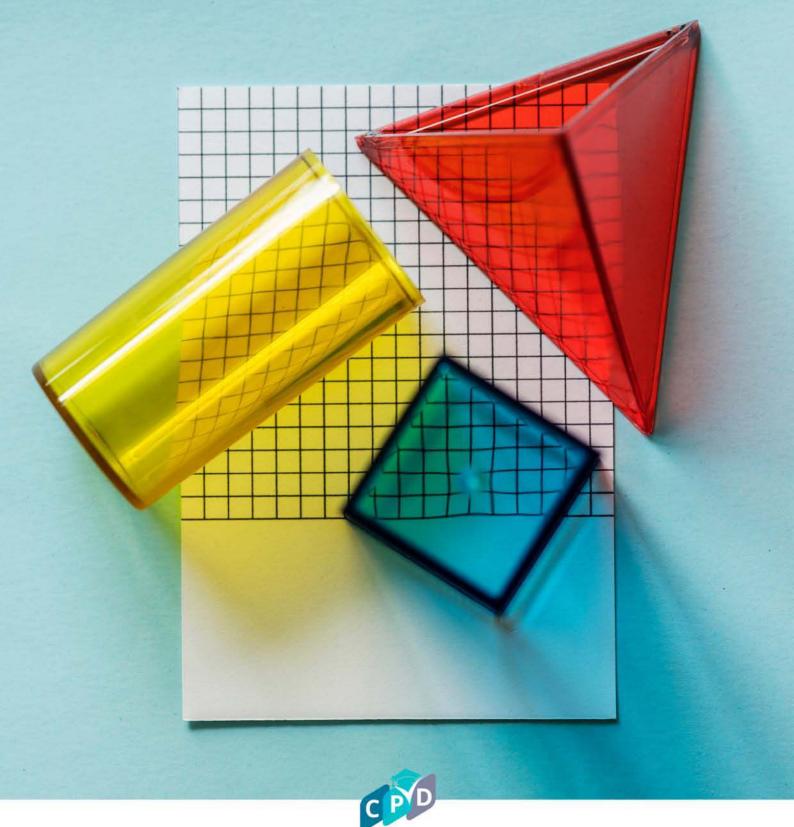# Academic Subject Workshops

Singapore Education System

The Singapore education system has been widely acclaimed for its success in nurturing students to be the leaders of tomorrow, evident from the global education rankings:

- In 2015, Singapore held the highest mean score in both mathematics and science in the Trends in International Mathematics and Science Study (TIMSS). TIMSS provides reliable and timely data on the mathematics and science achievements of U.S. students compared to that of students in other countries.
- In the 2016 Progress in International Reading Literacy Study (PIRLS), Singapore emerged second in reading literacy, after Russia Federation.
- In 2015, Singapore topped the OECD's Programme for International Student Assessment (PISA) in English, mathematics and reading. Every 3 years, PISA tests 15-year-old students from all over the world in reading, mathematics and science to gauge how well the students master key subjects in preparation for real-life situations in the adult world.
- In 2018, Singapore was ranked third after Sweden and Netherlands, and topped Asia in the EF English Proficiency Index for Schools, which is the world's largest ranking of countries and regions in terms of the acquisition of English skills by secondary and tertiary students.
- In the Worldwide Educating for the Future Index, Singapore ranked seventh overall in the world and is the only Asian economy to make it to the Top 10 in 2018. The index assesses the effectiveness of education systems across indicators such as education policy environment and teaching environment.

These rankings also point out the correlation between a good education system and economic progress. As a country with little natural resources, Singapore's investment in human capital has paid off handsomely.
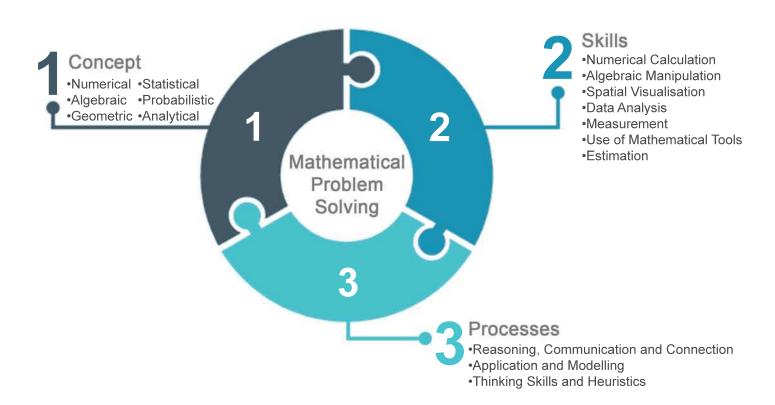
Mathematics
Workshop

