MPPM 1103:
Design and Implementation of Mathematics Curriculum

Comparison between Malaysia, Singapore and United Kingdom Mathematics Curriculum

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Malaysia Mathematics Curriculum

Malaysia Education System

Outcome-based education (OBE)

is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal.

FALSAFAH PENDIDIKAN NEGARA

" Pendidikan di Malaysia adalah satu usaha berterusan ke arah memperkembangkan lagi potensi individu secara menyeluruh dan bersepadu untuk mewujudkan insan yang seimbang dan harmonis dari segi intelek, rohani,emosi, dan jasmani berdasarkan kepada kepercayaan dan kepatuhan kepada Tuhan. Usaha ini adalah bagi melahirkan rakyat Malaysia yang berilmu, bertanggungjawab dan berkeupayaan mencapai kesejahteraan diri serta memberi sumbangan terhadap keharmonian dan kemakmuran masyarakat dan negara."

MUHAS


Every student will have …
Leadership skills
Bilingual proficiency
Thinking skills
Ethics and spirituality
Knowledge
National identity
… aligned with the National Education Philosophy

KBSR / KBSM	KSSR / KSSM
Communication, Man and his environment, Self-development of the individual	Communication, Spiritual, Attitude and Values, Humanitarian, Physical and Aesthetical Development, Science and Technology, Personal Appearance
Curriculum Specification which consists ‘Learning Objective’, ‘Learning Outcome’, and ‘Suggested Learning Activities’	Curriculum Standard documents which consists ‘Content Standards’, ‘Learning Standards’, ‘Performance Standards’ and ‘Notes’
Linear Elements of analytical and creative thinking skills	Modular The elements of creativity and innovation, entrepreneurial, information technology and communication
3R’s (Reading, wRiting and aRithmetic)	4R’s (Reading, wRiting, aRithmetic and Reasoning)

Mathematic Curriculum Frameworks

- Numbers and Operations
- Measurement and Geometry
- Relationship and Algebra
- Statistics and Probability
- Discrete Number

- Communication
- Reasoning
- Connections
- Problem Solving
- Representation

- Perception, interest, appreciation, confidently resilient and perseverance.
- Personality, interaction, procedure, intrinsic.

- Thinking skills
- Soft skills
- Information Communication Technology skills

The curriculum document is the main locus for the class implementation, text book writings, and even the items to be asked in the students' assessment

Topics in Primary School

Numbers and Operations	Measurements and Geometry	Relationship and Algebra	Statistics and Probability	Discrete Mathematics
• Whole Numbers • Basic Operations • Fractions, Decimals, and Percentage • Money	• Time • Measurements • Space	• Coordinate • Ratio and Proportions	• Data managements • Likelihood	

Year 1 – Year 3 (Key Stage 1)

Year 4 – Year 6 (Key Stage 2)

Standard Document

Content Standards	Learning Standards	Performance Standards

Standard Document

…general statement about cognitive and affective domain that can be achieved by the pupils.	…specific statement of what pupils should know and able to do conceptually and practically.	…general criterion that illustrate the level of performance that the students need to demonstrate as indicator of success called Descriptor.
Knowledge	Skills	Values

Example: KSSR edition 2011

NOMBOR DAN OPERASI

4. WANG HINGGA RM10

Tahun 1

STANDARD KANDUNGAN *Murid dibimbing untuk ...*	STANDARD PEMBELAJARAN *Murid berupaya untuk ...*
4.1 Mengenal pasti ringgit dan sen.	(i) Mengenal pasti mata wang Malaysia dalam bentuk syiling dan wang kertas. (ii) Mewakilkan nilai wang: (a) Sen hingga RM1. (b) Ringgit hingga RM10. (iii) Mewakilkan nilai wang dengan menggunakan abakus 4:1. (iv) Menukar wang: (a) Syiling hingga 1 ringgit. (b) Ringgit hingga RM10.
4.2 Tambah dan tolak melibatkan wang.	(i) Tambah dan tolak: (a) Sen hingga RM1. (b) Ringgit hingga RM10. (ii) Tambah dan tolak melibatkan wang dengan menggunakan abakus 4:1.

Example: KSSR edition 2017 (now in piloting phase)

BIDANG PEMBELAJARAN:

NOMBOR DAN OPERASI

TAJUK:

4.0 WANG

Objektif:
Membolehkan murid:

- Menghubung kaitkan penggunaan wang dalam kehidupan harian.
- Berfikir, menaakul dan membuat penerokaan di dalam kehidupan harian bagi memberi manfaat demi masa depan.
- Berkomunikasi, membuat perkaitan dan menyelesaikan masalah yang melibatkan kewangan.
- Mengaplikasi pendidikan kewangan di dalam kehidupan harian.
- Memupuk semangat keusahawan.

Example: KSSR edition 2017 (now in piloting phase)

NOMBOR DAN OPERASI

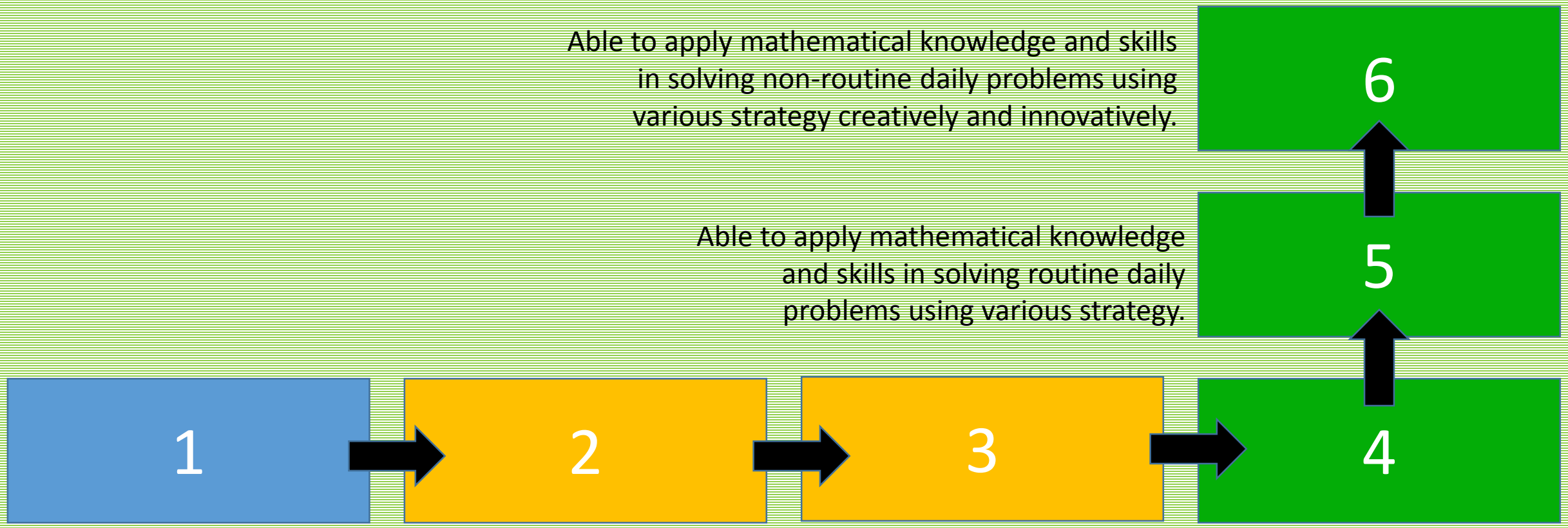
4.0 WANG

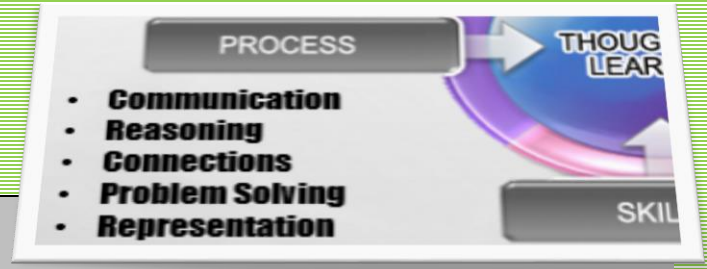
STANDARD KANDUNGAN	STANDARD PEMBELAJARAN	CATATAN
4.1 Wang kertas dan duit syiling.	4.1.1 Mengenal pasti mata wang Malaysia dalam bentuk syiling dan wang kertas. 4.1.2 Mewakilkan nilai wang: (i) Sen hingga RM1. (ii) Ringgit hingga RM10. 4.1.3 Menukar wang: (i) Syiling hingga RM1. (ii) Ringgit hingga RM10.	Menggunakan wang semasa dalam situasi harian. Mewakilkan nilai wang dengan menggunakan abakus 4:1. Menggunakan gabungan wang dalam bentuk syiling dan wang kertas.
4.2 Sumber kewangan dan simpanan.	4.2.1 Mengenal pasti sumber kewangan dan simpanan. 4.2.2 Merekod simpanan dan perbelanjaan daripada sumber kewangan.	Mengunakan situasi yang sesuai.
4.3 Penyelesaian masalah.	4.3.1 Menyelesaikan masalah harian melibatkan penambahan dan penolakan wang.	Sebelum menyelesaikan masalah proses penyelesaian secara mekanikal boleh dilakukan bagi menerangkan penambahan dan penolakan yang melibatkan: (a) Sen hingga RM1. (b) Ringgit hingga RM10 Tambah dan tolak melibatkan wang dengan menggunakan abakus 4:1.

General Descriptor for Performance Standard Framework

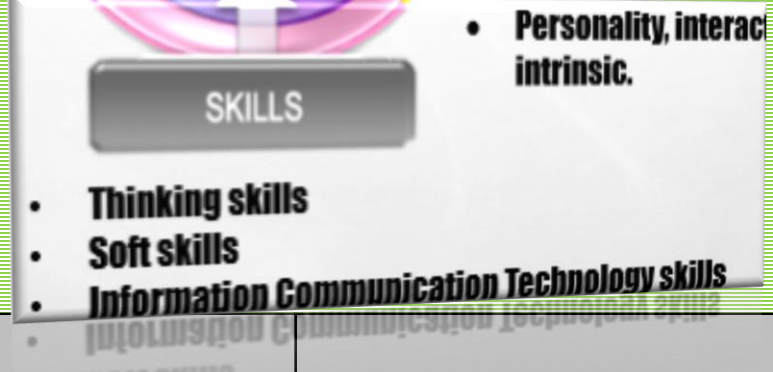
PERFORMANCE LEVEL	DESCRIPTOR FRAMEWORK	GENERAL DESCRIPTOR
1	Know	Pupils know the basics or can perform basic skills or to respond to the basic subject matter.
2	Know and understand	Pupils demonstrate their understanding in communicating mathematically; able to interpret and explain what they have learned.
3	Know, understand and able to do.	Pupils use their mathematical knowledge to perform particular skills in a particular situation.
4	Know, understand and able to do with good manner.	Pupils demonstrate their skills systematically and procedurally.
5	Know, understand and able to do with admirable manner.	Pupils demonstrate their skills systematically and procedurally in a new situation; and consistently with a positive attitude.
6	Know, understand and able to do with exemplary manner.	Pupils are able to apply their knowledge and skills in a new situation systematically, positively, creatively, innovatively and exemplary.

PERFORMANCE LEVEL	KNOWLEDGE PERFORMANCE INDICATOR
1	Know basic Mathematical knowledge
2	Know and understand basic mathematical knowledge
3	Know and understand basic mathematical knowledge; able to apply basic arithmetic operations; able to apply knowledge on basic conversion
4	Know and understand mathematical knowledge; able to apply calculation procedures in solving routine daily problems.
5	Able to apply mathematical knowledge and skills in solving routine daily problems using various strategy.
6	Able to apply mathematical knowledge and skills in solving non-routine daily problems using various strategy creatively and innovatively.

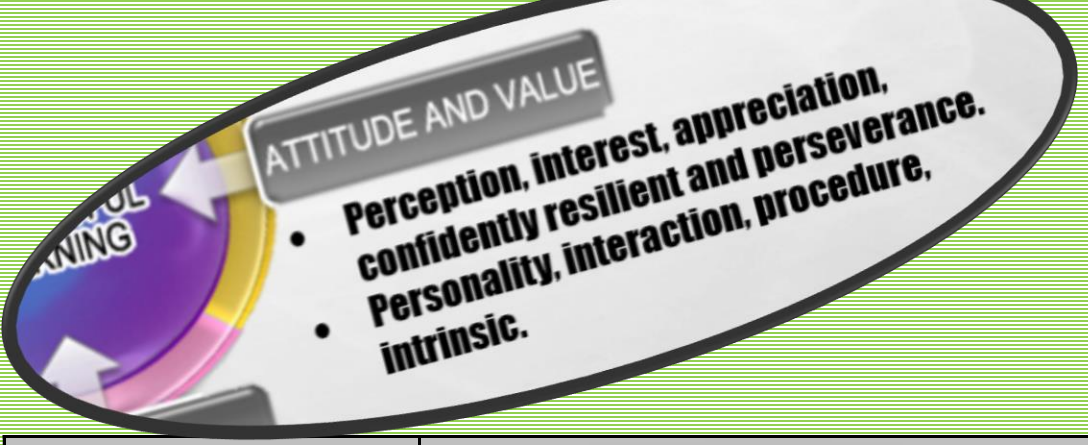

Able to apply mathematical knowledge and skills in solving non-routine daily problems using various strategy creatively and innovatively.
6
Able to apply mathematical knowledge and skills in solving routine daily problems using various strategy.
5
1
2
3
4
Know basic mathematical knowledge
Know and understand basic mathematical knowledge
Able to apply basic arithmetic operations;
Able to apply knowledge on basic conversion
Able to apply calculation procedures in solving routine daily problems.



