content is further organised into sub-strands (with further subheadings) as follows:

Number and Algebra

- Whole numbers (3 subheadings with 14 content descriptions)
- Fractions and decimals (2 subheadings with 5 content descriptions)
- Money (1 subheading with 2 content descriptions)

Measurement and Geometry

- Measurement (3 subheadings with 14 content descriptions)
- Geometry (2 subheadings with 4 content descriptions)

Statistics

- Data representation and interpretation (1 subheading with 3 content descriptions)

Table 3.7 *Frequency of dimensions in SC, Primary 3*

Year 3	Mathematics
Content descriptions	42
Learning experiences	65
21 st Century Competencies	2

AC – Depth

Depth: Challenging

The expectations of the AC: M in terms of depth are **challenging**. Within each of the strands of Number and Algebra, Measurement and Geometry, and Statistics and Probability, the sub-strands determine further detail of the requirements for learning. The year-level descriptions for Year 2 reveal significant cognitive demand by referring to the Mathematics proficiencies contained in the content descriptions. *Understanding* includes building robust knowledge of adaptable and transferrable concepts, and in Year 2 this is evident in students making connections, partitioning and combining numbers and identifying and describing the relationships between the four number operations. *Fluency* includes choosing appropriate procedures, which can be carried out flexibly, and at this year level, implies counting numbers in sequences, using informal units iteratively to compare measurements, describing outcomes of familiar chance events making comparisons. These statements define the range and nature of the expected actions in relation to the content descriptions. The depth of curriculum at Year 2 is exemplified by the verbs used to describe the knowledge and skills contained within the content descriptions. These verbs range from *recognise*, *describe* and *identify* to higher order verbs of *create*, *investigate* and *compare*.

SC – Depth

Depth: Challenging

The SC: M Primary 3 is considered to be **challenging** in terms of depth. Many suggested learning experiences accompanying the content descriptors provide students and teachers

with opportunities to perform both at lower and higher cognitive levels across the strands of Number and Algebra, Measurement and Geometry and Statistics. Whilst many require students to *recognise, describe, represent* or *estimate*, others ask them to *compare, explain, create* and *solve*, involving higher-order reasoning and problem-solving, the stated focus of the teaching and learning of the SC.

Singapore's Primary Mathematics Curriculum is underpinned by three principles of Mathematics teaching. Its first principle is explained (MOE, 2012, p. 19):

The learning of mathematics should focus on understanding, not just recall of facts or reproduction of procedures. Understanding is necessary for deep learning and mastery. Only with understanding can students reason mathematically and apply Mathematics to solve a range of problems. After all, problem-solving is the focus of the Mathematics Curriculum.

This focus does not reduce the considerable emphasis in the SC: M on fluency and mastery as prerequisites for successful performance and progress with Mathematics and its applications.

AC – Rigour

Rigour: Challenging

The level of rigour in the AC: M is regarded as **challenging** as it places a considerable demand on students to engage in reasoning and problem-solving. Problem-solving requires students to make choices, investigate problem situations and communicate their thoughts. Reasoning develops the capacity for logical thought and actions such as explaining answers and the processes of solving problems. This is reflected in the year-level statement which identifies how the problem-solving and reasoning proficiencies are embedded in the curriculum. For Year 2 students, problem-solving includes 'formulating problems from authentic situations,' representing problems by modelling and matching, and reasoning includes 'using known facts to derive strategies for unfamiliar calculations, comparing and contrasting related models of operations and creating and interpreting simple representations of data' (ACARA, 2016a, p. 16).

These problem-solving and reasoning skills are contained in the Achievement Standard at Year 2, which describes what a typical student is expected to achieve by the end of Year 2. The Achievement Standard requires students to *interpret, explain* and *make inferences*, which requires higher-order thinking skills and rigorous learning.

SC – Rigour

Rigour: Challenging

The clearly delineated Content and Learning Experiences in the SC: M lead towards facility in Problem-Solving. The level of rigour at Primary 3 is considered to be **challenging**, with mathematical processes of Reasoning, Communication and Connections, Applications and Thinking Skills and Heuristics embedded in the student and teacher actions specified in the Learning Experiences at this grade level. These include learning to 'lay out their work logically', 'reason inductively by observing patterns, similarities and differences', 'make connections among mathematical ideas' and to 'formulate methods and strategies to solve problems' (MOE, 2012, p.31).

Problem-solving includes both the solution and the collaborative creation of age-appropriate real-world problems such as simple shopping as well as the solution of non-routine problems which may involve multiplication and division in unfamiliar situations.

Comparative Analysis

Comparison of AC: M Year 2 and SC: M Primary 3 reveals commonalities in their structures. The three content strands for each curriculum are almost identical, as revealed in Table 3.8.

Table 3.8 *Mathematics content strands by country*

AC: Mathematics Content Strands	SC: Mathematics Content Strands
Number and Algebra	Number and Algebra
Measurement and Geometry	Measurement and Geometry
Statistics and Probability	Statistics

Furthermore, the AC: M mathematical proficiencies strands of understanding, fluency, problem-solving and reasoning parallel the SC: M mathematical processes of reasoning, communication and connections, applications and thinking skills and heuristics. Both curricula emphasise problem-solving as the central motivation and provide students with opportunities to create and solve routine and non-routine problems.

The content description and elaborations/learning experiences do differ in detail and breadth.

The AC: M's elaborations in Year 2 involve a greater variety of concrete materials and concrete methodologies in developing understanding of key concepts such as place value (using sticks in bundles, bead strings, place-value blocks, the abacus) and processes such as multiplication (introduced as repeated addition with groups and arrays) and division (grouping into equal sets). Year 2 students operate at the concrete and pictorial levels in the AC; for example, they use available materials to represent and explain array problems.

The SC: M also makes use of a more limited variety of concrete materials (base-ten sets, play money and pictorial representations) to illustrate and explain place value and to develop the standard algorithms for addition, subtraction, multiplication and division. It must be pointed out that SC students are further along their mathematical journey, having begun Numeracy training in Kindergarten 1 and 2 and continued in Primary 1 and 2. The progression from the concrete to pictorial then abstract on the learning continuum is evident. The content descriptions and learning experiences move Primary 3 students towards mastery of algorithms with addition/subtraction up to 4 digits using the combinations mastered in Primary 2 and multiplication and division up to 3 digits by 1 digit using the tables of 6, 7, 8 and 9 adding to 2, 3, 4, 5 and 10 mastered in Primary 2. Similarly, the concrete introduction to fractions in Primary 2 now moves on to the mastery of equivalent fractions to order fractions with denominators up to 12 and to begin adding and subtracting related fractions. The SC continues to develop the use of formal units for the measurement of length, capacity and mass begun in Primary 2, with further units (e.g. cm, m, km for length)

and simple conversions between them whilst the AC utilises uniform informal units at Year 2 level. Standard metrics appear in later years in the AC: M.

The SC: M sub-strand of time requires students to tell the time to the minute and to apply the abbreviations *h*, *min*, *a.m.* and *p.m.*, using examples such as television programs and bus schedules to find starting and finishing times and to determine duration. The content description that addresses time in the AC: M is more limited with time to the nearest quarter-hour. However, the AC includes naming and ordering months and seasons and use of calendars; none of these are covered in the SC: M. The AC also includes a sub-strand known as Location, which covers transformations such as the interpretation of simple maps of familiar locations, and the effect of one-step slides and flips on objects. This content is not found in the SC, nor is there any material similar to the AC's introductory unit on Probability, which introduces students to the language of chance.

Both the AC: M and the SC: M provide opportunity for challenging depth and rigour for Year 2/Primary 3 students at this stage of their respective mathematical education. It is likely that Singaporean Primary 3 students will have acquired more fluency and a more advanced suite of facts, broader content exposure and more sophisticated processes by the end of their third year at primary school than their Australian counterparts.

Additional Observations

It must be noted that SC students typically turn nine years of age in Primary 3, whereas AC students typically have their eighth birthday in Year 2.

The MOE in Singapore is responsible for the 'Nurturing Early Learners' Curriculum and Guides, a comprehensive range of kindergarten curriculum resources that supports early childhood educators. The Guides comprise seven volumes addressed to educators including one, Volume 6, devoted to Numeracy. This may explain the more advanced nature of SC: Mathematics Primary 1, 2 and 3.

Year/Grade Level

Australian Curriculum: Year 6

Singapore Curriculum: Primary 6

Learning Area/Subject

Australian Curriculum: Mathematics (AC: M)

Singapore Curriculum: Mathematics (SC: M)

Expectations: Knowledge and Skills

The AC: M aims to be relevant and applicable to the 21st century by equipping students with the capacity to think, solve problems and respond to challenges. By employing the proficiencies of understanding, fluency, problem-solving and reasoning, students are more able to respond to familiar and unfamiliar situations using mathematical strategies. The inclusion of the proficiencies into the AC: M is a key change in approach in this learning area; that is, the proficiencies included in the AC: M define the range and nature of those expected actions in relation to the content descriptions. The proficiencies are an integral part of Mathematics content across the three content strands: Number and Algebra, Measurement and Geometry, and Statistics and Probability, reinforcing the significance of working mathematically within the content and describing how the content is explored or

developed. They provide the language to build in the developmental aspects of the learning of Mathematics and are intended to underpin the teaching of mathematical content in Year 6.

At this year level:

- **understanding** includes connecting number calculations with counting sequences, partitioning and combining numbers flexibly and identifying and describing the relationship between addition and subtraction and between multiplication and division
- **fluency** includes readily counting numbers in sequences, using informal units iteratively to compare measurements, using the language of chance to describe outcomes of familiar chance events and describing and comparing time durations
- **problem-solving** includes formulating problems from authentic situations, making models and using number sentences that represent problem situations, and matching transformations with their original shape
- **reasoning** includes using known facts to derive strategies for unfamiliar calculations, comparing and contrasting related models of operations and creating and interpreting simple representations of data.

The AC: M incorporates content across the three strands of Number and Algebra, Measurement and Geometry and Statistics and Probability. By the end of Year 6, students recognise the properties of prime, composite, square and triangular numbers. They describe the use of integers in everyday contexts and solve problems involving all four operations with whole numbers. They are introduced to negative numbers through practical applications in areas such as temperature. Students connect fractions, decimals and percentages as different representations of the same number and solve problems involving the addition and subtraction of related fractions. Students make connections between the powers of 10 and the multiplication and division of decimals. They add, subtract and multiply decimals and divide decimals where the result is rational and locate fractions and integers on a number line. They calculate a simple fraction of a quantity. Students calculate common percentage discounts on sale items. They write correct number sentences using brackets and order of operations. They describe rules used in sequences involving whole numbers, fractions and decimals. Students locate an ordered pair in any one of the four quadrants on the Cartesian plane. Students connect decimal representations to the metric system and choose appropriate units of measurement to perform a calculation. They construct simple prisms and pyramids and make connections between capacity and volume. They solve problems involving length and area. They interpret timetables. Students describe combinations of transformations. They solve problems using the properties of angles. Students compare observed and expected frequencies and interpret and compare a variety of data displays, including those displays for two categorical variables. They interpret secondary data displayed in the media and describe probabilities using simple fractions, decimals and percentages.

In Singapore, Primary 5 and 6 students are enrolled either in the Foundation Mathematics or Standard Mathematics course of study. The current SC: Primary 6 Mathematics and Primary 6 Foundation Mathematics syllabuses (MOE, 2007) were implemented in 2007. They will be replaced by the new SC: Mathematics Primary 6 and Primary 6 (Foundation) courses in 2018. It is probable that the proposed 2018 Curriculum will continue the groupings of Primary 5 with Number and Algebra, Measurement and Geometry and Statistics and Probability and an extension to incorporate the introductory algebra from the 2007

Curriculum. The new Foundation Mathematics course will continue from Primary 5 to Primary 6, revisiting topics in the standard courses to assist students to prepare for Mathematics at secondary school.

Primary 6 Mathematics is arranged in eight Topics, with Measurement containing three sub-topics and Geometry comprising two sub-topics. Primary 6 Foundation Mathematics 2007 is arranged in six Topics with Fractions containing two sub-topics, Measurement containing three sub-topics and Geometry comprising two sub-topics.

The Mathematics Curriculum 2007 for Singapore focuses more on content and less on describing appropriate learning experiences than does the proposed new curricula. However, the preamble to the 2007 curriculum includes a description of three mathematical processes involved in the process of acquiring and applying mathematical knowledge. These are listed as: Reasoning, communication and connections, Thinking skills and heuristics, and Application and modelling.

Primary 6 Mathematics 2007 assumes that students have previously acquired a mastery of manipulating and using decimals. Thus, it has a stronger emphasis on understanding and using decimals. There is a focus on applying the knowledge and understanding of fractions and decimals to authentic problems involving percentages, ratios and speed. Measurement extends to problems related to area and circumference of circles, area and perimeter of composite figures, as well as volume and capacity of cubes and cuboids. Geometry involves finding unknown angles in geometric plane figures involving rectangle, parallelogram, trapezium and triangle. Students can draw and or recognise the nets of cubes, cuboids, cylinders, prisms and pyramids. Data analysis emphasises pie charts. Students develop an understanding of simple algebraic expressions involving a single variable including evaluation by substitution, simplification and writing word problems in algebraic terms.

The renewed Primary 6 Foundation Mathematics revises and extends decimals and fractions and introduces percentages with applications of all three to problem-solving. Measurement extends to problems related to area and perimeter of squares, rectangles and triangles and related composite figures. It also extends to calculation of volume and capacity of cubes and cuboids. Geometry includes the construction and classification of triangles, and angles in geometric figures. Data analysis emphasises pie charts. Algebra is not included in the Foundation course.

For the purposes of this comparative study, the SC: M Primary 6 is only considered as it is the course taken by most students and corresponds most closely with the single course provided by the AC: Mathematics at Year 6 level.

The curricula gain more similarity by Year 6/Primary 6, with the expectation that students are able to manipulate whole numbers, decimals, fractions and percentages. The SC has a more formal introduction to algebra and puts more emphasis on ratios and calculations related to speed. The AC has a broader Measurement section, revisiting translations and introducing the Cartesian plane.

The Statistics and Probability strand in the AC is considerably broader and deeper than in the SC, with emphasis on a wide variety of data representation and the corresponding

interpretations. Elaborations in the AC are broader in scope than in the SC and provide more direction to the broader aims of the curriculum.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

With regard to topic coverage, the expectations of the AC: M are deemed to be **comprehensive**. The AC: M incorporate 25 content descriptions across the three strands of Number and Algebra, Measurement and Geometry and Statistics and Probability. Under those strands, the content is further organised into threads:

Number and Algebra

- Number and place value (3 content descriptions)
- Fractions and decimals (7 content description),
- Money and financial mathematics (1 content description)
- Patterns and algebra (2 content descriptions)

Measurement and Geometry

- Using units of measurement (5 content descriptions)
- Shape (1 content description)
- Location and transformation (2 content descriptions)
- Geometric reasoning (1 content description)

Statistics and Probability

- Chance (3 content descriptions)
- Data representation (2 content descriptions).

Elaborations, although not mandatory in the AC: M, provide additional information for teachers to assist them with teaching strategies, links to the General Capabilities and cross-curriculum priorities or further clarification of the content description. One or more elaborations are linked to each content description in Year 6.

The content contained in the AC: M Year 6 curriculum builds on the content from Foundation through to Year 5 under the three content strands. The sequential nature of the AC: M implies that concepts are developed each year and become more sophisticated as students move through the years of schooling (see Table 3.9).

Table 3.9 *Frequency of curriculum dimensions in AC: M, Year 6*

Year 6	Mathematics
Content descriptions	27
Elaborations	46
General capabilities	5
Cross-curriculum priorities	3

SC – Breadth

Breadth: Comprehensive

The content of the SC: M Primary Syllabus 2007 is divided into eight Topics (three with sub-topics) across a total of 37 content descriptions. Calculators are allowed unless otherwise stated. There are 11 specified exclusions from the content. The renewed SC: M Primary 6 is due for implementation in 2018 and unavailable at the time of this study. More significant differences between the two curricula are likely to occur in discussions about breadth.

Based on the detail provided in the SC: M for Primary 6, per Table 3.10, breadth of coverage is considered to be **comprehensive**. The content includes:

Fractions

- Four operations (1 content description)

Percentages

- Percentages (3 content descriptions)

Ratio

- Ratio (5 content descriptions)

Speed

- Distance, time and speed (5 content descriptions)

Measurement

- Area and circumference of circle (3 content descriptions)
- Area and perimeter of composite figures (1 content description)
- Volume of cube and cuboid (6 content descriptions)

Geometry

- Geometrical figures (1 content description)
- Nets (4 content descriptions)

Data Analysis

- Pie charts (2 content descriptions)

Algebra

- Algebraic expressions in one variable (6 content descriptions).

Table 3.10 *Frequency of curriculum elements in SC: M, Primary 6*

Primary 6	Mathematics
Topics and subtopics	8 (3)
Content descriptions	37
Mathematical processes	3

AC – Depth

Depth: Challenging

In relation to depth in Year 6, the AC: M is regarded as **challenging**. Within each of the strands of Number and Algebra, Measurement and Geometry and Statistics and Probability, the sub-strands provide further detail. The year-level descriptions at the beginning of the Year 6 AC: M show a range of cognitive demand, and the understanding and fluency proficiencies describe the depth of the curriculum. *Understanding* includes building robust knowledge of adaptable and transferrable concepts and in Year 6 this is evident in students describing connections and making reasonable estimations. *Fluency* involves choosing appropriate procedures which can be carried out flexibly, and at this year level implies students being able to represent, convert and interpret mathematical concepts. After being taught the content, students are required to describe connections between concepts they have learnt and represent their knowledge in various ways. The verbs used to describe the knowledge and skills contained within the content descriptions range from *select* and *describe* to higher-order verbs of *create*, *interpret* and *compare*. The use of these verbs included in the content descriptions requires considerable in-depth exploration of concepts and justifies the high rating regarding depth of learning. The selective employment and training in the use of calculators complements and extends the range and depth of content.

SC – Depth

Depth: Challenging

The SC: M Primary Syllabus 2007 builds on the depth and fluency of Mathematics established in previous years. For example, operations with decimals are considered complete and time is given to completing mastery of the four operations with fractions without the use of calculators. Mechanical fluency in number operations is focused on applications to a minimum of clearly specified problem types in the areas of percentages, ratio and speed. The comprehensiveness of the problem sets offers Primary 6 students a sense of mastery and confidence in applying Mathematics in useful ways. The transference of this approach to more general problem-solving depends on exposure to problems beyond the specified inclusions.

The depth of cognitive demand is established in two ways: the breadth of topics (including algebra) is significant and the level of difficulty of the problem types in many topics is high.

AC – Rigour

Rigour: Challenging

The rigour of the AC: M is deemed to be **challenging**, placing considerable demand on students to engage in reasoning and problem-solving. The year-level statement for Year 6 specifies that problem-solving includes formulating and solving authentic problems, interpreting secondary data displays and finding unknown angles. The level of rigour is further exemplified by the reasoning description, which includes explaining mental strategies for performing calculations, describing results for continuing number sequences, explaining transformations and why the results of chance experiments may differ from expected results. The content descriptions at Year 6 require higher-order thinking skills. This is evident in the

language used to describe the content description. For example, students are required to 'interpret and compare a range of data displays, including side-by-side column graphs for two categorical variables' and also to 'Interpret secondary data presented in digital media and elsewhere.' These are demanding skills for students at this level. The content descriptions define the expectations on the students to be able to do more than procedural calculations and computations. Verbs used at the beginning of each content description imply higher-order thinking. Verbs such as *investigate and calculate*, *continue and create*, *explore the use of*, *interpret and use* and *investigate combinations* reveal the intent of the learning to be challenging and investigative.

The Achievement Standard defines what a typical student should be able to achieve by the end of Year 6 and states that students are expected to be able to 'solve problems involving all four operations', 'connect fractions, decimals and percentages, make connections between capacity and volume' and 'interpret secondary data in the media' (ACARA, 2016a, p.39). Higher-order mathematical thinking characterises the standards, thereby confirming the high rating for rigour.

SC – Rigour

Rigour: Challenging

The SC: M Primary Syllabus 2007 does not contain details of learning experiences aligned to the content specifications that assist in identifying the level of rigour. Singapore's curriculum renewal has resulted in the inclusion of learning experiences for each item of content, and the SC: M contains in its general outline a description of the mathematical processes to be used in the teaching of Mathematics (MOE, 2007, pp. 7-8). These mathematical processes include reasoning, communication, thinking skills and heuristics, and application and modelling.

Comparative Analysis

Comparison of the AC: M Year 6 and the SC: M Primary 6 reveals many similarities in their expectations of student achievement. Since the 2006 Singapore document is being replaced, many of the earlier, apparent differences may no longer be relevant. Both curricula emphasise problem-solving as their core purpose and the development and extension of mathematical processes as the means of achieving this purpose.

A key difference lies in the level of preparation students experience before their first year of primary education – Foundation in Australia and Primary 1 in Singapore. Although their ages are comparable at Year 6/Primary 6, the fact that Singaporean students have received many of their introductory mathematical experiences via a well-defined, national pre-school program means they are able to spend additional time on mastery of basic processes (e.g. tables and algorithms) and move more rapidly through their respective curricula during the early primary years. This difference is still evident in Year 6/Primary 6, where successful Singapore students have acquired greater breadth and depth on their mathematical journey because of their earlier exposure to the development of basic and necessary skills. Students in both countries are well prepared to commence Mathematics in secondary school.

Additional Observations

The availability of the Singapore Foundation Mathematics pathway, for students who are challenged by the mathematical content of the curriculum, is a major difference between the AC and the Singapore Mathematics curriculum. The content for Foundation Mathematics in P5 and P6 repeats some of the major topics previously covered in P1 to P4. This is likely to ensure that those students have a sound understanding of essential mathematical concepts. The intention of Foundation Mathematics is to teach concepts at a slower pace with more emphasis on practical and concrete experiences.

Year/Grade Level

Australian Curriculum: Year 9/10

Singapore Curriculum: Secondary 3/4 Mathematics O-Level S3-4 and Additional Mathematics S3-4 2012

Learning Area/Subject

Australian Curriculum: Mathematics (AC: M)

Singapore Curriculum: Mathematics (SC: M)

Expectations: Knowledge and Skills

The AC: M offers a common course for students in Years 7 to 10, with separate content descriptions for each year and an extension course, Year 10A, that caters for more mathematically able students. The SC: M Secondary S1 to S4 offers students three distinct levels of study: No(Technical) or N(T)-Level, aimed at students not preparing for university (12% of the S4 cohort in 2015) Normal(Academic) or N(A)-Level, the longer preparation for University (26% of the S4 cohort in 2015) and Express O-Level, the 4-year course leading directly to the GCE O-Level exam (62% of the S4 cohort in 2015). The SC combines S3 and S4 in the Content and Learning Experiences document for each of these levels. There are also S3-4 Additional Mathematics courses with substantial Content and Learning Experiences both at the Express O-Level and N(A)-Level providing for more mathematically able students. Comparison between the documents has involved consideration of the AC: Mathematics Years 9, 10 & 10A and the SC: Mathematics O-Level S3-4 and Additional Mathematics S3-4 as these are the courses taken by the majority of students in Singapore. Both the AC: M and the SC: M are explicit and detailed in their expectations for what students should learn.

The AC: M aims to ensure that students develop an increasingly sophisticated understanding of mathematical concepts and fluency with processes, and are able to pose and solve problems and reason in the three content strands of Number and Algebra, Measurement and Geometry and Statistics and Probability. By the end of Year 10, the major achievement standards for students can be summarised as Table 3.11 demonstrates.

Table 3.11 *Mathematics: Achievement Standards by Strands in AC, Year 10*

Content Strands and Substrands	Achievement Standards
Number and Algebra	Students:
Real Numbers (10A students)	define rational/irrational numbers, perform the four operations with surds and fractional indices
(10A students)	define logarithms, establish and apply the laws of logarithms
Money and financial mathematics	recognise the connection between simple and compound interest using digital technology to solve problems with authentic data
Patterns and Algebra	expand binomial expressions, factorise monic quadratic expressions, solve simple quadratic equations
	perform the four operations with simple algebraic fractions
	find unknown values after substitution into formulae
(10A students)	define polynomials, apply the factor and remainder theorems
Linear and non-linear relationships	solve problems involving linear equations and inequalities
	solve linear simultaneous equations algebraically & graphically
	recognise and apply the relationships between the gradients of parallel and perpendicular lines
	make the connections between algebraic and graphical representations of relations, sketch simple parabolas, circles and exponentials using digital technology as appropriate
(10A students)	sketch and interpret a range of parabolas, hyperbolas, circles and exponentials and their transformations
(10A students)	solve a wide range of quadratic equations derived from a variety of contexts including real-world problems
Measurement and Geometry	Students:
Using units of measurement	solve surface area and volume problems relating to composite solids (involving prisms and cylinders)
(10A students)	as above involving right pyramids, right cones and spheres
Geometric reasoning	use triangle and angle properties to prove congruence and similarity
	apply deductive reasoning to proofs and numerical exercises involving plane shapes
(10A students)	prove and apply angle and chord properties of circles
Pythagoras and trigonometry	use trigonometry to solve right-angled triangle problems
(10A students)	establish the sine, cosine and area rules for triangles and solve related problems
(10A students)	use of unit circle definitions and graphs of trigonometric functions and their features, angles of any magnitude, solution of simple trigonometric equations

Statistics and Probability	Students:
Chance	list outcomes for multi-step chance experiments and assign probabilities for these experiments
Data representation and interpretation	calculate quartiles and inter-quartile ranges and compare data sets by referring to the characteristics of the various data displays
(10A students)	compare data sets by calculating mean and standard deviation
	describe bivariate data where the independent variable is time
	use a variety of plots and histograms to describe the statistical relationship between two continuous variables
(10A students)	use digital technology to investigate numerical bivariate data sets, find the 'line of best fit' where appropriate
	evaluate statistical reports such as those reported in the media

The AC: M Years 9, 10 & 10A encompass the relevant General Capabilities. Literacy is embedded in developing students' capacity to read and understand problems and to communicate their solutions using appropriate language. Numeracy is required throughout. ICT is incorporated in content descriptions and elaborations such as graphing. Personal and Social Capabilities are addressed with the application of Mathematics to finance and everyday statistics in addition to fostering independent and collaborative working skills. The use of universal symbols and appreciation of the diverse cultural origins of mathematical knowledge enhance Intercultural Understanding. Cross-Curriculum Priorities are also incorporated where real-world problems are chosen from Aboriginal and Torres Strait Islander examples. Ethical Understanding is involved when analysing data and statistics for bias.

The SC: M Secondary S1 to S4 (2012) was implemented in 2013. The O-Level S3-4 and Additional Mathematics S3-4, the focus of this study, incorporate content across the three strands of Number and Algebra, Geometry and Measurement and Statistics and Probability with an extra Calculus strand in the O-Level S3-4 Additional Mathematics. This content is presented within the Mathematics Curriculum Framework – a pentagon centred on Mathematical Problem Solving surrounded by: Attitudes (Beliefs, Interest, Appreciation, Confidence, Perseverance), Metacognition (Monitoring of one's own thinking, Self-regulation of learning), Processes (Reasoning, communication and connections, Applications and modelling, Thinking skills and heuristics), Concepts (Numerical, Algebraic, Geometric, Statistical, Probabilistic, Analytical) and Skills (Numerical Calculation, Algebraic manipulation, Spatial visualisation, Data analysis, Measurement, Use of mathematical tools, Estimation).

By the end of Secondary 4, the major course content can be summarised, per Table 3.12.

Table 3.12 *Mathematics Syllabus Content and Learning Outcomes in SC, Secondary 1-4*

Content Strands and Substrands	Learning Outcomes
Number and Algebra	
Indices and surds (Additional)	the four operations with indices and surds, rationalising the denominator, solving equations involving indices and surds
Functions and graphs	sketching graphs of simple quadratic, power and exponential functions using digital technology for exploration
Equations and inequalities	solving quadratic equations by a variety of methods including graphically, solving problems involving quadratic equations, including algebraic fractional equations reducible to quadratics
(Additional)	quadratic theory including the relationship between the roots and coefficients of an equation, positive/negative definite quadratic expressions, deducing the quadratic formula
(Additional)	solving simultaneous equations with one linear and one quadratic, conditions for a line to intersect/not intersect or to be a tangent
(Additional)	solving quadratic inequalities
Polynomials and partial fractions (Additional)	the division algorithm for polynomials, the remainder and factor theorems and their application to factorising polynomials
(Additional)	solving cubic equations and graphing cubic polynomials
(Additional)	expressing a single algebraic fraction as partial fractions
Binomial expansions (Additional)	the binomial theorem, the Pascal triangle and finding the coefficients of the binomial expansion with appropriate notations
Power, exponential, logarithmic and modulus functions (Additional)	characteristics of the graphs of these functions and matching graphical displays of real-world data to these functions
(Additional)	the laws of logarithms, change of base of logarithms, natural logarithms, applications of exponential and logarithmic functions
(Additional)	solving simple equations involving exponential, logarithmic and modulus functions
Set language and notation	use of set language and notation, use of Venn diagrams
Matrices	matrix display and interpreting the data in a matrix
	problems involving addition, subtraction and multiplication of matrices, applications of matrix multiplication
Problems in real-world contexts (also for geometry and measurement)	solving a variety of problems based on real-world contexts
	interpreting and analysing data from table and graphs
	identifying assumptions made and the limitations of the solution
Geometry and Measurement	
Congruence and similarity	determining whether two triangles are similar or congruent
	ratio of areas of similar plane figures and volumes of similar solids
Properties of circles	symmetry and angle properties of circles

Proofs in plane geometry (Additional)	midpoint theorem, tangent-chord theorem deduce basic geometric properties using appropriate language, definitions and theorems
Pythagoras theorem and trigonometry (begun in S2)	extending sine and cosine to obtuse angles, formula for the area of a triangle
	use of the sine rule and cosine rules, solving problems involving angles of elevation/depression and bearings
Trigonometric functions, identities and equations (Additional)	the six trigonometric functions for angles of any magnitude in degrees and radians, exact values for special angles
(Additional)	unit circle definitions and graphs of trigonometric functions and their features
(Additional)	principle values of inverse trigonometric functions
(Additional)	compound and expanded trigonometric identities, simplification of trigonometric expressions, proofs of simple trigonometric identities
(Additional)	solution of simple trigonometric equations in a given interval
Mensuration	arc length, area of sector and segment of a circle, radian measure
Coordinate geometry	geometric problems involving use of coordinates
(Additional)	parallel, perpendicular lines, equation of perpendicular bisector of a line segment, explore area of polygon with given vertices
(Additional)	parabolas in the form $y^2=kx$, coordinate geometry of circles, problems involving intersection of a curve and a straight line
(Additional)	transformation of exponential and power functions to linear form to determine unknown constants, applications in science
Vectors in two dimensions	vector notation, translation by a vector, position vectors, magnitude of a vector, sum and difference of two vectors, multiplication of a vector by a scalar
	geometric problems involving the use of vectors
Statistics and Probability	
Data analysis	calculating quartiles, percentiles, interquartile range, standard deviation, using the mean and standard deviation to compare two sets of data
	analysis and interpretation of cumulative frequency diagrams and box-and-whisker plots, advantages and disadvantages of different forms of statistical representations
Probability	probability of simple combined, mutually exclusive and independent events
Calculus	
(Additional)	a comprehensive introduction to differentiation and integration

The SC: M (2012) O-Level S3-4 and Additional Mathematics S3-4 directly address two of the three emerging 21st Century Competencies. Critical and Inventive Thinking is central to SC: M, where problem-solving contributes to almost every content sub-strand. Exploratory methods of learning, both self-directed and collaborative, are incorporated regularly, as is the use of ICT in applications such as graphing and geometry software specified in many learning experiences. Communication, Collaboration and Information Skills are also developed in the presentation of solutions and collaborative work described in some of the learning experiences.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

The AC: M comprises three content strands: Number and Algebra, Measurement and Geometry and Statistics and Probability. For Years 9, 10 & 10A these are further subdivided into nine sub-strands, with a total of 66 content descriptions and 102 elaborations. This provides a **comprehensive** breadth of coverage. See Table 3.13.