Singapore Mathematics Framework

There has been greater focus on TIMSS and PISA, which indicates a growing interest in and emphasis on mathematics education worldwide. Mathematics is relevant in many fundamental aspects of our daily lives, from understanding basic information to facing the reality of having to make decisions regarding finances. Mathematics is also relevant in supporting a country's economy. All these knowledge and expertise can only come with a good background in mathematics. Hence, mathematics education is key to uphold individual and worldwide progress and success. It is then crucial to place emphasis on mathematics to educate the masses on critical thinking and problem-solving skills to boost competency in our competitive modern society.

It must be noted that learners have different abilities and learning styles, and thus it is necessary to tailor mathematics education to suit these differences. Some learners may have a flair for mathematical concepts, easily taking interest in the subject and excelling in it, while others may find mathematics challenging and tedious, and struggle to understand its importance. It is the duty of educators to craft a mathematics curriculum that reinforces strengths and tackles weaknesses, providing learners with necessary support to master the subject and realise their potential.
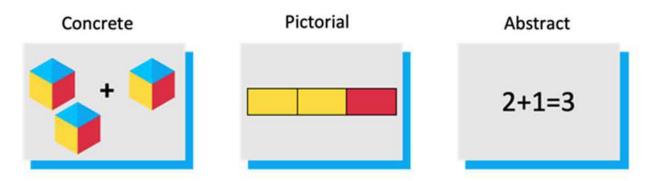
The framework of the mathematics curriculum centres on the ability to solve problems. Educators and learners alike should use the framework as a guide to teaching and learning mathematics at all stages of education and even in the working environment, as mathematics education is a lifelong process that remains applicable throughout one's life.

There are three inter-related components which emphasise on conceptual understanding, skills proficiency and mathematical processes.

1 Concept
- Numerical
- Algebraic
- Geometric
- Statistical
- Probabilistic
- Analytical

2 Skills
- Numerical Calculation
- Algebraic Manipulation
- Spatial Visualisation
- Data Analysis
- Measurement
- Use of Mathematical Tools
- Estimation

3 Processes
- Reasoning, Communication and Connection
- Application and Modelling
- Thinking Skills and Heuristics
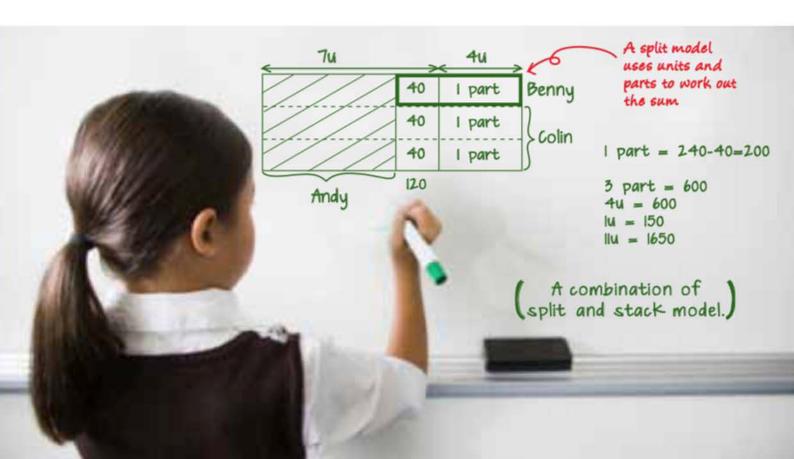
Mathematical Problem Solving

Concrete, Pictorial, Abstract (CPA) Approach

Throughout the course of mathematics education in Singapore, the Singapore Ministry of Education (MOE) has promoted the Concrete, Pictorial, Abstract (CPA) approach as a significant instructional strategy. In the concrete phase, learners engage in interactive activities, handling physical objects to demonstrate problems. In the pictorial phase, learners visualise the objects that they previously held physically, mentally constructing a visual version. In the abstract phase, learners now replace these physical and visual objects with numbers and math symbols to solve problems.