	MATHEMATICAL PROCESSES PERFORMANCE INDICATOR				
	PROBLEM SOLVING	**REASONING**	**CONNECTIONS**	**REPRESENTATIONS**	**COMMUNICATIONS**
1	Able to explain problem solving procedures but unable to solve the problems.	Able to give logical reasoning to mathematical activities with guidance.	Able to make connections between learned skills and to the other topics, as well as to daily life with guidance.	Able to make representation with guidance	Able to explain mathematical ideas in words or writings using mathematical symbols or visuals representations.
2	Able to solve given routine problems with guidance.	Able to give logical reasoning to mathematical activities without guidance.	Able to make connections between learned skills and to the other topics, as well as to daily life without guidance.	Able to make representations to show mathematical understanding without guidance.	Able to clarify mathematical ideas in words or writings using mathematical symbols or visual representations.
3	Able to solve routine problems involving one step calculation without guidance.	Able to show accurate reasoning to mathematical activities involving one step calculation.	Able to make connections between conceptual and procedural to solve mathematical statement.	Able to explain mathematical concept and procedure by making representations	Able to use mathematical terms, mathematical symbols, or visual representations correctly.
4	Able to solve more complex routine problems.	Able to show accurate reasoning to mathematical activities involving more than one step calculation.	Able to make connections between conceptual and procedural to solve routine daily problems.	Able to make representation to solve routine daily problems	Able to explain mathematical ideas systematically using mathematical term mathematical symbols, or visual representations correctly.
5	Able to solve more complex routine problems with various strategies.	Able to show accurate reasoning to mathematical activities involving routine problem solving.	Able to make connections between conceptual and procedural to solve routine daily problems using various strategies.	Able to make various representations to solve routine daily problems using various strategies.	Able to explain mathematical ideas systematically using mathematical term mathematical symbols, or visual representations correctly to solve routin daily problems.
6	Able to solve non-routine problems creatively and innovatively.	Able to explain accurate reasoning to mathematical activities involving non-routine problem solving creatively and innovatively.	Able to make connections between conceptual and procedural to solve non-routine daily problems creatively, and innovatively.	Able to make representations to solve non-routine daily problems creatively and innovatively.	Able to explain mathematical ideas systematically using mathematical term mathematical symbols, or visual representations correctly to solve non-routine daily problems creatively and innovatively.



PERFORMANCE LEVEL	MATHEMATICAL SKILLS PERFORMANCE INDICATOR		
	THINKING SKILLS	SOFT SKILLS	INFORMATION & COMMUNICATION TECHNOLOGY SKILLS
1	Able to restate mathematical knowledge and skills.	Demonstrate interest and willingness to learn.	Able to recognize and restate mathematical tools.
2	Able to explain mathematical knowledge and skills.	Strive to understand problems' posed.	Able to use and handle basic mathematical tools.
3	Able to apply mathematical knowledge and skills in various situations.	Able to communicate and have interest in learning.	Able to use and handle mathematical tools, develop and understand the mathematical concept, and to explore mathematical ideas.
4	Able to segregate information into smaller piece to have deeper understanding and make connection between the information.	Able to cooperate in team to solve problems.	Able to use mathematical tools to solve routine daily problems.
5	Able to make judgement and decision using knowledge, experiences, and skills, and give justifications.	Able to lead and guide peers.	Able to use mathematical tools to solve routine problems using various strategies.
6	Able to produce creative and innovative ideas, products or methods.	Able to lead, guide, and be an exemplary to peers.	Able to use mathematical tools to solve non-routine daily problems creatively and innovatively.



PERFORMANCE LEVEL	ATTITUDES AND VALUES IN MATHEMATICS PERFORMANCE INDICATOR
1	Able to restate one of the attitudes and values in mathematics with teacher guidance.
2	Able to explain one of the attitudes and values in mathematics by giving reasonable exemplar.
3	Able to demonstrate attitudes and values in mathematics with teacher guidance in a circumstance.
4	Able to demonstrate attitudes and values in mathematics in various circumstances.
5	Able to consistently apply attitudes and values in mathematics during teaching and learning processes.
6	Able to consistently apply positive attitudes and values in mathematics in daily life and able to guide and be exemplary to peers.

Singapore Mathematics Curriculum

Historical Development

1. Since to Singapore's self-independence in 1959, Singapore did not have an unified system of education.
2. Each type of school will teach their own type of mathematics, using textbooks from **different countries**.
3. A **common curriculum was developed** only after self-government, emphasis to ensure that Singapore could **develop an industrialised economy.**

5. setting up the Curriculum Development Institute of Singapore (CDIS) in 1980, deeper into developing teaching approaches and producing instructional materials.

6. The Primary Mathematics Project team, led by Dr Kho Tek Hong (an MOE subject specialist until his retirement), developed the Model Method (a pictorial way to represent mathematical quantities and relations in a concrete way) that proved very successful over the next few decades.

7. A Mathematical Framework was developed in the 1990s

8. Retaining mathematical problem solving as its core, and the **five inter-related components of concepts, skills, processes, attitudes and metacognition.**

9. Minor revisions were made to stress new initiatives such as thinking skills, information technology and National Education.

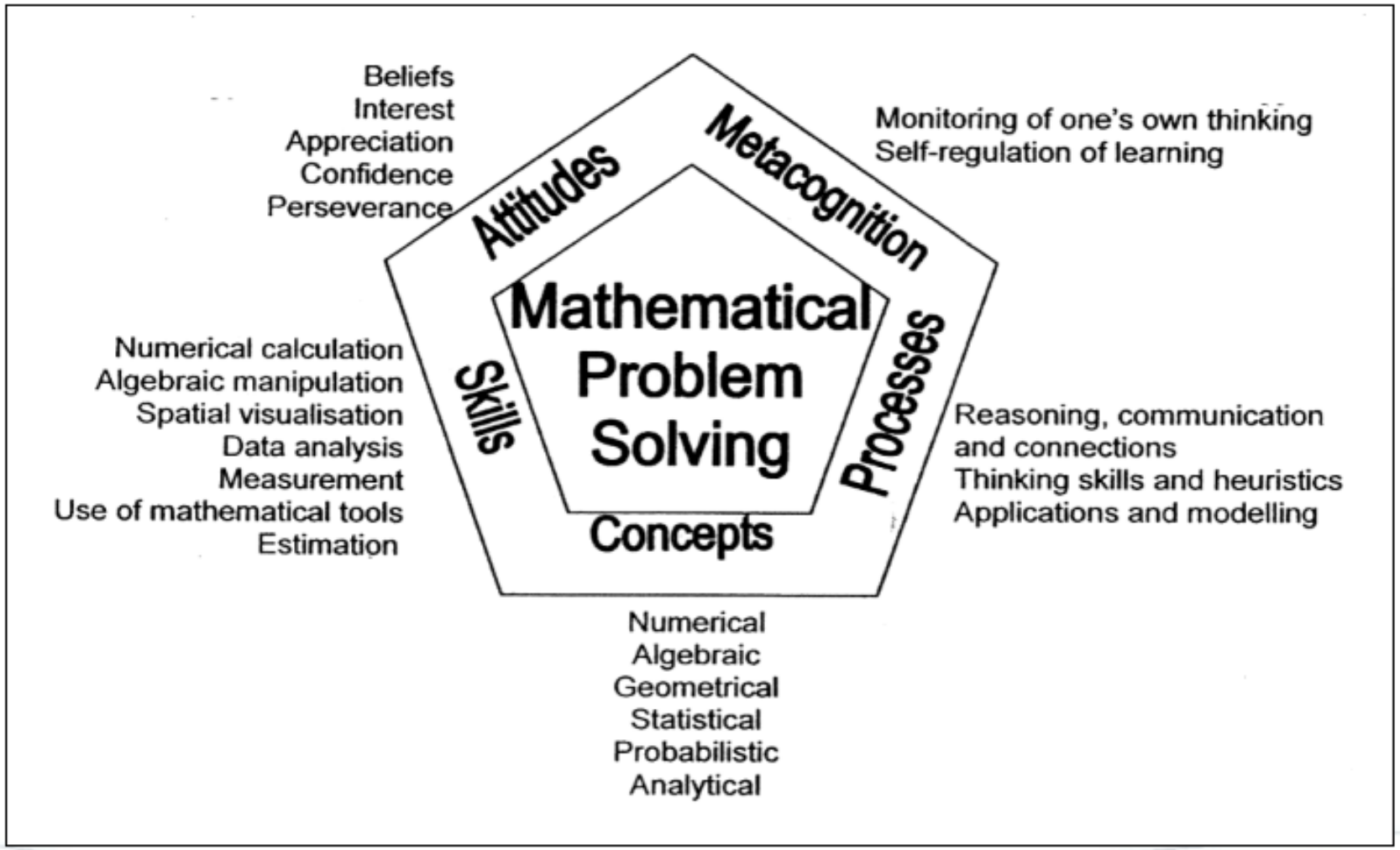
10. The CDIS worked hand in hand with the Ministry of Education (MOE) and together they developed learning goals **that focused on problem solving**.

11. In 1982, the first Singapore math program was created. Marshall Cavendish, the developer of Math Buddies, co-published the text book series with the Ministry of Education.

Singapore's Mathematical Framework

- The Mathematical Framework (Pentagon framework) was introduced in the 1990s to stress both the **process and product** in learning mathematics.
- **mathematical problem solving is at the heart of mathematics learning**, and it involves the application of mathematical concepts and skills, the development of process skills such as **reasoning and communicating, raising meta-cognition in problem solving, and nurturing a positive attitude towards learning mathematics**
- **(summarised by the five inter-related components of concepts, skills, processes, attitudes and metacognition).**

Framework of the school mathematics curriculum



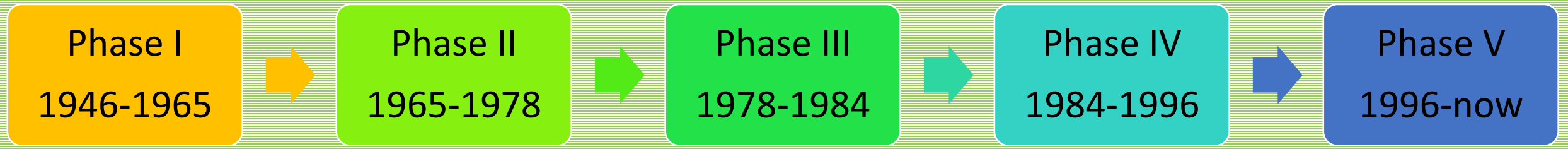
using textbooks from **different countries**.

common curriculum was developed only after self-government

focused on problem solving.

A Mathematical Framework was developed in the 1990s, mathematical problem solving as its core, and the **five inter-related components of concepts, skills, processes, attitudes and metacognition.**

Singapore Education



1946 – 1965 (Phase I) Conflict-Resolution & Quantitative Expansion

use of education, in the period after 1959 **to resolve some of the pressing conflicts and dilemmas Singapore faced in the 1950s.**

pressure to rapidly expand educational opportunities in Singapore with a **view not only to democratizing education**, but also **to use education as a device for achieving national cohesion and the economic restructuring of the society.**

The White Paper

In 1959 when the People's Action Party (PAP) came to power it acted upon the White Paper of 1956 and put in place a Five-Year Plan in education.

- The main features of this Plan were:
- **Equal treatment for the four language** streams of education: Malay, Chinese, Tamil and English;
- The establishment of **Malay as a national language** of the new state;
- Emphasis on the study of **Mathematics, Science and Technical Subjects.**

1965 – 1978 (Phase II) Qualitative Consolidation

1965 witnessed the **end of Singapore's merger with Malaysia**

new chapter in the history of Singapore

transformation from **statehood to nationhood**.

Under the leadership of PAP, education remained a key to it's **survival**.

PHASE II

• emphasis **from academic to technical education** to provide the manpower base for industrialization.

This period also witnessed the onset of **systematic improvements via research** undertaken by the Ministry of Education (MOE) to the education system.

1978 – 1984 (Phase III) Refinements and New Strides

High education **wastage** resulting in low literacy levels in the country.

- In line with the 'simple objective' of education in Singapore,

to educate a child to bring out his greatest potential so that he will grow into a good man and a useful citizen.

The New Education System –

- **Concern – high education wastage resulting in low literacy levels in the country.**

Goh's report 1979

- **New Education System** introduced ***streaming by academic ability***
- Streaming has served the system well as it is **flexible**
- Many pathways to cater to the **diverse needs of students with varying academic abilities**

1984 – 1996 (Phase IV) Towards Excellence in Schools

Future education policies in Singapore would be **guided by three principles**. These were:

Education policy must **keep in pace with the economy and society**;

Basics – Languages, Science, Mathematics and Humanities will be stressed to **encourage logical thinking and life-long learning**;

Creativity in schools must be boosted through a 'bottom up' approach

---initiative must come from principals and teachers instead of from the Ministry.