Table 3.13 *Mathematics components in AC, Years 9, 10 & 10A*

AC: Mathematics Years 9, 10 & 10A		
Strand	Content descriptions	Elaborations
Number and Algebra	23/7	34/10
Measurement and Geometry	13/6	20/11
Statistics and Probability	14/3	22/5
Totals	50/16 = 66	76/26 = 102

SC – Breadth

Breadth: Comprehensive

The SC: M content is organised along three similar strands: Number and Algebra, Geometry and Measurement and Statistics and Probability, with a Calculus strand in the O-Level S3-4 Additional Mathematics. The O-Level S3-4 Mathematics and O-Level S3-4 Additional Mathematics are considered to be **comprehensive** in terms of breadth of coverage. These include several significant content areas (such as Set Language, Matrices, Vectors and Calculus) not covered in the AC. There are 93 content descriptions across the three strands, within which content is further organised into 21 sub-strands, as detailed in Table 3.14.

Table 3.14 *Mathematics components O-Level, Secondary 3-4*

SC: O-Level S3-4 Mathematics and O-Level S3-4 Additional Mathematics		
Strand	Content descriptions	Learning experiences
Number and Algebra	27/15	17/12
Geometry and Measurement	25/19	12/16
Statistics and Probability (S3-4 only)	7/-	3/-
Calculus (S3-4 Additional only)	-/18	-/8
Totals	59/52 = 111	32/36 = 68

AC – Depth

Depth: Challenging

The AC: M year-level descriptions detail a significant cognitive demand for Year 9/10 students. The expectations are **challenging** at their stage of development in terms of the depth of coverage encompassed by the content descriptions. The Year 10 Achievement Standards require students to understand and apply Mathematics at a level only possible with significant conceptual and skills development within each content sub-strand. Examples include ‘make the connections between algebraic and graphical representations of relations’, and ‘interpreting and evaluating media statements and interpreting and comparing data sets’ (ACARA, 2016a, p. 65).

The Year 10A course is more demanding with content descriptions such as ‘use the definition of a logarithm to establish and apply the laws of logarithms’, and ‘investigate reports of studies in digital media and elsewhere for information on their planning and implementation’ (ACARA, 2016a, p. 71).

The proficiency strands of Problem Solving and Reasoning provide Year 10 students with opportunities to ‘develop the ability to make choices, interpret, formulate, model and investigate problem situations’ and ‘develop an increasingly sophisticated capacity for logical thought and actions, such as analysing, proving, evaluating, explaining, inferring, justifying and generalising’ (ACARA, 2016a, p.5).

SC – Depth

Depth: Challenging

The O-Level S3-4 Mathematics and O-Level S3-4 Additional Mathematics are considered to be **challenging** in terms of deep learning. Many suggested learning experiences accompanying content descriptors provide detailed evidence of the depth of sophistication both of conceptual understanding and skill levels required by students undertaking these courses. Examples from O-Level S3-4 include learning experiences such as ‘discuss some applications of matrix multiplication e.g. decoding messages and transformation matrices for movie making’ (within Number and Algebra: Matrices), ‘identifying assumptions made and the limitations of the solution’ (Number and Algebra: Problems in real-world contexts) and

‘discuss examples of inappropriate representations of data from newspapers and other sources, e.g. whether certain representations are misleading’ (Statistics and probability: Data analysis) (MOE, 2012).

The O-Level S3-4 and Additional course encompass much content which is beyond the scope of the AC: M Year 9-10 and 10A courses and is taught in later years in Australia. Examples of learning experiences include ‘expand $(a+b)^n$ for $n=2,3,4,\dots$ and generalise the result to the binomial theorem’ (Algebra: Binomial expansions), ‘deduce the formula $\sin(A+B)$ from the sine rule’ (Geometry and Trigonometry: Trigonometric functions, identities and equations) and ‘discuss examples of problems in real-world contexts (eg business and sciences) involving the use of differentiation’ (Calculus: Differentiation and integration).

In its documentation, the MOE, Singapore (2012, p.7) states:

the overarching goal of the Mathematics curriculum is to ensure that all students will achieve a level of mastery of Mathematics that will serve them well in life, and for those who have the interest and ability, to pursue Mathematics at the highest possible level.

At the O-Level S3-4, SC: M demands and facilitates higher-order reasoning as the content becomes mathematically increasingly sophisticated, in particular, problem-solving, which is in line with Singapore’s approach to teaching and learning.

AC – Rigour

Rigour: Challenging

The rigour of the AC: M Year 9/10 is considered to be **challenging** as it places considerable demand on students to engage in reasoning and abstract thinking. The Year-level statement at the beginning of the Year 10 curriculum states:

- **problem solving** includes calculating the surface area and volume of a wide range of prisms to solve practical problems, finding unknown lengths and angles using applications of trigonometry, using algebraic and graphical techniques to find solutions to simultaneous equations and inequalities and investigating independence of events
- **reasoning** includes formulating geometric proofs involving congruence and similarity, interpreting and evaluating media statements and interpreting and comparing data sets.

The intention of the AC: M is for teachers to teach the curriculum through the proficiencies, with a particular emphasis on problem-solving and reasoning. To this end, the AC: M provides the opportunity for students to apply logical reasoning and to communicate and justify their solutions both to familiar and unfamiliar problems using appropriate mathematical language.

The content descriptions both at Years 10 and 10A require higher-order thinking skills. In Year 10, under Measurement and Geometry: Geometric Reasoning, students ‘Apply logical reasoning, including the use of congruence and similarity, to proofs and numerical exercises involving plane shapes’ with elaborations including ‘communicating a proof using a

sequence of logically connected statements' (ACARA, 2016a, p. 68) and in the 10A content, students further develop their understanding of geometrical proof with 'Prove and apply angle and chord properties of circles' (ACARA, 2016a, p. 72). These are challenging content descriptions; students must develop sophisticated thinking skills to be able to work through problems related to this content.

SC – Rigour

Rigour: Challenging

The Content and Learning Experiences in the SC: O-Level S3-4 Mathematics and O-Level S3-4 Additional Mathematics describe a **challenging** level of rigour. The Mathematical Processes of Reasoning, Communication and Connections, Applications and Thinking Skills and Heuristics are embedded in the student and teacher actions specified in the Learning Experiences at this year level.

Students encounter a very broad range of advanced mathematical concepts, relationships and skills, with rules and formulae to discover and prove and problems to solve. An example in O-Level S3-4, within Geometry and Measurement: Vectors in two dimensions, is the content 'geometric problems involving the use of vectors' (G7.8) where students must apply their knowledge of the concept of vectors to solve geometric problems by new methods. The SC: O-level S3-4 Mathematics is very precise with its use of formal mathematical language, as seen in the learning experience of Probability (S2): 'Discuss and differentiate between mutually exclusive and non-mutually exclusive events, and between independent and dependent events' (MOE, 2012).

The O-Level S3-4 Additional Mathematics includes even more advanced content such as that found in Algebra: Power, Exponential, Logarithmic and Modulus Functions (A5). Students must 'relate the exponential and logarithmic functions to sciences (e.g. pH value, Richter scale of earthquakes, decibel scale for sound intensity, radioactive decay, population growth)'. In Geometry and Trigonometry: Proof in Plane Geometry (G3), a further level of formal rigour is required with the learning experience requiring students to 'Explain the logical steps in a proof using appropriate language, definitions and theorems' (MOE, 2012).

Comparative Analysis

Both the AC: Mathematics Year 9/10/10A and the SC: O-Level S3-4 Mathematics and O-Level S3-4 Additional Mathematics courses prepare students for the next stage in their mathematics education – High School Years 11/12 for Australian students and the various post-secondary education institutions available for Singapore students prior to University.

There are clear differences between the two courses. As outlined above, the AC: M contains significantly less content than does SC: M. Set language, matrices and vectors are not included in the AC, nor are solutions of cubic equations, partial fractions, the binomial theorem, modulus functions and their graphs, reciprocal trigonometric ratios, radian measure, exact values of trigonometric ratios for special angles or trigonometric identities. Singapore expects a comprehensive introduction to differential and integral calculus. The AC covers scatter plots and 'line of best fit' for bivariate data sets in statistics.

Whilst the AC is comprehensive in breadth and challenging both in depth and rigour for students at this stage of their mathematical journey, the SC is more comprehensive in breadth and more challenging both in depth and rigour due to the inclusion of a greater range of intellectually demanding content.

There is a major difference between the structure of the AC: M with its single pathway through Years 7-10 and additional Year 10A course material, and the SC: M with its three distinct secondary pathways: O-Level S1, S2, S3-4 (catering for 62% of students), Normal (Academic) S1, S2, S3-4 (26% of students) and the less demanding Normal (Technical) S1, S2, S3-4 (12% of students). Both O-Level and Normal (Academic) have substantial S3-4 Additional full courses for interested and more able students.

At the end of Year 10, successful Australian students should have a broad range of numerical, algebraic, geometrical and statistical concepts and skills enabling them to investigate and solve a wide variety of problems including those from real-world situations. They should have the necessary knowledge and familiarity with mathematical processes to be well prepared to continue their study of Mathematics in Years 11 and 12. At the end of Secondary 4, successful Singaporean students will be similarly equipped with an even broader range of concepts and skills. They are likely to have a more sophisticated knowledge and facility with mathematical processes enabling them to continue their mathematical education at a higher level.

Additional Observations

Singapore has a centralised system of education. The national Mathematics Curriculum is closely monitored and implemented in well-resourced schools by highly trained teachers, most of whom are subject specialists and use mandated or recommended textbooks. Teachers are supported with instructional or pedagogical guides and they undergo regular school inspections and audits. Pedagogy is highly influenced by various forms of testing and high stakes examinations. Singapore's small size allows for greater control over the whole education system, meaning that national directives and policies and feedback from schools can be quickly communicated.

Australia is a very large country (7.7 million sq. km. compared to Singapore's 690 sq. km.) with a geographically dispersed population of 23 million (compared to Singapore's 5.8 million). Australia has a state-based system of education. The AC: M Foundation to Year 10 provides a common curriculum for the states to implement as a basis for their own syllabuses. Delivery of the Mathematics curriculum is characterised by variability in resourcing across schools and a shortage of specialist teachers, leading to primary specialisation in disciplines such as maths and science in initial teacher education (AITSL, 2017).

c) Science

Comparative Curricula

Australian Curriculum: Science

Version 8.3, 2016

Singapore Curriculum: Science

Primary 6 Syllabus, 2014

Singapore Curriculum: Science

Lower Secondary – Normal (Academic) Course
Syllabus, 2013

Note: No curriculum comparison was conducted for Science Year 2 (AC) and P2 (Singapore).

Year/Grade Level

Australian Curriculum: Year 6

Singapore Curriculum: Primary 6

Learning Area/Subject

Australian Curriculum: Science (AC: S)

Singapore Curriculum: Science (SC: S)

Expectations: Knowledge and Skills

In Year 6, the AC: S expects students to compare and classify different types of observable changes to materials, analyse requirements for the transfer of electricity, describe how energy can be transformed from one form to another when generating electricity, explain how natural events cause rapid change to Earth's surface, describe and predict the effect of environmental changes on individual living things, and explain how scientific knowledge helps us to solve problems and inform decisions and identify historical and cultural contributions. With respect to Science inquiry skills, students are expected to follow procedures, to develop investigable questions, to design investigations into simple cause-and-effect relationships, to identify variables to be changed and measured and describe potential safety risks when planning methods. They collect, organise and interpret their data, identifying where improvements to their methods or research could improve the data, to describe and analyse relationships in data using appropriate representations, and to construct multimodal texts to communicate ideas, methods and findings.

At the Primary 5-6 level, the SC: S (Standard) expects students to identify organs and regulatory systems of humans and describe their functions, recognise processes in the sexual reproduction of plants and humans, describe the structure and function of plant and animal cells, show an understanding of different ecosystems and the interdependencies of species within them, and recognise structural as well as behavioural adaptations that support the survival of populations. They are expected to recognise the importance of the water cycle, show an understanding of the changes of state of water, and recognise the sun as the primary source of energy. Students recognise and give examples of various forms of energy and different types of forces and show an understanding of the fundamental concepts that underpin electric currents. With respect to procedural skills, students are expected to observe, collect and record information about phenomena, compare and classify properties and features, and investigate how the variation of one or more variables affect those phenomena. They are expected to show curiosity in exploring the natural world, show

objectivity in seeking and using data and information, value individual and team effort, and show concern regarding the human impact on the environment.

For Primary 5-6 students, the SC: S provides a second stream of learning named 'Foundation' which identifies lower expectations in terms of content and cognitive demand. Some of the more challenging scientific concepts that are addressed in the Standard stream are excluded from 'Foundation', such as the internal structures and functions of plant and animal cells. Some content descriptions are worded differently to reflect a less sophisticated expectation of cognitive demand; an example is found in the 'Standard' description; 'Show an understanding of how water changes from one state to another' which is expressed at the Foundation level as 'State how water changes from one state to another' (MOE, 2013, pp. 29-30). The differences between the two streams are significant with respect both to number of topics and cognitive demand. Of the 36 descriptions in the Standard category 'Knowledge, Understanding and Application' (KUA), 13 (36%) are omitted in the Foundation stream and a further ten (28%) contain minor omissions of content or have been reworded to target a lower cognitive demand. The situation is similar in the category of Skills and Processes (SP). The number of SP descriptions in the Foundation stream is reduced by approximately one-third and, where students in the Standard stream are expected to *investigate* a certain phenomenon, the expectations for students in the Foundation stream have been adapted to *observe and compare* or *observe and recognise*. Given these differences, the classifications for breadth, depth and rigour have been assigned individually for each stream.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC		Foundation	Standard		Foundation	Standard			

AC – Breadth

Breadth: Comprehensive

For students in Year 6, the expectations of the AC: S are deemed **comprehensive** in relation to breadth of coverage. The content descriptions address four topics in the Science Understanding strand, relating to one fundamental concept from each of the four disciplines of Biology, Chemistry, Earth and Space Science, and Physics, seven Science Inquiry Skills and two concepts relating to Science as a Human Endeavour. Each of the content descriptions in the SU and SHE strand is supported by several elaborations that provide additional detail. The topics in the SU strand are defined broadly enough to allow for sustained and rich learning opportunities. The SIS content comprehensively addresses the skills required to explore the topics through an inquiry approach. Combined with the SHE content, which addresses the nature, purpose and use of Science, the overall breadth of the Year 6 content is considered comprehensive.

SC – Breadth

Breadth: Comprehensive (Standard) / Fundamental (Foundation)

For students at Primary 6, the expectations of the SC: S Standard stream are considered **comprehensive**; those of the SC: S Foundation stream are considered **fundamental** in relation to breadth of coverage. Singapore's Science curriculum exposes students to a broad variety of scientific concepts from the fields of biology, chemistry and physics, all addressed within the contexts of five major themes (Diversity, Cycles, Systems, Interactions, and Energy). While the SC: S does not cover any topics related to astronomy or geology, some scientific concepts from the Earth sciences are addressed within the topics '*Cycles in Matter and Water*' and '*Interactions within the Environment*'. Although content relating to the nature of Science or its use and influence on society is not specifically addressed, the overall breadth of coverage in the Standard stream is demanding. Given the significant reduction in the content of the Foundation stream, which excludes the sub-themes 'Cell system' and 'Energy conversion' entirely and omits several concepts from the remaining themes, the classification of fundamental seems more appropriate for this stream.

AC – Depth

Depth: Limited

With regard to depth of coverage of knowledge and skills in the curriculum, the expectations of the AC: S (Year 6) are deemed to be **limited**. This rating is based, in the main, on the lack of specificity about which scientific concepts are the intended focus of teaching and learning and the depth to which they are to be explored.

SC – Depth

Depth: Challenging (Standard) / Fundamental (Foundation)

At Primary 6 level, the expectations of the SC: S (Standard) are considered **challenging** with respect to depth of coverage; those of the Foundation stream are considered **fundamental**. The content descriptions both in Standard and Foundation streams provide detailed information about the types of investigations students are expected to perform and the depth of conceptual understanding that is to be gained. Most of these descriptions indicate a *moderate* degree of depth. The following example from the topic 'Interactions with the environment' illustrates the point (MOE, 2014, p. 47):

- Identify the factors that affect the survival of an organism.*
- *physical characteristics of the environment (temperature, light, water)*
 - *availability of food*
 - *types of other organisms present (producers, consumers, decomposers).*

However, several content descriptions in the Standard stream point to a level of depth that can be considered *challenging* for students at the Primary 6 level. For example, in the topic Cycles in Matter and Water, students are expected to 'investigate the factors which affect the rate of evaporation and communicate findings (wind, temperature, exposed surface area)', which would indicate that students are expected to gain a substantial understanding of the particulate nature of matter. Other examples of challenging depth are found in the topic Cell

System which includes expectations that students understand the functions of sub-cellular organelles and compare animals with plant cells.

AC – Rigour

Rigour: Moderate

The terminology and expectations of the AC: S (Year 6) are indicative of a **moderate** degree of rigour. The elaborations of all three strands of the AC: S provide numerous examples that require students to compare, classify, describe and explain aspects of phenomena. Relatively few examples provide evidence for engaging students in abstract thinking and reasoning, or a level of individual planning, critical analysis and evaluation of investigations that would justify a higher classification of rigour at this year level.

SC – Rigour

Rigour: Moderate

The level of rigour encountered by Primary 6 students in the SC: S is considered **moderate** for both streams. Most content descriptions in the KUA category expect students to *identify, compare, recognise, or show an understanding* of certain aspects of scientific concepts and phenomena. Similarly, SP descriptions generally require students to *compare* and *investigate*, and never *to analyse or evaluate*; in one instance, students are asked to *apply or create*, as seen in the topic Electrical System: ‘construct simple circuits from circuit diagrams’. The introductory chapter on ‘How to Assess?’ suggests a range of non-mandatory assessment alternatives in addition to written tests, including reflection and journals, model-making, posters and debates. All of this reflects an expected level of rigour that warrants the rating of moderate.

Comparative Analysis

Most observations of the similarities and differences between the Australian and Singaporean Science curricula are of a general nature and apply equally to all year levels. These are discussed in detail in the comparative analysis at Year 10 level. With specific emphasis on Year 6 learning, the most pronounced differences are concerned with the selection of content regarding the knowledge and understanding of scientific concepts, as addressed in the SU strand of the AC: S and the KUA category of the SC: S.

While the selection of topics in Singapore’s Science Foundation stream is broadly comparable to the AC: S in the fields of Biology, Physics and Chemistry, the Standard stream introduces a significant number of scientific concepts that can be considered challenging for Year 6 level and are not covered in the AC: Science until students reach secondary school.

This is most obvious in the biological sciences where the detail of knowledge and depth of understanding expected of students in the SC: S (Standard) exceeds the expectations of the AC: S. For example, topics on human and plant physiology (organs and regulatory systems, sexual reproduction, internal cell structures and functions) are introduced in the AC: S in Year 8 and Year 9, food chains and webs are covered in Year 7 and a more sophisticated

focus on energy pathways through ecosystems occurs in Year 9. In the physical sciences, the SC: Science (Standard) covers the concept of energy conversion at P6 level; in the AC: Science this is introduced in Year 8. A final example is the study of the water cycle and the associated human impact that is undertaken by Year 7 students in the AC: Science.

Year/Grade Level

Australian Curriculum: Year 7-10

Singapore Curriculum: Lower Secondary

Learning Area/Subject

Australian Curriculum: Science (AC: S)

Singapore Curriculum: Science (SC: S)

Expectations: Knowledge and Skills

At the end of Year 10, the AC: S expects students to have gained an understanding of the structure and function of cells and multi-cellular organisms, the interdependencies of species in ecosystems, and the role of genes and DNA in the processes that underpin heredity and evolution. Students are expected to understand the structure of the atom and how properties of substances, as well as physical and chemical changes, can be explained through the particulate nature of matter. They are expected to describe and predict the motion of objects as a consequence of forces acting upon them and explain energy conservation and represent energy transfer and transformation within systems. They should have gained an understanding of different types of rocks and explain the theory of plate tectonics, describe and analyse interactions and cycles within and between Earth's spheres, and evaluate the evidence for scientific theories that explain the origin of the universe and the diversity of life on Earth. They are expected to analyse how the models and theories they use have developed over time and discuss the factors that prompted their review. Students are also expected to develop questions and hypotheses and independently design and conduct scientific investigation, explain how they have considered reliability, safety, fairness and ethical actions in their methods, identify where digital technologies can be used to enhance the quality of data, select evidence and develop and justify conclusions, identify alternative explanations for findings and explain any sources of uncertainty, evaluate the validity and reliability of claims made in secondary sources with reference to currently held scientific views, construct evidence-based arguments and select appropriate representations and text types to communicate science ideas for specific purposes.

At the Lower Secondary level, the SC: Science (Academic) expects students to study 18 topics from the fields of Biology, Chemistry and Physics. Students explore the diversity of matter and living things, gain an understanding of the fundamental models used in Science to explain natural phenomena, such as the cell as the basic unit of life, particles as the basic units of matter, and the ray model of light. They learn to think of nature and the technological world in terms of systems, such as the transport systems in plants and animals, the regulatory systems of the human body and electrical systems, and they gain an understanding of the interactions between components of those systems, such as forces, transfer of energy, chemical reactions, and interactions between organisms and populations within ecosystems. In addition, students study one topic relating to the nature of Science and its relationship with society. Students are provided with numerous opportunities to develop

the full suite of science inquiry skills ranging from posing questions and formulating hypotheses to planning investigations, recording and analysing data, evaluating methods, and verifying and communicating results.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

For students in Year 10, the expectations of the AC: S are regarded as **comprehensive** in relation to breadth of coverage. The content descriptors address eight topics in the Science Understanding strand, relating to two fundamental concepts from each of the four disciplines of Biology, Chemistry, Earth and Space Science, and Physics, eight Science Inquiry Skills and four concepts relating to Science as a Human Endeavour. Each of the content descriptors in the SU and SHE strand is supported by several elaborations that provide additional detail. Although sometimes loosely connected, the two topics within each of the disciplinary fields of the SU strand clearly address different scientific concepts and are defined broadly enough to be counted as separate topics and allow for sustained and rich learning opportunities. The SIS content comprehensively addresses the skills required to explore the topics through an inquiry approach. Combined with the SHE content, which addresses the nature, purpose and use of Science, the overall breadth of the Year 10 content is considered comprehensive.

SC – Breadth

Breadth: Fundamental

For students at the end of the Lower Secondary stage, the expectations of the SC: S are considered **fundamental** in relation to breadth of coverage. The topics addressed within the designated themes of Diversity, Models, Systems, and Interactions cover a range of essential scientific concepts from the disciplines of Biology, Chemistry, and Physics. Some major topics from the biological sciences, such as genetics and evolution, are not found at this stage of learning, and there is no evidence of the study of concepts relating to Geology, Geophysics, or Astronomy. While content relating to the nature of Science and its mutual impact on society is covered broadly in a separate topic, the science inquiry skills, as addressed in the topic descriptions, are primarily concerned with planning and conducting stages of scientific investigation. Less attention is paid to the skills involved in questioning, data processing and analysis, evaluation and communication.

AC – Depth

Depth: Challenging

The expectations of the AC: S (Year 10) are **challenging** with respect to the depth of coverage of knowledge and skills encountered in the curriculum. Notwithstanding the non-mandatory nature of the elaborations, which are the primary source of information for gauging the expected depth and rigour of the curriculum, the concepts addressed in these elaborations and the wealth of scientific terminology used in the wording of these suggested learning activities clearly demonstrate sophisticated and in-depth study.

SC – Depth

Depth: Challenging

For students at the end of the Lower Secondary stage, the expectations of the SC: S are considered **challenging**. The topic descriptions of the SC: S provide a substantial amount of detail regarding the specific scientific concepts that students are expected to understand, frequently including scientific terminology and examples that indicate a challenging level of depth. For example, topic 17 requires students to ‘show an understanding that the rate of heat loss or gain by a body through radiation is affected by the (i) nature of its surface and (ii) temperature difference between the body and its surroundings’ (MOE, i2013, pp. 31-32), requiring an in-depth exploration of the concepts of energy conversion, radiation and heat transfer.

AC – Rigour

Rigour: Moderate

The expectations of the AC: S at the end of Year 10, per the content elaborations and achievement standards, indicate a **moderate** degree of rigour. The elaborations of all three strands of the AC: S provide numerous examples of considerable demand on students’ ability to engage in abstract thinking and reasoning. Students are expected to research, plan investigations, analyse data, and apply critical, creative, and collaborative skills to solve problems and apply solutions to real world issues. Less evidence is available of quantitative analysis and mathematical application of scientific concepts, justifying a rating of a moderate level of rigour.

SC – Rigour

Rigour: Challenging

For students at the Lower Secondary stage, the expectations of the SC: S are considered **challenging** with respect to rigour. While the SC: S does not articulate specific standards of achievement, the descriptions of the kind of investigations students are expected to perform and the conceptual knowledge students are expected to gain are evidence of the challenging nature of the study. In particular, the topics relating to the physical sciences, which include quantitative descriptions of phenomena, require students to develop a rigorous and systematic approach to scientific investigation and a high level of abstract thinking. The level of rigour seems less pronounced in the expectations relating to science inquiry skills, at least as far as data analysis and critical evaluation of results are concerned.

Comparative Analysis

Similar to the AC: S strands of *Science Understanding* (SU) and *Science Inquiry Skills* (SIS), the SC: S addresses conceptual knowledge and inquiry skills in the two separate categories 'Knowledge, Understanding and Application' (KUA) and 'Skills and Processes' (SP). In addition, the SC: S emphasises the importance of including attitudes and dispositions in the learning area of Science, which is supported by the introductory statement 'In all scientific inquiry, the adoption of certain mental attitudes such as curiosity, creativity, objectivity, integrity, open-mindedness, perseverance and responsibility are advocated'. The SC: S addresses such content frequently and in close connection with knowledge and skills in the separate category 'Ethics and Attitudes' (EA), which does not have an equivalent in the AC: S.

The AC: S retains the traditional subdivision into the major disciplines of Science for its SU content; that is, students are expected to address the biological, chemical, physical, and Earth and space sciences. In comparison, the SC: S uses 'Themes' akin to the AC: S's 'Key Ideas' as the main organising principle. Each of the four Themes of Diversity, Models, Systems, and Interactions includes 'Essential Takeaways' and 'Key Inquiry Questions' that are intended to articulate the big ideas, guide teachers and foster student engagement in the inquiry process. In principle, such an approach could be considered conducive to an integrated way of teaching Science, but the four to six individual topics contained in each Theme are largely drawn from only one single discipline of Science. They do not appear to include strong connections to other disciplines nor do they provide explicit links to other learning areas such as Mathematics, technologies, or the social sciences.

While content relating to the nature of Science and its role and mutual impact on society is covered in the Singaporean and Australian curricula, it is arguably more strongly emphasised in the AC: S. Australia's Science as a Human Endeavour (SHE) strand is presented with equal prominence to, and in close connection with, the SU and SIS strands. In the SC: S the equivalent content is addressed in a separate topic known as 'The Scientific Endeavour', which appears somewhat detached from the content of the Themes and offers the following in the syllabus introduction (MOE, 2013, p.6):

It aims to deepen students' understanding of what Science is and how it is practised and applied, i.e. the nature of Science. The coverage of these ideas is not limited to the topic itself but should be reinforced through the subsequent topics.

A small number of content descriptions in the SC: S's other topics include explicit links to the nature of Science or its relationship with society.

The AC: S, in comparison to the SC: S, includes some major concepts from the fields of Biology and Earth and space Science that are commonly addressed at Year 10 level in many national curricula. This includes the entire field of Astronomy and important concepts such as the theories of plate tectonics and evolution. SC: S places strong emphasis on human biology and sexual reproduction, including the discussion of topics such as puberty, sexually transmitted diseases, abortion and pre-marital sex. While some similar topics are addressed through the AC: Health and Physical Education, the field of human biology has less presence in the AC: Science.

The SC: S lists the skills and processes that are integral to the conduct of scientific investigations, supported by brief high-level definitions in an introductory chapter to the curriculum. This list includes some important skills that the AC: Science does not address explicitly as separate stages of the investigation process, such as *observing*, *inferring*, or *verifying*. In the SC: Science, processes such as *creative problem-solving* and *decision-making* are an integral part of scientific inquiry. While the SC: S also addresses skills and processes within the content descriptions of topics (in the category SP), compared to the equivalent descriptions of the AC: S SIS strand, the references do not detail discrete skills or processes; rather, the tendency is to focus on the content and prescribe in detail the context in which the skill is to be applied. A typical example from the “Planning and conducting” stage illustrates this point:

AC: S (AC SIS199, AC SIS200):

Plan, select and use appropriate investigation types, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods

Select and use appropriate equipment, including digital technologies, to collect and record data systematically and accurately (ACARA, 2017)

SC: S (Topic 18 ‘Chemical Changes’):

Investigate the following chemical reactions/changes:

- effect of acidic, alkaline and neutral solutions on indicators (include litmus paper, Universal Indicator and natural indicators obtained from plants)

- reactions between acids and alkalis; acids and metals; and acids and carbonates (MOE, 2013, p.32).