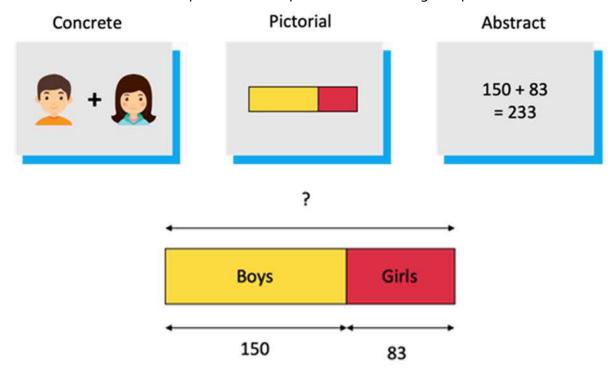| Concrete	Pictorial	Abstract
		$2+1=3$

The Model Method

Participants of this course will be provided with insights on the significance of the model method as an essential heuristic in problem-solving. Participants will gain a greater understanding of various model types (e.g. part-whole, comparison and changing models) that are used to solve word problems at the different levels of the education system. Participants will also be able to raise any difficulties faced when using models to solve problems, and tackle their weaknesses head-on.

Four Operations
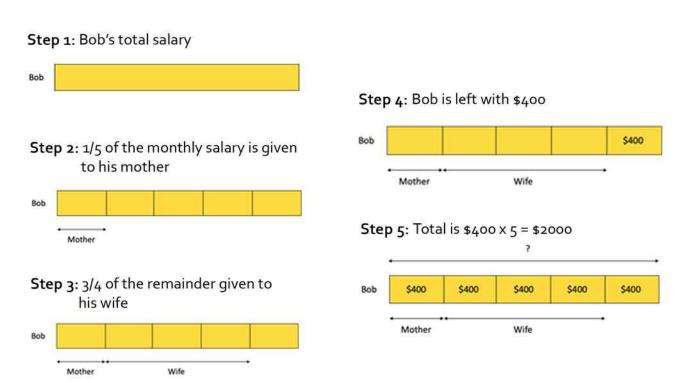## (Addition, Subtraction, Multiplication, Division)

Concepts: Part-Whole Concept, Change Concept, Comparison Concept, Placeholder Concept, Remainder Concept, Equal Concept, Repeated Variable Concept, Constant Difference Concept, Constant Quantity Concept

83 girls and 150 boys took part in a swimming competition.
How many children took part in the swimming competition?

Concrete	Pictorial	Abstract
👦 **+** 👧	🟨🟥	150 + 83 = 233

?

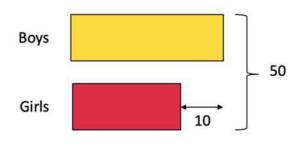| Boys	Girls

150   83

Fraction, Ratio and Percentage

Bob gave 1/5 of his monthly salary to his mother. He gave 3/4 of the remainder to his wife and saves the rest. He saves $400 every month. How much is his monthly salary?
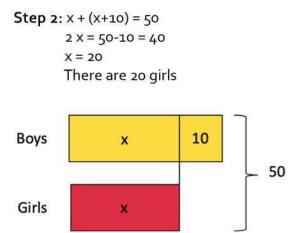
Step 1: Bob's total salary

Bob [🟨]

Step 2: 1/5 of the monthly salary is given to his mother

Bob [🟨🟨🟨🟨🟨]
Mother

Step 3: 3/4 of the remainder given to his wife

Bob [🟨🟨🟨🟨🟨]
Mother   Wife

Step 4: Bob is left with $400

Bob [🟨🟨🟨🟨 | $400]
Mother   Wife

Step 5: Total is $400 x 5 = $2000

?