1996 – present(Phase V) The Way Forward

In 1997, the Prime Minister, Mr Goh Chok Tong in his speech (Goh, 1997) announced at the opening of the conference that Singapore's vision for meeting this challenge is encapsulated in four words: **THINKING SCHOOLS, LEARNING NATION**

- **to prepare young Singaporeans for the new circumstances and new problems** that they will face in the new millennium.

emphasized that **ensure our young can think for themselves,** so that the next and future generations can find their **own solutions** to whatever new problems they may encounter.

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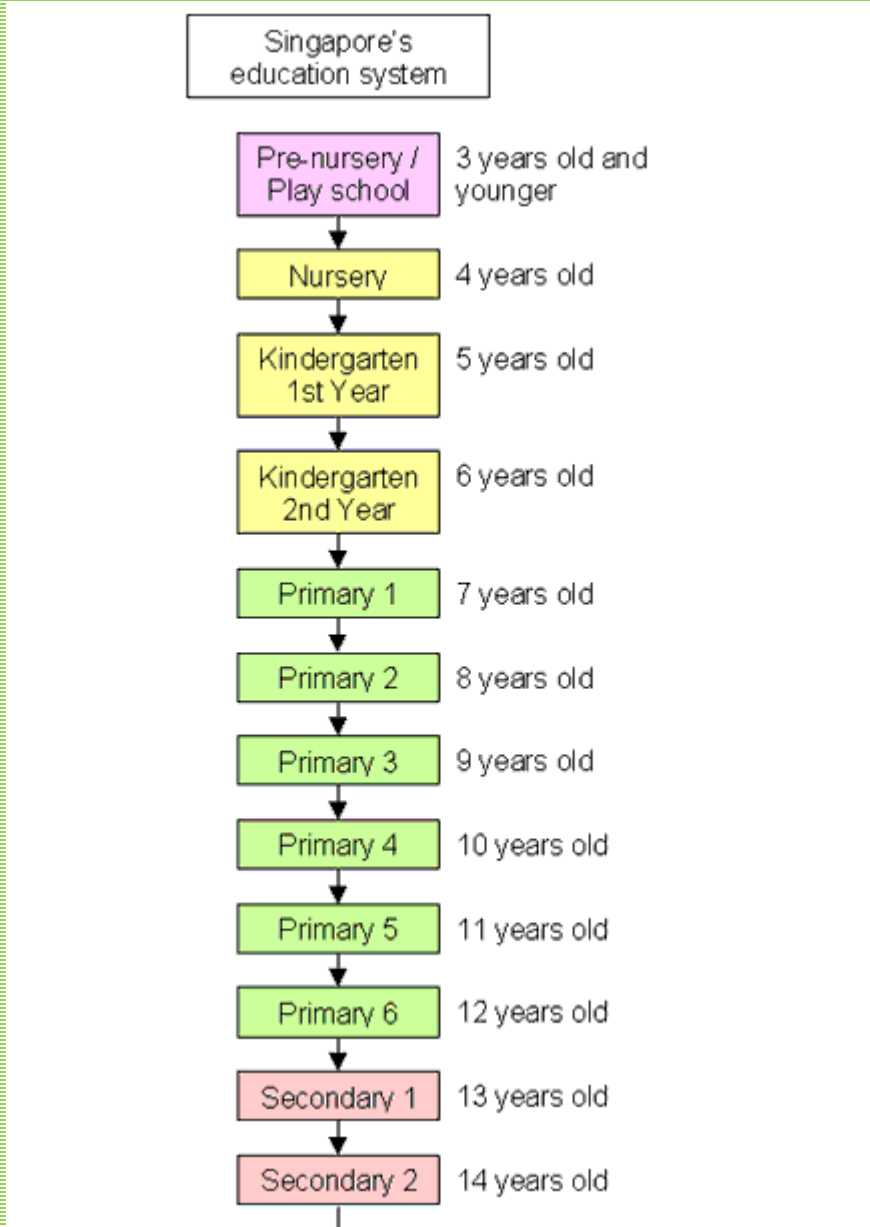
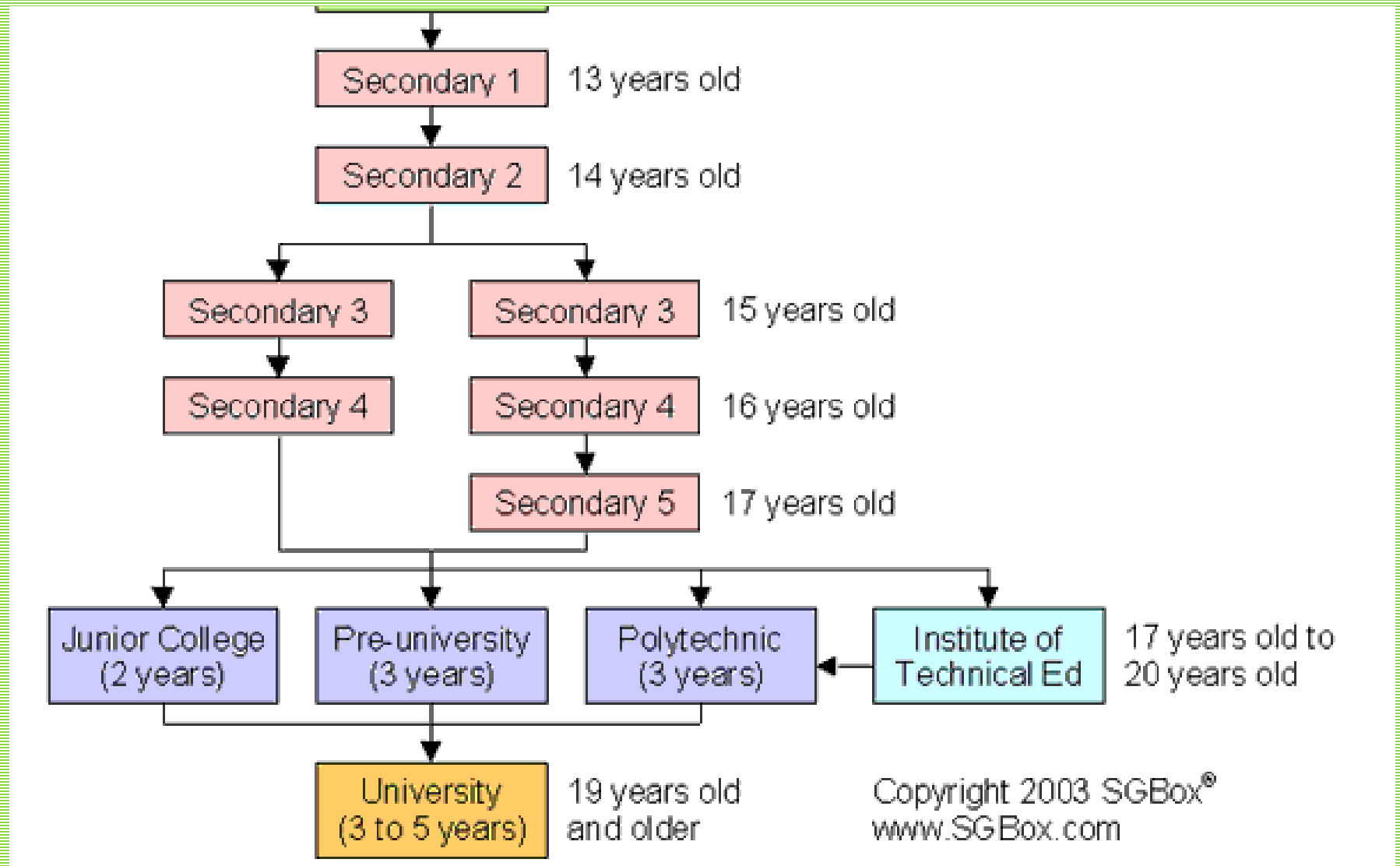
Survival Economics/ Education 1965-1978

Sustainable development through efficiency-driven education, 1978-1996

Toward the knowledge based economy through ability-driven education, 1996-present

Overall look of Singapore education system




Secondary 1
13 years old
Secondary 2
14 years old
Secondary 3
Secondary 3
15 years old
Secondary 4
Secondary 4
16 years old
Secondary 5
17 years old
Junior College
(2 years)
Pre-university
(3 years)
Polytechnic
(3 years)
Institute of
Technical Ed
17 years old to
20 years old
University
(3 to 5 years)
19 years old
and older
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Primary students

- Singapore's educational structure comprises
- **six years of primary,**
- **four years of secondary and**
- **two years pre-university**
- Only the first four years of primary follow a common curriculum
- pupils follow one of **two 'orientation' curricula in the last two years of primary, one of these being a reduced curriculum at a slower pace**.
- There is a leaving exam at the end of primary: some pupils take a different exam if they have followed the 'reduced' curriculum.

The two courses of study for primary students

The Foundation Stage (Primary 1 to 4)

- Emphasis is on building a strong foundation in English, Mathematics and Mother Tongue.
- All students take the same course of study for mathematics

The Orientation Stage (Primary 5 to 6)

- Students are streamed.
- Subject-based banding is adopted.
- Students take **either the Foundation Mathematics or Mathematics course of study.**

Secondary school

The three courses of study for secondary students

- Pupils sit a national examination called the Primary School Leaving Examination (PSLE) at the end of Primary six.

The examination assesses pupils suitability for secondary education and places them in an **appropriate secondary school course that suit their learning ability.**

- **Three Courses are available at the secondary school level**.

Pupils undergo four or five years of secondary education with different emphases.

- **Special Course**
- **Express Course**
- **Normal Course (Academic / Technical)**

Secondary School

Special/Express mathematics course - 4 year / GCE'O' level maths

- Normal (Academic) mathematics course - 4 year / GCE 'N' level maths syllabus A
  - Additional year / GCE 'O' level maths

Normal (Technical) mathematics course - 4 year / GCE 'N' level maths syllabus T
- Additional year / GCE 'N' level maths syllabus A

Education System in Singapore

Education	School/Level	Grade From	Grade To	Age From	Age To	Years	Notes
Primary	Primary Education	1	6	7	13	6	a four-year foundation stage (Primary 1 to 4) and a two-year orientation stage (Primary 5 to 6)
Secondary	Special" and Express	7	10	14	17	4	four-year courses leading up to the Singapore-Cambridge GCE O' Level examination. Based on results of the PSLE, students are placed in different secondary education tracks or streams: "Special", "Express", "Normal (Academic)", or "Normal (Technical)
Secondary	Normal-level (N-level)	7	10	14	17	4	Normal is a four-year course leading up to a Normal-level (N-level) exam, with the possibility of a fifth year followed by an O-level.
Vocational	Vocational						
Tertiary	Tertiary-Higher Education						

Primary Education

- School Education is a priority in well regulated Singapore and follows the core western model. The first 4 years of primary education form a foundation stage with a common curriculum.
- **During the 2 year orientation phase that follows though, pupils are streamed per subject according to their learning abilities, or difficulties.**

Secondary Education

- **The *special* and *express* tracks are 4-year programs leading to Cambridge GCE O Levels.**
- **The *normal* stream may take a student on a 5 year journey to the same destination but via N Levels**, with choices of following academic or technical curriculae.

Vocational Education

- Vocational training is provided by the institute of technical training.

Tertiary Education

- Students who completed their **GCE O Levels may proceed directly to polytechnics.**
- But, to enter university though, students must first **pass their A Levels after studying for 2 years more at a pre-university.**

Prior to PSLE Primary 1 to 5

- From January to May is the first Semester and at the end of the semester **SA1 (Semestral Assessment 1)** is conducted.
- The second Semester is from July to November and at the end of the semester **SA2 (Semestral Assessment 2)** is conducted.
- In the middle of each semester, a term test is conducted which is named **CA1 (Continual Assessment 1**) **and CA2 (Continual Assessment 2)**.

PSLE Primary School Leaving Examination **- Primary 6**

- Based on their results, candidates are streamed into three different courses: Express, Normal (Academic) and Normal (Technical).

iPSLE

- The iPSLE examination is offered to Singaporeans studying abroad and whose school has adopted a curriculum similar to that offered in Singapore.

- **GCE 'Normal' Level**
- conducted **annually** in Singapore.
- **taken after four years in the normal academic or normal technical stream** (secondary education).

GCE N(Academic) Level (after that can either go to PFP or O level)

- taken by Normal Academic students after four years of secondary school education.
- This **may lead to a possibility of moving on to the Secondary 5 Normal (Academic)stream to take their 'O'-Levels**.
- **GCE Normal(Technical) Level**
- **lead students to the ITE or Institute of Technical Education.**
- Alternatively, **if students performed well enough in Secondary One, they may be laterally transferred to the Secondary 2 N(A)-Normal Academic stream.**

Polytechnic Foundation Programme(PFP)

- Polytechnic Foundation Programme(PFP)is a programme that is for Secondary 4N(A) students.
- provide more pathways to the tertiary education for the Secondary 4 N(A) students **instead of going Secondary 5N to take the O-Level.**

- **GCE 'O' Level**
- The GCE 'O' Level examinations, or more commonly known as 'O' Levels, are conducted annually in Singapore. Like the 'N' Levels, it is done after four years of express or five years of normal academic secondary education and is under the same examining authority.