Skills relating to the early stages of scientific inquiry, such as questioning and formulating hypotheses, as well as those concerned with the critical evaluation of methods and results, are rarely addressed in the SP category and the processes of *creative problem-solving* and *decision-making*, that are described in the introductory chapter of the SC: S are not addressed in any of the objectives outlined in the topic descriptions.

Similar points can be made regarding the inclusion of 21st Century Competencies in the SC: S. While the importance of competencies in domains such as Civic Literacy, Global Awareness and Cross-cultural Skills, Critical and Inventive Thinking, and Information and Communication Skills, is emphasised in an introductory chapter, the content descriptions of the topics themselves do not reflect this as strongly as is the case in the AC: S. References to skills from the above listed domains are rarely included in the SP category of the SC: S and, while they are more frequently addressed in the category Ethics and Attitudes, the expectations articulated in the descriptions rarely go beyond students showing an awareness or appreciation of such competencies, as, for example, in topic 5: ‘show an awareness of how teamwork and perseverance are important in the study of biodiversity’, or in topic 7: ‘show an appreciation of scientific attitudes such as creativity and open-mindedness in creating models to explain the fundamental nature of things and the willingness to re-examine existing models’ (MOE, 2013, pp. 22-23).

Based on the detail provided by the SC: S regarding the depth of conceptual understanding to be achieved by students in Year 10, the expectations are deemed more highly than those

of the AC: S. Further examples are evident in descriptions such as ‘show an understanding of how respiration and photosynthesis are related to the flow of energy through food chains and food webs’ in topic 19, and ‘show understanding that work is done when object moves in the same direction as the force is applied’ in topic 15 (MOE, 2013, pp. 31-33).

The SC: S also requires students to quantitatively explore various concepts, such as density and pressure, which implies a greater level of mathematical rigour than that expected in the AC: S.

Additional Observations

Singapore’s Science curriculum emphasises the importance of an inquiry-based approach to teaching Science and expects teachers to adopt this pedagogical paradigm. The statement that ‘(c)entral to the curriculum framework is the inculcation of the spirit of scientific inquiry’ appears prominently in the first chapter of the Science curriculum framework (MOE, 2014a, p.1). Equally clearly expressed are the roles of the student as an inquirer and the teacher as the leader of inquiry. This approach is reflected in the organisational diagram of the SC: S (see Figure 3.8). The SC: S includes a comprehensive section on ‘Teaching and Learning through Inquiry’ that provides information on the purpose and intent of inquiry-based learning and familiarises teachers with the essential components of this pedagogical approach.

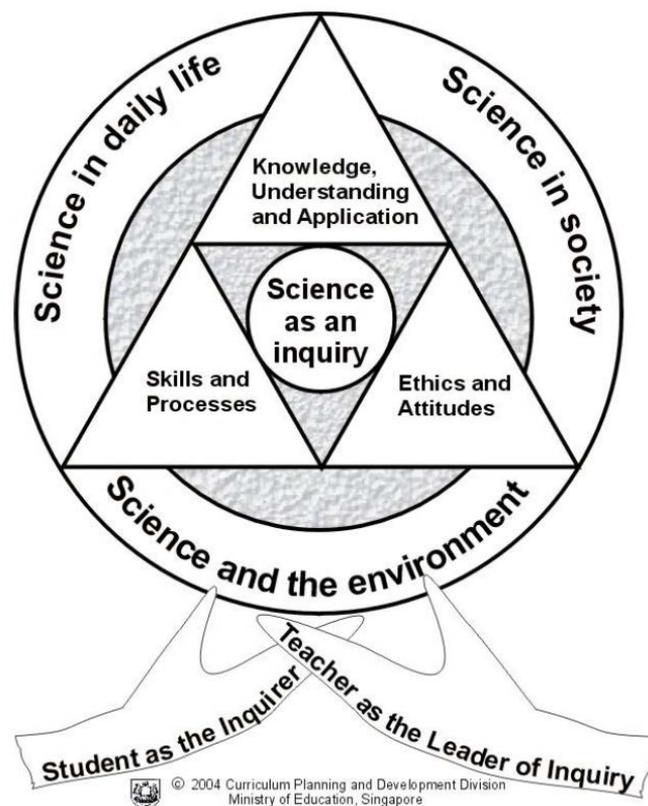


Figure 3.3 Organisational diagram of the Singapore Science Curriculum

Reproduced from: Ministry of Education, Singapore (<https://www.moe.gov.sg/docs/default-source/document/education/syllabuses/sciences/files/science-lower-upper-secondary-2014.pdf>, August 2017).

d) Humanities and Social Sciences

Comparative Curricula

Australian Curriculum: Humanities and Social Sciences	Version 8.3, 2016
Australian Curriculum: Civics and Citizenship	Version 8.3, 2016
Australian Curriculum: Economics and Business	Version 8.3, 2016
Australian Curriculum: Geography	Version 8.3, 2016
Australian Curriculum: History	Version 8.3, 2016
Singapore Curriculum: Social Studies	Primary Syllabus, 2012
Singapore Curriculum: Social Studies	Normal Technical Syllabus, 2014
Singapore Curriculum: Social Studies	Upper Secondary Express Normal Academic syllabus, 2016

Year/Grade Level

Australian Curriculum: Year 2

Singapore Curriculum: Primary 3

Learning Area/Subject

Australian Curriculum: Humanities and Social Sciences (AC: HASS)

Singapore Curriculum: Social Studies (SC: SS)

Expectations: Knowledge and Skills

The expectations of the AC: HASS in Year 2 involve the topic *Our past and present connections to people and places*. The content is organised into two strands: inquiry and skills, and knowledge and understanding. The inquiry and skills strand develops students' capacity to question, research, analyse, evaluate and reflect, and communicate. The knowledge and understanding strand is divided into two sub-strands: History and Geography. These sub-strands are interrelated and allow Year 2 students to explore near and distant places with which they are familiar, and investigate the connections between past and present, and between people and places. The three guiding inquiry questions are:

- What does my place tell me about the past and present?
- How are people connected to their place and other places, past or present?
- How has technology affected daily life over time and the connections between people in different places?

For Primary 3 students, the SC: SS involves the topic *Understanding Singapore*. This is the first year of the Primary 3 and Primary 4 cluster of study entitled *Understanding Singapore in the Past and Present*. The content focuses upon the physical environment of Singapore and is organised into four strands: knowledge outcomes, skills outcomes, values outcomes, and key concepts. Written in an engaging tone, the inquiry focus of the content in SC: SS Primary 3 is:

- How do we appreciate the country we live in?

There are three stated key understandings:

- Knowing the place I live in helps me appreciate where I am
- We meet our needs by changing the physical environment we live in
- We use resources wisely to protect the environment.

The content for Primary 3 students also designates locations for field-based learning.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

For students in Year 2, the expectations of the AC: HASS are regarded as **comprehensive** in relation to breadth of coverage. The concepts and skills of AC: HASS allow learners to build upon experiences from the curriculum in Foundation and Year 1 as they continue to explore their personal past and present in a way which aligns with Paul Hanna’s ‘expanding communities’ model for social science education (Stallones, 2003). The AC: HASS presents its designated concepts within the overview statements for each sub-strand, with no glossary, explanation, elaboration or direct association with the listed discipline-specific descriptions of knowledge and understanding. Each skill category has one or more elements, each with one or more elaborations. The content descriptors are mapped against the associated cross-curriculum priorities and general capabilities. See Table 3.15.

Table 3.15 *Frequency of curriculum elements and dimensions in AC: HASS, Year 2*

Year 2	Humanities and Social Sciences	
General capabilities	7	
Cross-curriculum priorities	3	
Inquiry questions	3	
Content description: inquiry and skills	10	
Elaborations	35	
Year 2	History	Geography
Key concepts	5	4
Inquiry questions	3	3
Content description: knowledge and understanding	3	5
Elaborations	11	14

SC – Breadth

Breadth: Fundamental

For students in Primary 3, the expectations of the SC: SS are **fundamental** in relation to breadth of coverage. While the content builds upon the personal view of the world explored in Primary 1 and Primary 2, and it is in line with Hanna’s ‘expanding communities’ model for social science education and is age-appropriate, student inquiry is entirely contained within

the Singaporean geographical context. The knowledge and understandings, key concepts and field-based learning experiences are relatively narrow and prescribed, with no elaborations and little or no apparent opportunity for choice or variation. See Table 3.16.

Table 3.16 *Frequency of curriculum elements and dimensions in SC, Primary 3 Social Studies*

Primary 3	Social Studies
Knowledge outcomes	5
Skills outcomes	5
Values outcomes	4
Key concepts	4
Guiding questions	5
Knowledge and understandings	5
Knowledge assessment objectives	8
Skills assessment objectives	7
Values assessment objectives	4

AC – Depth

Depth: Fundamental

Based on the details of knowledge and topics specified in the AC, the expectations of the AC: HASS for Year 2 are considered to be **fundamental**. In Year 2, the content descriptions of the AC: HASS are limited to eight areas of knowledge and understanding associated with the topic *Our past and present connections to people and places*. HASS is a single subject area with three overarching inquiry questions and a single list of targeted skills. The History and Geography sub-strands are presented separately, each with its own additional inquiry questions. The depth and detail to which learners should explore each content statement are indicated within its wording, with further possible indicators of depth provided through multiple elaborations which operate as suggestions for classroom implementation. The inquiry skills in the content descriptions focus mainly upon age and stage appropriate observations, interpretations and communication.

SC – Depth

Depth: Fundamental

The expectations of the SC: SS for Primary 3 are considered to be **fundamental** in relation to depth. In Primary 3, the content of the SC: SS is limited to three areas of geographical knowledge: *Knowing the Place I Live in Helps Me Appreciate Where I Am*, *We Meet Our Needs by Changing the Physical Environment We Live in* and *We Use Resources Wisely to Protect the Environment*. The detail with which learners engage in each area is prescribed, with the targeted outcomes being for students to ‘use’, ‘describe’, ‘recognise’, ‘understand’, ‘process ... in appropriate ways’ and ‘design with the help of the teacher’ (MOE, 2012b). The possible locations for field-based learning experiences are also specified in the SC: SS. The associated learning activities are somewhat repetitive and lack specificity.

AC – Rigour

Rigour: Moderate

The cognitive demand placed on Year 2 students in the AC: HASS indicates a **moderate** degree of rigour. The directive terms and expectations on Year 2 students throughout the content descriptions of AC: HASS are predominantly associated with recall, recount and simple description and application. This corresponds to the expectations of cognitive development for students in Year 2. The Year 2 achievement standards for AC: HASS, written for a ‘typical student’, are dominated by the following terms: ‘identify’, ‘describe’, ‘sequence’ – with limited use of ‘analyse’, ‘interpret’ and ‘reflect’ (ACARA, 2017m).

SC – Rigour

Rigour: Moderate

The cognitive demand placed on Primary 3 students in the SC: SS reveals a **moderate** degree of rigour. The directive terms and expectations of students are associated with either knowledge recall and recount or behavior and attitudes. This is reflected in the Primary 3 level descriptor – ‘pupils will come to appreciate Singapore, the country we live in’ as well as in the outcomes expectations: ‘use’, ‘recognise’, ‘describe’, ‘follow’, ‘work’, ‘appreciate’, ‘show curiosity’, ‘value’ and ‘demonstrate’. There is no indication that students are required to analyse, evaluate or reflect on their learning nor is there detail regarding the texts or modes through which students record, communicate or demonstrate their knowledge, skills or understandings. The sole recommended student performance task contains the option for completion by individuals or pairs of students.

Comparative Analysis

Both the AC: HASS in Year 2 and SC: SS in Primary 3 are designed to equip students with knowledge, understanding and skills associated with the people, places, issues and events that have shaped their world. Each curriculum draws in some way upon the ‘expanding communities’ model to shape the context, scope and developmental sequence to be followed.

A key indicator of both the similarities and the differences between AC: HASS and SC: SS can be found in the underlying concepts that shape each curriculum, per Table 3.17.

Table 3.17 *Summary of concepts in AC Year 2 HASS and SC Primary 3 SS*

Concepts in Year 2 AC: HASS	Key concepts in Primary 3 SC: SS
Significance Continuity and change Cause and effect Place Space Environment Interconnection Perspectives Empathy	Location Environment Conservation Change and continuity

While both curricula explore notions of place and space, the AC: HASS includes a wider range of concepts and also engages students in exploring causal relationships and varying points of view.

Furthermore, in the AC: HASS in Year 2 there is clear and systematic alignment between the aims and intentions, the content descriptions (inquiry skills, knowledge and understanding), and the achievement standard. It is noted that Singapore's Social Studies curriculum operates within a framework of aims and intentions that is grounded in constructivist inquiry. In the SC: SS, the stated underlying philosophy is for students to 'attain relevant knowledge and understandings of [real-world] issues, develop critical and reflective thinking skills, and appreciate multiple perspectives' (MOE, 2016a, p. 1). This philosophy informs the SC: SS aim to 'empower students to be informed, concerned and participative citizens' (MOE, 2016a, p. 2), with further guidance provided that 'inquiry is recommended for the learning of concepts, skills and exploration in the Social Studies primary syllabus' (MOE, 2012b, p. 6) and advice regarding the processes and pedagogies of inquiry is provided. Models of Scientific Inquiry, Historical Inquiry and Geographical Inquiry are also mentioned, but there is little elaboration.

These aims and intentions do not appear to be replicated in the content statements of the SC: SS in Primary 3, which are narrow and prescriptive, with the targeted skills being generic rather than linked to a specific learning area or discipline, and the knowledge requirements being limited and overtly parochial in intention and scope. There is also little evidence of a developmental hierarchy in expectations or achievement. The assessment objectives – for knowledge, skills or values – remain the same for each year from Primary 1 through to Primary 6.

Year/Grade Level

Australian Curriculum: Year 6

Singapore Curriculum: Primary 6

Learning Area/Subject

Australian Curriculum: Humanities and Social Sciences (AC: HASS)

Singapore Curriculum: Social Studies (SC: SS)

Expectations: Knowledge and Skills

The expectations of the AC: HASS in Year 6 involve the topic: *Australia in the past and present and its connection with a diverse world*. The content is organised into two strands: inquiry and skills, knowledge and understanding. The inquiry and skills strand develops students' capacity to question, research, analyse, evaluate and reflect, and communicate. The knowledge and understanding strand is divided into four sub-strands: History, Geography, Civics and Citizenship, and Economics and Business. These sub-strands are interrelated and allow Year 6 students to explore events, developments and issues that shape Australia as a democratic nation and to understand how they are interconnected with diverse people and places across the globe. The three guiding inquiry questions are:

- How have key figures, events and values shaped Australian society, its system of government and citizenship?

- How have experiences of democracy and citizenship differed between groups over time and place, including those from and in Asia?
- How has Australia developed as a society with global connections, and what is my role as a global citizen?

The expectations of the SC: SS in Primary 6 involve the topic: *Discovering Southeast Asia*. This is the second part of the Primary 5 and Primary 6 cluster of study entitled *Appreciating the World and Region We Live In*. The content is organised into four strands: knowledge outcomes, skills outcomes, values outcomes, and key concepts. The inquiry focus of the content in SC: SS Primary 6 is:

- How is Southeast Asia important to Singapore?

There are three stated key understandings:

- We live in a diverse region
- We appreciate Southeast Asia for its diversity and the common ties we share
- We cooperate with one another to promote progress and understanding in Southeast Asia.

The content also designates locations for field-based learning.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

For students in Year 6, the expectations of the AC: HASS are **comprehensive** in relation to breadth of coverage. The concepts and skills of AC: HASS (Year 6) allow learners to build upon experiences from the curriculum in Year 3, Year 4 and Year 5 as they continue to explore their personal past and present, an approach that aligns with Hanna’s ‘expanding communities’ model for social science education (Stallones, 2003). In Years 5 and 6, the AC: HASS expands to include four sub-strands (History, Geography, Civics and Citizenship, Economics and Business), presenting concepts and additional inquiry questions within the overview statements for each sub-strand. Each knowledge and understanding content description contains multiple elaborations. The inquiry and skill categories apply across all four sub-strands and each has one or more elements, with one or more elaborations. See Table 3.18.

Table 3.18 *Frequency of curriculum dimensions and elements in AC: HASS, Year 6*

Year 6	Humanities and Social Sciences			
General capabilities	7			
Cross-curriculum priorities	3			
Inquiry questions	3			
Content description: inquiry and skills	12			
Elaborations	54			
Year 6	History	Geography	Civics and Citizenship	Economics and Business
Key concepts	6	5	3	4
Inquiry questions	4	3	3	3
Content description: knowledge and understanding	4	4	6	3
Elaborations	17	13	19	10

SC - Breadth

Breadth: Fundamental

For students in Primary 6, the expectations of the SC: SS are **fundamental** in relation to breadth of coverage. While the content builds upon a broader view of the world explored in Primary 3, Primary 4 and Primary 5, which aligns with Hanna's 'expanding communities' model for social science education, student inquiry returns to being entirely directed to the Singaporean geo-political context in Primary 6. The knowledge and understandings, key concepts and field-based learning experiences are narrow or prescribed, with no elaborations and very limited opportunities for choice or variation. See Table 3.19.

Table 3.19 *Frequency of curriculum elements in SC: Social Studies, Primary 6*

Primary 6	Social Studies
Knowledge outcomes	4
Skills outcomes	5
Values outcomes	3
Key concepts	7
Guiding questions	2
Knowledge and understandings	5
Knowledge assessment objectives	8
Skills assessment objectives	7
Values assessment objectives	4

AC – Depth

Depth: Fundamental

The expectations of the AC: HASS for Year 6 are regarded as **fundamental**. In Year 6, the content descriptions of the AC: HASS expand to 17 areas of knowledge and understanding associated with the topic *Australia in the past and present and its connection with a diverse world*. The depth to which learners should explore each content statement is indicated within its wording, with further possible indicators of depth provided through multiple elaborations which operate as suggestions for classroom implementation. The content descriptions and associated inquiry questions primarily focus upon the collection and recall of information and presentation of narratives and explanations.

SC – Depth

Depth: Fundamental

With respect to depth, the expectations of the SC: SS for Primary 6 are evaluated as **fundamental**. In Primary 6, the content of the SC: SS is limited to three areas: *We Live in a Diverse Region*, *We Appreciate Southeast Asia for its Diversity and the Common Ties We Share* and *We Cooperate with One Another to Promote Progress and Understanding in Southeast Asia*. The content that learners may explore in each of the three areas is prescribed; the targeted knowledge outcomes expect students to ‘identify’, ‘recognise’, ‘explain’ and ‘understand’. The targeted skills outcomes expect students to be able to independently ‘develop’, ‘process’, ‘express’, ‘design’ and ‘work’, and possible locations for field-based learning experiences are recommended. While the wording of the three focus areas encourages student engagement, the associated learning activities are repetitive and lack specific detail.

AC – Rigour

Rigour: Moderate

The cognitive demand placed on Year 6 students in the AC: HASS indicates a **moderate** degree of rigour. The directive terms and expectations of students found in the content descriptions are predominantly associated with recall, recount, explanation and application. This corresponds to the cognitive development of students at Year 6. The Year 6 achievement standards for AC: HASS, written for students in this age group, are dominated by the following terms: ‘identify’, ‘explain’, ‘describe’, ‘compare’, ‘locate’ – with some use of ‘analyse’, ‘interpret’, ‘reflect’ and ‘take action’.

SC – Rigour

Rigour: Moderate

The cognitive demand placed on Primary 6 students in the SC: SS indicates a **moderate** degree of rigour. The directive terms and expectations of students are solely associated with either knowledge recall and recount or behavior and attitudes. This is shown in the Primary 6 level descriptor requiring teachers to ensure that ‘pupils will develop a deeper appreciation of the value of regional cooperation’ and the outcomes expectations: ‘identify’, ‘recognise’, ‘explain’, ‘understand’, ‘process in appropriate ways’, ‘work effectively’, ‘show interest in’,

‘value’ and ‘appreciate’. There is no evidence of a requirement for students to analyse, evaluate or reflect on their learning nor is there any indication of the texts or modes through which students record, communicate or demonstrate their knowledge, skills or understandings. There is one suggested student performance task containing the option for completion as an individual or as part of a group.

Comparative Analysis

The AC: HASS for Year 6 and the SC: SS for Primary 6 are both designed to equip students with knowledge, understanding and skills associated with the people, places, issues and events that have shaped their world. Each curriculum draws in some way upon the ‘expanding communities’ model to shape the context, scope and developmental sequence to be followed.

A key indicator both of the similarities and the differences between AC: HASS and SC: SS can be found in the underlying concepts that shape each curriculum. The pattern apparent in Year 2/Primary 3 is replicated and expanded in Year 6/Primary 6. See Table 3.20.

Table 3.20 *Summary of concepts in AC: HASS, Year 6 and SC: SS, Primary 6*

Concepts in Year 6 AC: HASS	Key concepts in Primary 6 SC: SS
Sources	Cooperation
Continuity and change	Diversity
Cause and effect	Culture
Perspectives	Change and continuity
Empathy	Interconnectedness
Significance	Heritage
Place	Preservation
Space	
Environment	
Interconnection	
Change	
Government and democracy	
Laws and citizens and citizenship	
Diversity	
Identity	
Resource allocation	
Making choices	
Consumer and financial literacy	
Business environment	

While both explore notions of place and space, the AC: HASS includes a wider range of concepts and also engages students in exploring causal relationships and varying points of view.

Students learning about the AC: HASS encounter clear and systematic alignment between the curriculum aims and intentions, the content descriptions (inquiry skills, knowledge and understanding) and the achievement standard. As mentioned earlier, the SC: SS operates within a framework of aims and intentions that is grounded in constructivist inquiry. In the SC: SS, the stated underlying philosophy expects students to ‘attain relevant knowledge and understandings of [real-world] issues, develop critical and reflective thinking skills, and appreciate multiple perspectives’ (MOE, 2016, p. 1). This philosophy is used to underpin the

SC: SS aim to ‘empower students to be informed, concerned and participative citizens’ (MOE, 2016, p. 2). It is also stated that ‘inquiry is recommended for the learning of concepts, skills and exploration in the Social Studies primary syllabus’ (MOE, 2016, p. 6) and advice regarding the processes and pedagogies of inquiry is provided. Models of Scientific Inquiry, Historical Inquiry and Geographical Inquiry are also mentioned, but little elaboration is provided.

The content statements of the SC: SS in Primary 6 are prescriptive, with the targeted skills being generic rather than linked to a specific learning area or discipline, and the knowledge requirements appear limited and deliberately parochial in intention and scope. In this sense, the overarching aims and intentions, with a focus on inquiry, are not evident. There is also little evidence of a developmental hierarchy in expectations or achievement. As an example, the assessment objectives – for knowledge, skills or values – remain the same for each year from Primary 1 through to Primary 6, and the Key Learner Outcomes only describe student attainment of knowledge, skills and values at ‘the end of six years of Social Studies education’ (MOE, 2016, p. 4).

In the documentation, it is explicitly stated that Social Studies in Singapore is not examinable at primary level.

Year/Grade Level

Australian Curriculum: Year 9 and Year 10. History (AC: H), Geography (AC: G), Civics and Citizenship (AC: CC), Economics and Business (AC: EB)

Singapore Curriculum: Secondary 3 and Secondary 4

Learning Area/Subject

Australian Curriculum: Humanities and Social Sciences (AC: HASS)

Singapore Curriculum: Social Studies (SC: SS)

Expectations: Knowledge and Skills

In the AC: HASS diverge in Year 7 to form four discrete subject areas for Year 7 through to Year 10. Students are able to study:

- Australian Curriculum: History (AC: H)
- Australian Curriculum: Geography (AC: G)
- Australian Curriculum: Civics and Citizenship (AC: CC)
- Australian Curriculum: Economics and Business (AC: EB).

In Year 9, the AC: H explores the making of the modern world through a series of depth studies and a mandatory study of World War I and its significance for Australia. The content is organised into two strands: inquiry and skills, knowledge and understanding. The inquiry and skills strand develops students’ capacity in chronology, terms and concepts, historical questions and research, analysis and use of sources, perspectives and interpretations, and explanation and communication. The four guiding inquiry questions are:

- What were the changing features of the movements of people from 1750 to 1918?
- How did new ideas and technological developments contribute to change in this period?
- What was the origin, development, significance and long-term impact of imperialism in this period?

- What was the significance of World War I?

In Year 10, the AC: H offers a focus on the history of the modern world and Australia from 1918 to the present, with an emphasis on Australia's global context. The content is organised into two strands: inquiry and skills, knowledge and understanding. The inquiry and skills strand develops students' capacity in chronology, terms and concepts, historical questions and research, analysis and use of sources, perspectives and interpretations, and explanation and communication. The three guiding inquiry questions are:

- How did the nature of global conflict change during the twentieth century?
- What were the consequences of World War II? How did these consequences shape the modern world?
- How was Australian society affected by other significant global events and changes in this period?

In Year 9, the AC: G provides a study of biomes and food security, and geographies of interconnections. The content is organised into two strands: inquiry and skills, knowledge and understanding. The inquiry and skills strand develops students' capacity in observing, questioning and planning, collecting, recording, evaluating and representing, interpreting, analysing and concluding, communicating, and reflecting and responding. The three guiding inquiry questions are:

- What are the causes and consequences of change in places and environments and how can this change be managed?
- What are the future implications of changes to places and environments?
- Why are interconnections and interdependencies important for the future of places and environments?

For Year 10 students, the AC: G material provides a study of environmental change and management, and geographies of human wellbeing. The content is organised into two strands: inquiry and skills, knowledge and understanding. The inquiry and skills strand develops students' capacity in observing, questioning and planning, collecting, recording, evaluating and representing, interpreting, analysing and concluding, communicating, and reflecting and responding. The three guiding inquiry questions are:

- How can the spatial variation between places and changes in environments be explained?
- What management options exist for sustaining human and natural systems into the future?
- How do world views influence decisions on how to manage environmental and social change?

In Year 9 and Year 10, the AC: CC provides a study of Australia's system of government and its global connections. The content is organised into two strands: skills, and knowledge and understanding. The skills strand develops students' capacity in questioning and research, analysis, research and interpretation, problem-solving and decision-making, and communication and reflection. The knowledge and understanding strand has three themes: government and democracy, law and citizens, and citizenship, diversity and identity. The three guiding inquiry questions in Year 9 are:

- What influences shape the operation of Australia's political system?
- How does Australia's court system work in support of a democratic and just society?
- How do citizens participate in an interconnected world?

The three guiding inquiry questions in Year 10 are:

- How is Australia's democracy defined and shaped by the global context?
- How are government policies shaped by Australia's international legal obligations?
- What are the features of a resilient democracy?

In Year 9, the AC: EB provides a study of interactions within the global economy. The content is organised into two strands: skills, and knowledge and understanding. The skills strand develops students' capacity in questioning and research, interpretation and analysis, economic reasoning, decision-making and application, and communication and reflection.

The four guiding inquiry questions are:

- How do participants in the global economy interact?
- What strategies can be used to manage financial risks and rewards?
- How does creating a competitive advantage benefit business?
- What are the responsibilities of participants in the workplace and why are these important?

In Year 10, the AC: EB offers a study of Australia's economic performance and standard of living. The content is organised into two strands: skills, and knowledge and understanding. The skills strand develops students' capacity in questioning and research, interpretation and analysis, economic reasoning, decision-making and application, and communication and reflection. The four guiding inquiry questions are:

- How is the performance of an economy measured?
- Why do variations in economic performance in different economies exist?
- What strategies do governments use to manage economic performance?
- How do governments, businesses and individuals respond to changing economic conditions?

In the SC, students in Secondary 3 and Secondary 4 undertake a mandatory two-year course in Social Studies and sit for a final examination in this subject. For these learners, Social Studies (SC: SS) is organised into four strands: knowledge outcomes, skills outcomes, values outcomes and key concepts. Three issues are explored over the two years of the course, with each issue containing its own inquiry focus:

- Issue 1: *Exploring Citizenship and Governance*
 - Inquiry focus: Working for the good of society: Whose responsibility is it?
- Issue 2: *Living in a Diverse Society*
 - Inquiry focus: Living in a diverse society: Is harmony achievable?
- Issue 3: *Being Part of a Globalised World*
 - Inquiry focus: Being part of a globalised world: Is it necessarily good?

The aim of the SC: SS is to explore 'societal issues that have been shaping Singapore society and the world' (MOE, 2016, p.5). These broader issues are stated as:

- The need to respond to the 'new diversities' in society
- The need to strengthen the heart of an economically vibrant nation
- The need to grow an informed, concerned and participative citizenry.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

Year 9 and 10 students encounter high expectations through the combined agency of four subject areas; these are deemed to be **comprehensive** in relation to breadth of coverage. The concepts and skills of AC: H, AC: G, AC: CC, and AC: EB in Year 10 allow learners to build on experiences from each of these specific subject areas in Year 7 and Year 8. Each subject has its own collection of overarching concepts, inquiry questions, inquiry skills, knowledge and understanding, with associated elaborations to support teaching and learning. See Table 3.21.

Table 3.21 *Frequency of dimensions and elements of combined subjects in AC, Years 9-10*

Year 9/Year 10	AC: H 9	AC: H 10	AC: G 9	AC: G 10	AC: CC 9	AC: CC 10	AC: EB 9	AC: EB 10
General capabilities	7	7	7	7	7	7	7	7
Cross-curriculum priorities	3	3	3	3	3	3	3	3
Inquiry questions	4	3	3	3	3	3	3	4
Content description: inquiry and skills	12	12	9	9	8	8	7	7
Elaborations	18	20	17	22	19	15	13	18
Content description: knowledge and understanding	16	21	10	11	8	8	5	5
Elaborations	25	32	29	35	25	14	23	21

SC – Breadth

Breadth: Fundamental

For students in Secondary 3 and Secondary 4, the expectations of the SC are deemed to be **fundamental** in relation to breadth of coverage. The skills and values of the SC: SS are replicated in each of the three topics, while the knowledge outcomes, key concepts and key understandings are drawn only from the geo-political context of 21st century Singapore. See Table 3.22.

Table 3.22 Frequency of curriculum elements in SC, Secondary 3-4

Secondary 3/Secondary 4	SC: SS
Knowledge outcomes	12
Skills outcomes	6
Values outcomes	5
Key concepts	14
Key understandings	9
Guiding questions	11
Content	13
Knowledge with understanding assessment objectives	1
Interpreting and evaluating sources/given information assessment objectives	7
Constructing explanations assessment objectives	2

AC – Depth

Depth: Fundamental

The expectations of the AC: HASS for Year 10 are **fundamental**, based on the details of knowledge and topics outlined in the curriculum. In Year 10, the AC: HASS expands to include four separate subject areas: History, Geography, Civics and Citizenship, and Economics and Business. Each has its own content descriptions (incorporating skills, knowledge and understanding) and associated elaborations to support teaching and learning. The depth to which learners should explore each content statement is indicated within its wording. Individually, each subject area has the potential to be challenging in its depth. Collectively, the coverage and mastery of the multiple components of the four subject areas could be challenged by time constraints. The content descriptions primarily focus upon descriptions, explanations, interpretations and communication.