Bob [$400 | $400 | $400 | $400 | $400]
Mother   Wife

Algebra

There are 50 children in a swimming competition.
If there are 10 more boys than girls, how many girls are there?

Step 1: 10 more boys than girls

Boys

Girls

50

10

Step 2: $x + (x+10) = 50$

$$2x = 50-10 = 40$$

$$x = 20$$

There are 20 girls

Boys

x 10

Girls

x

50

Using Heuristics to
Tackle Mathematics Problems

A heuristic is a general approach used to dictate how students can solve problems when the solutions are unclear. These include using a representation (e.g., drawing a diagram, tabulating), making a guess (e.g., trial and error/guess and check, making a supposition), walking through the process (e.g., acting it out, working backwards) and changing the problem (e.g., simplifying the problem, considering special cases).

In this course, besides mastering the model method, educators will also be guided on how to effectively craft questions to not only test learners' understanding, but also to identify the challenges they face in problem-solving and thereafter provide personalised guidance accordingly, to guide learners as they use various heuristics to solve mathematical problems.
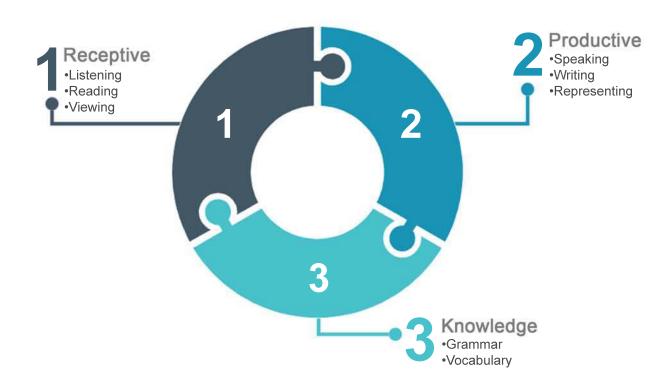
English
Workshop

Singapore English Framework

When Singapore gained independence in 1965, the government encountered the pressing issue of a divided population with people of different races and religions. At the time, the population of Singapore was expanding quickly and the government underwent pressure to provide its people with employment. The government had to propose a solution to these problems by unifying its people, as well as by guiding the country towards progress. The overarching solution to these issues was to introduce English as the lingua franca, and the working language for government and business. English is widely used and serves many roles in Singapore. Locally, English is the common language that promotes the formation of connections between the different ethnic and cultural groups. Globally, English allows Singaporeans to be included and engage in a knowledge-based economy where English is the lingua franca of the Internet, of science and technology and of world trade.

The three components in the framework of English includes:
- Receptive Skills: Listening, Reading and Viewing are vital for deriving meaning from ideas or information.
- Productive Skills: Speaking, Writing and Representing allow for the creation of meaning.
- Knowledge about language: Grammar and Vocabulary, provide the building blocks required for the implementation of the aforementioned receptive and productive skills for effective communication.

1 Receptive
- Listening
- Reading
- Viewing

2 Productive
- Speaking
- Writing
- Representing

3 Knowledge
- Grammar
- Vocabulary

Grammar

A strong foundation in the use of English grammar will enable its learners to use the language accurately, fluently, and appropriately for a variety of purposes, audiences, contexts, and cultures.

This course will introduce the following items, structure and learner strategies, including but not limited to:

- Grammar items
- Tenses
- Parts of Speech
- Modals
- Passive/Active Voice
- Direct and Indirect Speech
- Prepositions
- Conjunctions and Connectors
- Concord
- Question Tags
- Question Words

In addition, this course will touch on pedagogy in teaching grammar, and how strategies should be incorporated to integrate the concept of grammar in teaching. We will undertake the whole-part-whole approach to teaching grammar, which entails beginning to teach grammar by exposing learners to naturalistic and authentic text samples in the course of listening, reading and viewing. Teachers will then direct learners' attention to certain grammatical items found in the texts and discuss the rules as well as contexts in which the items are used. Finally, teachers will provide learners with the chance to apply their learning of these grammatical rules to a particular context, such as in a simple role-play.