- **Singapore-Cambridge GCE 'A' Level**
- is conducted annually. It is taken before the completion of 2 years of Junior College or 3 years at tertiary education.

United Kingdom Mathematics Curriculum

Introduction of United Kingdom

- The United Kingdom of Great Britain and Northern Ireland, commonly known as **the United Kingdom**, **the UK** or **Britain**.

- Consists of four countries: **England**, **Northern Ireland**, **Scotland** and **Wales**.

- The UK is a unitary state governed under **constitutional monarchy** and a **parliamentary system**, with its seat of government in a **capital city of London**.

Introduction

- Education in UK is supervised by **Ministry of Education** and **Department of Business, Innovation and Skills**.

- Local government is responsible **for implementation policy for public education and state schools**.

- **State provided free educations** to students.

- **Parents can choose to educate their children in any way appropriate**.

Historical Development of Educational System

There are **TWO** types of educational institutions: religious and secular.

Religious

- During the Middles Ages, formal education was already taking shape.
- School is run by different district people who always go to the Church often, and some are connected to Cathedrals, chantries and monasteries.
- It is a very elementary education.

Secular

- Grammar school that prepared students to enter colleges in Oxford.

There are **TWO** separate systems providing different types of education: academic and vocational

Academic

- Institution: provided specialised knowledge in Latin and Greek necessary for their future studies in one of the Oxford colleges.

Vocational

- Apprentices learnt their trade skills in schools run by the various guilds.

- The modern system of education in England are affected mainly in the **second half of the 19th-century**.

- Later, leaders of the Chartist Movement (1838-1857) and the Radicals (late 18th century and early 19th century) were in favour of some sort of national system of education.

- There are some obstacles to develop a national system of free compulsory education.

No 1

- During the first decade of 19th century, they have indications of new thinking in the education field.

No 2

- Whitbread support the local church responsible for education and every child should have 2 years of education between the ages of 7 and 14.

No 3

- It was considered too expensive

No 4

- It was helped by the gradual increase in collectivist thought especially after 1865.

No 5

- The various Factory Acts of 1833, 1844, and 1867 were another contributory factor towards the general tendency towards national education.

No 6

- 6. Political stability and economic prosperity were associated with the education of the people.

No 7

- 7. In 1869, two other societies were established: the Education League, which turned secular and the National Education Union, which was conservative. It was mainly due to these two societies that the Education Act of 1870 (also known as Forster Act) was passed.

The Education Act of 1870

- 1. The act required the establishment of elementary schools nationwide, had to be non-denominational.

- 2. Religious instruction was an integral part of the school curriculum but was not compulsory. This was to be nondenominational.

- 3. Elementary education became effectively free with the passing of the 1891 Education Act.

20th Century Modern System of Education

- In the 20th century, education became a sensitive social, economic and political issue in England.

- The most important piece of legislation was the Education Act of 1944 (known as the “Butler Act”).

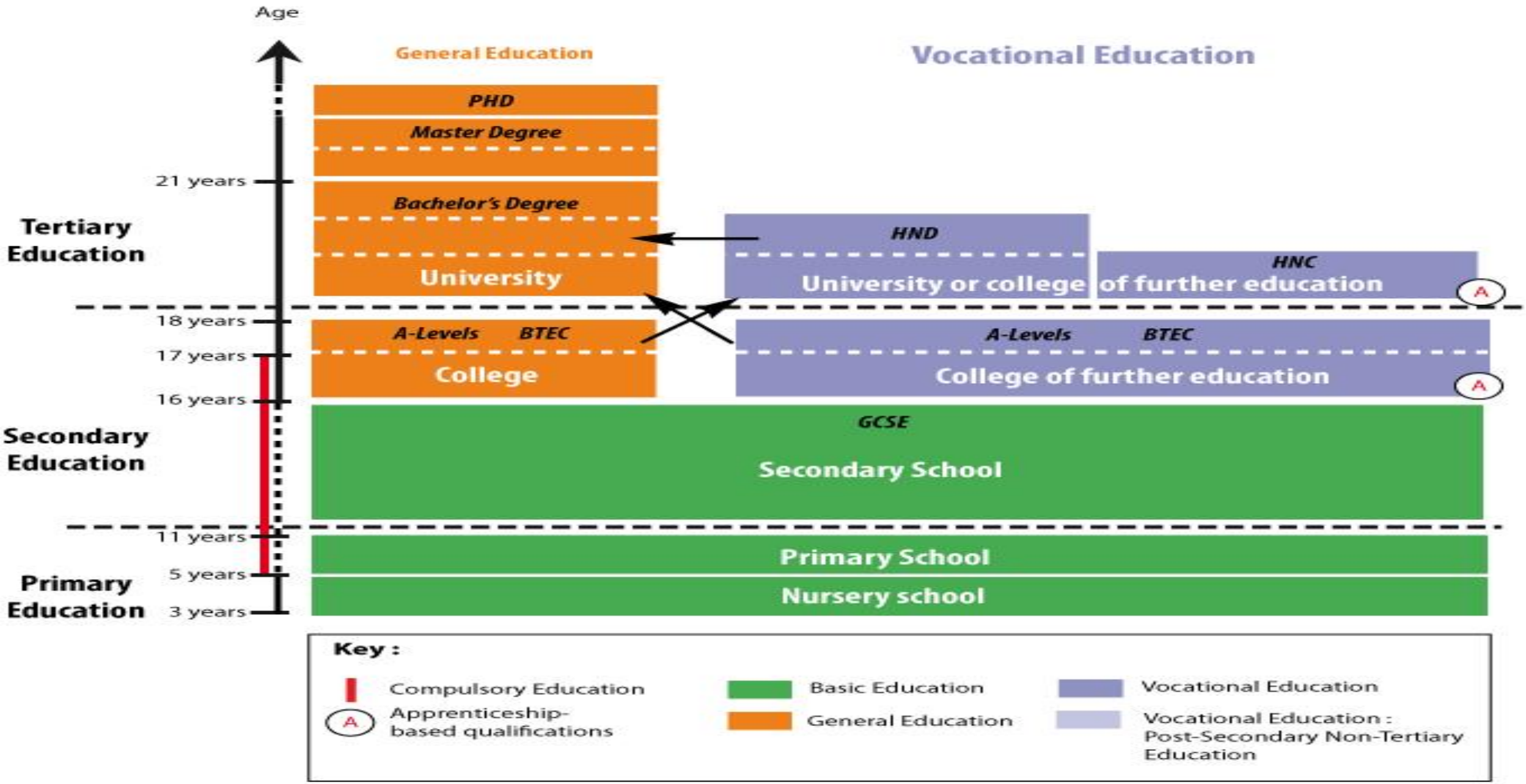
- Education of the individual is the foundation of the education of the academic and community (1944 Education Act Part II, 7).

- “the school day in every county school and in every voluntary school shall begin with collective worship on the part of all pupils in attendance”

Tripartate System

- Grammar Schools : who were interested in pursuing their studies beyond the O-level GCE stage. It provided an academic education for pupils between the ages of 12 and 19
- Secondary Modern Schools : attended a four year course leading to the School Leaving Certificate. The course usually offered instruction in English, at least one other language, geography, history, mathematics, science, drawing, manual instruction or domestic subjects, and physical exercise. When pupils left school they normally entered into the working world.
- Secondary Technical Schools: It provided a general education with special emphasis on technical subjects.

Education System in UK



Education System in the UK

- Five stages of education system in the UK:
  - **Early years**
  - **Primary** [Keystage 1: 5-7years old (Year1-2) , Keystage 2: 7-11 (Year 3-6)]
  - **Secondary** [Keystage 3: 11-14years old (Year7-9) , Keystage 4: 15-16 (Year 10-11)]
  - **Further Education (FE)**: is not compulsory and covers non-advanced education which can be taken at further (including tertiary) education colleges and HE institutions (HEIs).
  - **Higher Education (HE)**: is study beyond GCE A levels and their equivalent which, for most full-time students, takes place in universities and other HEIs and colleges.

- Early years:
  - The **Education Act 2002** extended the National Curriculum for England to include the Foundation Stage which was first introduced in September 2000, and covered children's education from the age of 3 to the end of the reception year, when children are aged 5.
  - The **Early Years Foundation Stage (EYFS)** came into force in **September 2008**, and is a single regulatory and quality framework for the provision of learning, development and care for children in all registered early years settings between birth and the academic year in which they turn 5.
  - **September 2010** onwards, three and four year olds are entitled to **15 hours of free nursery education for 38 weeks** of the year.

Education System in the UK

Primary education

- The major goals of primary education are achieving basic literacy and numeracy amongst all pupils, as well as establishing foundations in science, mathematics and other subjects. Children in England and Nare assessed at the end of Key Stage 1 and Key Stage 2.

Secondary education

- After four years of secondary school, at about the age of 16, pupils sit the General Certificate of Secondary Education (GCSE) examination. This is taken in a wide range of subjects according to the pupils' ability. Usually four to eight or even as many as ten subjects. The exams are marked by an independent body.

Education System in the UK

FE education

- FE in the United Kingdom therefore includes education for people over 16, usually excluding universities. It is primarily taught in FE colleges, work-based learning, and adult and community learning institutions.

HE education

- There are three main levels of HE course:

(i) Postgraduate courses leading to higher degrees, diplomas and certificates (including Doctorate, Masters (research and taught), Postgraduate diplomas and certificates as well as postgraduate certificates of education (PGCE) and professional qualifications) which usually require a first degree as entryqualification.

(ii) Undergraduate courses which include first degrees (honours and ordinary), first degrees with qualified teacher status, enhanced first degrees, first degrees obtained concurrently with a diploma, and intercalated first degrees (where first degree students, usually in medicine, dentistry or veterinary medicine, interrupt their studies to complete a one-year course of advanced studies in a related topic).

(iii) Other undergraduate courses which include all other higher education courses,

for example SVQ or NVQ: Level 5, Diploma (HNC/D level for diploma and degree holders), HND (or equivalent), HNC (or equivalent) and SVQ or NVQ: Level 4 and Diplomas in HE.

Cockcroft Report (1982)

- In the **mid of 1970s**, government started to concern curriculum, teaching methods and assessment.

- Definition of numeracy: the ability to **apply mathematics in daily life, further education and employment**.

- Aims: The setting up of the **government-sponsored Cockcroft Report** to improve national numeracy standards in England and Wales for age of up to 16 and providing an updated definition of numeracy, supported by Shirley Williams, then the Labour Government education minister.

- setting a minimal utilitarian numeracy curriculum, and gave greater curricular emphasis to application to **real-life contexts, practical work, calculators and realistic problem-solving**.

Cockcroft Report (1982)

- **Examinations** at the end is to access whether students met the needs with a range of mathematical attainment.

- **Incorporate coursework** to assess **practical problem-solving** and **investigational skills**.

- **Mediocre performance** of England's Maths in international comparisons like SIMS (Second International Maths Study, in the early 1980s) and TIMSS (Trends in International Mathematics and Science Study) triggered government intervention, **National Curriculum Strategy** in the **late 1980s**.

National Numeracy Strategy (1999 – 2005)

- England's international performance failed to rise, government decide to **National Numeracy Strategy** across all year groups in all elementary schools in 1999/2000.

- Definition of numeracy: 'proficiency' with calculation and solution of word problems.

- Cost: $150 million in the first year (1999/2000)

  $100 million for the next 5 years

  no expenses for within 10 years

Aims: **To raise standards of numeracy, in national and international tests**.

National Numeracy Strategy (1999 – 2005)

- Funded by **previous government in 1996**, led by **Anita Straker**, and carried out in 13 local schools with low results in national test.

- Aspect of the reform:

1. An increased emphasis on number and on calculation, especially mental strategies for calculation
2. A three-part template for daily Maths lesson
3. Detailed planning using a centrally provided week-by-week framework of detailed objectives.

Mathematics Textbooks of England

- There are **different curriculum** to cater for **different needs and interests of students**.

  for example: England's Oxford University Press (higher, intermediate and foundation)

- England textbooks are larger and thicker due to **contains numerous and various contents**.

- **Class size is smaller**, individualized teaching and small group activities.

Mathematics Textbooks of England

- Teachers **may use materials outside the book** (class activities, exercise), taking into consideration of student's level of understanding.

- England's textbook has **interesting pictures with colours** and **stories** to attract student's interest.

- Consists of **modules** centred around **themes** ("High flyers", "Sealife" etc) and each module has several sections in which **heterogeneous mathematical concept** (Algebra, Function, and Statistics all in one section)

Mathematics Textbooks of England

- Has **several strands** in **one module** (linear equation, solving simultaneous equations)

- Has **various features** (projects, practice, application exercises, technology, student self-assessments, and career connections etc)

- **Inductive approach**: accepting the facts only after evidence is given.

Mathematics Textbooks of England

- **Mathematical content** in England's textbooks are presented **in the context of real-life situations**.