SC – Depth

Depth: Fundamental

The expectations of the SC: SS for Secondary 3 and Secondary 4 are evaluated as **fundamental**. Over the two-year period of study, the content of the SC: SS is limited to three areas: *Exploring Citizenship and Governance*, *Living in a Diverse Society* and *Being Part of a Globalised World*. The content that learners may explore within each of the three topics is prescribed; the targeted knowledge outcomes are dedicated solely for students to ‘understand’. The targeted skills outcomes expect students to be able to independently ‘examine’, ‘gather’, ‘interpret’, ‘evaluate’ and ‘demonstrate’. As with other year levels, possible locations for field-based learning experiences are listed in the SC: SS. In line with the broad outcome, little detail or specificity is provided to support learning.

AC – Rigour

Rigour: Challenging

The cognitive demand placed on Year 10 students in each of the four subject areas that comprise the AC: HASS indicates a **challenging** degree of rigour. The directive terms and expectations of students visible throughout the content descriptions of the four subject areas are predominantly associated with acquisition and application. Across the four subject areas, the Year 10 achievement standards for the ‘typical’ student are dominated by the following terms: ‘analyse’, ‘evaluate’, ‘apply’ and ‘take action’.

SC – Rigour

Rigour: Moderate

The cognitive demand placed on Secondary 3 and Secondary 4 students in the SC: SS indicates a **moderate** degree of rigour. While Section 3 of the SC: SS provides details of the ‘recommended pedagogy’ as ‘inquiry-based learning’ (MOE, 2016a, pp. 14-17), the directive terms and expectations of students detailed in Section 2: Content are solely associated with either knowledge recall and recount, or behavior and attitudes. This is reflected in the descriptors for each topic – ‘begin exploring’, ‘appreciate diversity’, ‘understand and make meaning’ and ‘will therefore appreciate’ – and in the outcomes expectations: ‘understand’, ‘examine’, ‘demonstrate’, ‘empathise’, ‘respect’ and ‘appreciate’. While there is some indication that students are expected to ‘interpret and evaluate’ information sources to ‘make well-reasoned and substantiated conclusions’, there is no indication that students will need to undertake critical analysis or reflect on their learning. No detail is given regarding the ways in which students record, communicate or demonstrate their knowledge, skills or understandings. Two of the four guiding questions are associated with knowledge outcomes and content that are designated as ‘non-examinable’. It is a requirement that all students complete one ‘inquiry investigation’ either in Secondary 3 or Secondary 4. The scope of this investigation is determined by the school, with some outcomes not to be assessed ‘if students require more help from teachers’ (MOE, 2016, 2017, p. 19).

Comparative Analysis

The AC: HASS in Year 9 and Year 10, and the SC: SS in Secondary 3 and Secondary 4 occur at similar end points in secondary schooling. AC: HASS marks the final two years of an 11-year unbroken sequence of humanities education. SC: SS provides a two-year course for presentation at the General Certification of Education (GCE) ‘O’ and ‘N(A)’ examinations. The SC: SS does not include a course in Secondary 1 and Secondary 2, except at the non-examinable level. As a consequence of meeting GCE requirements, the majority of Singapore students do not receive continuous education in the humanities, and it appears that this lack of continuity impacts upon the breadth, depth and rigour of the SC: SS.

The AC: HASS in Years 7-10 replaces the four integrated sub-strands with four separate subject areas: History, Geography, Civics and Citizenship, and Economics and Business. Across all year levels, the targeted inquiry skills are organised developmentally or hierarchically according to the subject-specific aims and associated achievement standards.

Australian students in Years 9 and 10 experience clear and systematic alignment between the curriculum aims and intentions, the content descriptors (inquiry skills, knowledge and understanding) and the achievement standard. A constructivist inquiry approach informs the SC: SS's aims and intentions and, as in the primary years, the stated underlying philosophy is for Secondary 3 and Secondary 4 students to 'attain relevant knowledge and understandings of [real-world] issues, develop critical and reflective thinking skills, and appreciate multiple perspectives' (MOE, 2016, p. 2). This philosophy is used to inform the SC: SS's aim to 'empower students to be informed, concerned and participative citizens' (MOE, 2017, p. 3). Detailed advice is provided regarding the pedagogy of inquiry-based learning, the elements of inquiry and the stages of the Social Studies inquiry process. No examples are provided to support teachers or schools in the implementation of these approaches.

In the AC: H, AC: G, AC: CC and AC: EB, the possible amount of time allocated to the delivery of each subject area is indicated in the notional advice given to the curriculum writers, for example, Year 10 is accorded 17% of time (5% History, 5% Geography, 2% Civics and Citizenship, 5% Economics and Business). (ACARA, 2013, p. 9).

This curricular design contrasts with the SC: SS which imposes no temporal parameters upon the delivery of its curriculum. Instead, focus is given to student preparation for the GCE 'O' and 'N(A)' examinations at the end of Secondary 4 and its associated assessment requirements: one examination paper of 1 hour and 45 minutes duration, made up of one source-based question based on an unseen issue to assess skills, and one structured-response question to assess knowledge and understanding. The presence or absence of these parameters consequently impacts upon any judgement of breadth, depth and rigour regarding the content and expectations of the AC: HASS and the SC: SS.

The following overall conclusions are drawn from this comparative analysis of the AC: HASS (including AC: H, AC: G, AC: CC and AC: EB) and the SC: SS:

- both curricula provide frameworks for teaching and learning that are developmentally and culturally appropriate
- the breadth of the AC: HASS expands over time, with the inclusion of an increased number of sub-strands in Year 6 and four discrete subject areas in Year 10, and this may impact upon the depth with which the curriculum is implemented in schools (or classrooms)
- the breadth of the SC: SS is relatively narrow and unchanging while at the same time providing little allowance for the study of topics in greater depth
- the AC: HASS provides details of student performance expectations via the achievement standards for each sub-strand and subject
- the SC: SS provides no guidance on or details about student performance expectations
- the AC: HASS provides for continuous developmental acquisition of the skills and knowledge associated with all four strands of the Humanities
- the SC: SS is broken at the end of Primary 6, with no explicit connection or sequence between the developmental demands in Primary 6 and the requirements in Secondary 3/Secondary 4

- while the SC: SS is presented within a philosophical and pedagogical framework of constructivism, inquiry and 21st century learning, the content is constrained within the parameters of the expectations of citizens of Singapore
- both AC: HASS and SC: SS rely on the programming and classroom practices of individual teachers, schools or districts to fulfil their potential for student engagement and rigour in learning, with the AC: HASS providing greater specific support and guidance in these areas.

Additional Observations

A year-by-year comparison of the 'topics' for each year in the AC: HASS and the SC: SS is shown in Table 3.23. It is noted that in the pre-secondary years AC: HASS is a seven-year course, SC: SS is a six-year course. In the secondary years, AC: H, AC: G, AC: CC and AC: EB are four-year courses, SC: SS is a two-year course. The coloured bands indicate the comparison points in the preceding analysis.

Table 3.23 Year-by-year comparison of 'topics' in AC: HASS and SC: SS

Year	Australian Curriculum	Singapore Curriculum
Foundation/ Kindergarten	HASS: My Personal World	
Year 1/ Primary 1	HASS: How My World is Different From the Past and Can Change in the Future	SS: Knowing Myself, Others and My Surroundings
Year 2/ Primary 2	HASS: Our Past and Present Connections to People and Places	SS: Coming Together as a Nation
Year 3/ Primary 3	HASS: Diverse Communities and Places and the Contribution People Make	SS: Understanding Singapore
Year 4/ Primary 4	HASS: How People, Places and Environments Interact, Past and Present	SS: Valuing Our Past
Year 5/ Primary 5	HASS: Australian Communities – Their Past, Present and Possible Futures	SS: Appreciating the World
Year 6/ Primary 6	HASS: Australia in the Past and Present and Its Connection with a Diverse World	SS: Discovering Southeast Asia
Year 7/ Secondary 1	H: The Ancient World G: Water in the World; Place and Liveability CC EB	SS not offered
Year 8/ Secondary 2	H: The Ancient to the Modern World G: Landforms and Landscapes; Changing nations CC EB	
Year 9/ Secondary 3	H: The Making of the Modern World G: Biomes and Food Security; Geographies of Interconnections CC EB	SS: Exploring Citizenship and Governance Living in a Diverse Society Being Part of a Globalised World
Year 10/ Secondary 4	H: The Modern World and Australia G: Environmental Change and Management; Geographies of Human Wellbeing CC EB	

To qualify for the GCE 'O' and 'N(A)', Singapore students may also enroll in additional studies in History or Geography.

In Secondary 3 and Secondary 4, the SC: H is organised into two strands: key knowledge and skills, and values and attitudes. Three topics are explored over the two years of the course: *European dominance and expansion in the late 19th century*, *The world in crisis* and *Bi-polarity and the Cold War*. Each topic has its own inquiry focus:

- How were systems and societies transformed by colonialism?
- What forces and developments changed Europe and the Asia-Pacific in the first half of the 20th century?
- How did the Cold War impact the world order in the post-1945 years?

In Secondary 3 and Secondary 4, the SC: G is organised into two strands: knowledge, and skills. Three themes are covered over the two years of the course, each consisting of three topics:

- *Our Dynamic Planet (Physical Geography)*
 - Coasts – Should coastal environments matter?
 - Living with Tectonic Hazards – Risk or opportunity?
 - Variable Weather and Changing Climate – A continuing challenge?
- *Our Changing World (Human Geography)*
 - Global Tourism – Is tourism the way to go?
 - Food Resources – Is technology a panacea for food shortage?
 - Health and Diseases – Are we more vulnerable than before?
- *Geographical Skills and Investigations*
 - Topographical map reading skills
 - Geographical data and techniques
 - Geographical investigations

Both courses are designed to align with Singapore’s 21st Century Competencies and Character and Citizenship Education, but their structures, details and expectations differ markedly, as detailed in Tables 3.24 and 3.25.

Table 3.24 *History – curriculum design in SC, Secondary 3-4*

Secondary 3/Secondary 4	SC: H
Knowledge and skills	14
Values and attitudes	11
Key knowledge	8
Inquiry questions	3
Key concepts	28

Table 3.25 *Geography – curriculum design in SC, Secondary 3-4*

Secondary 3/Secondary 4	SC: G
Learning outcomes	84
Content knowledge	66
Content skills	45
Key questions	18

e) Technologies

Comparative Curricula

Australian Curriculum: Technologies	Version 8.3, 2016
Singapore Curriculum: Design and Technology	Teaching and Learning Syllabus Lower Secondary, 2007
Singapore Curriculum: Food and Consumer Education	Syllabus Lower Secondary, 2014

Year/Grade Level

Australian Curriculum: Year 2
Singapore Curriculum: Primary 3

Learning Area/Subject

Australian Curriculum: Technologies (AC: T)
Singapore Curriculum: Design and Technology (SC: D&T); Food and Consumer Education (SC: FCE)

There are no comparative subjects in Year 2/Primary 3 for Technology education in Singapore. See notes in Year 8 comparison regarding ICT in the SC.

Year/Grade Level

Australian Curriculum: Year 6
Singapore Curriculum: Primary 6

Learning Area/Subject

Australian Curriculum: Technologies (AC: T)
Singapore Curriculum: Design and Technology (SC: D&T); Food and Consumer Education (SC: FCE)

There are no comparable subjects in Year 6/Primary 6 for Technology education in Singapore. See notes in Year 8 comparison regarding ICT in the SC.

Year/Grade Level

Australian Curriculum: Year 8
Singapore Curriculum: Secondary 3

Learning Area/Subject

Australian Curriculum: Technologies (AC: T)
Singapore Curriculum: Design and Technology (SC: D&T); Food and Consumer Education (SC: FCE)

As there are no comparable subjects in Year 10/Secondary 4 for Technology education, the comparative analysis of the two curricula has been undertaken at Year 8/Secondary 3.

Expectations: Knowledge and Skills

The expected learning for the AC: T for Year 8 is presented in the achievement standards (subject-specific or learning area) for the Year 7 to 8 band. Schools choose from two sets of

achievement standards to report on student learning. The Technologies learning area has five key ideas (creating preferred futures, project management and types of thinking: systems, design and computational). There are two subjects: Design and Technologies and Digital Technologies; the two subjects have a common strand structure. The processes and production skills strand provides common threads that are addressed across both subjects. In the AC: Design and Technologies, students create designed solutions for each of the following prescribed technologies contexts: engineering principles and systems, food and fibre production; food specialisations, and materials and technologies specialisations. In Digital Technologies, students are expected to create a range of digital solutions through guided play and integrated learning as they explore digital systems and the representation of data and develop processes and production skills. Both subjects have a common strand structure (ACARA, 2017d).

The expected learning for the SC in relation to Technology education for Secondary 3 is addressed in two subjects: Design and Technology (SC: D&T) and Food and Consumer Education (SC: FCE). Design and Technology (SC: D&T) was published in 2006 for implementation in 2007. It is a compulsory project-based subject focused on design and the application of knowledge and process skills. Students engage in designing and making activities through a process of design. Activities are suited to their interest, ability and design contexts. The syllabus comprises three learning domains (design appreciation, designing, making). Suggested topics for each domain are provided and should be implemented using an integrated approach and drawing on knowledge and skills developed in other subject areas. Learning outcomes for each topic are provided, similar to the AC content descriptions. Assessment guidelines include assessment objectives and advice regarding mode and weightings. An assessment rubric is provided for five levels, with guidelines that include assessment objectives and advice regarding mode and weightings.

SC: FCE is focused on preparing students for 21st century life in relation to health and financial management. SC: FCE was published in 2014 and is closely aligned to Singapore's 21st Century Competencies. There are two core areas of study: Food Studies and Consumer Studies. In Food Studies, students learn about diet and health and food management skills. In Consumer Studies, students learn about principles of consumerism, how to manage resources and financial literacy. Students also choose one from three elective modules (food entrepreneurship, nutrition and food science and FCE and the community).

Singapore's ICT Masterplan provides a direction for the use of ICT in education. The basic philosophy underpinning the Masterplan is that the educational system should prepare the students to meet future needs. The AC: Digital Technologies and the Singapore ICT baseline standards are not directly in line. The baseline ICT standards are more closely linked to the AC: ICT capability. The main difference between the two curricula lies in the expectations for knowledge and understanding/content. The AC specifies content relating to digital systems and representation of data whereas the SC focuses on ICT skills addressed through the content of other learning areas. Computer studies courses are provided in later years and have some similarities to the AC: Digital Technologies in the earlier years of schooling. More information about the Masterplan is provided in "Additional Observations" at the end of this section and in the section on General Capabilities.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

For Year 8 students, the expectations of the AC: T are **comprehensive** in relation to breadth of coverage. Students are expected to address twenty content descriptions across two subjects: Design and Technologies and Digital Technologies. This content provides the opportunity to develop knowledge and understanding of technologies and society and four technologies contexts in Design and Technologies. The comprehensive nature of this curriculum is seen as students explore a range of technologies contexts (engineering principles and systems, food and fibre production, food specialisations and materials and technologies specialisations). The breadth of the processes and production skills strand is comprehensive. It comprises five threads (investigating and defining, generating and designing, producing and implementing, evaluating, and collaborating and managing). Students are expected to create designed solutions (at least one product, one service and one environment) and digital solutions for a range of contexts from Year 7 to Year 8. In Digital Technologies, they develop knowledge and understanding of digital systems and the representations of data. In Digital Technologies, students define problems and design, and implement and evaluate a range of digital solutions, including using visual programming.

Table 3.26 *Frequency of content descriptions and elaborations in AC, Year 8 Technologies*

Year 8 Technologies	Strand: knowledge and understanding	Strand: process and production skills	Total
Design and Technologies content descriptions	5	5	10
Elaborations	29	23	52
Digital Technologies content descriptions	2	8	10
Elaborations	10	38	48

SC – Breadth

Breadth: Fundamental

For students at the end of Secondary 3, the expectations of the SC: D&T and SC: FCE are **fundamental** in relation to breadth of coverage. The content in D&T is presented as three learning domains (*design appreciation, designing, making*). Suggested topics for each

domain are provided and should be implemented using an integrated approach and drawing on knowledge and skills developed in other subject areas. It is an expectation that between five and eight projects may be completed, with each project taking four to six weeks. Students learn about three types of technology: electronics, mechanisms and structures (MOE, 2007b). The breadth is extended in the *making* domain when students ‘understand the basic properties of common materials in relation to their use (resistant materials, wood, metal and plastics and modelling materials)’ (MOE, 2007b) and related practical processes. In the SC: FCE, students additionally become familiar with meal planning, diet-related diseases, methods of cooking, food and kitchen safety, culinary skills and food and culture (MOE, 2014b). Food and fibre production is not addressed in the CS. In relation to digital technologies, the focus is on ICT capability rather than knowledge and understanding of digital systems, data or the processes and production skills associated with creating digital solutions.

AC – Depth

Depth: Challenging

The expectations of the AC: T are considered **challenging** for Year 8 learners. According to the website, the AC: T requires students to ‘analyse how and why...’ (ACTDEK032), allowing depth in communicating ideas and processes. Students are also asked to ‘critique needs or opportunities...’ (ACTDEP035), providing an opportunity for deep understanding. Strategic thinking is evident when students are planning, creating and communicating ideas and information, negotiating criteria and evaluating. The transfer of knowledge and skills from one context to another provides opportunities for deeper engagement and the depth to which learners may explore each content description is clearly indicated with multiple elaborations across the two subjects.

SC – Depth

Depth: Fundamental

For Secondary 3 students, the expectations of the SC: D&T and the SC: FCE are equally regarded as **fundamental**. For example, D&T students ‘appreciate how technology is applied to enhance product functionality’ and ‘recognise the use of different methods of reinforcing structures’ (MOE, 2007b). In FCE, students ‘state the reasons for cooking food (palatability, safety, digestibility)’ and ‘list the different food groups found in the My Healthy Plate and their functions’ (MOE, 2014b).

Some content in D&T is more challenging, such as ‘describe the use of mechanisms in conversion and transmission of motion’, ‘evaluate their artefact against design specifications’ (MOE, 2007b). In FCE, students ‘distinguish, compare and analyse the differences in the results of the sensory properties in food products’ and ‘evaluate eating patterns and link to the different diet-related diseases’ (MOE, 2014b).

AC – Rigour

Rigour: Challenging

The rigour of the AC: T is deemed to be **challenging**. The cognitive demand placed on Year 8 students includes investigating, analysing, evaluating, critiquing and developing criteria for

success. For example, students should ‘independently develop criteria for success to evaluate design ideas, processes and solutions and their sustainability’ (ACTDEP038). Students are required to plan and work collaboratively including online sharing of ideas, such as ‘use project management processes when working individually and collaboratively to coordinate production of designed solutions’ (ACTDEP039). In Digital Technologies, students ‘define and decompose real-world problems taking into account functional requirements and economic, environmental, social, technical and usability constraints’ (ACTDIP027) and ‘design algorithms represented diagrammatically and in English, and trace algorithms ...’ (ACTDIP029). Multiple elaborations provide pedagogical suggestions for how the content descriptions could be addressed in the classroom, several of which identify opportunities for increased rigour.

SC – Rigour

Rigour: Moderate

The level of rigour of the SC: D&T and the SC: FCE is assessed as **moderate**. While the cognitive demand on Secondary 3 students in D&T is sometimes challenging, such as when students ‘reflect on the progress of their work as they design and make’ and ‘investigate and evaluate a range of relevant consumer products in terms of meeting needs and fitness for purpose’ (MOE, 2007b), the overall expectation as described in the curriculum is moderate.

In FCE, the level of rigour is moderate when students ‘state the impact of eating habits on health’, but more challenging when they ‘differentiate the nutritional requirements of the different groups of people (young children, teenagers, adults, elderly)’ (MOE, 2014b). The level of rigour also increases depending on the elective module selected. For example, in the Nutrition and Food Science module, students ‘develop skills of seeking, interpreting, analysing and evaluating information for effective decision-making’, and in Food Entrepreneurship, students ‘exhibit entrepreneurship skills (financial, marketing) when developing a proposal for a food venture’ (MOE, 2014b). These expectations are appropriate for the age group.

Comparative Analysis

The AC: T and the SC: D&T / SC: FCE are not comparable. The breadth of the SC is achieved across two subjects but does not address food and fibre production or Digital Technologies as in the AC. Engineering principles and systems are addressed in a limited way in SC: D&T. The depth and rigour of the AC is challenging and of the SC generally moderate. However, greater depth and rigour are expected in the SC: FCE than in the SC: D&T. This may be a result of the development of more recent curriculum; that is, 2014 versus 2006.

The breadth, depth and rigour of the AC: Digital Technologies and the Singapore ICT competencies are not comparable. Although a rationale and key ideas supports the AC: Digital Technologies and also for ICT Capability, the SC: ICT is defined by a vision statement published by the Ministry of Education, Singapore, as represented in Figure 3.4.

Vision



*Future-ready &
Responsible Digital Learners*

Outcome Goal



*Quality Learning in the Hands of Every Learner-
Empowered with Technology*

Enablers



*Teachers as Designers of Learning
Experiences & Environments*



*School Leaders as
Culture Builders*

Implementation focuses on



*Integrating ICT into
curriculum & assessment*



*Designing
quality online
resources*



*Developing
Cyber Wellness &
New Media Literacies*



*Providing
professional development &
facilitating learning communities*



*Innovating & developing
good practices for
ICT in education*



*Providing infrastructure
to support anytime,
anywhere learning*

Figure 3.4 ICT Connection Masterplan 4

Reproduced from: Ministry of Education, Singapore (<https://ictconnection.moe.edu.sg>, August 2017)

In comparison to the AC, where Digital Technologies and Design and Technologies are two distinct subjects, Singapore's ICT curriculum offers guidelines on baseline ICT standards for digital learners. These standards align with the broad purpose of the AC: General Capability, ICT Capability. However, the AC is more detailed in its expectations, as described in the learning continuum. The SC baseline ICT standards (see Figure 3.5) outline targeted skills without specific knowledge requirements or a developmental hierarchy of achievement expectations. Educators have a basic framework for designing learning experiences for students but there is no evidence of how this is implemented at a school level. The MOE encourages schools to design their own programs from primary levels up and, in some cases, to work with companies to develop new skills.

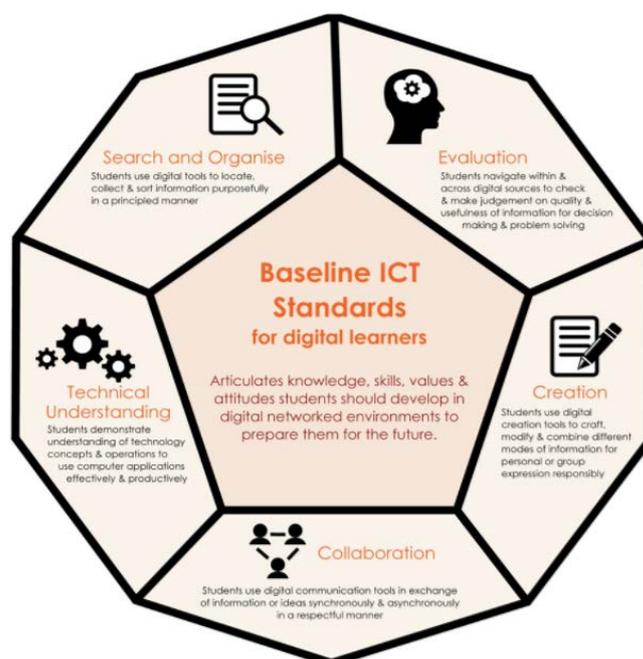


Figure 3.5 Baseline ICT Standards for digital learners.

Reproduced from: Ministry of Education, Singapore (<https://ictconnection.moe.edu.sg/masterplan-4/key-features/being-and-becoming-responsible/new-baseline-ict-standards>, August 2017)

Table 3.27 provides a quantitative indication that, in Year 8, the AC and the SC differ in terms of breadth. The AC expresses content as knowledge and understanding and processes and production skills, whereas the content in the SC is presented as domains/areas of study and learning outcomes.

Table 3.27 Comparison of content: AC and SC

Year 8	Australian Curriculum		Singapore Curriculum	
General capabilities/ 21 st century competencies	7		3	
Cross-curriculum priorities	3		-	
Learning area	Technologies		Sciences	
Key ideas	5		-	
Subjects	Design and Technologies	Digital Technologies	Design and Technology	Food and Consumer Education
Objectives/aims	6	5	5	7
Knowledge and understanding content descriptions/learning outcomes	5	2	12	17 core food 14 elective food
Elaborations	29	10	-	-
Processes and production skills/learning outcomes	5	8	22	12 core food
Elaborations	23	38	-	-

Students learning through the AC use technologies knowledge and understanding, processes and production skills, and systems, design, and/or computational thinking to solve and produce creative solutions to problems, needs or opportunities. They communicate and record their ideas using a range of media and technologies. These specialised problem-solving activities will be sophisticated, acknowledge the complexities of contemporary life and may make connections to related specialised occupations and further study. Students develop a global perspective; they have opportunities to understand the complex interdependencies involved in the development of technologies and between the developer and user in their solutions, and how these can contribute to preferred futures. Students develop an understanding of the interdependence of technologies development, values, beliefs and environment (aka systems thinking). Through undertaking technologies processes, students develop systems, design and computational thinking, and organisational and project management skills (ACARA, 2017d)

Embedded in its curriculum documentation, a Singaporean student should have ‘a good sense of self-awareness, a sound moral compass, and the necessary skills and knowledge to take on challenges of the future. A student is responsible to his family, community and nation’ (MOE, 2017f). Some similarity exists between the Australian government’s goals for its students (MCEETYA, 2008) and Singapore’s expectation for its students to develop an awareness of the environment and maintain good physical and mental health. An overarching aim is that students become confident, self-directed, active contributors and concerned citizens. These aspirations for students are particularly evident in the SC: FCE as it is strongly aligned to the SC 21st Century Competencies.

Additional Observations

There are two distinct computing syllabi available in the SC, although it is not possible to make direct comparisons as they sit outside the parameters of this comparative study. The 2012 Computer Application Syllabus is compulsory for any upper secondary students taking the Normal Technical Educational pathway. The syllabus is compulsory and reflects a set of competencies in Computer Fundamentals, Media Elements, Document Processing, Spreadsheets, Multimedia Communication and Media Computing.

From 2017, Upper Secondary students following the normal and express pathway will undertake a compulsory computing syllabus at O-level. This syllabus is more in line with the types of thinking described in the AC: T, that is, systems thinking, computational thinking and design thinking. It includes data, communications, abstraction and algorithms and programming which are part of the foundations of the AC: Digital Technologies from Foundation to Year 10.

The SC: ICT has moved through a number of masterplan reviews:

- The first ICT Masterplan in Education (1997 to 2002) laid the foundation for schools to harness and use ICT. Under this phase, schools were equipped with the basic ICT infrastructure and teachers with a basic level of ICT integration skills.
- The second ICT Masterplan (2003 to 2008) further strengthened the integration of ICT into teaching and learning, established baseline ICT standards for students and promoted the innovative use of ICT among schools.

- The third ICT Masterplan in Education (2009 to 2014) was launched in August 2008 by the MOE and it was a continuation of the earlier two masterplans, with the goal of transforming pedagogy and providing students with the ICT competencies necessary for the future (Lim et al., 2014).
- The fourth Masterplan for ICT in Education (mp4) promises to build on the achievements of the first three masterplans and broadens the focus beyond Self-Directed Learning and Collaborative Learning to the Total Curriculum. In mp4, ICT is used productively to develop knowledge through subject mastery, skills through 21st Century Competencies, and attitudes through responsible digital citizenry. The mp4 is also aligned to MOE's direction towards student-centric and values-driven education (Lim et al, 2014).

f) Health and Physical Education

Comparative Curricula

Australian Curriculum: Health and Physical Education	Version 8.3, 2016
Singapore Curriculum: Physical Education	Syllabus (Primary, Secondary, Pre-University), 2006
Singapore Curriculum: Health Education	Syllabus for Primary Level, 2007
Singapore Curriculum: Food and Consumer Education	Syllabus, 2014 (Food Studies)
Singapore Curriculum: Physical Education	Physical Education (Primary, Secondary, Pre-University), 2006

Year/Grade Level

Australian Curriculum: Year 3
Singapore Curriculum: Primary 3

Learning Area/Subject

Australian Curriculum: Health and Physical Education (AC: HPE)
Singapore Curriculum: Physical Education (SC: PE) and Health Education (SC: HE)

Expectations: Knowledge and Skills

The AC: HPE is articulated through two interrelated strands of Personal, social and community health and Movement and physical activity. By the age of seven, students are expected to be able to make simple decisions and start taking action to keep themselves and others healthy, safe and physically active. Being able to recognise opportunities for health, safety and wellbeing promotion; examine health-related messages; and recognise, respect and celebrate diversity are all strategies that are foundational for future learning. Building on previous learning, students identify how emotional responses impact on others' feelings, develop personal and social skills and some help seeking strategies. The curriculum expects students to broaden the range and complexity of their fundamental movement skills and investigate the body's response to different types of physical activities. The HPE curriculum is distinguished by an expectation that Year 3 students be able to test alternatives to solve movement challenges and have the capacity to recognise how strengths and achievements contribute to their own and others' identities.

The SC: PE for Primary 3 is described through four components: fundamental movement, educational gymnastics, dance, and swimming as avenues to develop students' psychomotor skills, control and co-ordination demonstrating age-appropriate technical skill, for example, being able to perform a simple gymnastics sequence.

Prior to 2007, Health in Singapore was taught within English and other subjects. Now it has an assigned separate 30-minute period per week. Health Education is organised into three dimensions: Physical Health, Environment and Your Health, and Emotional and Psychological Health, providing a holistic approach to health beyond just the physical. Students are expected to transfer their knowledge across these three dimensions. Seven-year-old students are expected to apply their learning about physical, social and emotional health to their own lives, for example, by practising good hygiene such as hand-washing.