Vocabulary

Cultivating effective language use requires learners to constantly expand their vocabulary and use words selectively in certain combinations and structures to articulate their desired message and to express a range of intentions and nuances. While learners' knowledge of grammar determines the variety of words used in various contexts, a rich vocabulary will allow learners to understand and grasp knowledge and ideas in a wide range of texts. It will also provide learners with a wide spectrum of words and expressions to effectively communicate even the most subtle of differences in the meaning of ideas, thoughts, feelings, and actions.

This course aims to introduce learners to a range of vocabulary according to themes. Besides guiding learners to read and write simple texts, learners will be exposed to high-frequency and structural words which may be challenging for learners to understand and use, and words required for the study of other subjects. By building a wide vocabulary, learners will possess a strong proficiency in English as the basis for the effective study of language, specifically in reading and appreciating a wide range of texts, and in producing various kinds of texts that serve a range of purposes.

Thereafter, we will take a look at how teaching materials are crafted to aid learners in building on their vocabulary. This will give educators insights into choosing suitable vocabulary to suit different purposes, audiences, contexts, and cultures.
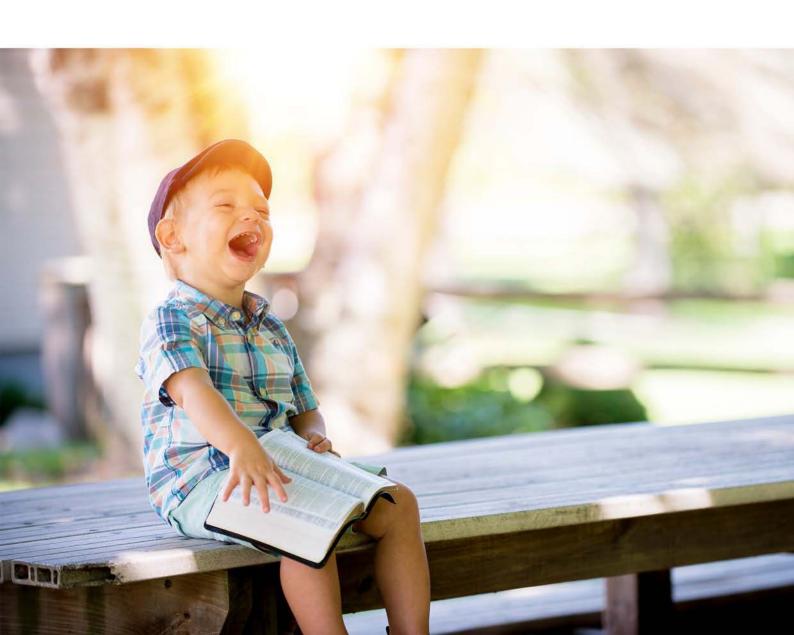
Comprehension Skills

Learners should enhance their language skills by learning to read, view, enjoy, respond to and understand a variety of texts critically. This would aid them in deriving meaning from print and non-print texts, and guide them to achieve fluency in reading and viewing step-by-step in order to understand content thoroughly.

In this course, we will provide a comprehensible introduction to the reading comprehension component, which has been arranged into three progressive stages:

- Beginning Reading (Learning to read)
- Close Reading and Viewing (Deriving meaning and understanding information from texts)
- Critical Reading and Viewing (Examining texts critically to infer implied meaning, judgement, higher-order thinking and evaluation)

Through this course, educators will be exposed to ways to guide learners along their language journey, from the beginning stage of reading to the independent stage of reading. Additionally, educators will also discover how to develop reading comprehension strategies for comprehending content at the literal, interpretive and evaluative levels, and critical reading skills in learners.

Writing

Learning to write for a range of creative, personal, academic and functional purposes will help learners to articulate their thoughts and feelings, hold meaningful conversations with others and ease their learning in schools.

In this course, educators will learn the mechanics of writing, i.e. penmanship and spelling accuracy, to cultivate a readiness for writing. To engage learners in continuous text creation, educators will also be introduced to the pedagogy in teaching the skills and strategies needed to enhance one's writing.

This encompasses the process of:
- Idea generation,
- Selection,
- Development,
- Organisation, and
- Revision in writing and representing to address purpose, audience, context, and culture in a variety of texts.

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