- **Calculators are widely used** in England and the types of questions given is **not contrive** which involved the real exchange rates.

Aims of Cambridge Mathematics

1. To champion and secure access to a quality Maths education for all

2. To collaborate to use UK position in Maths education, to show leadership and to develop an authoritative voice

3. To develop and make available world class teaching and learning materials

Aims of Cambridge Mathematics

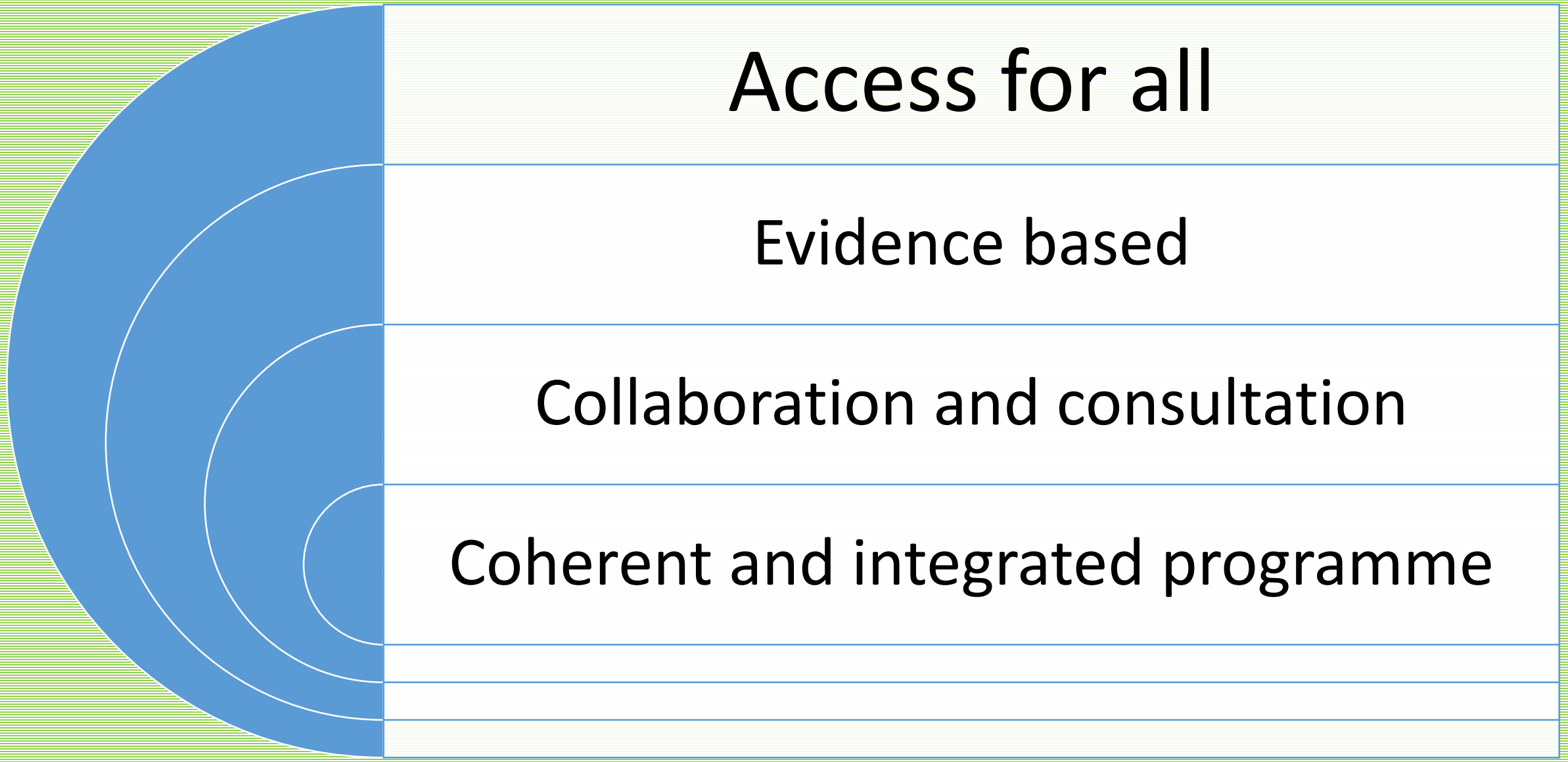
4. To develop and make available world class teaching and learning materials.

5. to support an infrastructure to enhance the quality of teacher education and continuing professional development

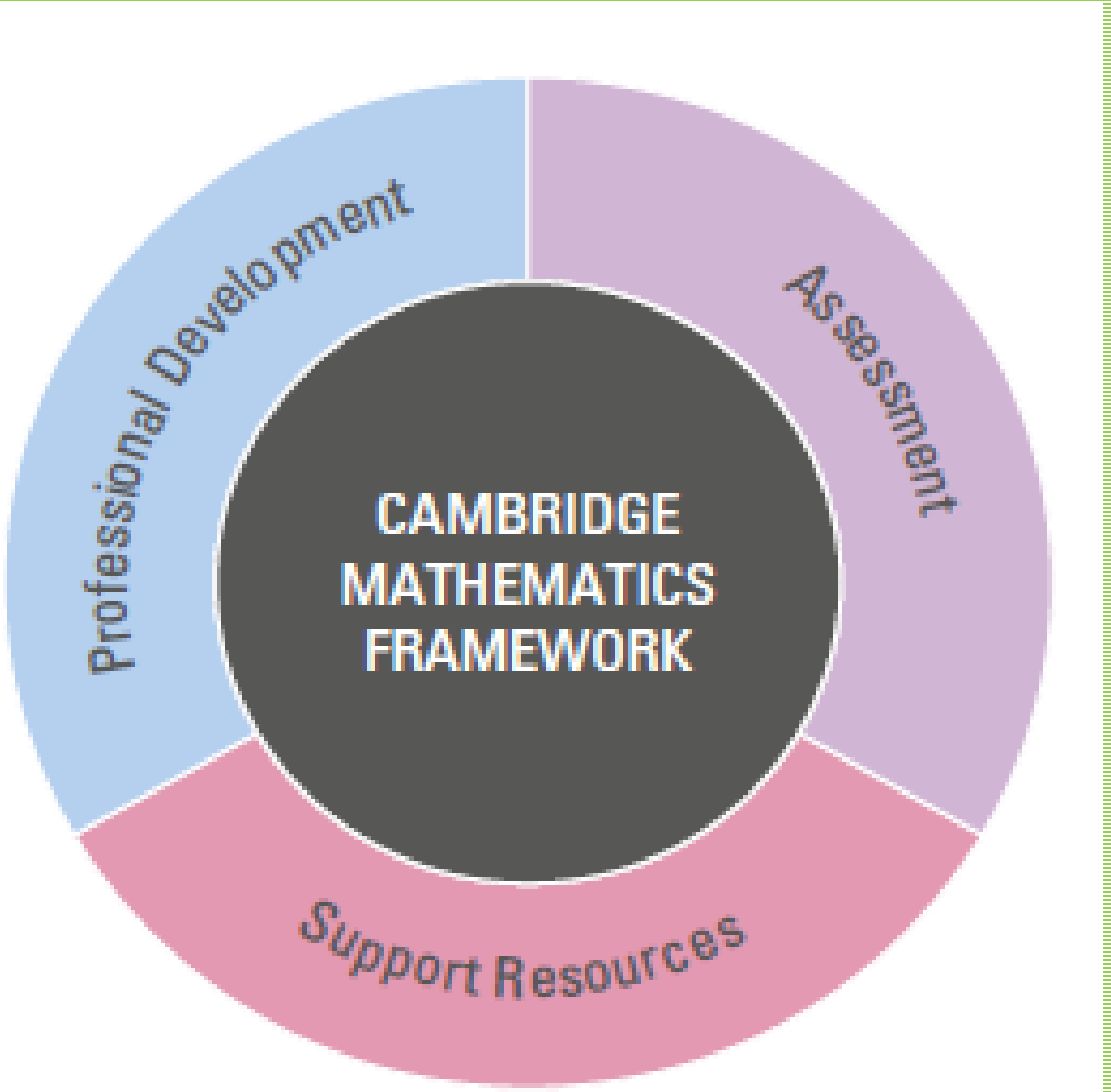
6. to develop assessments that support the development of powerful mathematical reasoning

7. to develop an approach that is recognised and valued by parents, young people, teachers, institutions and governments.

Principles


Access for all
Evidence based
Collaboration and consultation
Coherent and integrated programme

Framework



- The four integrated elements of Cambridge Mathematics are:

1. the Cambridge Mathematics Framework, the content spine to which the other elements will link
2. resources, both paper based and electronic
3. a coherent formative and summative assessment offer
4. a professional development framework encompassing both subject and pedagogical knowledge.

Comparison	Malaysia	Singapore	United Kingdom
Aim and objectives	An on-going effort towards further developing the potential of individuals in a holistic and integrated manner, in order to produce individuals who are intellectually, spiritually,emotionally and physically (Falsafah Pendidikan Negara)	Prepare young Singaporeans for the new circumstances and new problems that they will face in the new millennium	To create a world-class state education system and a highly educated society in which same opportunity is given no matter what background
Content	The curriculum document is the main locus for the class implementation, text book writings, and even the items to be asked in the students' assessment.	After Pri 4, Pri 5 & 6 divided to foundation and mathematics course. (refer to others) Secondary divided into three stream: Express, Normal and Technical.	Consists of modules centred around themes each module has several sections in which heterogeneous mathematical concept (Algebra, Function, and Statistics all in one section) Has several strands in one module (linear equation, solving simultaneous equations)
teaching approaches/methods	**Outcome-based Learning**	Problem solving is the core of the education of Singapore(PENTAGON FRAMEWORK)	Support Resources, Professional Development and Assessment
assessment and evaluation methods	PRIMARY – PBS (PENTAKSIRAN BERASAKAN SEKOLAH) UPSR SECONDARY – PT3, SPM STPM AND PRE-U	PRIMARY SIX- PSLE, IPSLE, SECONDARY- O LEVEL, N LEVEL PRE-U- ALEVEL	Assessment (Aged 7 and 11) GCSE at Year 11 (Aged 16) A Level (Aged 18) University, Post Graduate, pHD

Ranking in the World

- TIMSS (Trends in International Mathematics and Science Study)
- OECD (Organization for Economic Cooperation and Development)
- PISA (Program for International Student Assessment)

TIMSS (Trends in International Mathematics and Science Study)

- a series of international assessments of the mathematics and science knowledge of students around the world.
- Singapore ranked in the top three nations in the world in studies such as the Trends in International Mathematics and Science Study (TIMSS) since 1995

TIMSS 2003

Exhibit 1

Mathematics Achievement

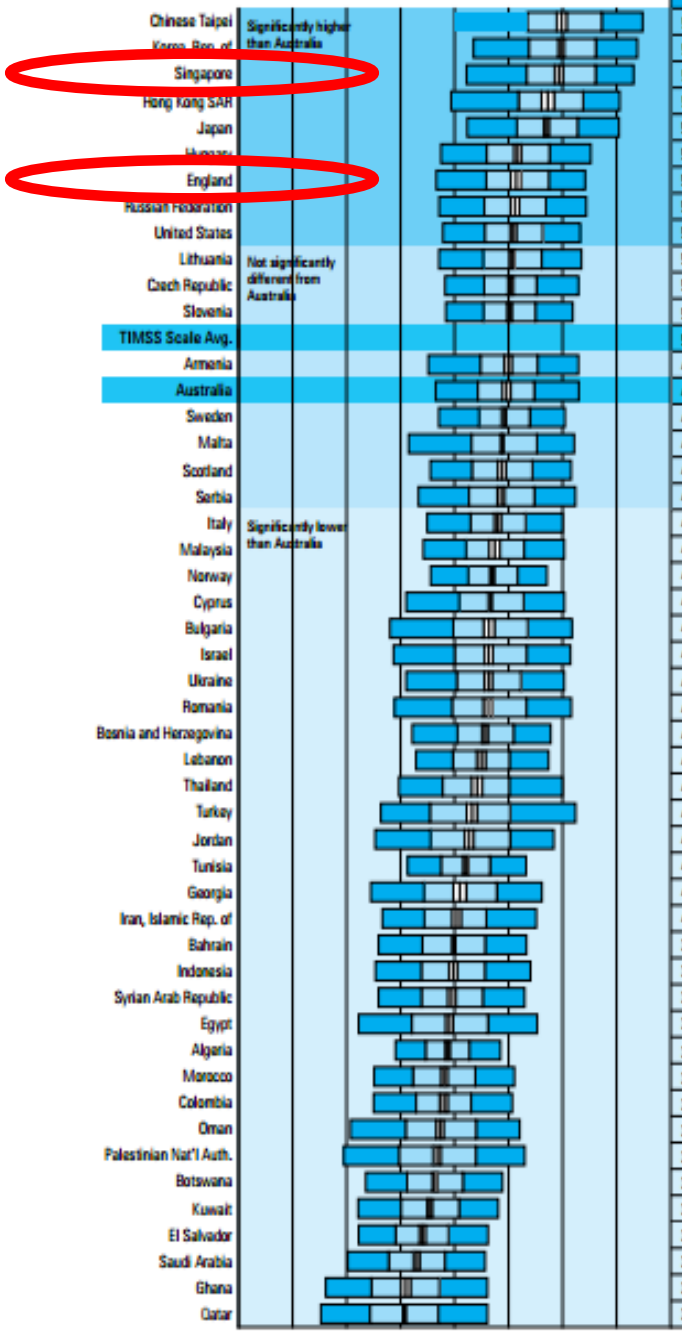
Grade 8		Grade 4	
Singapore	605	Singapore	594
Korea, Rep. of	589	Hong Kong, SAR	575
Hong Kong, SAR	586	Japan	565
Chinese Taipei	585	Chinese Taipei	564
Japan	570	Belgium (Flemish)	551
Belgium (Flemish)	537	Netherlands	540
Netherlands	536	Latvia	536
Estonia	531	Lithuania	534
Hungary	529	Russian Federation	532
Malaysia	508	England	531
Latvia	508	Hungary	529
Russian Federation	508	United States	518
Slovak Republic	508	Cyprus	510
Australia	505	Moldova, Rep. of	504
United States	504	Italy	503
Lithuania	502	Australia	499
Sweden	499	International Avg.	495
Scotland	498	New Zealand	493
Israel	496	Scotland	490
New Zealand	494	Slovenia	479
Slovenia	493	Armenia	456
Italy	484	Norway	451
Armenia	478	Iran, Islamic Rep. of	389
Serbia	477	Philippines	358
Bulgaria	476	Morocco	347
Romania	475	Tunisia	339
International Avg.	467	Benchmarking Participants	
Norway	461	Indiana State, US	533
Moldova, Rep. of	460	Ontario Province, Can.	511
Cyprus	459	Quebec Province, Can.	506
Macedonia, Rep. of	435		
Lebanon	433		
Jordan	424		
Iran, Islamic Rep. of	411		
Indonesia	411		
Tunisia	410		
Egypt	406		
Bahrain	401		
Palestinian Nat'l Auth.	390		
Chile	387		
Morocco	387		
Philippines	378		
Botswana	366		
Saudi Arabia	332		
Ghana	276		
South Africa	264		
* England	498		
Benchmarking Participants			
Basque Country, Spain	487		
Indiana State, US	508		
Ontario Province, Can.	521		
Quebec Province, Can.	543		