The AC: HPE and the SC are comparable in requiring Year 3 students to develop fundamental movement skills and be physically active through a variety of modified games and activities. Both curricula encourage students to take action and expect seven-year-olds to understand how to be healthy, safe and active. Both expect students to understand and build upon their strengths and take action beyond self. A focus on technical skill is more explicit in the SC.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

For students in Year 3, the expectations of the AC: HPE are **comprehensive** in relation to breadth of coverage. The curriculum expects teachers to cover 17 content descriptions as well as nine focus areas over Years 1 and 3. This content, supported by 57 elaborations, covers a comprehensive range of health and physical activity topics from understanding identities and valuing diversity to developing movement concepts and strategies in games. Students are expected to demonstrate a wide range of understanding and skills that will assist them to make simple but informed decisions about health, safety and being active, as described in the Years 1 and 3 achievement standard. The AC: HPE also draws upon general capabilities, particularly personal and social capability, critical and creative thinking, and ethical understanding, to enhance the curriculum.

SC – Breadth

Breadth: Comprehensive

On balance, the expectations of the SC for Primary 3 students across health and physical education are **comprehensive**. The focus is on students expanding their knowledge and skills. There are four components of the Primary 3 PE syllabus and four expected learning outcomes. Students are expected to spend half of their PE curriculum time developing fundamental movement skills that build a strong foundation for lifelong participation in sports and games and lay foundations for future learning. The remainder of a Primary 3 student's learning is in Educational gymnastics (40%), Dance (10%) and swimming. Swimming can be provided within the curriculum time – in which case time is adjusted on other components – or conducted out of school hours. Health education in P3 expects teachers to cover 25 detailed learning objectives through eight health topics in P3 across physical, emotional, psychological, and environmental health. These topics in P3 include: diet and growth; eating right, food and teeth, eye care, safety in public places, mosquito-borne disease, caring for others, and conflict with others. Through developing knowledge and skills, Primary 3 students are expected to develop and practise good health habits and attitudes.

AC – Depth

Depth: Fundamental

The expectations of the AC: HPE curriculum are regarded as **fundamental**. The depth to which learners are encouraged to explore content includes connecting foundational knowledge and observations with more abstract concepts such as identity. Students are also expected to move beyond recall to show that they can apply their reflections to their sense of self as well as transfer their movement skills to a range of situations. Deep and creative thinking is encouraged, whereby students are expected to create games and movement sequences to solve movement challenges. Connecting learning between strands, sub strands and threads enables application of understanding to a range of contexts. For example, in the ‘interacting with others’ thread, describing ways to include others to make them feel they belong (ACPPS019) is related to expected learning from the ‘team work and leadership’ thread, and students use strategies to work in group situations when participating in physical activities (ACPMP030).

SC – Depth

Depth: Challenging

The expectations of the Primary 3 curriculum in relation to depth are **challenging**. The Primary 3 PE curriculum expects students to perform a variety of movement and game skills in a coordinated and technically correct manner, identify and use elements of movement to perform a dance in a rhythmic manner and perform simple gymnastics sequences. Such depth of skill mastery requires concerted and consistent effort from students. Fifty percent of curriculum time on fundamental skills means that students can deepen their skill learning. Potential for deeper learning is also provided through creative dance and educational gymnastics content, where students are expected to understand expressive movement and respond to open-ended movement tasks with novel responses. Through SC: HE, students are expected to behave safely, establish good health habits and healthy attitudes, show consideration for others and demonstrate care for the environment. Seven-year-old students are expected to understand that good eating and exercise are needed to develop and maintain healthy growth, identify types of food and make healthy choices. There is a focus on considerable depth of factual knowledge. For example, students are expected to know how to prevent accidents while playing and stay safe on the road and in public places. They are expected to know how germs are spread and how to take precautions against illness and disease. There is a wide scope of health topics to cover in depth in thirty minutes per week.

AC – Rigour

Rigour: Moderate

The terminology and expectations of the AC: HPE (Year 3), as shown in the content descriptions, are predominantly associated with the development of skills and concepts (see Webb’s DoK 1997; 1999), indicating a **moderate** degree of rigour in the Year 3 HPE curriculum. The cognitive demand placed on Year 3 students in the HPE curriculum content requires them to develop skills and understanding through comparing, applying, describing and explaining, supported by the elaborations tied to a content point. The expected learning also utilises creative and collaborative skills for enabling students to apply solutions to their

own movement problems, issues and everyday lives. Multiple elaborations provide additional suggestions designed to encourage multiple approaches and solutions to stretch students' cognitive capacity. The Year 3 achievement standards for HPE use verbs such as 'identify', 'describe', 'examine', 'demonstrate', 'select' and 'apply.'

SC – Rigour

Depth: Moderate

The cognitive demand of the Health and PE Primary 3 subjects involves variable opportunities for flexibility of thinking and choice. Therefore, on balance, the SC is measured as **moderate**. PE for seven-year-olds is structured around four components, which predominantly centre on the development of skills and concepts, indicating a limited degree of rigour. For example, the cognitive demand placed on Primary 3 students in PE involves development of skills to *demonstrate, incorporate movement concepts and perform in technically correct ways* (MOE, 2005, p. 8). After Primary 2, the focus of dance moves from the application of creative thinking skills to performance of folk dance. There is scope for PE teachers to engage students in higher order thinking through open-ended tasks in educational gymnastics where students are expected to create novel responses as well as begin to *refine, extend and increase the complexity of skills* (MOE, 2006, p. 8).

In SC: HE, there is an emphasis on acquiring detailed health knowledge and putting this into action. For example, *recognise the importance of developing good oral hygiene habit* (MOE, 2006, p. 11). Although guidance provided in the syllabus document encourages teaching approaches that stimulate creativity, problem-solving and decision-making, opportunities for higher order thinking are not described in learning objectives. Students are expected to make right choices and good decisions about their behaviour. For example, with a focus on personal safety in public places, students are expected to *recognise dangerous situations and react to them in ways to reduce any harmful effects* (MOE, 2006, p. 14). This places considerable responsibility on seven-year-old students and although the focus is on *knowing ways to ensure safety*, the learning may involve a level of creative thinking.

Comparative Analysis

The expectations of students in the AC: HPE and SC: PE Primary 3 have some commonalities. However, consideration of breadth and depth indicates that there are differences at this comparison point.

Both curricula organise learning around concepts of health, safety and physical skill development and provide teachers with opportunities to engage students in creative thinking and making healthy and safe choices. Both curricula expect seven-year-olds to begin to take responsibility for their own and others' health and wellbeing. The types of activities and the requirement to demonstrate and apply strategies set high expectations for children of this age.

The Singaporean and Australian curricula are both flexible in allowing teachers to substitute or select appropriate activities based on student need and local context, provided the chosen activities help students attain expected learning outcomes and achievement standards.

Both curricula regard movement as a powerful tool for developing self-management, social and cooperative skills and emphasise affective, cognitive and psychomotor development. In relation to physical activity, both the AC: HPE and the SC: PE expect students to develop a range of fundamental movement skills. In the AC: HPE, Year 1 and 2, students focus on fundamental movement skills, active play and minor games with and without equipment. Similarly, in the SC, movement is based around fundamental movement skills developed through exploration of movement concepts, gymnastics actions, creative dance and individual, pair or group activities using a variety of equipment.

Both curricula expect seven-year-olds to understand some fundamentals of mental health, for example expressing feelings appropriately. Students are expected to recognise that different situations can cause different emotions, recognise their own strengths and work to include others. Both also promote help seeking, especially around personal safety. The SC: HE syllabus has an explicit focus on students using strategies to resolve conflict respectfully, as well as the issue of bullying (MOE, 2006, pp. 19-20). In the AC: HPE, bullying is not explicit until Year 3 and 4 elaborations.

There are points of difference between the two curricula in relation to the cognitive demand placed on students. For example, the AC: HPE expects students to be able to create games, propose and test alternatives and articulate how physical activity affects their bodies, whereas 50% of the SC requires Primary 3 students to demonstrate correct technique. Open ended tasks are an expected part of the Primary 3 curriculum in educational gymnastics. Folk dance is a compulsory part of the SC whereas it is referred to in the AC: HPE as one of many ways to engage students in rhythmic movement sequences. In the AC, Dance is one of the Arts strands.

There are also differences in the type, breadth and extent of topics and learning expectations that teachers are expected to cover in the AC: HPE compared to the SC PE curriculum. The AC: HPE places emphasis on the development of health literacy where students are expected to examine health messages whereas the SC expects all seven-year-olds learners to know and apply health information that is provided by health agencies. Learning to swim is a mandated part of the SC while a wider range of safety skills are expected in the AC.

The nature of teacher support varies across the two curricula. The AC: HPE provides teachers with 10 work samples to support their understanding of Year 1 and 3 achievement standards whereas the SC: provides extensive descriptions of the skills and concepts to be taught in PE, for example detailed information about gymnastics actions to be taught (MOE, 2006, p. 14). The SC also provides assessment information and descriptors for overall grades in PE which centre on knowledge, skills, and personal/social traits (Singapore, 2006, p. 42). In contrast, the achievement standard for Year 3 in the AC: HPE also expects teachers to make judgements about a broader range of student understanding including physical and social changes as children grow, how achievements contribute to identities and how their body reacts to physical activity.

Therefore, while the learning expectations of seven-year-old students are generally comparable between curricula, there are differences in the way that health information is investigated, the extent to which hygiene is included in the curriculum and a variable focus on correct technique versus participation in physical activities.

Year/Primary Level:

Australian Curriculum: Year 6

Singapore Curriculum: Primary 6

Learning Area/Subject

Australian Curriculum: Health and Physical Education (AC: HPE)

Singapore Curriculum: Physical Education (SC: PE) and Health Education (SC: HE)

Expectations: Knowledge and Skills

The AC: HPE is presented through two interrelated strands: Personal, social and community health and Movement and physical activity. By the age of eleven, students are expected to have the knowledge, understanding and skills to create opportunities and take action to enhance their own and others' health, wellbeing, safety and physical activity participation. Building on previous learning, they understand the physical and social changes that are occurring for them and examine how the nature of their relationships changes over time. The curriculum expects students to develop skills and understanding about more complex movement patterns and situations through, for example, challenge and adventure activities and sport. They can effectively communicate and problem-solve in groups. Understanding how participation in physical activity can enhance health-related fitness and wellbeing across the lifespan and contribute to intercultural understanding is foundational to future learning. The HPE curriculum is distinguished by an expectation that students gain an understanding of the cultural significance of physical activity.

The SC: PE is described through six broad components. Games, Dance, Educational Gymnastics, and Swimming build upon expected learning from previous years. Health and Fitness Management and Athletics are introduced at this comparison point. Eleven-year-old students are expected to understand fitness principles such as F.I.T.T. and perform fundamental athletic skills involved in throwing, jumping and running events. Students are expected to develop skilful movement and understand basic games concepts.

Health Education is a separate subject and emphasises government health and health promotion messages, simple first aid, disease, pollution, stress management, relationships, and peer influence. Eleven-year-old students are expected to understand emotional and relationship changes during puberty, understand their own strengths and how to deal with sexual abuse.

Both the AC: HPE and the SC: PE are comparable and explicit in requiring eleven-year-old students to expand their physical competence and apply creative thinking and problem-solving skills in movement situations. Both curricula expect eleven-year-olds to understand puberty and apply their learning to their own lives and those of others.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

For students in Year 6, the expectations of the AC: HPE curriculum are **comprehensive** in relation to breadth of coverage. The curriculum expects teachers to cover 18 content descriptions and 11 focus areas. This content, supported by 63 elaborations, covers an exhaustive range of health and physical activity topics from understanding physical and social changes to group problem-solving and composition of movement. Students are expected to demonstrate a wide range of understanding and skills that will assist them to investigate and take action to improve their own health and that of others, monitor safety and wellbeing and achieve movement outcomes as described in the achievement standard. The AC: HPE also draws upon general capabilities to develop relationship management skills (personal and social capability), apply critical and creative thinking processes, develop intercultural understanding and demonstrate ethical behaviour (ethical understanding), to further expand the curriculum.

SC – Breadth

Breadth: Fundamental

The Primary 6 curriculum is considered to be **fundamental** in relation to breadth of content. It builds upon student knowledge from previous years but does not provide a range of content that is much broader than in earlier years. The Primary 6 PE curriculum articulates six broad components; educational gymnastics (25%), folk dance and line dance (5%), games (50%), health and fitness management (5%), athletics (15%). Swimming can be provided within the curriculum time – in which case time is adjusted on other components – or conducted out of school hours. An appreciation for the heritage of other countries is cultivated through folk dances in Primary 6. Three dimensions of health: physical, emotional/psychological and environmental are detailed through eight topics and 12 learning objectives in the Health Education curriculum. Students are expected to understand and adopt important but narrow health messages about, for example, preventing the spread of transmissible disease. Learning objectives focus on understanding and practising good nutrition, exercise, and hygiene habits without exploring other socio-cultural influences (such as media) which might influence these aspects of health and physical activity. Primary 6 students are expected to understand relationships during puberty as well as the role of self-esteem and effective communication. Many learning objectives focus on a deficit view of health with a focus on recommendations and responsibility. For example, students are expected to know how to resist negative peer influences, know the dangers of substance use and abuse and maintain clean, safe, and healthy environments. Eleven-year-olds are expected to manage their emotions, care and develop wholesome relationships with others. A focus on simple first aid skills at this stage of schooling distinguishes this curriculum.

AC – Depth

Depth: Challenging

The expectations of the AC: HPE curriculum for eleven-year-olds are considered to be **challenging**. The depth to which learners may explore a range of complex topics is indicated through content descriptions and further through extensive elaborations that include possible critical inquiry approaches. The curriculum expects students to use higher order thinking in the majority of content descriptions to plan and enact creative solutions to promote health as well as solve and assess movement challenges. Interconnected learning across HPE sub strands requires cognitive effort to transfer thinking and learning from one context to another.

SC – Depth

Depth: Fundamental

The expectations of the Singapore Primary 6 curriculum in relation to depth are **fundamental**. Most expected learning outcomes in the PE curriculum are skills-based and do not reflect opportunities for the student to consistently engage in complex thinking. Skill-based expectations which exemplify this fundamental depth include: understanding and demonstrating concepts and skills in a variety of modified games, performing three dances to music (one is standard across all schools), choreographing a simple group dance, developing fundamental athletic movements, swimming a recognised stroke and demonstrating water confidence and safety (MOE, 2005). A level of more complex thinking may be possible when students refine a gymnastics sequence or demonstrate their understanding of fitness principles. The SC: HE states an intent to empower students to take care of their health, the health of others and the environment although the opportunity to do this is not reflected in learning objectives such as ‘recognise the importance of developing good oral hygiene habits to ensure that the teeth are healthy and well maintained’ (MOE, 2006, p. 11). The curriculum allows students to connect to global diseases such as prevention of SARS, Tuberculosis, cholera and dysentery, and the learning objectives focus on understanding impact. An example of this is that students ‘understand that a polluted environment is harmful to everyone’s health’ (MOE, 2006, p. 15).

AC – Rigour

Rigour: Moderate

The terminology and expectations of the AC: HPE (Year 6), expressed through the content descriptions, are predominantly associated with the development of skills and concepts (as per Webb’s DoK, 1997; 1999), indicating a **moderate** degree of rigour. The cognitive demand placed on Year 6 students in the HPE curriculum content requires them to develop skills and understanding through investigating, planning, examining, exploring, negotiating and applying critical and creative thinking in movement and health contexts. Elaborations reinforce multiple approaches and provide further support to stretch students’ cognitive capacity. The expected learning also demands that students use flexible thinking, use conceptual knowledge and apply solutions to real life issues beyond the classroom. The Year 6 achievement standard for HPE requires the application of conceptual knowledge in order to make judgements individually or collaboratively and creatively solve a problem.

SC – Rigour

Rigour: Moderate

The SC: PE is structured around six components, which predominantly centre on the development of skills and concepts, indicating a **moderate** degree of rigour. The cognitive demand placed on Primary 6 students involves development of the skills to demonstrate, recognise, identify, differentiate, contribute, refine, and perform. Eleven-year-olds are also expected to understand detailed knowledge about healthy diets, hygiene, eye care, oral hygiene, water and fire safety, first aid and diseases. Students are expected to understand and manage stress, understand social and emotional changes associated with puberty, develop positive self-esteem, and protect themselves against sexual abuse. There is a great deal of information described in the curriculum with little reference to higher order thinking in the scope of content. Students are expected to be involved in active learning through teaching approaches such as cooperative learning, multiple intelligences, and investigation, all of which may provide opportunities for rigour. Some health learning objectives such as ‘make choices and react to dangerous situations in ways to reduce harmful effects’ suggest opportunity for more complex thinking that invite reasoning and probe underlying thinking.

Comparative Analysis

Evidence from achievement standards and content descriptions suggests that the AC offers greater breadth and depth than the SC.

The SC: PE expects that all Primary 6 students will be taught educational gymnastics, dance, games, health and fitness management, athletics and swimming, whereas the AC: HPE allows contextualisation in the teaching of educational gymnastics, dance and swimming due to issues around qualifications, cost, and access to facilities across Australia.

There is parity in content covering transitions and help seeking in relation to puberty, although the AC expects 11-year-olds to investigate resources and strategies, not just know about them. Both curricula expect Year 6 students to understand emotions. In the SC, students must know how to relate to others and manage their own emotions. In the AC, students examine the influences of emotions on behaviour and relationships.

Both curricula focus on providing explicit learning about preventative health and movement. The SC expects students to display behaviour change. However, the AC: HPE acknowledges that this learning contributes to, but does not necessarily solve, society’s health and wellbeing issues (ACARA, 2012a). Both curricula value movement as an asset that involves knowledge, understanding, skills and dispositions, leading to competence, confidence, and positive health outcomes (ACARA, 2012a). There is an expectation that Year 6 students will have built upon their fundamental movement skills towards a deeper understanding of game concepts and skills. Both Year 6 curricula detail essential topics and skills that protect and promote physical, social, and emotional health and safety and provide students with opportunities to practise health-enhancing behaviours. Practising these behaviours has a greater focus in the SC. The AC: HPE expects students to plan and practise health-promoting strategies whereas the SC expects students to engage in sports and games to acquire concepts and skills that enable participation.

Application of movement concepts and strategies and regular participation in physical activity feature in both curricula as does demonstrating team work, safety and fair play. Eleven-year-olds in both countries are expected to be involved in a range of physical activities that may be individual or group-based, take place indoors or outdoors, and be competitive or non-competitive.

Some points of difference are apparent between the two curricula. One of the most significant differences is that AC Health and PE is one discrete subject whereas these subjects are taught separately in the SC. Although both provide opportunity for extended thinking, there is evidence that these opportunities are more prominent in the AC: HPE. The SC features physical and environmental health content where students are expected to learn facts. Despite an overarching PE objective that describes understanding and applying thinking skills, expected learning outcomes by the end of Primary 6 focus largely on demonstrating, refining and understanding. The SC expects 11-year-old students to understand and apply the F.I.T.T. principle. Dissimilarly, this focus is not apparent in the AC until the later years of schooling where Australian students are afforded opportunities to create and monitor personal fitness plans.

Community health and connecting to the environment in the AC: HPE differ from environmental health in the SC. In the latter, the focus is on preventing accidents, personal safety and the spread of disease whereas the AC focus is on investigating preventative health and exploring how outdoor activity supports wellbeing and connection. The AC: HPE places a greater focus on diversity, identities, and the influence of the media on health and wellbeing.

The two curricula do reveal differences in the flexibility of content used by teachers. Overall, the AC: HPE provides more flexibility to account for shifting patterns of influences, needs, interests and local priorities in health and physical activity, whereas the SC explicitly describes health issues, strategies and illnesses such as food-borne and transmissible diseases. The SC specifically lists diseases such as SARS, tuberculosis, cholera, dysentery, AIDS and Hepatitis B and explicitly mentions discrimination, bullying, substance use, psychoactive substances, risks, addictive behaviours, abuse, exploitation and harm. What presents as a deficit view of physical health in the SC contrasts with an open-ended, strengths-based approach adopted by the AC that focuses on recognising, valuing and harnessing individual and community resources to positively influence health, safety and active living of 11-year-olds.

Successful 11-year-olds in Australia and in Singapore relate positively to their peers and the world around them. They understand physical, social and emotional changes that are happening for them, how relationships change over time and how to promote some aspects of health. They develop skills in and understanding about more complex movement patterns in a variety of physical activities. Students develop ways and skills to know how to cope with puberty and establish and manage positive relationships. Successful students have the knowledge, skills, and dispositions to successfully participate in a wide range of physical activities. They have the skills and knowledge to make healthy lifestyle choices, both in and out of school, including healthy eating and daily physical activity.

Additional Observations

Both the AC and SC advise that Health/HPE content is best reinforced through broader whole school approaches to, for example, social and emotional learning.

Year/Grade Level

Australian Curriculum: Year 10

Singapore Curriculum: Secondary Grade 4

Learning Area/Subject

Australian Curriculum: Health and Physical Education (AC: HPE)

Singapore Curriculum: Physical Education (SC: PE) and Food Studies (SC: FS) component of Food and Consumer Education (SC: FCE)

Expectations: Knowledge and Skills

The AC: HPE is articulated through two interrelated strands of Personal, social and community health and Movement and physical activity. The curriculum expects students, by the age of fifteen, to be able to critically analyse health and physical activity information to apply and refine strategies that build and optimise personal and community health and wellbeing and improve their own and others' performance. In Year 10, students apply more specialised movement skills and complex movement strategies and concepts in different movement environments. The curriculum also provides opportunities for students to refine and consolidate personal and social skills in demonstrating leadership, teamwork, and collaboration in a range of physical activities. The AC: HPE is distinguished by an expectation that students can analyse how participation in physical activity and sport influences an individual's identity and explore the role participation plays in shaping cultures.

Similar learning in Singapore is delivered through Physical Education and the Food Studies component of Food and Consumer Education. Health is not a separate subject for Secondary Grade 4 students, nor is it part of PE. Fifteen-year-olds are expected to understand the importance and benefits of physical activity, be proficient in a variety of physical activities, demonstrate fair play, team work and sportsmanship, be physically fit and play safely (MOE, 2005). The SC: PE expects students to develop their tactical awareness, appreciate games, and extend their game performance. The Food Studies curriculum expects students to have developed knowledge about diet, disease, food safety and health and choose and prepare nutritious food for a variety of age groups. Students are expected to have developed an understanding of the importance of a balanced diet, know how to plan or modify meals and use nutritional tools. This learning enables fifteen-year-olds to make healthy diet-related choices.

The AC: HPE and the SC: PE are comparable in requiring fifteen-year-olds to make informed decisions about nutrition and physical wellbeing and apply them to their own lives. The core content and topics of the SC: Secondary 4 PE curriculum (games, fitness, dance, and swimming) are extended to Pre-university key stages. This aspect may be considered a strength of the SC: PE syllabus. In contrast, the AC: HPE is described more generally and only applicable for students up to the age of fifteen.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC		PE/FS			PE	FS			PE/FS

AC – Breadth

Breadth: Comprehensive

For students in Year 10, breadth of content coverage in the AC: HPE is assessed as **comprehensive**. The curriculum expects teachers to cover 18 content descriptions and 10 focus areas over Years 9 and 10. This content, supported by 76 elaborations, covers an exhaustive range of health and physical activity topics including empathy, ethical decision-making, and considering diverse communities to personalised fitness plans. Students are expected to demonstrate a wide range of understandings and skills that will enable them to apply informed decision-making when taking action to enhance their own health and that of others, and to consider safety, wellbeing and movement, as described in the achievement standard.

SC – Breadth

Breadth: Fundamental

On balance, the content coverage in the SC across Physical Education and Food Studies can be considered **fundamental**. Secondary Grade 4 PE is delivered through five areas and only seven associated learning outcomes. This prescriptive content includes: folk, social and line dance (5%), games (55%), health and fitness management (20%), track and field (20%). Swimming can be provided within the curriculum time – in which case time is adjusted on other components – or conducted out of school hours. The Food Studies content includes 29 learning outcomes related to two narrow topics of Diet and health and Food management. Students are expected to demonstrate learning outcomes in relation to meal planning, diet-related diseases, cooking, safety, culinary skills, and food and culture. Students are not expected to engage with health content beyond food and nutrition. There is no content in relation to broader understandings of health such as ‘a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity’ (World Health Organisation, 1948). Nor is there mention of health literacy as a skill for future life and learning (Nutbeam, 2006).

AC – Depth

Depth: Challenging

The expectations of the AC: HPE are deemed to be **challenging** in terms of depth. Students are expected to use strategic and extended thinking governed by the Year 10 content descriptions. Specifically, students are expected to evaluate emotional situations, critically analyse health information, examine the impact of transitions on relationships, evaluate decision making, critique contextual factors, and transfer understanding from one context to others. This learning places significant cognitive demand on students and requires teachers

to create rich environments for students to successfully complete such tasks. The curriculum provides opportunities for connecting learning between strands, sub strands and threads. Students are expected to transfer learning between physical and health-related issues to synthesise their learning.

SC – Depth

Depth: Fundamental / Challenging

Depth of learning varies between PE and Food Studies syllabi. The expectations of the Secondary Grade 4 PE curriculum in relation to depth are **fundamental**. Students are expected to extend, refine and master psychomotor and games skills and concepts, develop a competitive spirit, develop leadership and have a holistic perspective on health and fitness. Expected learning outcomes by the end of Secondary 4/5 require fifteen-year-olds to acquire knowledge and skills to play four games (at least one from each game category – territorial, net/wall, striking and fielding), perform a social dance, design fitness, physical activity, and nutrition programs, perform six track and field events, swim 50 metres of one stroke and demonstrate two survival techniques. Teachers are provided with details about content requirements such as the games to teach, techniques of track and field events and stretches to be avoided. However, the opportunity for students to be engaged in strategic and extended thinking is limited. The description of Grade ‘A’ evidences this in PE, where the student ‘has a very good knowledge and skills in a variety of physical activities and consistently demonstrates positive personal/social traits’ (MOE, 2005, p. 42).

On the other hand, Food Studies content is **challenging** in relation to depth of content. Learning outcomes expect students to understand food and nutrition and develop trans-cultural awareness. Students think critically and solve problems in relation to dietary needs, energy balance, diet-related disease, and cooking skills and methods. Students are expected to understand multicultural literacy in the global context (MOE, 2014b, p. 6). Elective modules described in the syllabus require students to plan, research, problem-solve and evaluate real-life projects. If students undertake the FCE and the Community elective, they are expected to ‘discuss social issues affecting the health and wellbeing of families and the community’ (MOE, 2014b, p. 13).

AC – Rigour

Rigour: Challenging

The terminology and expectations of the AC: HPE content descriptions are associated with a **challenging** degree of rigour. The cognitive demand placed on Year 10 students is high; they have to develop skills and understandings to evaluate, critically analyse, examine, propose, investigate, critique, analyse, refine, reflect and transfer understanding from one context to others. The HPE curriculum expects that Year 10 students apply self-generated solutions to complex real world issues; for example, students are expected to plan and evaluate new and creative interventions that promote their own and others’ connection to community and natural and built environments. The curriculum requires that students uncover and select relevant and credible supporting evidence for their analyses, judgements and solutions. The breadth and depth of curriculum content in the AC: HPE sustain inquiry into personally and socially relevant issues and topics. Further examples of the curriculum’s

capacity for rigour are provided through an extensive set of elaborations such as critiquing media representations of diverse people and analysing what makes (or could make) the representations inclusive. The Year 10 achievement standard for HPE uses language such as critically analyse, synthesise, justify, design and refine.

SC – Rigour

Rigour: Challenging

On balance, the SC Secondary 4 curriculum indicates a **challenging** degree of rigour. The FCE syllabus enables students to nurture and develop critical thinking, problem-solving and creativity, a spirit of enterprise, innovation, and aesthetic awareness; to make informed and discerning food-related decisions (MOE, 2014b). Elective modules provide opportunities for students to interpret, analyse, apply scientific principles, design and create products and consider ethical issues which all facilitate higher-order thinking. Teacher support information linked to learning outcomes in the FCE syllabus correspond with 21st Century Competencies such as critical and inventive thinking.

On the other hand, the PE curriculum is structured around learning outcomes that predominantly centre on the development of skills and concepts with lesser intellectual challenge, indicating a moderate degree of rigour. While the learning outcomes are sequential and coherent, intellectual challenge is more variable. The cognitive demand placed on fifteen-year-old students draws on skills to develop deep understanding and play games, dance, perform athletic events, swim, rescue and plan action to improve personal health, fitness, and wellbeing. The SC Secondary 4 curriculum largely includes lower-level thinking strategies such as: acquire knowledge and skills and demonstrate a range of physical activities. However, some learning outcomes demand more complex thinking to design and justify healthy lifestyle management plans for people of different age groups and to create solutions to game situations (MOE, 2005).

Comparative Analysis

Both the SC: PE and the AC: HPE allow flexibility to select activities based on the needs, capacities and interests of students and are designed to challenge students physically and mentally. In both jurisdictions, physical education is designed to provide immediate and lifelong benefits (Graham, 1998). Both curricula require that students demonstrate an understanding of the importance of staying physically active throughout life and participate in a wide range of activities. Successful students in both countries can make decisions and solve problems. The AC: HPE and SC expect fifteen-year-old students to make personal fitness plans, and display team work in a variety of physical activities.

Both curricula categorise games and include the study of movement concepts, tactics and strategies. The SC classifies games as territorial, net/wall and striking and fielding and expects students to be skilled in games from all three categories by the age of fifteen. Similarly, the AC: HPE uses the classifications of invasion, net and wall, striking and fielding and target games, and allows flexibility in terms of which games are learnt.

Overall, students experience considerable cognitive demand imposed by both curricula at this comparison point. The Year 9 and 10 AC: HPE demands consistent use of complex thinking to engage with content and demonstrate achievement, whereas the SC curriculum

gives more weight to fundamental skills such as describing, demonstrating, identifying, and developing. The AC: HPE demands that students critically analyse socio-cultural factors that impact on wellbeing, relationships, decisions and behaviours and propose ways to counter prejudice and prevent violence and harassment. The AC: HPE also requires fifteen-year-old students to 'examine the role physical activity, outdoor recreation, and sport play in the lives of Australians and investigate how this has changed over time' (*ACPMP104*). Similarly, the SC: FS expects students to 'evaluate eating patterns and link to different diet-related diseases.' However, whereas the AC demands that students 'reflect on how fair play and ethical behaviour can influence the outcomes of movement activities' (*ACPMP107*), the SC expects fifteen-year-old students to be able to 'perform a social dance to the beat of the music' (MOE, 2005, p. 19).

The integrated study of physical education and health education in the AC distinguishes this curriculum, ensuring breadth of coverage of each while supporting their interconnectedness. The AC: HPE places a greater emphasis on the health, safety, wellbeing and physical activity of others and the community, as well as self. Year 10 AC: HPE students are expected to develop deeper understanding of how the health, safety and activity choices of others are made. The AC: HPE also explicitly requires that Year 10 students become skilled at cardiopulmonary resuscitation (CPR). This particular skill is not mentioned in the SC, but water safety, swimming, survival and rescue techniques are expected content in the SC: PE.

Other differences exist between the two curricula. The AC: HPE demands a more explicit focus on analysis of attitudes, beliefs, diversity, community connection and wellbeing. The SC expects students to develop social skills through participation in PE. However, the AC: HPE expects students to evaluate the outcomes of using these skills. The SC expects students to create fitness interventions incorporating physical activity as well as nutrition whereas the AC: HPE expects such strategies to be evaluated. Both curricula expect these interventions to be applied in the wider community. The SC expects all fifteen-year-olds to be skilled in track and field events whereas this is not a requirement of the AC: HPE. Year 10 students are expected to apply criteria to make judgements about and refine their own and others' specialised movement skills whereas refinement and mastery is not expected until Pre-University in the SC.

Health literacy (Nutbeam, 2006) is explicitly described in the AC: HPE as a personal and community asset to be developed, evaluated, enriched, and communicated as one of the five underpinning propositions in the AC: HPE. Year 10 AC: HPE students are expected to develop knowledge and understanding of, and skills in, all three dimensions of health literacy: functional, interactive, and critical. Health literacy is not articulated in the SC.

As a final observation, support for teachers to deliver the curriculum also varies between the SC and the AC: HPE. There are no instructional samples to support Secondary 4 PE teachers in the SC whereas the AC: HPE provides diverse work samples that support teachers to make judgements about student learning. However, the SC provides four ideas for assessment, descriptors for grading and suggested resources for Primary and Secondary PE teachers. Information about techniques, types of games and dances to be taught is provided for SC PE teachers in far more detail than that provided in the focus areas and glossary of the AC: HPE. SC: FS teachers are provided with pedagogical advice such as

enquiry-based learning, Socratic questioning and Bloom's Taxonomy as well as detailed assessment guidelines.

Additional Observations

The PE objectives explicitly acknowledge the positive link between physical well-being, mental health, self-esteem and academic achievement (MOE, 2005, pp. 2-3). This is implicit in the AC: HPE.

Objectives of the Singapore PE curriculum include the development of courtesy, loyalty and acceptable sports behaviours (dealing with emotionally charged competitive sports situations). Similar terms are not used in the AC: HPE.

Sample yearly plans detailing suggested proportions of time spent on each component of the curriculum at each 'band' level are provided in the documented curriculum.

Health is part of the AC: HPE Foundation to Year 10. Health education is taught in the primary years and SC content emphasises health messages advocated by the Health Promotion Board and recommended by the Guidance Branch (MOE, 2005, p. 2). Both curricula expect students to apply what they have learnt. Singaporean primary schools may integrate HE with other subjects, but the MOE warns that 'the learning outcomes and the rigour for each subject should not be compromised in the process' (MOE, 2006, p. 32).

Project-based learning is practised in Singapore classrooms to develop thinking skills, creativity, and inventive thinking by using real-life problems. However, the approach is not articulated in the written curriculum.

All education aspires to contributing to behaviour change including the development of good citizens (MCEETYA, 2008). The AC: HPE is underpinned by a focus on educative purpose and although acknowledging education's contribution to positive behaviours, does not position them as the only rationale for the learning area nor the only criteria for judging student achievement. The intention of the AC: HPE is to focus on knowledge, skills and attitudes related to health, wellbeing, safety and physical activity; to build understanding, question why we might need them, analyse what social dynamics shape them, and investigate strategies and possible responses to scenarios. Student levels of physical activity, weight loss and healthy eating beyond the school gate are not seen as the remit of educators. Singapore uses a behaviour driven approach to curriculum outcomes where success of the syllabus is 'determined by pupils' demonstration of behaviour such as practising good health habits and exhibiting socially responsible behaviour' (MOE, 2006, p.1). Students are expected to constantly and actively apply and practise the knowledge learnt in their everyday lives. The SC also provides a sequence of topics for Health Education.

In the SC, there is continual reference to recognising and changing unhealthy behaviours. This could be viewed as a deficit model of health. In contrast, Australia's national HPE curriculum maintains a consistent strengths-based approach and emphasises questions such as 'What keeps me healthy and active?' rather than 'What risks, diseases and behaviours should I learn to avoid?' (McCuaig, Quennerstedt, & Macdonald, 2013).

Another similarity between the two curricula is that learning is described in two-year bands from Year 1/Primary1 to Year 10/Secondary Grade 4. Only Foundation content in the AC: HPE is provided as a single year level.

g) Languages

Comparative Curricula:

Australian Curriculum: Languages, Italian	Version 8.3, 2016
Singapore Curriculum: Mother Tongue, Malay: Malay Languages	Syllabus (Primary), 2015
Singapore Curriculum: Malay Language	Syllabus (Secondary), 2011

Year/Grade Level

Australian Curriculum: F-6
Singapore Curriculum: Primary 1 to Primary 6

Learning Area/Subject

Australian Curriculum: Languages, Italian (AC: L)
Singapore Curriculum: Mother Tongue, Malay (SC: MT)

Expectations: Knowledge and Skills

The AC: L includes fourteen foreign language-specific curricula and two frameworks - a Framework for Aboriginal Languages and Torres Strait Languages and a Framework for Classical Languages with language-specific curricula for Classical Greek and Latin. The AC: L comprises two sequences of learning, one from Foundation to Year 10 and one from Year 7 to 10. First, second, and background learner pathways have been developed for use with language learners who possess varying levels of knowledge and skill in some languages such as Chinese, Auslan and the Framework for Aboriginal Languages and Torres Strait Islander Languages. Notably, the framework also has a Language Revival Learner Pathway (AC: Languages, Framework for Aboriginal Languages and Torres Strait Islander Languages – Structure) (ACARA, 2017a).

The curriculum for all languages and frameworks is structured around the two interrelated strands of *Communicating* and *Understanding*. The same sub-strands of *socialising, informing, creating, translating, reflecting, systems of language, language variation and change* and *role of language and culture* are present in both sequences and all pathways. In the AC: L, learning is described in bands of years (F-2, 3-4, 5-6, 7-8, 9-10 and 7-8 and 9-10 (Year 7 Entry)). The Year 6 (F-10) and Year 10 (Year 7 Entry) content is described in bands; however, the curriculum does not explicitly describe the developmental sequence of learning from Foundation and from Year 7 (Year 7 Entry).

The structure of the AC: L consists of the Content Descriptions, Elaborations and Achievement Standards and applies across all the languages. The General Capabilities (Literacy, Numeracy, Information and Communication Technology (ICT) Capability, Critical and Creative Thinking, Personal and Social Capability, Ethical Understanding and Intercultural Understanding) and the Cross-Curriculum Priorities (Aboriginal and Torres Strait Islander Histories and Cultures, Asia and Australia's Engagement with Asia and Sustainability) are imbedded in the Content Descriptions of the curriculum.

Underpinning the SC: Primary 1- 6 is an education system that promotes and supports bilingualism. The SC mandates that all students are afforded the opportunity to become

proficient in the language of instruction, English and at least one Mother Tongue language: Chinese, Malay or Tamil (SC: MT). The SC framework includes ten years of compulsory education comprising six years of Primary School and four years of Secondary School. The same structure underpins the learning experiences of Mother Tongue Languages in the SC: Content, Teaching Strategies and Assessment. In Primary 5 and Primary 6 more capable students are given the opportunity to study their Mother Tongue in more depth in the Higher Mother Tongue course. The Mother Tongue is essentially taught as a second language.

Both the AC: L and the SC: MT base the design and structures on frameworks that exhibit a high degree of commonality across languages. For the purposes of comparison, this comparative study considers AC: Italian and SC: Malay, as follows:

AC: Italian

At the end of Year 6, students will have completed seven years of study of Italian as a second language.

SC: Malay

At the end of Primary 6, students will have completed six years of study of Malay as a Mother Tongue.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

For students in Year 6, the expectations of the AC: L are considered **comprehensive** in terms of content coverage.

Within the Communication strand, each sub-strand includes a number of threads of content descriptions (CDs), each of which provides elaborations as examples of how the content might be interpreted in the classroom. Also included are key concepts and key processes, as well as text types in the *creating* sub-strand. The elaborations, key concepts (KC), key processes (KP) and text types vary considerably in nature and number in each of the sequences, as in Table 3.28.

Learning the language to communicate with others and learning how language works as a system are both strategies that are integrated with the aim of understanding the cultural context of language. Students are expected to develop their knowledge and skills in the language within appropriate topics that begin with the local and familiar (family, friends, home, routine, lifestyle) and expand to broader conceptual contexts (society, environment, wellbeing, fact, giving reasons, drawing conclusions, opinion).

Table 3.28 *Strands: F-10 Languages, Year 6*

Communicating	Year 6 (F-10)			
Sub-strand	CDs	Elaborations	KCs	KPs
Socialising	4	21	8	9
Informing	2	8	4	6
Creating	2	7	5 and five text types	5
Translating	2	6	4	3
Reflecting	2	6	2	4
Total	12	48	28	27

Understanding	Year 6 (F-10)	
Sub-strand	CDs	Elaborations
Systems of language	3	17
Language variation and change	3	9
Role of language and culture	1	3
Total	7	29

SC – Breadth

Breadth: Comprehensive

For students in Primary 6, the expectations of the SC: MT, Malay are considered **comprehensive** in relation to content coverage. The Primary 6, Mother Tongue, Malay curriculum represents six years of learning a second language in addition to the language of instruction, English, and ensures a developmental sequence of learning.

In the SC, the acquisition of language efficiency (*Kecekapan Bahasa*) is divided into two components – Knowledge of Language (*Pengetahuan Bahasa*) and Language Skills and Strategies (*Kemahiran & Strategi Bahasa*). These inter-related components have a number of sub-components:

- Knowledge of Language (*Pengetahuan Bahasa*): Linguistics – phonology, spelling, vocabulary, grammar, syntax; Language Use - cultural references, language variation, the diversity of language, the functional purpose of language.
- Language Skills and Strategies (*Kemahiran & Strategi Bahasa*): Receptive Skills – listening and reading; Active Skills – speaking and writing; Interactive Skills – oral interaction and writing interaction.

Furthermore, the elements that comprise the sub-components are clearly defined and prescribed. These act as drivers for developing knowledge and skills and being able to apply them in the appropriate context.

Notably, students are exposed to at least two languages from Primary 1 to Primary 6 where learning takes place in English, the preferred language, while also learning a Mother Tongue language. Tables 3.29 and 3.30 show the structure of learning of the SC for Mother Tongue, Malay Primary 1-6.

Table 3.29 Knowledge of Language in SC, Primary 1-6

Linguistics	Elements	Language Use	Elements
Phonology	5	Cultural references	3
Spelling	8 plus 7 sub-elements	Language variation and diversity	1
Vocabulary	4		
Grammar	7 plus 19 sub-elements	The functional purpose of language	1
Syntax	4 plus 10 sub-elements		
Total	28 plus 36	Total	5

Table 3.30 Language Skills and Strategies in SC, Primary 1-6

Language Skills	Learning Outcomes	Sub -skills related to outcomes
Listening (<i>Mendengar</i>)	1.1	1.1.1 -1.1.4 = 4
	1.2	1.2.1- 1.2.12 = 12
Speaking (<i>Bertutur</i>)	2.1	2.1.1-2.1.2 = 2
	2.2	2.2.1-2.2.3 = 3
	2.3	2.3.1-2.3.3 = 3
	2.4	2.4.1-2.4.4 = 4
	2.5	2.5.1-2.5.3 = 3
	2.6	2.6.1- 2.6.4 = 4
	2.7	2.7.1-2.7.4 =4
Reading (<i>Membaca</i>)	3.1	3.1.1-3.1.4 = 4
	3.2	3.2.1-3.2.2 = 2
	3.3	3.3.1-3.3.12 = 12
Writing (<i>Menulis</i>)	4.1	4.1.1-4.1.3 = 3
	4.2	4.2.1-4.2.3 = 3
	4.3	4.3.1-4.3.4 = 4
	4.4	4.4.1-4.4.3 = 3
	4.5	4.5.1-4.5.2 = 2
Oral Interaction (<i>Interaksi Lisan</i>)	5.1	5.1.1-5.1.4 = 4
	5.2	5.2.1-5.2.3 = 3
	5.3	5.3.1-5.3.4 =4
Writing Interaction (<i>Interaksi Penulisan</i>)	6.1	6.1.1-6.1.2 = 2
	6.2	6.2.1-6.2.3 = 3
	6.3	6.3.1-6.3.4 = 4
Total = 6	Total = 23	Total = 92

AC – Depth

Breadth: Challenging

The expectations of the AC: L, Italian Year 6 (F–10) are deemed to be **challenging**, based on consideration of the coverage of skills and knowledge. The focus at this stage is on building interactional skills, maintaining and contributing to conversations, expressing ideas, points of view and preferences using appropriate language for a range of purposes.

Learners engage with, and create, a variety of texts such as emails, blogs and dialogues and reflect on the use of language. Learners manipulate the language appropriately in unfamiliar contexts. They recognise verbal and non-verbal cues and increase their range of Italian

vocabulary, grammar and tenses and use adverbs, adjectives, and prepositions to create more complex sentences. Students are becoming more independent but still require support from teacher scaffolding and modelling. They are expected to demonstrate a deeper understanding of the differences and similarities in the cultural practices of Italians and Australians.

Students are also expected to use higher-order skills and deep thinking to modify (ACLIT048), interpret (ACLIT052), reflect (ACLITC040), (ACLIT049), review (ACLIT045), synthesise (ACLITC043), and understand the diversity of languages and cultures represented in the classroom and the multilingual and multicultural character of the Australian society (ACLIT055) and reflect on their own assumptions about the values, beliefs and cultural norms of Italians compared to their own (ACLITU057).

SC – Depth

Depth: Challenging

The expectations of the SC: MT, Malay, Primary 6 are assessed as **challenging**, based on the coverage of skills and knowledge expected from the Outcomes and the Proficiency descriptors which describe explicitly the language skills and levels of attainment which students should achieve at key stages of learning, for example, at the end of Primary 2, Primary 4 and Primary 6.

At the end of grade 6, for example, students are expected to ‘listen to and understand a wide range of spoken texts topics related to themselves, family, school, the community and the environment; speak, read a range of texts, write using a range of text types, interact orally and in written form about themselves, family, school, the community and the environment’. Higher-order skills are instanced in the Proficiency Descriptors criteria and the core skills and values where the student is encouraged to appreciate the culture, history, art, customs and community of the Mother Tongue in the wider context of the pluricultural nature of Singapore society.

The depth of the SC is evident in the skills and knowledge in the content areas of the language skills, the learning outcomes and the proficiency descriptors which require learners to achieve deeper thinking, depth of skills, capabilities, and in-depth knowledge in order to acquire the required level of proficiency expected at the end of Primary 6. The content area of the SC is dense and prescriptive and delves into the minutiae of grammar, languages systems, vocabulary and idiomatic expressions.

AC – Rigour

Rigour: Challenging

The AC: L, Italian, Year 6 content develops skills and understanding through a range of key processes: comparing, connecting, corresponding, creating, exchanging, explaining, identifying, informing, interpreting, making decisions, modifying, participating, performing, planning, recognising, reflecting, researching, reviewing, selecting, sharing, synthesising, understanding, taking action, transacting, translating. In summary, these expectations indicate a **challenging** degree of rigour.

Students are given multiple opportunities to apply capabilities, strategies and knowledge to a range of contexts. The elaborations give clear direction to teachers on how to provide learning experiences that are challenging and allow students to engage with Italian in a deeper and broader way.

For Year 6 students, this is the seventh year of learning another language, and the AC recognises that students build on language learning strategies and intercultural awareness to the experience of learning Italian. Students' textual knowledge developed through English literacy learning also supports further development of literacy in Italian, as seen in the description: 'Students are expanding their social networks, experiences and communicative repertoires both in their first language and Italian. There is an expectation that students will develop skills of reflecting, reading language for cultural and contextual meaning, selecting appropriate language and creating texts to engage particular audiences, develop metalanguage to describe rules and variations in language structures and consider how language features and expressions reflect cultural and experiences' (ACARA: Years 5 and 6 Band Descriptions). The elaborations provide suggestions for teacher action that encourage multiple approaches, strategies and solutions to help facilitate students' deeper and broader engagement with learning Italian.

SC – Rigour

Rigour: Challenging

The SC, Mother Tongue, Malay, Primary 6 establishes the development of requisite skills, understanding and knowledge that indicate a **challenging** degree of rigour for Year 6 students. Cognitive demands placed on students include constant focus on the key elements of language learning - *listening, speaking, reading, writing, oral and written interaction* and increasing awareness of cultural diversity and the changing nature of language in given contexts, time, place and audience. Rigour is encouraged and achieved through dense, explicit, detailed and prescriptive application of all elements of the language learning, systems of language, grammar, vocabulary, types of questions, verb conjugation, tense, idiomatic language and proverbs to be taught by the end of Primary 6.

Explicit teaching is dictated by the provision of clear expectations of content, knowledge and skills to be developed by the students, and guidance is provided on how teachers can align teaching and learning in the classroom to the proficiency descriptors. Pedagogical guidance forms a critical bridge between syllabi and delivery in Singapore. Teaching strategies and Assessments resemble pedagogical guidance on ways in which teachers might facilitate deeper learning and higher-order thinking. The six elements of language learning are broken down into sub-elements and further separated into numerous threads. Expectations of levels of proficiency aimed at every grade from Primary 1 to 6 are clearly delineated.

Comparative Analysis

The AC and SC have much in common in relation to the skills, knowledge and understanding needed to establish sound foundations in learning in the early years of language acquisition. There is close alignment with the entry points in courses and the study and age level of students. Australian students begin the study of Italian as a second

language aged 5 in Foundation; in Singapore, students commence the study of Mother Tongue, Malay in Primary 1 at the age of 6.

In the AC: L, Italian Year 6 (F-10), students have completed seven years of study of the language and are eleven years of age. They have learned the mechanics of writing, the relationship between sounds and pronunciation, aspects of language systems of Italian, rhythm and intonation, Italian phonemes, letter patterns, spelling, grammar and punctuation, and have become literate in the language of instruction in Australian schools, English.

Through SC: MT, Malay, Primary 6, 11-year-old students have completed six years of studying the language. They learn the systems of language of Malay and are expected to apply the skills acquired during six years of schooling. At this exit point, the SC student is also becoming literate in the language of instruction, English. The SC student gains skills and proficiency in acquiring the elements of language learning by being exposed to at least two languages during the six years of primary education – the language of instruction, English, and the Mother Tongue, Malay. Therefore, the level of cognitive understanding and the possibility of deeper thinking about language acquisition are likely to be well developed by the end of Primary 6.

In the AC, the learning area of Languages is part of the core curriculum from Foundation to Year 8. The AC offers fourteen languages and access to the languages of Australia's Indigenous people via the Framework for Aboriginal Languages and Torres Strait Languages. Students may also engage with classical languages through the Framework for Classical Languages, with language-specific curricula for Classical Greek and Latin. Notably, the implementation of the curriculum is not under the jurisdiction of ACARA. State and territory authorities, school principals and, in some cases, local community school councils and parents, make decisions on which language or languages will be offered for study. Time allocation for lessons is a local decision.

Conversely, the SC provides prescriptive and detailed guidance to teachers regarding all aspects of the implementation of the curriculum. The Contents of the Mother Tongue, Malay, Primary 1 to 6 curriculum clearly defines the aims and objectives, skills and competences and values and attitudes that need to be taught and instilled in students. The Teaching Strategies outline preferred classroom management strategies, pedagogy and resources for successful delivery of the curriculum. The Assessment guides teachers on how to create formative and summative assessments, which are closely aligned to the language learning outcomes and help determine the students' learning experience and level of proficiency. In summary, this is the Mother Tongue, Malay curriculum model.

A significant difference in primary education between Australia and Singapore is that at the end of Primary 6, the Singapore student must sit for compulsory national examinations. The results largely determine the choice of secondary school. Singapore students sit for the Primary School Leaving Examination (PSLE) and take examinations on subject combinations decided by the school. Prior to the PSLE at the end of Primary 6, the Singapore student sits for school-based examinations in English, Mathematics and Mother Tongue at the end of Primary 4. The results of these examinations determine whether a student will continue the study of the Mother Tongue at a standard or foundation level in Primary 5 and 6 or whether the student will be able to undertake the study of Higher Mother

Language during the last two years of primary education. At the end of Primary 5, students also take school-based examinations with a subject combination chosen by parents in addition to English, Mathematics, Science and Mother Tongue at standard and foundation level. Higher Mother Tongue school assessment is also available at the end of the year.

Students in Australian schools do not undertake compulsory national examinations at the end of Year 6.

Both curricula demonstrate the demand for deep thinking, reflection, analysis, and evaluation. Inherent in the AC: L and SC: MT is the valuing of the multi-cultural characteristics of their respective societies and an appreciation of the close link between language acquisition and culture.

A more detailed comparative analysis is given at the end of the AC: Languages, Italian, Year 10 and SC: MT, Malay, Secondary Grade 4.

Additional Observations

The SC is detailed and prescriptive, and clearly outlines the aims and objectives, content, skills, competencies, values and attitudes. These elements constitute the expectations to be learned and acquired during six years of Primary School. Best practice for classroom management and pedagogy is clearly defined in Teaching Strategies and teachers are guided in the type of teaching and learning resources to use. Formative and summative assessment strategies inform teachers on how to facilitate the students' acquiring of knowledge and to enable them to demonstrate how to apply knowledge and skills appropriately in a given context.

Underpinning the SC is a set of eight core skills and values – Character Development, Self-Management Skills, Social and Cooperative Skills, Literacy and Numeracy, Communication Skills, Information Skills and Thinking Skills and Creativity. The core skills and values are implicitly aligned in the curriculum and are related to the desired outcomes that students become morally, intellectually, physically, socially and aesthetically well-rounded people and citizens of Singapore and the global world.

Year/Grade Level

Australian Curriculum: Year 10 (Foundation to Year 10)

Singapore Curriculum: Secondary Grade 4

Learning Area/Subject

Australian Curriculum: Languages (AC: L), Italian

Singapore Curriculum: Mother Tongue (SC: MT), Malay

Expectations: Knowledge and Skills

The AC: L expects students of Italian to develop specific skills, knowledge and understanding essential to learning a language in order to communicate with others and understand how the language is constructed. The underpinning philosophy is that learning Italian is integrated with a growing appreciation of the cultural context of the language, the communities in which Italian is spoken and their place in the world. Building on earlier skills acquired from Foundation to Year 10, learners acquire a range of strategies that can be applied to communicate effectively, knowledge of systems of language and conventions of

use, and begin to understand the relationship between language and culture. Year 10 students of Italian continue to develop proficiency in the skills essential to listening, speaking, reading, writing and interacting in a second language. Students develop their skills and knowledge within appropriate topics, using a range of texts. The AC: L expects Year 10 Italian students to learn to interpret, create, evaluate and analyse a range of genres of texts. The General Capabilities are carried across from F-6 to Years 7-10.

As seen in the SC: MT, the study of a second language continues to be one of the core, compulsory subjects of the curriculum. Students have the option to study Higher Mother Tongue (as in Primary 5 and 6) and students who are considered to have the aptitude and ability may have the opportunity to study a third language as a foreign language. Foreign languages available to most students include French, German, Japanese; more recently, this list has been expanded to include Arabic and Bahasa Indonesia (Point 3.2) (MOE, 2011, p. 3). For selected students who have not chosen either Chinese or Malay as a Mother Tongue, Singapore's national curriculum provides opportunities to study these languages through the Chinese and Malay Special Program. The intention is that more students will be able to learn conversational Chinese and Malay.

Singapore's curriculum structure for Mother Tongue (Malay, Secondary, Grades 1-4) consists of Curriculum Content, Teaching Strategies and Assessment. The curriculum clearly delineates what students are expected to know, understand and be able to do in the curriculum contents (MOE, 2011, pp. 20-26), teaching and learning outcomes (MOE, 2011, pp. 29-36), and evaluation of skills (MOE, 2011, pp. 43-46). The SC also provides a school planning program and an extensive grammar and proverb list identifying what should be taught and learnt by the end of Secondary Grade 2 and Secondary Grade 4, respectively (MOE, 2011, pp. 49-84). The elements of language learning are Listening, Speaking, Reading and Writing. Notably, the language learning elements of Oral interacting and Writing interacting present in the SC Primary Grades 1-6, are not stated in the Secondary Grade 1-4 curriculum.

The prescriptive nature of the curriculum is visible in the content, skills and knowledge, teaching strategies and manner of assessment. It ensures a developmental sequence of learning and the level of proficiency expected in listening, speaking, reading and writing the Malay language. Students are expected to have acquired language-learning strategies for effective communication and understanding of the language. The eight core skills and values continue to underpin the SC: MT, Malay, Secondary, Grades 1-4.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

For students in Year 10, the expectations of the AC: L, Italian 10 (F-10) are **comprehensive** in relation to breadth of coverage. As denoted in Table 3.31, the AC: L comprises two inter-related strands *Communicating* and *Understanding*, each with sub-strands and a total of 19 content descriptions (CDs). The content focuses on the skills of communicating in Italian, and an understanding of the systems of the language, conventions of its use and the culture of the Italian language and Italian speaking communities. In the *Communicating* strand, there are 12 content descriptions under the sub-strands of *socialising*, *informing*, *creating*, *translating* and *reflecting*. Key concepts and key processes are identified for each content description. In the *Understanding* strand, there are seven content descriptions in the sub-strands of *systems of language*, *language variation and change*, and *language and culture*. The content descriptions reflect the key ideas that developing the knowledge, understanding and skills to communicate effectively and the awareness of the relationship of language and culture shape learning. Students are expected to demonstrate proficiency in the skills and content as described in the achievement standard.

Table 3.31 *Communicating and Understanding Strands in AC, Year 10*

Communicating	Year 10 (F-10)			
Sub-strand	CDs	Elaborations	KCs	KPs
Socialising	4	18	9	13
Informing	2	9	6	8
Creating	2	9	5 and six text types	5
Translating	2	6	6	4
Reflecting	2	10	8	3
Total	12	52	40	33

Understanding	Year 10 (F-10)	
Sub-strand	CDs	Elaborations
Systems of language	3	12
Language variation and change	3	13
Role of language and culture	1	5
Total	7	30

SC – Breadth

Breadth: Comprehensive

For students in Secondary, Grade 4, the expectations of the SC: MT, Malay are considered **comprehensive** in relation to content coverage. The elements of language learning are prescribed in detail, with emphasis given to all aspects of grammatical acquisition, systems of language, vocabulary, idioms and proverbs.

The end of Secondary, Grade 4 represents 10 years of learning a second language in addition to the language of instruction, English, and ensures a developmental sequence of learning from Primary Grades 1-6.

In the SC, the acquisition of language efficiency (*Kecekapan Bahasa*) is divided into two components: Knowledge of Language (*Pengetahuan Bahasa*) and Language Skills and Strategies (*Kemahiran & Strategi Bahasa*). Students are expected to gain knowledge of, and proficiency in, languages skills and be able to apply them appropriately according to context and audience. These inter-related components have several sub-components:

- Knowledge of Language (*Pengetahuan Bahasa*): a prescriptive list of grammar elements pertaining to Bahasa Melayu. (see table below)
- Language Skills and Strategies (*Kemahiran & Strategi Bahasa*): listening, speaking, reading and writing.

Through secondary grades 1-4, students are given the option to study Mother Tongue, Malay at the level that best suits their ability:

(Bahasa Melayu Lanjutan) Advanced Bahasa Malay,
Standard Malay,
(Bahasa Melayu B) Bahasa Malay Syllabus B and,
Bahasa Melayu Asas) Basic Bahasa Malay

The structure of learning of the SC for Mother Tongue, Malay, Secondary, Grade 4 at the standard level is shown in Tables 3.32 and 3.33.

Table 3.32 *Grammar list: Systems of language and language variation*

Word Formation	Elements
Prefixes	24
Suffixes	10
Combined Affixes	23
Compound Words	6
Types of Nouns	4
Types of Verbs	6
Adjectives and adverbs	17
Types of verse and verse formation	17
Punctuation	4
Proverbs	80
Total	191

Table 3.33 Language Learning Outcomes and Skills

Language Skills	Learning Outcomes	Sub-Learning outcomes	Sub-skills related to outcomes
Listening Skills (Kemahiran Mendengar)	<p>1.1 Listen to a variety of directives and orders to give appropriate response</p> <p>1.2 Understand and respond appropriately to information from various sources</p> <p>1.3 Listen to and understand prose and poetry and respond appropriately</p>	<p>1.1.1 Understand various instructions and orders to carry out a task</p> <p>1.2.1 listen to a variety of information and respond appropriately</p> <p>1.3.1 Listen to and understand texts and respond appropriately</p> <p>1.3.2 Listen to and understand poetry and respond appropriately</p>	<p>plus 7 sub-skills</p> <p>plus 7 sub-skills</p> <p>plus 5 sub-skills</p> <p>plus 6 sub-skills</p>
Speaking (Bertutur)	<p>2.1 Interact with others in formal and informal situations</p> <p>2.2 Communicate appropriately for the purpose, context and audience</p>	<p>2.1.1 Speak about anything related to daily life using language that is appropriate</p> <p>2.1.2 Respond to questions using the correct language</p> <p>2.1.3 Speak using the right language and expressions</p> <p>2.2.1 Communicate clearly and precisely appropriate for the purpose, context and audience</p>	<p>plus 4 sub-skills</p> <p>plus 8 sub-skills</p> <p>plus 10 sub-skills</p> <p>plus 7 sub-skills</p>
Reading (Membaca)	<p>3.1 Read various texts (prose and non-prose) confidently with correct pronunciation, intonation and fluency</p> <p>3.2. read and understand the information contained in the various texts to provide an appropriate response</p>	<p>3.1.1 read prose and poetry for various purposes</p> <p>3.2.1 read and understand a variety of multi-modal texts to give appropriate response</p> <p>3.2.2 read to extract information in a logical and coherent way in order to arrive at a rationale and informed judgement</p> <p>3.2.3 read to interpret and evaluate information for a particular purpose</p>	<p>plus 2 sub-skills</p> <p>plus 10 sub-skills</p> <p>plus 2 sub-skills</p> <p>plus 6 sub-skills</p>

Writing (<i>Menulis</i>)	4.1 Write a variety of creative and non-creative texts for various purposes using correct language	4.1.1 organise information for a particular purpose 4.1.2 write using the correct conventions of the text type 4.1.3 provides and presents content appropriate to purpose of the task 4.1.4 produce a wide variety of text types using correct grammar and adjusting language appropriately to suit the purpose of the task	plus 5 sub-skills 3 sub-skills 6 sub-skills 6 sub-skills
Total = 4	Total = 8	Total = 16	Total = 94

AC – Depth

Depth: Challenging

The expectations of the AC: L, Italian Year 10 (F-10) are **challenging** in relation to depth of coverage of topics, skills and knowledge. The content descriptions in the AC expect students to demonstrate skills beyond recall and memorisation. Students learn to manipulate knowledge and skills in unfamiliar situations and to connect learning between the strands, sub-strands and threads, applying their understanding in a range of contexts. They are expected to demonstrate a deep understanding of the underpinning concept that effective communication, language and culture are closely interrelated. The Content Descriptions require higher-order thinking in *analysing, discussing, debating, explaining, evaluating, interpreting, negotiating, persuading, questioning, reflecting, reviewing* and *summarising*. Depth of understanding and sophistication of knowledge and skills are also evident in the AC's achievement standards when students demonstrate they are able to 'discuss topics such as education, work, the environment and youth issues as well as concepts from a range of learning areas', 'compare and evaluate ideas across languages and cultures', 'defend interpretations of texts and diverse points of view, and elaborate, clarify and qualify ideas using supporting evidence and argument' and 'reflect on their own and others' use of language, the language choices made, and the cultural assumptions or understandings which shape them and analyse how culture affects communication' (ACARA, 2017f).