* Nearest comply guidelines for sampling participation rate.

IEA

TIMSS & PIRLS International Study Center

Figure 3.2: Distribution of TIMSS 2007 Mathematics Achievement at Year 8



	Average Scale Score		Years of Formal Schooling*	Average Age at Time of Testing	Human Development Index**
Chinese Taipei	598	(4.5)	8	14.2	0.932
Korea, Rep. of	597	(2.7)	8	14.3	0.921
Singapore	593	(3.8)	8	14.4	0.922
Hong Kong SAR	572	(5.8)	8	14.4	0.937
Japan	570	(2.4)	8	14.5	0.953
Hungary	517	(3.5)	8	14.6	0.874
England	513	(4.8)	9	14.2	0.946
Russian Federation	512	(4.1)	7 or 8	14.6	0.802
United States	508	(2.8)	8	14.3	0.951
Lithuania	506	(2.3)	8	14.9	0.862
Czech Republic	504	(2.4)	8	14.4	0.891
Slovenia	501	(2.1)	7 or 8	13.8	0.917
TIMSS Scale Avg.	500				
Armenia	499	(3.5)	8	14.9	0.775
Australia	496	(3.9)	8	13.9	0.962
Sweden	491	(2.3)	8	14.8	0.956
Malta	488	(1.2)	9	14.0	0.878
Scotland	487	(3.7)	9	13.7	0.946
Serbia	486	(3.3)	8	14.9	0.810
Italy	480	(3.0)	8	13.9	0.941
Malaysia	474	(5.0)	8	14.3	0.811
Norway	469	(2.0)	8	13.8	0.968
Cyprus	465	(1.6)	8	13.8	0.903
Bulgaria	464	(5.0)	8	14.9	0.824
Israel	463	(3.9)	8	14.0	0.932
Ukraine	462	(3.6)	8	14.2	0.788
Romania	461	(4.1)	8	15.0	0.813
Bosnia and Herzegovina	456	(2.7)	8 or 9	14.7	0.803
Lebanon	449	(4.0)	8	14.4	0.772
Thailand	441	(5.0)	8	14.3	0.781
Turkey	432	(4.8)	8	14.0	0.775
Jordan	427	(4.1)	8	14.0	0.773
Tunisia	420	(2.4)	8	14.5	0.766
Georgia	410	(5.5)	8	14.2	0.754
Iran, Islamic Rep. of	403	(4.1)	8	14.2	0.759
Bahrain	398	(1.6)	8	14.1	0.866
Indonesia	397	(3.8)	8	14.3	0.728
Syrian Arab Republic	395	(3.8)	8	13.9	0.724
Egypt	391	(3.6)	8	14.1	0.708
Algeria	387	(2.1)	8	14.5	0.733
Morocco	381	(3.0)	8	14.8	0.646
Colombia	380	(3.6)	8	14.5	0.791
Oman	372	(3.4)	8	14.3	0.814
Palestinian Nat'l Auth.	367	(3.5)	8	14.0	0.731
Botswana	364	(2.3)	8	14.9	0.654
Kuwait	354	(2.3)	8	14.4	0.891
El Salvador	340	(2.8)	8	15.0	0.735
Saudi Arabia	329	(2.9)	8	14.4	0.812
Ghana	309	(4.4)	8	15.8	0.553
Qatar	307	(1.4)	8	13.9	0.875

Exhibit 1.2: Distribution of Mathematics Achievement

TIMSS 2011 Mathematics 8th Grade

Country	Average Scale Score	Mathematics Achievement Distribution
Korea, Rep. of	613 (2.9)	
2 Singapore	611 (3.8)	
Chinese Taipei	609 (3.2)	
Hong Kong SAR	586 (3.8)	
Japan	570 (2.6)	
2 Russian Federation	539 (3.6)	
3 Israel	516 (4.1)	
Finland	514 (2.5)	
2 United States	509 (2.6)	
1 England	507 (5.5)	
Hungary	505 (3.5)	
Australia	505 (5.1)	
Slovenia	505 (2.2)	
1 Lithuania	502 (2.5)	
TIMSS Scale Centerpoint	500	
Italy	498 (2.4)	
New Zealand	488 (5.5)	
Kazakhstan	487 (4.0)	
Sweden	484 (1.9)	
Ukraine	479 (3.9)	
Norway	475 (2.4)	
Armenia	467 (2.7)	
Romania	458 (4.0)	
United Arab Emirates	456 (2.1)	
Turkey	452 (3.9)	
Lebanon	449 (3.7)	
Malaysia	440 (5.4)	
1 Georgia	431 (3.8)	
Thailand	427 (4.3)	
Macedonia, Rep. of	426 (5.2)	
Tunisia	425 (2.8)	
Chile	416 (2.6)	
Iran, Islamic Rep. of	415 (4.3)	
Qatar	410 (3.1)	
Bahrain	409 (2.0)	
Jordan	406 (3.7)	
Palestinian Nat'l Auth.	404 (3.5)	
Saudi Arabia	394 (4.6)	
Indonesia	386 (4.3)	
Syrian Arab Republic	380 (4.5)	
Morocco	371 (2.0)	
Oman	366 (2.8)	
Ghana	331 (4.3)	

100 200 300 400 500 600 700 800

Ninth Grade Participants

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

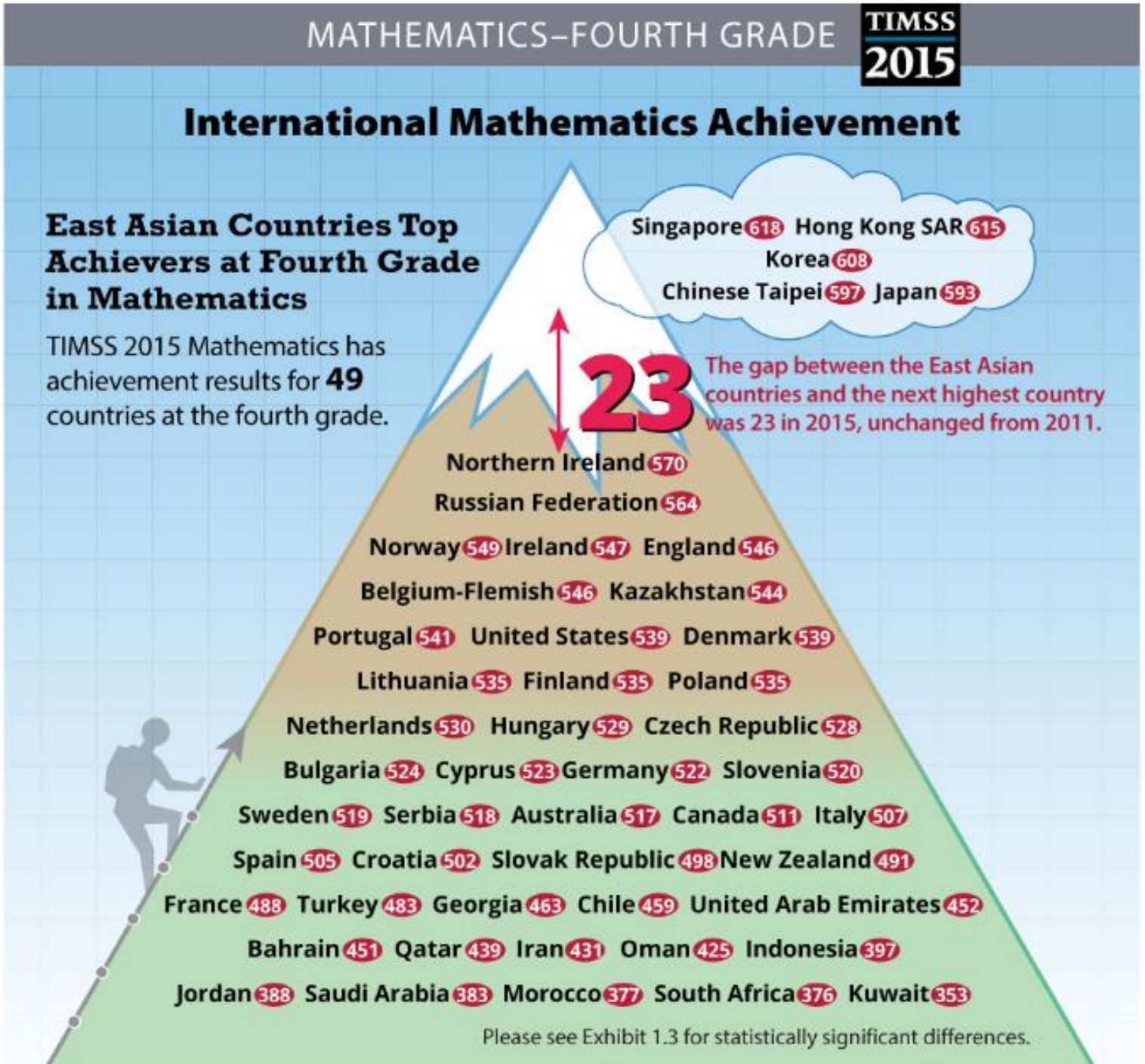
Country	Average Scale Score	Mathematics Achievement Distribution
2 Singapore	621 (3.7)	
Korea, Rep. of	606 (2.6)	
Chinese Taipei	599 (2.4)	
Hong Kong SAR	594 (4.6)	
Japan	586 (2.3)	
Russian Federation	538 (4.7)	
Kazakhstan	528 (5.3)	
1 1 Canada	527 (2.2)	
Ireland	523 (2.7)	
1 United States	518 (3.1)	
England	518 (4.2)	
Slovenia	516 (2.1)	
Hungary	514 (3.8)	
Norway (9)	512 (2.3)	
2 Lithuania	511 (2.8)	
3 Israel	511 (4.1)	
Australia	505 (3.1)	
Sweden	501 (2.8)	
TIMSS Scale Centerpoint	500	
2 Italy	494 (2.5)	
Malta	494 (1.0)	
1 New Zealand	493 (3.4)	
Malaysia	465 (3.6)	
United Arab Emirates	465 (2.0)	
Turkey	458 (4.7)	
Bahrain	454 (1.4)	
1 2 Georgia	453 (3.4)	
Lebanon	442 (3.6)	
Qatar	437 (3.0)	
Iran, Islamic Rep. of	436 (4.6)	
Thailand	431 (4.8)	
Chile	427 (3.2)	
Oman	403 (2.4)	
Kuwait	392 (4.6)	
Egypt	392 (4.1)	
Botswana (9)	391 (2.0)	
Jordan	386 (3.2)	
Morocco	384 (2.3)	
South Africa (9)	372 (4.5)	
Saudi Arabia	368 (4.6)	