SC – Depth

Depth: Challenging

The expectations of the SC: MT, Malay, Secondary, Grade 4 are assessed as **challenging**, based on the dense coverage of skills and knowledge in the content areas of the language skills and level of proficiency expected. The *Kemahiran Masa Kini – Skills for Present Times*; *Kemahiran Berfikir – Thinking Skills* and *Kemahiran Menyelidik – Enquiring Skills* provide opportunities for deeper thinking and learning. Explicit reference is made to Bloom's Taxonomy in the Secondary Curriculum: Bahasa Melayu, emphasising the importance of

higher-order skills such as *analysing, synthesising, evaluating* and *reflecting* in order to attain the assessment targets in the subject and demonstrate deep understanding and knowledge (MOE, 2011, p. 25).

AC – Rigour

Rigour: Challenging

The AC: L, Italian Year 10 (F-10) indicates a **challenging** degree of rigour. The terminology in the content descriptions demonstrates that students are expected to develop skills and understanding through a range of key processes such as *analysing, debating, evaluating, explaining, interpreting, negotiating, persuading, reflecting* and *summarising*. Students are expected to develop skills, knowledge and understanding that go beyond recall and recognition of learned concepts and principles. Learners are expected to manipulate the language appropriately according to context, audience and place, to be able to ‘interpret and create meaning’, ‘analyse and apply linguistic, cultural and textual features’, and ‘understand that language has the power to influence social relationships, beliefs and values’.

While not mandatory, the AC’s elaborations provide additional suggestions designed to extend students’ proficiency and to engage them in more abstract thinking and reasoning. This is seen in the choice of verbs and phrases such as debating pros and cons related to topics, using comparisons when expressing thoughts and ideas, negotiation options, solving problems and discussing alternative decisions, making judgements, comparing different perspectives, analysing and discussing the emotional impact of text features and reflecting on their own experiences of the process of translating. Elaborations also provide suggestions for teacher action that encourage multiple approaches, strategies and solutions to help facilitate students’ deeper and broader engagement with the Italian language.

The expected learning involves considering diverse perspectives, analysing and challenging assumptions, reflecting on language and intercultural exchanges, analysing the features of a range of texts and creating authentic texts. Students are given multiple opportunities to apply capabilities, strategies and knowledge to new contexts. This involves the ability to manipulate the language appropriately to suit time, place and audience and apply critical and creative skills to solve problems and find solutions in unfamiliar contexts.

The AC: L, Italian Year 10 (F-10) provides students with many opportunities for cognitive and intellectual challenge. The knowledge and skills expected in the content descriptions and achievement standards are consistently challenging.

SC – Rigour

Rigour: Challenging

The SC’s Mother Tongue (Malay, Secondary 10) material develops skills, understanding and knowledge in ways that indicate a **challenging** degree of rigour. Cognitive demands include the key elements of language learning: listening, speaking, reading and writing. There is also a strong emphasis on awareness of cultural diversity and ways in which language adapts according to context, time, place and audience.

Rigour is clearly detailed and prescribed in Section Three of the Malay Language Syllabus for Secondary School (MOE, 2011, pp. 29-39). In Part 3.1, *Pengajaran dan Pembelajaran* –

Teaching and Learning, teachers are given direction regarding the appropriate pedagogy and methodology to facilitate learning and attain the goals and objectives of learning the Malay language (MOE, 2011, p. 10). Teachers are guided on recommended principles of teaching, class management, student-centered learning and how to differentiate. In Part 3.2, *Perancangan Program Bahasa Melayu di Sekolah*, pp. 36-39 – Planning Teaching Program for Malay Language, teachers receive explicit direction on programming that will engage students in deep learning and higher-order thinking. Teachers are given detailed instructions on how to attain the learning objectives of the curriculum, how to facilitate the acquisition of skills and proficiency in the elements of language learning (listening, speaking, reading and writing) and on suggested methods of assessment. This suggests a challenging degree of rigour.

Comparative Analysis

At the end of four years of secondary school, the AC and SC have much in common in relation to the skills, knowledge and understanding needed in learning a second language. In the AC: L, Italian Year 10 (F-10), students have completed eleven years of study of the language and are 15 years of age. In the SC: MT, Malay, Secondary Grade 4, students have completed ten years of studying the language and are also 15 years old.

Some significant differences between the two curricula can be seen. The SC mandates the study of a Mother Tongue as a second language throughout a student's primary and secondary education. In order to differentiate levels of competency and proficiency, four levels of Mother Tongue have been developed in the Secondary Curriculum; Higher Mother Tongue, Standard Mother Tongue, Mother Tongue Syllabus B and Basic Mother Tongue. The courses follow the same framework but there is a corresponding decrease in number of hours of lesson time per week, depth and breadth of content coverage, learning outcomes, systems of language and the expectations of the level of acquisition of the skills of second language learning from Higher Mother Tongue to Basic Mother Tongue. In addition, while there is provision for some students to study a third language as a foreign language, this option is only offered to students deemed to have the aptitude and ability to do so.

In the AC, the learning area of Languages is part of the core curriculum from Foundation to Year 8. In Years 9 and 10, students have the option to continue the study of a second language, choose a different second language for study or not study a second language at all. No one language is mandated. Depending on their school offerings, students may elect to study any of the fourteen world languages included in the curriculum. They also have access to the languages of Australia's Indigenous people via the Framework for Aboriginal Languages and Torres Strait Languages and to classical languages through the Framework for Classical Languages, with language-specific curricula for Classical Greek and Latin. Talent, aptitude and ability are not considerations when students choose to study languages offered by the AC.

As implementation of the curriculum is not the responsibility of the ACARA, time allocation for number of lessons per week is also a decision that is undertaken by the states and territories, the various educational jurisdictions and individual school principals and school councils.

Another significant difference in secondary education between Australia and Singapore is that at the end of Secondary, Grade 4, Singaporean students must sit for compulsory national examinations. The level of proficiency gained in these national examinations will largely determine senior and tertiary study options. Students in Australian schools do not undergo compulsory national examinations at the end of Year 10.

The SC provides prescriptive and detailed guidance to teachers regarding all aspects of the implementation of the curriculum. The Contents of the Mother Tongue (Malay, Secondary 1 to 4) curriculum clearly outlines the aims and objectives, skills and competences and values and attitudes that are to be taught and instilled in students. Teachers are advised on preferred classroom management strategies, pedagogy and resources to be used in effective teaching and learning in the classroom and for successful delivery of the curriculum. They are instructed on how to create formative and summative assessments that are closely aligned to the language learning outcomes and help determine the students' learning experience and level of proficiency. Developmental and conceptual sequences of learning outcomes of the elements of language learning are clearly stated at the end of Secondary Grade 2 and Grade 4.

The Achievement Standards of the AC: L, Italian, Years 9-10 illustrate the desired content, knowledge and skills expected to be acquired over two years of learning and content descriptions, key processes, key concepts and the elaborations give guidance to teachers. The AC does not direct teachers on matters of pedagogy or methodology.

The demands of both curricula represent the capacity for students to engage in deep thinking, reflection, analysis, and evaluation. Inherent in the AC: L and SC: MT are the valuing of the multi-cultural characteristics of their respective societies and the appreciation of the close link between language acquisition and culture.

h) General Capabilities

Comparative Curricula

Australian Curriculum: General Capabilities

Singapore Curriculum: Character and Citizenship Education

Singapore Curriculum: Character and Citizenship Education

Version 8.3, 2016

Syllabus (Primary), 2014

Syllabus (Secondary),
2014

Introduction

Integral to its three-dimensional design, the AC identifies seven capabilities that play a significant role “in equipping young Australians to live and work successfully in the twenty-first century” (ACARA, 2017g). These are:

- Literacy
- Numeracy
- Critical and Creative Thinking
- ICT Capability
- Personal and Social Capability
- Ethical Understanding
- Intercultural Understanding



Figure 3.6 General Capabilities in the Australian Curriculum

From “General capabilities in the Australian Curriculum” by ACARA, 2018 (PDF documents: <https://www.australiancurriculum.edu.au/f-10-curriculum/general-capabilities>). Copyright by Australian Curriculum, Assessment and Reporting Authority (ACARA).

Each capability is organised into elements and sub elements within continua focused on the development of skills and attributes of learners as they progress through their schooling. The continua establish expectations of learning at the end of Foundation, Years 2, 4, 6 and 10.

The Melbourne Declaration provides the basis for the AC. Similarly, the SC aspires to developing young learners who are confident, self-directed, active and concerned citizens. In Singapore, this aspiration is encapsulated in the Desired Outcomes of Education (DOE) (MOE, 2017f).

As with the AC, Singapore’s national curriculum identifies competencies designed to ‘help our students thrive in a fast-changing world’ (MOE, 2017e). The *Teach Less, Learn More* policy initiative of 2005 supported “pedagogical change to encourage active and independent learning by trimming syllabus content and to enhance critical and inquiry based learning among students” (Tan, Koh, Chan, Onishi-Costes & Hung, 2017, p. 4). Further policy initiatives led to the development of the Framework for 21st Century Competencies and Student Outcomes in 2010. This framework combines the core values, social and emotional learning 21st Century Competencies and Desired Outcomes of Education.

At the centre of the framework are the Core Values of respect, responsibility, integrity, care, resilience and harmony. The inner ring of the framework addresses the social and emotional competencies necessary for personal and social growth and development. The outer ring of the framework outlines the emerging 21st Century Competencies necessary for students’ future and effective engagement with the world. The Desired Outcomes of Education (DOE) encompass the framework as the “attributes that educators aspire for every Singaporean to possess upon the completion of his formal education” (MOE, 2017f).



Figure 3.7 Framework for 21st Century Competencies and Student Outcomes

Source: Ministry of Education, Singapore. <https://www.moe.gov.sg/education/education-system/21st-century-competencies>

The Social and Emotional Learning principles (SEL) are closely aligned to two of the AC: GC; that is, Personal and Social Capability and Intercultural Understanding. These competencies underpin a Character and Citizenship Education syllabus designed to guide educators in teaching SEL skills through the stages of schooling. The syllabus is divided into five domains: Self, Family, School, Community and Nation. Each domain is defined by learning expectations that detail knowledge, skills, attitudes and values to be demonstrated by the end of Primary 2, Primary 4, Primary 6, Secondary 2 and Secondary 5.

The SC identifies 21st Century Competencies in each learning area syllabus. These include Civic Literacy, Global Awareness, and Cross-cultural Skills, Critical and Inventive Thinking Skills, Communication, Collaboration and Information Skills. All syllabi explain the place of the Competencies within each learning area. These competencies are more closely aligned to the AC's capabilities of Critical and Creative Thinking, Intercultural Understanding, Ethical Understanding and ICT Capability, but Singapore's documents and syllabi do not address Literacy and Numeracy as discrete capabilities in the way they are demonstrated in the AC.

In this comparison of the Singapore and Australian curricula, the focus is on the SC Character and Citizenship Education (SC: CCE) syllabus, AC Personal and Social Capability and AC Intercultural Understanding Capability. Particular consideration is given to the ways in which Singapore's curriculum addresses emerging 21st Century Competencies through learning area, compared to the teaching of Critical and Creative Thinking, Intercultural Understanding, Ethical Understanding and ICT Capability in the AC's learning areas of Science, Music, and Social Studies.

Year/Grade Level

Australian Curriculum: Year 2

Singapore Curriculum: Primary 2

Learning Area/Subject

Australian Curriculum: General Capabilities (AC: GC)

Singapore Curriculum: 21st Century Competencies (SC: 21st CC); Character and Citizenship Education (SC: CCE)

Expectations: Knowledge and Skills

See Introduction above.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

The AC General Capabilities are considered **comprehensive** at Year 2 as they encompass a broad range of skills that students are expected to develop within the first three years of schooling. Per Table 3.34, the General Capabilities continua describe 85 sub-elements that students are expected to demonstrate prior to the end of Year 2. These sub-elements build upon the learning expectations established in the preceding levels of each continuum.

Table 3.34 *Frequency of capabilities and sub-elements in AC, Year 2*

General Capability	Sub-elements
Critical and Creative Thinking	12
Personal and Social Capability	16
Information Communication Technology Capability	14
Intercultural Understanding	9
Ethical Understanding	8
Numeracy	12
Literacy	14

Three of the AC: GS's are closely aligned with curriculum disciplines. For example, many of the capabilities described within the Personal and Social Capability are reinforced in the Health and Physical Education learning area. Skills described in the Numeracy continuum are closely aligned to the content and proficiencies of AC: M, and the capabilities described within the Literacy continuum are closely aligned to content and processes described in the AC: E. Additionally, skills described in the ICT Capability resonate with the Digital Technologies learning area; six of the nine capabilities are aligned with content descriptions in the Digital Technologies curriculum.

SC – Breadth

Breadth: Comprehensive

The SC: 21st Century Competencies (SC: 21st CC) are **comprehensive** in breadth for students in Primary 3. The Character and Citizenship Education syllabus is detailed, and provides support across the stages of schooling and a progression of skill and knowledge development. The 21st Century Competencies are expressed within learning areas. Each syllabus describes skills to be developed when linked to learning area content. Although not as prescriptive as the AC: GC, each of the SC: 21st CC has been identified in the syllabus documents and information is provided to support the development of these skills across the years of schooling. Within Singapore's Social Studies syllabi at Primary 3, for example, students make observations, compare and classify, provide explanations, ask questions, work collaboratively and demonstrate responsible choices. Further detail about the 21st Century Competencies is provided in the introductory passages of each syllabus, and definitions of key skills are provided to guide teachers when including these concepts within teaching and learning plans.

AC – Depth

Depth: Fundamental

The AC General Capabilities are considered **fundamental** in depth at Year 2. At this level, the capabilities primarily focus on identification, discussion and description. Students make some decisions about learning in familiar situations and begin to demonstrate the ability to discuss a variety of capability-related concepts. The General Capabilities describe progressions of learning and this level outlines capabilities that do not require higher-order thinking skills for students to be successful.

The General Capabilities at Year 2 typically engage students in activities and develop their skills in describing, identifying, and comparing as they begin to make decisions about their learning.

SC – Depth

Depth: Fundamental

Singapore's 21st Century Competencies are regarded as **fundamental** in depth at Primary 3. The Character and Citizenship Education syllabus focuses on the development of skills that require students to listen, consider, express, know and show understanding of content across the five domains. Within learning areas, the competencies are expressed in terms such as *observe, classify, compare, explain, demonstrate* and *appreciate*. The Character and Citizenship Education syllabus details the development of skills at this level. The expectations of the competencies within the learning areas are defined at the beginning of each syllabus with some additional general descriptions within the year level content. For example, the SC Social Studies syllabus requires Primary 3 students to process information, make observation, express thoughts, work collaboratively, and demonstrate creativity and curiosity. The 21st Century Competencies are further expanded within the syllabus. A stage-by-stage description linked to learning area content is provided to support educators.

AC – Rigour

Rigour: Moderate

For Year 2, the level of rigour of the AC's General Capabilities is considered **moderate**. The capabilities are designed to promote flexible thinking, engage learners with peers, develop understanding of others, and encourage learners to question, describe, discuss and predict. The General Capabilities are developmental in nature and the capabilities and dispositions increase in complexity as students move through the stages of schooling.

SC – Rigour

Rigour: Moderate

For Primary 3 students, the 21st Century Competencies are considered to offer a **moderate** level of rigour, intended to support students to reach the Desired Outcomes of Education by becoming confident, self-directed, active and concerned citizens. The Character and

Citizenship Education syllabus and the 21st Century Competencies, as expressed in the learning areas, promote the development of skills relating to comparing, describing, explaining and classifying.

An example exists in Singapore's Music syllabus, where the importance of the 21st Century Competencies is identified by way of an explanatory table at the beginning of the document. The syllabus provides a description of the role of the Music program in developing the competencies. The syllabus content enables students to develop creative thinking skills by creating, composing and performing soundscapes. Critical thinking skills are developed through the opportunity to provide reasoned judgements for choices within Learning Objective 2. These statements of learning are not explicitly linked to the development of 21st Century Competencies, but the inclusion of this content within the learning area enables a practical emphasis on these skills.

Year/Grade Level

Australian Curriculum: Year 6

Singapore Curriculum: Primary 6

Learning Area/Subject

Australian Curriculum: General Capabilities (AC: GC)

Singapore Curriculum: 21st Century Competencies (SC: 21st CC); Character and Citizenship Education (SC: CCE)

Expectations: Knowledge and Skills

In this comparison of the Singapore and Australian curricula, the focus is on the SC Character and Citizenship Education syllabus, AC Personal and Social Capability and AC Intercultural Understanding Capability. It includes comparison between the 21st Century Competencies embedded in learning area content for the SC and the AC Critical and Creative Thinking Capability, AC Intercultural Understanding Capability, AC Ethical Understanding Capability, and AC ICT Capability in the learning areas of Science, Music and Social Studies.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

The AC: GC are **comprehensive** in their breadth. There are 85 capabilities described for learners to demonstrate by the end of Year 6. See Table 3.35.

Table 3.35 *Frequency of capabilities in AC, Year 6*

General Capability	Number of capabilities
Critical and Creative Thinking	12
Personal and Social Capability	16
Information Communication Technology Capability	14
Intercultural Understanding	9
Ethical Understanding	8
Numeracy	12
Literacy	14

SC – Breadth

Breadth: Comprehensive

The SC's 21st Century Competencies are regarded as **comprehensive** in breadth for Primary 6 learners. The Character and Citizenship Education syllabus is detailed, providing support across the stages of schooling and a clear progression of skill and knowledge development. The 21st Century Competencies are identified within each learning area syllabus and, where appropriate, linked to learning area content.

AC – Depth

Depth: Fundamental

At Year 6 level, the AC: General Capabilities require students to continue to identify and discuss some sub-elements within each capability. This is work that emphasises analysis and evaluation. While these capabilities are of a higher order, they are not broadly applied across the capabilities and the depth of learning expected by the curriculum is deemed to be **fundamental**. The verbs, describing actions students would undertake by the end of Year 6, still focus largely on lower-order skills such as identify, describe, discuss and use, with the inclusion of some higher-order skills such as *analyse*, *assess*, *compare* and *explain*. On balance, the cognitive actions described within the General Capabilities at Year 6 are of a lower order. Table 3.36 provides a count of the verbs used to describe learning expectations for students completing Year 6.

Table 3.36 *Verbs describing cognitive level, Year 6*

Verb	Count	Verb	Count	Verb	Count	Verb	Count	Verb	Count
analyse	3	classify	1	condense	1	describe	9	explain	11
apply	2	collect	1	consider	1	devise	1	explore	2
articulate	1	combine	2	contribute	1	discuss	4	formulate	1
assess	4	compare	5	convert	1	edit	1	generate	2
choose	1	compose	2	create	2	evaluate	2	identify	20
clarify	2	comprehend	1	deliver	1	examine	2	interpret	2
interpret	1	modify	1	prepare	1	respond	1	suggest	1
justify	1	monitor	2	probe	1	retrieve	1	test	2
listen	1	navigate	1	read	1	scrutinise	1	understand	1
locate	1	plan	1	reflect	1	seek	1	use	11
maintain	1	pose	1	rehearse	1	select	1	view	1
manage	1	practise	1	research	1	solve	2		

SC – Depth

Depth: Fundamental

The depth of learning expected for Primary 6 in Singapore’s 21st Century Competencies is considered **fundamental**. The Character and Citizenship Education syllabus focuses on the development of skills which require students to identify, describe, reflect, express, know and show understanding of content across the five domains. Within learning areas, the competencies are expressed in terms such as observe, classify, compare, explain, demonstrate and appreciate.

The Character and Citizenship Education syllabus provides information regarding the development of skills at this level. The expectations of the competencies within the learning areas are found at the beginning of each syllabus, with some additional general descriptions within the year level content. The cognitive actions described within the Character and Citizenship Education syllabus and the actions described within the examined learning areas at Primary 6 are of a lower order. Table 3.37 provides a count of the verbs and actions used to describe learning expectations for students completing Primary 6 SC: S and SC: CCE.

Table 3.37 *Verbs and Actions in Science and Character and Citizenship Education*

SCIENCE				CHARACTER AND CITIZENSHIP			
Verb/action	Count	Verb/action	Count	Verb/action	Count	Verb/action	Count
Investigate	9	Compare	6	Know	22	Describe	1
Communicate	7	Measure	1	Understand	17	Express	1
Show Curiosity	5	Show objectivity	4	Recognise	5	Manage	2
Show concern	7	Recognise	1	Accept	1	Process	1
Value teamwork	2	Construct	2	View	1	Reflect	6
Respect	6	Record	1	Present	1	Develop	3
Observe	3	Collect	1	Identify	6	Seek	6
				Monitor	1	Make	3
				Think	5	Provide	2
				Show	7	Consider	2
				Consider	4	Use	1
				Value	2	Contribute	2
				Respect	1		

AC – Rigour

Rigour: Moderate

With respect to rigour, the AC's General Capabilities are deemed to be **moderate**. All capabilities build on those described for learning at the end of Year 4 and they are designed to prepare students for learning in future stages of schooling. Table 3.38 indicates how students engage in the Pose Questions sub-element of Critical and Creative Thinking and move from posing exploratory questions based on observation to posing questions in order to analyse abstract ideas, requiring increasingly sophisticated thinking and speaking skills.

Table 3.38 *Australian Curriculum: Critical and Creative Thinking*

Sub-element	Level 1 Typically, by the end of Foundation, students:	Level 2 Typically, by the end of Year 2, students:	Level 3 Typically, by the end of Year 4, students:	Level 4 Typically, by the end of Year 6, students:	Level 5 Typically, by the end of Year 8, students:	Level 6 Typically, by the end of Year 10, students:
Pose questions	pose factual and exploratory questions based on personal interests and experiences	pose questions to identify and clarify issues, and compare information in their world	pose questions to expand their knowledge about the world	pose questions to clarify and interpret information and probe for causes and consequences	pose questions to probe assumptions and investigate complex issues	pose questions to critically analyse complex issues and abstract ideas

SC – Rigour

Rigour: Moderate

The SC 21st Century Competencies are at a **moderate** level of rigour for students in Primary 6. The Character and Citizenship Education syllabus and the 21st Century Competencies, as expressed in the learning areas, promote the development of skills relating to comparing, describing, classifying, explaining, working in teams, investigating and communicating. Unlike the AC GC learning continua, the 21st Century Competencies are generalised within learning areas rather than prescribed within a separate syllabus document.

Comparative Analysis

Using the Science, Social Studies and Music syllabi, this comparative study demonstrates how 21st Century Competencies have been embedded in the Singapore academic curriculum and Character and Citizenship Education, with the intent of improving content mastery, high performance and academic achievement. The amount of content relating to the competencies reflects the importance that Singapore's education authorities attach to this aspect of learning.

The SC Science syllabus at Primary 6 level requires students to make observations, compare and classify, provide explanations, ask questions, work collaboratively, investigate, communicate, show objectivity and to demonstrate responsible choices. The 21st Century Competencies are further expanded upon in the introductory passages of the Science syllabus, and definitions of key skills are provided to guide teachers when including these concepts within teaching and learning plans.

The development of skills from Primary 3 to Primary 6 is limited to the inclusion of investigating and communicating findings related to learning area content and demonstrating objectivity. While there is an increase in the amount of content that students are required to learn between P3 and P6, the descriptions provided within this section of the syllabus are general and linked to the content of the learning topic; these skills are described in terms of how a learner may develop a particular skill, rather than providing detail of what that skill may look like at that level.

Students following the SC Social Studies syllabus in Primary 6 are required to locate and process information from a range of sources, make decisions about the reliability of data, communicate confidently within a group and plan how they might present their learning. The 21st Century Competencies are further expanded upon within the syllabus. A stage-by-stage description linked to learning area content is provided to support educators. The descriptions provided within this section of the syllabus are general and linked to the content of the learning topic. An example of this is seen in the statement that 'The learner also develops relationship management skills through working with others when undertaking the performance tasks' (MOE, 2013a). This statement describes how a student may develop relationship management skills but does not articulate what the development of these skills may entail or how these may be demonstrated.

Singapore's Music syllabus for P6 reflects the importance of the 21st Century Competencies in an explanatory table. The syllabus provides a high-level description of the role of the Music program in developing the competencies and linking the content of the syllabus to Civic Literacy, Global Awareness, Cross Cultural Skills and Critical and Inventive Thinking Skills. The syllabus content allows for students to develop creative thinking skills through the opportunity to create, compose and perform soundscapes. Critical thinking skills are developed as students offer reasoned judgements for their choices and as they analyse and evaluate a performance.

A point of difference between the two national curricula is that the AC's General Capabilities provide clear expectations for skill development at set stages of schooling, albeit through a separate document. In the AC, each General Capability has been organised into a series of discrete skills supported by a continuum of learning that describes skill development across set stages of schooling, and the capabilities are linked to learning area content across all levels of the curriculum. By the end of Year 6, for instance, students are expected to demonstrate the ability to analyse, explain, describe, generate alternative solutions, justify decisions and thinking, assess and evaluate ideas and information in a range of contexts. In their curriculum, Singaporean students encounter more general descriptions of skills that are linked to the content of the learning topic, and the degree of complexity associated with the development of the skills is not as evident over Primary 3-6 stages of schooling.

Year/Grade Level

Australian Curriculum: Year 10

Singapore Curriculum: Secondary 4

Learning Area/Subject

Australian Curriculum: General Capabilities (AC: GC)

Singapore Curriculum: 21st Century Competencies (SC: 21st CC); Character and Citizenship Education (SC: CCE)

Expectations: Knowledge and Skills

At this level, the comparison of the Singapore and Australian curricula focuses on the SC Character and Citizenship Education syllabus, AC Personal and Social Capability and AC Intercultural Understanding Capability. The comparison includes the 21st Century Competencies embedded in learning area content for the SC and the AC Critical and Creative Thinking Capability, AC Intercultural Understanding Capability, AC Ethical Understanding Capability, and AC ICT Capability in the learning areas of Science, Music and Social Studies.

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Comprehensive

The breadth of the AC: GC is considered to be **comprehensive** at Year 10. As detailed in Table 3.39, the continua of learning of the seven capabilities contain 85 separate capabilities.

Table 3.39 *Frequency of capabilities in AC, Year 10*

General Capability	Number of capabilities
Critical and Creative Thinking	12
Personal and Social Capability	16
Information Communication Technology Capability	14
Intercultural Understanding	9
Ethical Understanding	8
Numeracy	12
Literacy	14

SC – Breadth

Breadth: Comprehensive

The SC Character and Citizenship Education and 21st Century Competencies are regarded as **comprehensive** in breadth. By the end of Secondary 4, students are expected to have developed a wide range of skills relating to management of themselves and their relationships with others through the Character and Citizenship Education syllabus. The 21st Century Competencies as expressed within learning area content are more detailed and describe a broad range of skills and dispositions to be developed prior to the completion of Secondary 4.

AC – Depth

Depth: Challenging

The AC: General Capabilities are **challenging** in depth by Year 10 as they require students to apply higher-order thinking skills such as analysis, justification and evaluation in increasingly diverse and complex situations. The capabilities described in the final level of each continuum establish high expectations for learners, particularly in terms of the capacity to apply the capabilities across learning areas.

SC – Depth

Depth: Challenging

By the end of Secondary 4, students are encountering a **challenging** level of depth in the SC's Character and Citizenship Education and 21st Century Competencies. This syllabus requires students to evaluate, analyse, apply, take action, self-monitor, demonstrate

empathy, collaborate, value diversity and show leadership in a range of situations relating to the five domains. The 21st Century Competencies detail skills and attitudes across all learning areas and emphasise higher-order thinking skills such as evaluating, predicting, inferring, verifying, developing hypotheses and seeking clarification.

AC – Rigour

Rigour: Challenging

As the final point on a developmental continuum of learning, the expectations at this level are considered **challenging** as they require students to demonstrate or develop a sophisticated range of capabilities and dispositions in a variety of local and global contexts. At this final level, the General Capabilities outline higher order thinking skills and multifaceted behaviours for young learners to attain. Students are expected to develop skills which enable them to identify and act upon issues in local, national and global contexts, be able to articulate ideas and points of view across a range of topics and demonstrate empathy and respect for others in diverse contexts.

SC – Rigour

Rigour: Challenging

In relation to rigour, the SC's Character and Citizenship Education and 21st Century Competencies are judged to be **challenging** for Secondary 4 students. Through engagement with the content of the Character and Citizenship Education syllabus, the learning should enable effective communication between socio-cultural groups within the students' community, consideration of issues from a national viewpoint, understanding of themselves as individuals and the ability to set goals related to developing excellence. In the learning areas, the nominated 21st Century skills are complex, aiming at the development of critical thinking and evaluation skills, skills relating to expressing and articulating ideas and reasons for choices, skills which require respectful debate when encountering disparate views and the application of high-level research skills.

Comparative Analysis

For students completing the compulsory years of schooling, the AC: GC and Singapore's 21st Century Competencies both demand higher-order thinking skills and sophisticated behaviours.

For Singaporean students, the Science syllabus at Secondary 4 describes the skills and processes that support higher-order skills. The syllabus outlines pedagogical approaches designed to ensure both mastery of basic Science concepts and the development of a sense of curiosity and inquiry about Science and the world. There is a strong recommendation that pedagogical approaches foster students' skills and habits of mind directly related to Civic Literacy, Global Awareness and Cross-cultural Skills, Critical and Inventive Thinking, and Information and Communication Skills. As students progress through each theme in the Science syllabus, links to these 21st Century Competencies are made through the Skills and Process and Ethics and Attitudes strands of the syllabus. For example, the Models theme in one of the learning objectives in the Ethics and Attitudes strands states that students will

'show an awareness that technologies resulting from knowledge of the atom have created social and ethical issues, risks and costs (e.g. atomic bomb)' (MOE, 2013). This learning objective would require students to develop skills related to Global Awareness, Critical Thinking and Information and Communication skills.