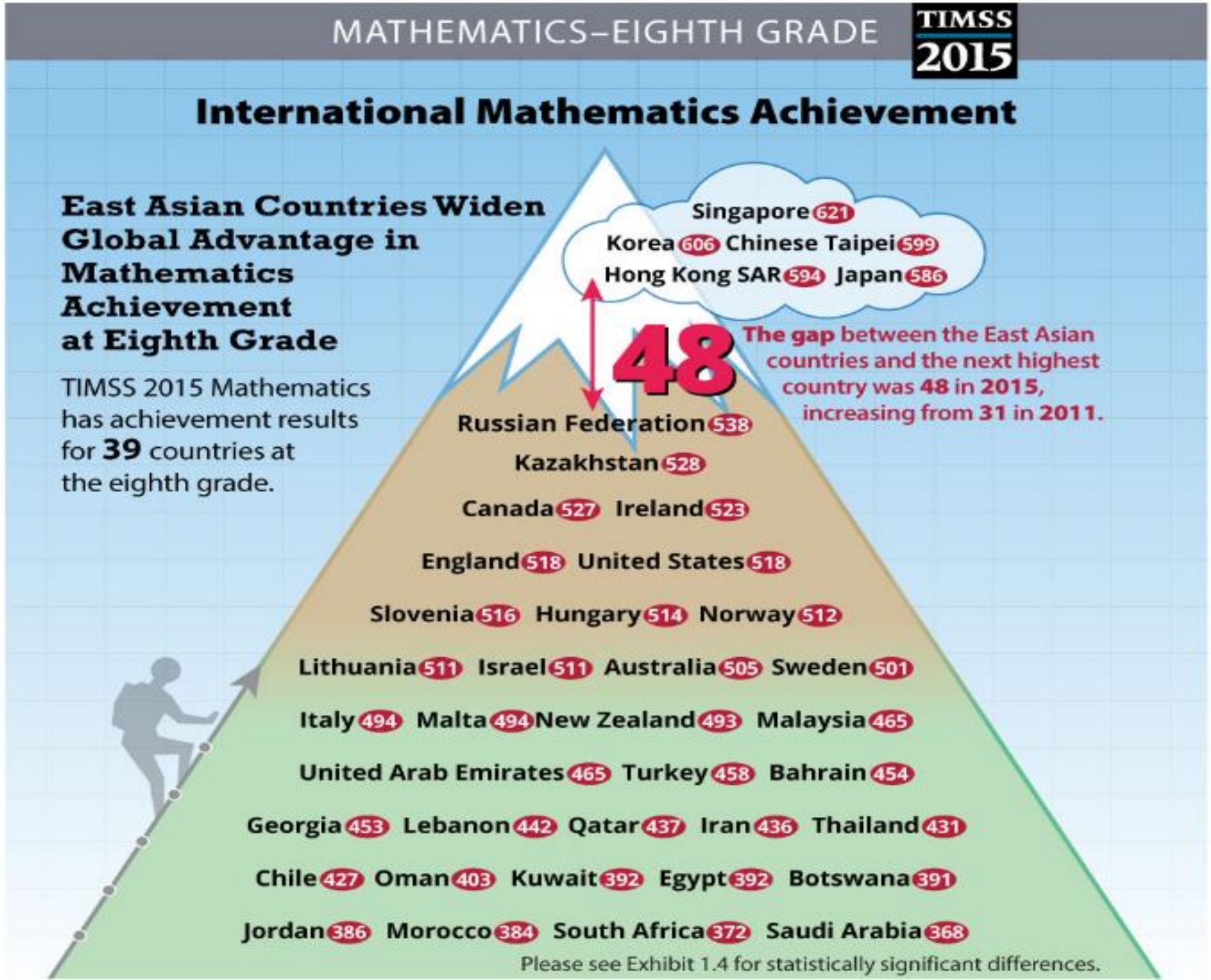
SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

	On the overall reading scale	On the reading subscales					On the mathematics scale	On the science scale
		Access and retrieve	Integrate and interpret	Reflect and evaluate	Continuous texts	Non-continuous texts		
OECD average	493	495	493	494	494	493	496	501
Shanghai-China	556	549	558	557	564	539	600	575
Korea	539	542	541	542	538	542	546	538
Finland	536	532	538	536	535	535	541	554
Hong Kong-China	533	530	530	540	538	522	555	549
Singapore	526	[illegible]	525	529	522	539	562	542
Canada	[illegible]	517	522	535	524	527	527	529
New Zealand	521	521	517	531	518	532	519	532
Japan	520	530	520	521	520	518	529	539
Australia	515	513	513	523	513	524	514	527
Netherlands	508	519	504	510	506	514	526	522
Belgium	506	513	504	505	504	511	515	507
Norway	503	512	502	505	505	498	498	500
Estonia	501	503	500	503	497	512	512	528
Switzerland	501	505	502	497	498	505	534	517
Poland	500	500	503	498	502	496	495	508
Iceland	500	507	503	496	501	499	507	496
United States	500	492	495	512	500	503	487	502
Liechtenstein	499	508	498	498	495	506	536	520
Sweden	497	505	494	502	499	498	494	495
Germany	497	501	501	491	496	497	513	520
Ireland	496	498	494	502	497	496	487	508
France	496	492	497	495	492	498	497	498
Chinese Taipei	495	496	499	493	496	500	543	520
Denmark	[illegible]	502	492	493	496	493	503	499
United Kingdom	494	491	491	503	492	506	492	514
Hungary	[illegible]	501	496	489	497	487	490	503
Portugal	489	488	487	496	492	488	487	493
Macao-China	487	493	488	481	488	481	525	511
Italy	486	482	490	482	489	476	483	489
Latvia	484	476	484	492	484	487	482	494
Slovenia	483	489	489	470	484	476	501	512
Greece	483	468	484	489	487	472	466	470
Spain	481	480	481	483	484	473	483	488
Czech Republic	478	479	488	462	479	474	493	500
Slovak Republic	477	491	481	466	479	471	497	490
Croatia	476	492	472	471	478	472	460	486
Israel	474	463	473	483	477	467	447	455
Luxembourg	472	471	475	471	471	472	489	484
Austria	470	477	471	463	470	472	496	494
Lithuania	468	476	469	463	470	462	477	491
Turkey	464	467	459	473	466	461	445	454
Dubai (UAE)	459	458	457	466	461	460	453	466
Russian Federation	459	469	467	441	461	452	468	478
Chile	449	444	452	452	453	444	421	447
Serbia	442	449	445	430	444	438	442	443
Bulgaria	429	430	436	417	433	421	428	439
Uruguay	426	424	423	436	429	421	427	427
Mexico	425	433	418	432	426	424	419	416
Romania	424	423	425	426	423	424	427	428
Thailand	421	431	416	420	423	423	419	425
Trinidad and Tobago	416	413	419	413	418	417	414	410
Colombia	413	404	411	422	415	409	381	402
Brazil	412	407	406	424	414	408	386	405
Montenegro	408	408	420	383	411	398	403	401
Jordan	405	394	410	407	417	387	387	415
Tunisia	404	393	393	427	408	393	371	401
Indonesia	402	399	397	409	405	399	371	383
Argentina	398	394	398	402	400	391	388	401
Kazakhstan	390	397	397	373	399	371	405	400
Albania	385	380	393	376	392	366	377	391
Qatar	372	354	379	376	375	361	368	379
Panama	371	363	372	377	373	359	360	376
Peru	370	364	371	368	374	356	365	369
Azerbaijan	362	361	373	335	362	351	431	373
Kyrgyzstan	314	299	327	300	319	293	331	330

Countries/economies with a share of low achievers above the OECD average

	Mathematics				Reading		Science	
	Mean score in PISA 2012	Share of low achievers in mathematics (Below Level 2)	Share of top performers in mathematics (Level 5 or 6)	Annualised change in score points	Mean score in PISA 2012	Annualised change in score points	Mean score in PISA 2012	Annualised change in score points
OECD average	494	23.0	12.6	-0.3	496	0.3	501	0.5
Shanghai-China	613	3.8	55.4	4.2	570	4.6	580	1.8
Singapore	573	8.3	40.0	3.8	542	5.4	551	3.3
Hong Kong-China	561	8.5	33.7	1.3	545	2.3	555	2.1
Chinese Taipei	560	12.8	37.2	1.7	523	4.5	523	-1.5
Korea	554	9.1	30.9	1.1	536	0.9	538	2.6
Macao-China	538	10.8	24.3	1.0	509	0.8	521	1.6
Japan	536	11.1	23.7	0.4	538	1.5	547	2.6
Liechtenstein	535	14.1	24.8	0.3	516	1.3	525	0.4
Switzerland	531	12.4	21.4	0.6	509	1.0	515	0.6
Netherlands	523	14.8	19.3	-1.6	511	-0.1	522	-0.5
Estonia	521	10.5	14.6	0.9	516	2.4	541	1.5
Finland	519	12.3	15.3	-2.8	524	-1.7	545	-3.0
Canada	518	13.8	16.4	-1.4	523	-0.9	525	-1.5
Poland	518	14.4	16.7	2.6	518	2.8	526	4.6
Belgium	515	19.0	19.5	-1.6	509	0.1	505	-0.9
Germany	514	17.7	17.5	1.4	508	1.8	524	1.4
Viet Nam	511	14.2	13.3	m	508	m	528	m
Austria	506	18.7	14.3	0.0	490	-0.2	506	-0.8
Australia	504	19.7	14.8	-2.2	512	-1.4	521	-0.9
Ireland	501	16.9	10.7	-0.6	523	-0.9	522	2.3
Slovenia	501	20.1	13.7	-0.6	481	-2.2	514	-0.8
Denmark	500	16.8	10.0	-1.8	496	0.1	498	0.4
New Zealand	500	22.6	15.0	-2.5	512	-1.1	516	-2.5
Czech Republic	499	21.0	12.9	-2.5	493	-0.5	508	-1.0
France	495	22.4	12.9	-1.5	505	0.0	499	0.6
United Kingdom	494	21.8	11.8	-0.3	499	0.7	514	-0.1
Ireland	[illegible]	21.5	11.2	-2.2	483	-1.3	478	-2.0
Latvia	491	19.9	8.0	0.5	489	1.9	502	2.0
Luxembourg	490	24.3	11.2	-0.3	488	0.7	491	0.9
Norway	489	22.3	9.4	-0.3	504	0.1	495	1.3
Portugal	487	24.9	10.6	2.8	488	1.6	489	2.5
Italy	485	24.7	9.9	2.7	490	0.5	494	3.0
Spain	484	23.6	8.0	0.1	488	-0.3	496	1.3
Russian Federation	482	24.0	7.8	1.1	475	1.1	486	1.0
Slovak Republic	482	27.5	11.0	-1.4	463	-0.1	471	-2.7
United States	481	25.8	8.8	0.3	498	-0.3	497	1.4
Lithuania	479	26.0	8.1	-1.4	477	1.1	496	1.3
Sweden	478	27.1	8.0	-3.3	483	-2.8	485	-3.1
Hungary	477	28.1	9.3	-1.3	488	1.0	494	-1.6
Croatia	471	29.9	7.0	0.6	485	1.2	491	-0.3
Israel	466	33.5	9.4	4.2	486	3.7	470	2.8
Greece	453	35.7	3.9	1.1	477	0.5	467	-1.1
Serbia	449	38.9	4.6	2.2	446	7.6	445	1.5
Turkey	448	42.0	5.9	3.2	475	4.1	463	6.4
Romania	445	40.8	3.2	4.9	438	1.1	439	3.4
Cyprus[1,2]	440	42.0	3.7	m	449	m	438	m
Bulgaria	439	43.8	4.1	4.2	436	0.4	446	2.0
United Arab Emirates	434	46.3	3.5	m	442	m	448	m
Kazakhstan	432	45.2	0.9	9.0	393	0.8	425	8.1
Thailand	427	49.7	2.6	1.0	441	1.1	444	3.9
Chile	[illegible]	51.5	1.6	1.9	441	3.1	445	1.1
Malaysia	421	51.8	1.3	8.1	398	-7.8	420	-1.4
Mexico	[illegible]	54.7	0.6	3.1	424	1.1	415	0.9
Montenegro	410	56.6	1.0	1.7	422	5.0	410	-0.3
Uruguay	409	55.8	1.4	-1.4	411	-1.8	416	-2.1
Costa Rica	407	59.9	0.6	-1.2	441	-1.0	429	-0.6
Albania	394	60.7	0.8	5.6	394	4.1	397	2.2
Brazil	391	67.1	0.8	4.1	410	1.2	405	2.3
Argentina	388	66.5	0.3	1.2	396	-1.6	406	2.4
Tunisia	388	67.7	0.8	3.1	404	3.8	398	2.2
Jordan	386	68.6	0.6	0.2	399	-0.3	409	-2.1
Colombia	376	73.8	0.3	1.1	403	3.0	399	1.8
Qatar	376	69.6	2.0	9.2	388	12.0	384	5.4


MATHEMATICS–FOURTH GRADE
TIMSS 2015
International Mathematics Achievement
East Asian Countries Top Achievers at Fourth Grade in Mathematics
TIMSS 2015 Mathematics has achievement results for 49 countries at the fourth grade.
Singapore 618 Hong Kong SAR 615
Korea 608
Chinese Taipei 597 Japan 593
23
The gap between the East Asian countries and the next highest country was 23 in 2015, unchanged from 2011.
Northern Ireland 570
Russian Federation 564
Norway 549 Ireland 547 England 546
Belgium-Flemish 546 Kazakhstan 544
Portugal 541 United States 539 Denmark 539
Lithuania 535 Finland 535 Poland 535
Netherlands 530 Hungary 529 Czech Republic 528
Bulgaria 524 Cyprus 523 Germany 522 Slovenia 520
Sweden 519 Serbia 518 Australia 517 Canada 511 Italy 507
Spain 505 Croatia 502 Slovak Republic 498 New Zealand 491
France 488 Turkey 483 Georgia 463 Chile 459 United Arab Emirates 452
Bahrain 451 Qatar 439 Iran 431 Oman 425 Indonesia 397
Jordan 388 Saudi Arabia 383 Morocco 377 South Africa 376 Kuwait 353
Please see Exhibit 1.3 for statistically significant differences.


MATHEMATICS–EIGHTH GRADE
TIMSS 2015
International Mathematics Achievement
East Asian Countries Widen Global Advantage in Mathematics Achievement at Eighth Grade
TIMSS 2015 Mathematics has achievement results for 39 countries at the eighth grade.
Singapore 621
Korea 606 Chinese Taipei 599
Hong Kong SAR 594 Japan 586
48
The gap between the East Asian countries and the next highest country was 48 in 2015, increasing from 31 in 2011.
Russian Federation 538
Kazakhstan 528
Canada 527 Ireland 523
England 518 United States 518
Slovenia 516 Hungary 514 Norway 512
Lithuania 511 Israel 511 Australia 505 Sweden 501
Italy 494 Malta 494 New Zealand 493 Malaysia 465
United Arab Emirates 465 Turkey 458 Bahrain 454
Georgia 453 Lebanon 442 Qatar 437 Iran 436 Thailand 431
Chile 427 Oman 403 Kuwait 392 Egypt 392 Botswana 391
Jordan 386 Morocco 384 South Africa 372 Saudi Arabia 368
Please see Exhibit 1.4 for statistically significant differences.

Maths [edit]

Fourth grade [edit]

TIMSS（1995）		TIMSS(2003)		TIMSS(2007)		TIMSS(2011)	
1.	Singapore 625	1.	Singapore 594	1.	Hong Kong 607	1.	Singapore 606
2.	South Korea 611	2.	Hong Kong 575	2.	Singapore 599	2.	South Korea 605
3.	Japan 597	3.	Japan 565	3.	Taiwan 576	3.	Hong Kong 602
4.	Hong Kong 587	4.	Taiwan 564	4.	Japan 568	4.	Taiwan 591
5.	Netherlands 577	5.	Flanders (Belgium) 551	5.	Kazakhstan 549	5.	Japan 585
6.	Czech Republic 567	6.	Netherlands 540	6.	Russia 544	6.	Northern Ireland 562
7.	Austria 559	7.	Latvia 536	7.	England (and Wales) 541	7.	Flanders (Belgium) 549
8.	Slovenia 552	8.	Lithuania 534	8.	Latvia 537	8.	Finland 545
9.	Ireland 550	9.	Russia 532	9.	Netherlands 535	9.	England (and Wales) 542
10.	Hungary 548	10.	England (and Wales) 531	10.	Lithuania 530	10.	Russia 542

Eighth grade [edit]

TIMSS（1995）	TIMSS-R（1999）	TIMSS(2003)	TIMSS(2007)	TIMSS(2011)
1. Singapore 643	1. Singapore 604	1. Singapore 605	1. Taiwan 598	1. South Korea 613
2. South Korea 607	2. South Korea 587	2. South Korea 589	2. South Korea 597	2. Singapore 611
3. Japan 605	3. Taiwan 585	3. Hong Kong 586	3. Singapore 593	3. Taiwan 609
4. Hong Kong 588	4. Hong Kong 582	4. Taiwan 585	4. Hong Kong 572	4. Hong Kong 586
5. Flanders (Belgium) 565	5. Japan 579	5. Japan 570	5. Japan 570	5. Japan 570
6. Czech Republic 564	6. Flanders (Belgium) 558	6. Flanders (Belgium) 537	6. Hungary 517	6. Russia 539
7. Slovakia 547	7. Netherlands 540	7. Netherlands 536	7. England (and Wales) 513	7. Israel 516
8. Switzerland 545	8. Slovakia 534	8. Estonia 531	8. Russia 512	8. Finland 514
9. Netherlands 541	9. Hungary 532	9. Hungary 529	9. United States 508	9. United States 509
10. Slovenia 541	10. Canada 531	10. Malaysia 508	10. Lithuania 506	10. England (and Wales) 507

OECD (Organization for Economic Cooperation and Development)

- Singapore is the smartest country in the world, followed by Hong Kong, South Korea, Taiwan, Japan, Finland, Estonia, Switzerland, Netherlands and Canada rounding out the top 10.
- ranking countries' school systems based on students math and science test scores.

OECD (Organization for Economic Cooperation and Development)

1. **Singapore**
2. Hong Kong
3. South Korea
4. Japan (tie)
4. Taiwan (tie)
6. Finland
7. Estonia
8. Switzerland
9. Netherlands
10. Canada
11. Poland
12. Vietnam
13. Germany
14. Australia
15. Ireland
16. Belgium
17. New Zealand
18. Slovenia
19. Austria
20. **United Kingdom**
21. Czech Republic
22. Denmark
23. France
24. Latvia
25. Norway
26. Luxembourg
27. Spain
28. Italy (tie)
28. United States (tie)
30. Portugal
31. Lithuania
32. Hungary
33. Iceland
34. Russia
35. Sweden
36. Croatia
37. Slovak Republic
38. Ukraine
39. Israel
40. Greece
41. Turkey
42. Serbia
43. Bulgaria
44. Romania
45. UAE
46. Cyprus
47. Thailand
48. Chile
49. Kazakhstan
50. Armenia
51. Iran
52. **Malaysia**

Program for International Student Assessment (PISA)

- The Program for International Student Assessment (PISA) is an international assessment that **measures 15-year-old students' reading, mathematics, and science literacy every three years.**
- PISA is coordinated by the Organization for Economic Cooperation and Development (OECD), an intergovernmental organization of industrialized countries, and is conducted in the United States by NCES.

PISA 2009

OECD average	493	495	493	494	494	493	496	501
Shanghai-China	556	549	558	557	564	539	600	575
Korea	539	542	541	542	538	542	546	538
Finland	536	532	538	536	535	535	541	554
Hong Kong-China	533	530	530	540	538	522	555	549
Singapore	526	526	525	529	522	539	562	542
Canada	524	517	522	535	524	527	527	529
New Zealand	521	521	517	531	518	532	519	532
Japan	520	530	520	521	520	518	529	539
Australia	515	513	513	523	513	524	514	527
Netherlands	508	519	504	510	506	514	526	522
Belgium	506	513	504	505	504	511	515	507
Norway	503	512	502	505	505	498	498	500
Estonia	501	503	500	503	497	512	512	528
Switzerland	501	505	502	497	498	505	534	517
Poland	500	500	503	498	502	496	495	508
Iceland	500	507	503	496	501	499	507	496
United States	500	492	495	512	500	503	487	502
Liechtenstein	499	508	498	498	495	506	536	520
Sweden	497	505	494	502	499	498	494	495
Germany	497	501	501	491	496	497	513	520
Ireland	496	498	494	502	497	496	487	508
France	496	492	497	495	492	498	497	498
Chinese Taipei	495	496	499	493	496	500	543	520
Denmark	495	502	492	493	496	493	503	499
United Kingdom	494	491	491	503	492	506	492	514
Hungary	494	501	496	489	497	487	490	503
Portugal	489	488	487	496	492	488	487	493
Macao-China	487	493	488	481	488	481	525	511
Italy	486	482	490	482	489	476	483	489
Latvia	484	476	484	492	484	487	482	494
Slovenia	483	489	489	470	484	476	501	512
Greece	483	468	484	489	487	472	466	470
Spain	481	480	481	483	484	473	483	488
Czech Republic	478	479	488	462	479	474	493	500
Slovak Republic	477	491	481	466	479	471	497	490
Croatia	476	492	472	471	478	472	460	486
Israel	474	463	473	483	477	467	447	455
Luxembourg	472	471	475	471	471	472	489	484
Austria	470	477	471	463	470	472	496	494
Lithuania	468	476	469	463	470	462	477	491
Turkey	464	467	459	473	466	461	445	454
Dubai (UAE)	459	458	457	466	461	460	453	466
Russian Federation	459	469	467	441	461	452	468	478
Chile	449	444	452	452	453	444	421	447
Serbia	442	449	445	430	444	438	442	443
Bulgaria	429	430	436	417	433	421	428	439
Uruguay	426	424	423	436	429	421	427	427
Mexico	425	433	418	432	426	424	419	416

Romania	424	423	425	426	423	424	427	428
Thailand	421	431	416	420	423	423	419	425
Trinidad and Tobago	416	413	419	413	418	417	414	410
Colombia	413	404	411	422	415	409	381	402
Brazil	412	407	406	424	414	408	386	405
Montenegro	408	408	420	383	411	398	403	401
Jordan	405	394	410	407	417	387	387	415
Tunisia	404	393	393	427	408	393	371	401
Indonesia	402	399	397	409	405	399	371	383
Argentina	398	394	398	402	400	391	388	401
Kazakhstan	390	397	397	373	399	371	405	400
Albania	385	380	393	376	392	366	377	391
Qatar	372	354	379	376	375	361	368	379
Panama	371	363	372	377	373	359	360	376
Peru	370	364	371	368	374	356	365	369
Azerbaijan	362	361	373	335	362	351	431	373
Kyrgyzstan	314	299	327	300	319	293	331	330

Results from PISA 2012

	Mathematics			
	Mean score in PISA 2012	Share of low-achievers (Below Level 2)	Share of top-performers in mathematics (Level 5 or 6)	Annualised change
OECD average	494	23.1	12.6	**-0.3**
Shanghai-China	613	3.8	55.4	**4.2**
Singapore	573	8.3	40.0	**3.8**
Hong Kong-China	561	8.5	33.7	**1.3**
Chinese Taipei	560	12.8	37.2	1.7
Korea	554	9.1	30.9	1.1
Macao-China	538	10.8	24.3	**1.0**
Japan	536	11.1	23.7	0.4
Liechtenstein	535	14.1	24.8	0.3
Switzerland	531	12.4	21.4	0.6
Netherlands	523	14.8	19.3	**-1.6**
Estonia	521	10.5	14.6	0.9
Finland	519	12.3	15.3	**-2.8**
Canada	518	13.8	16.4	**-1.4**
Poland	518	14.4	16.7	**2.6**
Belgium	515	18.9	19.4	**-1.6**
Germany	514	17.7	17.5	**1.4**
Viet Nam	511	14.2	13.3	m
Austria	506	18.7	14.3	0.0
Australia	504	19.7	14.8	**-2.2**
Ireland	501	16.9	10.7	-0.3
Slovenia	501	20.1	13.7	**-0.6**
Denmark	500	16.8	10.0	**-1.8**
New Zealand	500	22.6	15.0	**-2.5**
Czech Republic	499	21.0	12.9	**-2.5**
France	495	22.4	12.9	**-1.5**
United Kingdom	494	21.8	11.8	-0.3
Iceland	493	21.5	11.2	**-2.2**
Latvia	491	19.9	8.0	0.5
Luxembourg	490	24.3	11.2	**-0.3**
Norway	489	22.3	9.4	-0.3
Portugal	487	24.9	10.6	**2.8**
Italy	485	24.7	9.9	**2.7**
Spain	484	23.6	8.0	0.1
Russian Federation	482	24.0	7.8	1.1
Slovak Republic	482	27.5	11.0	**-1.4**
United States	481	25.8	8.8	0.3
Lithuania	479	26.0	8.1	-1.4

Spain	484	23.6	8.0
Russian Federation	482	24.0	7.8
Slovak Republic	482	27.5	11.0
United States	481	25.8	8.8
Lithuania	479	26.0	8.1
Sweden	478	27.1	8.0
Hungary	477	28.1	9.3
Croatia	471	29.9	7.0
Israel	466	33.5	9.4
Greece	453	35.7	3.9
Serbia	449	38.9	4.6
Turkey	448	42.0	5.9
Romania	445	40.8	3.2
Cyprus[1,2]	440	42.0	3.7
Bulgaria	439	43.8	4.1
United Arab Emirates	434	46.3	3.5
Kazakhstan	432	45.2	0.9
Thailand	427	49.7	2.6
Chile	423	51.5	1.6
Malaysia	421	51.8	1.3
Mexico	413	54.7	0.6
Montenegro	410	56.6	1.0
Uruguay	409	55.8	1.4
Costa Rica	407	59.9	0.6
Albania	394	60.7	0.8
Brazil	391	67.1	0.8
Argentina	388	66.5	0.3
Tunisia	388	67.7	0.8
Jordan	386	68.6	0.6
Colombia	376	73.8	0.3
Qatar	376	69.6	2.0
Indonesia	375	75.7	0.3
Peru	368	74.6	0.6

Malaysia 421

Singapore 573

United Kingdom 494