The Social Studies syllabus for Secondary 4 provides detailed descriptions of the higher-order skills considered crucial for achievement in Social Studies and, more broadly, for the development of informed, concerned and participative citizens. The content of this syllabus has been specifically designed to develop skills related to Global Awareness and Cross Cultural Skills, Civic Literacy and Information and Communication Skills. The syllabus content has been planned around three issues:

1. Exploring Citizenship and Governance
2. Living in a diverse Society
3. Being Part of a Globalised World

As Singaporean students progress through the content described in the syllabus, they focus explicitly on developing the skills identified in the 21st Century Competencies. These skills are clearly set out in the Skills and Values strands of each part of the syllabus.

The AC General Capabilities and the SC Character and Citizenship syllabus and the 21st Century Competencies set aspirational standards for young people before the commencement of senior secondary schooling. Both national curricula highlight Social and Emotional competence, understanding of and empathy towards other cultures, Critical and Creative Thinking skills, skills related to judgment and dealing fairly with others and the effective use of technologies.

i) Cross-Curriculum Priority – Aboriginal and Torres Strait Islander Histories and Cultures

Introduction

In this comparison of the representation of Indigenous² Peoples in the AC and the SC, the Orang Laut people are recognised as the Indigenous inhabitants of Singapore. They are a Malay sub-group. The Singapore Constitution, Part XIII, General Provisions, Minorities and special position of Malays, section 152 explains their status:

The Government shall exercise its functions in such manner as to recognise the special position of the Malays, who are the indigenous people of Singapore, and accordingly it shall be the responsibility of the Government to protect, safeguard, support, foster and promote their political, educational, religious, economic, social and cultural interests and the Malay language (Tan & Hairon, 2011, p. 13)

The comparison of Indigenous content begins with a general statement about the various dimensions or aspects of the two curricula followed by a more in-depth analysis of the AC: Humanities and Social Sciences/History with the SC: Social Studies/History learning areas.

Year/Grade Level

Australian Curriculum: Years 2, 6 and 9/10

Singapore Curriculum: Primary 3/4, Primary 6 and Secondary 3/4

Expectations: Knowledge and Skills

In the AC, the focus on Aboriginal and Torres Strait Islander Histories and Cultures is presented as a Cross-Curriculum Priority (CCP) – one of three – that is to be delivered through all learning areas, where relevant, and seeks to develop cultural and intercultural awareness / responsiveness in all students.

The AC states that the three Cross-Curriculum Priorities:

...are only addressed through learning areas and do not constitute curriculum on their own, as they do not exist outside of learning areas. Instead, the priorities are identified wherever they are developed or have been applied in content descriptions. They are also identified where they offer opportunities to add depth and richness to student learning in content elaborations. They will have a strong but varying presence depending on their relevance to the learning area (ACARA, 2017h).

Key Ideas describe the three key concepts of Country/Place, Culture and People, supported by nine Organising Ideas. Within the learning areas, Content Descriptions and Elaborations highlight the requirement and suggestions for the CCP's inclusion in the curriculum.

References to Aboriginal and Torres Strait Islander Histories and Cultures are found in the

² The term 'Indigenous' is used as a generic term representative of First Peoples, First Nations, Aboriginal and Torres Peoples and other Indigenous people across the world.

learning areas of the Humanities and Social Sciences, Languages and The Arts. The Achievement Standards are not inclusive of the CCPs.

The F–10 AC overview states that the Cross-curriculum priorities “are not separate subjects in themselves; they are addressed through learning area content, where appropriate, and identified by icons.” In the AC: Science, for example, the CCP is embedded as follows:

Students will have opportunities to learn that Aboriginal and Torres Strait Islander Peoples have longstanding scientific knowledge traditions and developed knowledge about the world by: observation, using all the senses; prediction and hypothesis; testing (trial and error); making generalisations within specific contexts such as the use of food, natural materials, navigation and sustainability of the environment. (ACARA, 2017l)

For the HASS curriculum, this statement suggests that the diverse cultures of Aboriginal and Torres Strait Islander Peoples are explored through:

- long and continuous strong connections with Country/Place and their economic, cultural, spiritual and aesthetic value of place, including the idea of custodial responsibility. Students examine the influence of Aboriginal and Torres Strait Islander Peoples on the environmental characteristics of Australian places, and the different ways in which places are represented.
- experiences before, during and after European colonisation including the nature of contact with other peoples, and their progress towards recognition and equality. In particular, students investigate the status and rights of Aboriginal and Torres Strait Islander Peoples, past and present, including civic movements for change, the contribution of Aboriginal and Torres Strait Islander Peoples to Australian society, and contemporary issues.
- exploration of how groups express their particular identities, and come to understand how group belonging influences perceptions of others. (ACARA, 2017m)

Within the General Capabilities dimension of the AC, there is no specific mention of Aboriginal and Torres Strait Islander cultures. It can be inferred through Intercultural Understanding (*develop respect for cultural diversity, and consider and develop multiple perspectives*), Personal and Social Capability (*appreciate diverse perspectives*), and in Ethical Understanding (*recognise ethical concepts*).

Singapore’s curriculum contains elements in the learning expectations that relate directly or indirectly to content about Malay histories and cultures. Bilingualism is a key feature of the national education system, and this is relevant to the study of Malay content, as follows:

While most subjects are taught in English, all students also learn an official Mother Tongue Language. This equips them with the language competencies to access Asian cultures, and encourages them to appreciate their culture and heritage. It also enables them to connect with people from different backgrounds in a multi-cultural environment, to give them a competitive edge and thrive in a globalised world. (MOE, 2016b, p. vi)

Malay is one of three mother tongue languages offered in schools to assist students to retain their ethnic identity, culture, heritage and values. The Malay language syllabus is located in both the Primary and Secondary curriculum and in the Special Program. At the Secondary 3 and 4 levels, the curriculum aims to form in students:

Positive attitudes to become citizens who are intellectually, socially, morally and aesthetically balanced and improving students' understanding of community members' attitudes and culture. They have the opportunity to understand culture, value systems and different worldviews. (MOE, 2011)

As part of the Mother Tongue Languages syllabus, Literature in Malay is offered at Secondary 3 and 4 levels as a full subject or part of an elective subject.

More broadly, the development of students' cross-cultural skills is regarded as critical for character and citizenship; therefore, SC: Character and Citizenship Education (SC: CCE) is a subject both at Primary and Secondary levels (MOE, 2017). The Citizenship Competencies in the Primary syllabus recognise that a person with socio-cultural sensitivity and awareness:

- Empathises with others through understanding, acceptance and respect
- Engages in appropriate behaviour with other sociocultural groups in both local and international contexts, in a way which would enhance social cohesion. (MOE, 2014c, p. 4)

Measurement of Curriculum: Breadth, Depth and Rigour

	BREADTH			DEPTH			RIGOUR		
	Limited	Fundamental	Comprehensive	Limited	Fundamental	Challenging	Limited	Moderate	Challenging
AC									
SC									

AC – Breadth

Breadth: Limited

The AC states that the cross-curriculum priority should cut across all areas of the curriculum and “enable the delivery of learning area content at the same time as developing knowledge, understanding and skills relating to Aboriginal and Torres Strait Islander Histories and Cultures, Asia and Australia’s Engagement with Asia, and/or Sustainability”(ACARA, 2017h). The breadth of this area of the curriculum is deemed to be **limited** as content descriptions are provided in three learning areas in Years 2, 6 and 10; that is, in HASS (Year 2 x 1, Year 6 x 1, Year 10 x 6), Languages (Year 2 x 1, Year 6 x 0, Year 9/10 x 1), and The Arts (Year F-2 x 6, Year 5-6 x 6, Year 10 x 9).

The cross-curriculum priority features strongly in the Framework for Aboriginal Languages and Torres Strait Islander Languages, located within the AC’s Languages learning area.

SC – Breadth

Breadth: Comprehensive

While there is no equivalent to the AC: Aboriginal and Torres Strait Islander Histories and Cultures cross-curriculum priority in the SC, the development of cultural competency in

students is **comprehensive** across the SC. This is seen particularly through the provision of Character and Citizenship Education, the emphasis on 21st Century Competencies and Student Outcomes, and the study of Mother Tongue Languages such as Malay language.

AC – Depth

Depth: Limited

There is **limited** depth evident in the place of the cross-curriculum priority in the AC's learning areas. While there is greater representation in the content elaborations, especially in HASS, Languages and The Arts, the material is not connected to the three key concepts of the CCP or to the nine Organising Ideas.

SC – Depth

Depth: Fundamental

The depth of curriculum relating to Malay culture, language, history and knowledge is deemed to be **fundamental**. Content extends through all year levels of learning both in primary and secondary and articulated through the 21st Century Competencies detailed in each of the learning areas. The SC is inclusive of the complexities of cultural diversity.

AC – Rigour

Rigour: Moderate

The CCP within the AC's learning areas provides teachers with some important content to teach. This content, coupled with the CCP's Key Ideas and associated Organising Ideas, helps teachers to understand the intention and importance of the cross-curriculum priority. Feedback from jurisdictions, for example, indicates that teachers are in need of support to 'handle content accurately and sensitively' and there were 'limited' resources on the AC website to support the 'usefulness' of the priority (Association of Independent Schools, NSW, 2017). Additional feedback also indicates the need for ways to make links across the three dimensions of the AC (Independent Schools Queensland, 2017). Therefore, based on this evidence, the CCP can be considered **moderate** in relation to rigour.

SC – Rigour

Rigour: Challenging

Cultural diversity is integral to the SC and, combined with the depth and breadth of curriculum, the level of rigour is deemed to be **challenging**, particularly as it demonstrates a consistent contribution to a culturally responsive curriculum.

Comparative Analysis

Each nation's curriculum aims to reflect its cultural diversity and the development of cultural and intercultural capabilities in its students. A feature common to both the Australian and Singaporean curricula is the development of capabilities or competencies that equip students to "live and work successfully in the twenty-first century" (ACARA, 2017g). Any reference to Indigenous histories and cultures is somewhat limited in the AC due to the small number of relevant content descriptions in the learning areas; there is no reference in the

General Capabilities, and the cross-curriculum priority is absent from the achievement standards.

On the other hand, the presence of Indigenous material in the SC is much stronger, and bilingual education and Malay culture are presented as integral to nation-building in Singapore. Malay language and literature are offered as discrete subjects in the SC, whereas similar study is made available through the AC cross-curriculum priorities. As an elective, the Aboriginal Languages and Torres Strait Islander Languages Framework in the AC is flexible in design and caters for different language pathways.

Cultural sustainability: A focus on AC: Humanities and Social Sciences and SC: History (Primary 3, Primary 6, Secondary 3/4)

This section considers the ways in which the Australian and Singaporean curricula focus on cultural identity through the subjects of HASS and History, respectively, per Table 3.40.

Table 3.40 *Cultural identity in HASS and History/Civics and Citizenship/Social Studies*

Year level AC/SC	Subject AC/SC
Year 2/Cluster 2: Primary 3 and 4	Humanities and Social Sciences/Social Studies
Year 6/Cluster 3: Primary 6	Humanities and Social Sciences/Social Studies
Years 9 and 10/Secondary 3 and 4	History and Civics and Citizenship/History and Social Studies

In the AC: HASS, Aboriginal and Torres Strait Islander content is represented through the content descriptions and elaborations. In the SC: Social Studies and History curriculum, Malay content is expressed through a focus on the development of knowledge, skills and values in cultural diversity.

Year 2/Primary 3 and 4 Humanities and Social Sciences/Social Studies

The Year 2 AC: HASS topic is: *Our past and present connections to people and places*. Students explore:

connections between the past and present and between people and places. Students examine remains of the past in their local area, coming to understand how connections have changed the lives of people over time and space and how their community values and preserves connections to the past. (ACARA, 2017m)

The AC's HASS learning area is organised into two broad interrelated strands: knowledge and understanding, and inquiry and skills. Of a total of 18 content descriptions in Year 2 HASS, one content description is tagged with the Aboriginal and Torres Strait Islander Histories and Cultures cross-curriculum priority: *The ways in which Aboriginal and Torres Strait Islander Peoples maintain special connections to particular Country/Place* with all three of its elaborations tagged with the CCP (ACARA, 2017m). It appears in the Geography sub-strand within the knowledge and understanding strand in *Concepts for developing understanding* with the inquiry questions:

- What is place?
- How are people connected to their place and other places?
- What factors affect my connection to places?

The Aboriginal and Torres Strait Islander cross-curriculum priority does not appear in the Year 2 History sub-strand content elaborations.

In the Primary 3 and 4 SC: Social Studies, the topic *Understanding Singapore Past and Present* (Cluster 2) and designed to develop in students:

An appreciation of the country they live in as they learn about the contributions of different groups of people to the growth of Singapore. Pupils would also come to value the resilience as well as resourcefulness of our forefathers and political leaders. (MOE, 2012b, p. 3)

For Primary 3 students, the sub-topic is *Understanding Singapore*; this is guided by the overarching question of 'How do we appreciate the country we live in?'

In Primary 4, the sub-topic is *Valuing Our Past*. The inquiry focus is: How is life in Singapore today shaped by what happened in the past? Through one of its guiding questions: '*How did different people contribute to Singapore's growth?*' the knowledge and understanding for this sub-topic draws on how different people contributed to Singapore's Early Growth. Students are required to investigate:

- Different people and their contributions
 - The Indigenous people (Orang Laut)
 - The Malays – Example: Munshi Abdullah

Year 6/Primary 6 Humanities and Social Sciences/Social Studies

The AC Year 6 HASS topic is *Australia in the past and present and its connection with a diverse world*. Students investigate:

The events and developments that shaped Australia as a democratic nation and stable economy, and the experiences of the diverse groups who have contributed to and are/were affected by these events and developments, past and present. (ACARA, 2017m)

As with Year 2, the curriculum is organised into strands: knowledge and understanding, and inquiry and skills. Of a total of 29 content descriptions, there is one content description tagged with the Aboriginal and Torres Strait Islander Histories and Cultures cross-curriculum priority. This appears in the History sub-strand in *Concepts for developing understanding* with the associated inquiry questions:

- Why and how did Australia become a nation?
- How did Australian society change throughout the twentieth century?
- Who were the people who came to Australia? Why did they come?
- What contribution have significant individuals and groups made to the development of Australian society? (ACARA, 2017m)

The content description is: *Experiences of Australian democracy and citizenship, including the status and rights of Aboriginal and Torres Strait Islander Peoples, migrants, women and children* with four of its six elaborations tagged with the CCP (ACARA, 2017m).

In the SC: Social Studies, Primary 6, students are in the second year of Cluster 3 and focusing on *Appreciating the World and Region We live In*. They learn about:

The world and the various communities of people. Fostered in the pupils would be a deeper appreciation of the interconnectedness of the world and the legacy of human achievements of societies, past and present. The journey for the child culminates with an understanding of Southeast Asia and Singapore's ties with the region. (MOE, 2012b, p. 3)

After completing *Appreciating the World* in Primary 5, *Discovering Southeast Asia* is the topic for Primary 6.

Years 9 and 10/Secondary 3/4

In the AC Years 9 and 10 History curricula, one content description in Year 9 and four content descriptions in Year 10 are tagged with the Aboriginal and Torres Strait Islander Histories and Cultures cross-curriculum priority.

In Year 9 History, the CCP appears within the Historical Knowledge and Understanding strand in the Depth Study, *Making a Nation*, with the content description: "The extension of settlement, including the effects of contact (intended and unintended) between European settlers in Australia and Aboriginal and Torres Strait Islander Peoples" (ACARA, 2017m). Both content elaborations are tagged with the CCP.

In Year 10 History four content descriptions (ACDSEH104) appear within the Historical Knowledge and Understanding strand in the Depth Study, Rights and Freedoms, as follows:

- Background to the struggle of Aboriginal and Torres Strait Islander Peoples for rights and freedoms before 1965, including the 1938 Day of Mourning and the Stolen Generations
- The significance of the following for the civil rights of Aboriginal and Torres Strait Islander Peoples: 1962 right to vote federally; 1967 Referendum; Reconciliation; Mabo decision; Bringing Them Home Report (the Stolen Generations), the Apology
- Methods used by civil rights activists to achieve change for Aboriginal and Torres Strait Islander Peoples, and the role of ONE individual or group in the struggle
- The continuing nature of efforts to secure civil rights and freedoms in Australia throughout the world, such as the Declaration on the Rights of Indigenous Peoples

The four content descriptions are accompanied by five elaborations, four of which are tagged with the CCP.

In the AC Years 9 and 10 Civics and Citizenship curriculum, there are no content elaborations in Year 9. The Year 10 curriculum has one elaboration tagged with the Aboriginal and Torres Strait Islander Histories and Cultures cross-curriculum priority. The Year 10 CCP appears in the Knowledge and Understanding strand in the content description 'How Australia's international legal obligations shape Australian law and government policies, including in relation to Aboriginal and Torres Strait Islander Peoples'. Two of its four elaborations are tagged with the CCP.

SC Secondary 3/4

In SC Secondary 3/4, Social Studies is offered through three courses: Normal (Technical); Normal (Academic); and Express. With a focus on *Living in a Multicultural Society* and *Protecting our Environment* occurring at Lower Secondary levels, Secondary 3 and 4 progress this learning to *Managing our Financial Resources* and *Caring for Society*. There is no specific mention of Malay Peoples or cultures. In the Normal (Academic) and Express courses, one of the three issues explored by students is *Living in a Diverse Society*. The inquiry focus is about that capacity of a diverse society to achieve harmony, and the guiding questions indicate a requirement for sophisticated research and discussion:

1. What is diversity?
2. Why is there greater diversity in Singapore now?
3. What are the experiences and effects of living in a diverse society?
4. How can we respond in a diverse society?

In Upper Secondary, History is offered through the Express and Normal (Academic) courses. There is no mention of Singapore's Malay peoples in either course, but there is content related to Malaya and colonisation, decolonisation and independence. The issue of European hegemony is taught throughout the syllabus, underlined by an explanation that "students will understand not just concepts such as balance of power, hegemony, geopolitics and nationalism, but also acquire historical thinking skills" (MOE, 2016c, p. 6). The AC does not refer to notions of hegemony, although this could be inferred through content relating to colonisation and assimilation policies.

Singapore's curriculum provides evidence of a commitment to a culturally responsive curriculum that resonates with students at all levels of learning and is integrated across the different layers of the learning areas. The curriculum introduces concepts such as 'new diversities' that are not found in the AC.

Additional Observations

There are significant differences in the nature and experiences of the Indigenous people of Australia and Singapore, and this is clearly reflected in the curricula of the two nations. Contributing factors to the differences include the following:

- geographical features (i.e. Singapore is 719 km² in size while the Australian continent spans 7.692 million km²)
- diversity of Indigenous groups (up to 150 Australian Aboriginal and Torres Strait Islander language groups compared to the one major Malay language group)
- predominance of the Muslim faith among Malays, whereas in Australia there is significant diversity in religious beliefs amongst Aboriginal and Torres Strait Islander peoples. In the population of Singapore, 14% are Malay with about 99% of these being Muslims; hence, the Malay culture is closely intertwined with Islam since the vast majority of Malays are Sunni Muslims (MRGI, 2017).

Whilst it is evident in the SC how the curriculum relates specifically to the learning of Malay students, the AC does not state how its curriculum is specifically inclusive of Aboriginal and Torres Strait Islander students (for example, NAPLAN results continue to highlight the

substantial learning gap between Aboriginal and Torres Strait Islander students and their non-Indigenous counterparts).

j) Student Diversity

Comparative Curricula

Australian Curriculum: Student Diversity

Version 8.3, 2016

Singapore Curriculum: Special Education, Learning Support, Gifted Education

Year/Grade Level

All

Learning Area/Subject

Australian Curriculum: Student Diversity

Singapore Curriculum: Special Education, Learning Support, Gifted Education

Expectations: Knowledge and Skills

Guided by the Melbourne Declaration, the development of the AC is based on the premise that “(a)ll students are entitled to rigorous, relevant and engaging learning programs drawn from a challenging curriculum that addresses their individual learning needs”(ACARA, 2017). The AC “sets the expectations for what all young Australians should be taught, regardless of where they live in Australia or their background” (ACARA, 2017). Accessibility to the AC for *all* students is governed by legislation including the Disability Discrimination Act 1992 and the Disability Standards for Education 2005 (AGDET, 2005).

Designed to be inclusive of all students, the AC’s three-dimensional design encompasses eight learning areas, seven general capabilities and three cross-curriculum priorities, giving teachers the flexibility to cater for student diversity by personalising learning. Teachers can address individual learning needs by incorporating specific teaching of the general capabilities or cross-curriculum priorities through the learning area content; all decisions regarding personalised learning are based on assessment of a student’s current levels of learning, strengths, goals and interests.

The AC is written for teachers and provides explicit advice about the use of the general capabilities and the cross-curriculum priorities to teach aspects of learning area content to students with diverse needs. In addition to general advice, more specific advice is provided to assist the learning of students with disability, students identified as gifted and talented, and students for whom English is an additional language or dialect (EAL/D). Illustrations of practice and other materials support teachers in their work.

The process for designing teaching and learning programs is the same for all students. As a starting point, teachers utilise the AC learning area content aligned to the student’s chronological age. Teachers personalise programs by:

- drawing from learning area content at different levels along the Foundation to Year 10 sequence to personalise age-equivalent learning area content
- using the general capabilities and/or cross-curriculum priorities to adjust the learning focus of the age-equivalent learning area content
- aligning individual learning goals with age-equivalent learning area content.

Teachers assess students' progress through the AC in relation to the achievement standards. Some students' progress will be assessed in relation to their individual learning goals; that is, a school may design an individual learning program to ensure that a student can access aspects of the AC.

In Australia, state and territory education authorities carry responsibility for schools and teachers and for the delivery of the AC. Thus, approaches to assessment and reporting differ across the states and territories, as do the methods of catering for students with diverse needs.

Consideration of Singapore's national curriculum reveals some similarities and some differences in relation to student diversity. In Singapore, students with disability are generally placed in one of the twenty Special Education (SPED) schools. According to the Singapore MOE, there were 5,441 students in the 20 SPED schools in 2015 (MOE, 2016a, p. 15). Students with a disability who have the cognitive ability to access the mainstream curriculum may be placed in mainstream schools, provided their needs can be met with minimal adaptations to the curriculum. There are limited guidelines to support teachers of students with disability within the SC (MOE, 2011a).

Special Education

The MOE launched the Special Education Curriculum Framework: 'Living, Learning and Working in the 21st Century' in 2012. There are no specific guidelines for teachers concerning the implementation of the Framework on the MOE website. An infographic accompanies a description of the Framework on the MOE website:

The Framework affirms the importance of Character and Citizenship Education (CCE) as the Foundation for Values-Based SPED and Information Communication Technology (ICT) as an Enabler for teaching and learning in SPED. It also articulates the Vision for SPED, a set of core Principles, Living, Learning and Working Outcomes that students should aspire towards at the end of their SPED in schools, and Learning Domains for a holistic education (Social-Emotional, Academic, Daily Living, Vocational, the Arts, Physical Education and Sports) (MOE, 2017j).

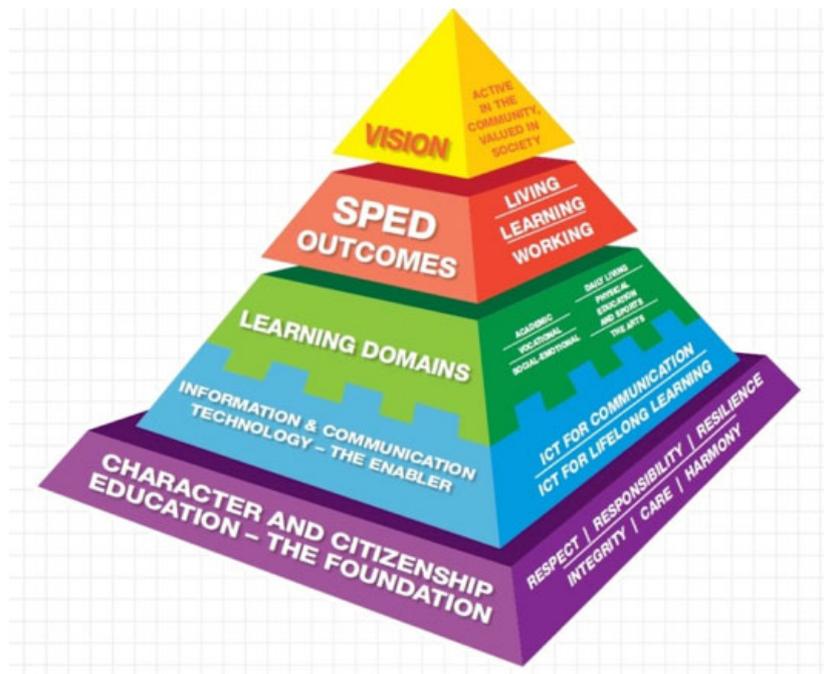


Figure 3.8 *Special Education Curriculum Framework*

Reproduced from: Ministry of Education, Singapore (<https://www.moe.gov.sg/education/special-education/special-education-schools/sped-curriculum-framework>, October 2017)

competencies to access the curriculum. There is no explanation of how this learning support is to be implemented (MOE, 2017).

Gifted and Talented Students

Singapore's Gifted Education Programme (GEP) is designed 'to provide leadership in the education of the intellectually gifted. We are committed to nurturing gifted individuals to their full potential for the fulfilment of self and the betterment of society' (MOE, 2017k).

Gifted and Talented education is primarily delivered through special programs, with guidance offered to schools and teachers. Students may access six program options:

- Individualised Study Options (focusing on areas such as innovation, problem solving and digital media)
- Enrichment Activities and Programs for Primary and Secondary students
- Special Programmes intended to deepen students' interest, which includes mentoring by professionals and academics
- NUS-MOE Humanities and Social Sciences Research (HSSR), a joint program with the National University of Singapore that focuses on independent research and study in Humanities
- Enrichment Activities and Program for Learners with High Ability (accessed by students in mainstream schools with a high ability in English Language, Mathematics and Science).

Bilingualism

Bilingualism, or mother tongue policy, is at the core of the Singapore education system. While English is the first language, and the medium of instruction, students are expected to study a *Mother Tongue* language which may be one of the three official languages: Chinese, Malay and Tamil. Syllabi for each of these languages are presented in the native language.

EAL/D does not feature as specific advice as it does in the AC. Nevertheless, in acknowledging Singapore's linguistic and cultural pluralism, one of the MOE's main objectives is to educate all students with their 'mother tongue' to enable them to learn about their culture, identify with their ethnic heritage, and protect Asian values and cultural characteristics. This approach is not apparent in the AC.

Comparative Analysis

Unlike Australia, Singapore has a separate curriculum framework for students with disability who are not cognitively able to access the mainstream curriculum. The AC provides more comprehensive guidance and support to teachers in meeting the needs of students with diverse learning needs than appears to be the case in the SC. While Australia has a philosophical preference for teaching students with disability in mainstream contexts wherever possible, Singapore's approach makes specialist schools the placement of choice for the majority of these students.

Students deemed to have particularly high levels of ability receive support through special programs delivered outside the mainstream curriculum in Singapore. This differs from the more integrative approach offered by the AC.

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7. LIST OF ABBREVIATIONS

ABS	Australian Bureau of Statistics
AC	Australian Curriculum
ACER	Australian Council of Educational Research
AC: CC	Australian Curriculum: Civics and Citizenship
AC: CCP	Australian Curriculum: Cross-Curriculum Priority
AC: E	Australian Curriculum: English
AC: EB	Australian Curriculum: Economics and Business
AC: G	Australian Curriculum: Geography
AC: GC	Australian Curriculum: General Capabilities
AC: HASS	Australian Curriculum: Humanities and Social Sciences
AC: H	Australian Curriculum: History
AC: HPE	Australian Curriculum: Health and Physical Education
AC: L	Australian Curriculum: Languages
AC: M	Australian Curriculum: Mathematics
AC: S	Australian Curriculum: Science
AC: T	Australian Curriculum: Technologies
AC: TA	Australian Curriculum: The Arts
ACARA	Australian Curriculum, Assessment and Reporting Authority
AGDET	Australian Government Department of Education and Training
AITSL	Australian Institute of Teaching and School Leadership
CCP	Cross-Curriculum Priority
COAG	Council of Australian Governments
DoK	Depth of Knowledge
DOE	Desired Outcomes of Education
EAL/D	English is an additional language or dialect
FITT	Frequency, Intensity, Type (of exercise), Time
GCN	Global Curriculum Network
GDP	Gross Domestic Product

GCSE O-Level	General Certificate of Education (GCE) Ordinary Level
GEP	Gifted Education Programme
ICT	Information and Communication Technology
IEP	Individualised Education Plan
KC	Key Concepts
KP	Key Processes
MCEETYA	Ministerial Council on Education, Employment, Training and Youth Affairs
NAEP	National Assessment of Educational Progress (USA)
NAPLAN	National Assessment Program for Literacy and Numeracy
OECD	Organisation for Economic Cooperation and Development
PISA	Programme for International Student Assessment
PSLE	Primary School Leaving Exam
PIRLS	Progress in International Reading Literacy Study
SC: E	Singapore Curriculum: English Language
SC: M	Singapore Curriculum: Mathematics
SC: S	Singapore Curriculum: Science
SC: SS	Singapore Curriculum: Social Studies
SC: D&T	Singapore Curriculum: Design and Technology
SC: FCE	Singapore Curriculum: Food and Consumer Education
SC: PE	Singapore Curriculum: Physical Education
SC: HE	Singapore Curriculum: Health Education
SC: CCE	Singapore Curriculum: Character and Citizenship Education
SEL	Social and Emotional Learning
SPED	Special Education (Singapore)
TIMSS	Trends in International Mathematics and Science Study
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VUCA	Volatile, Uncertain, Complex, Ambiguous
WHO	World Health Organisation

8. ACKNOWLEDGEMENTS

The Australian Curriculum, Assessment and Reporting Authority (ACARA) would like to thank the following copyright holders for reproduction of their material in this report:

Ministry of Education (MOE), Singapore for Figure 2.11 Framework for 21st Century Competencies and Students on p. 32; Figure 3.3 Organisational diagram of the Singapore Science Curriculum on p. 90; Figure 3.4 ICT Connection Masterplan 4 on p. 112; Figure 3.5 Baseline ICT Standards for digital learners on p. 113; Figure 3.8 Special Education Curriculum Framework on p.167.

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