GEOGRAPHY

TEACHING AND LEARNING SYLLABUSES

Lower Secondary

Express Course

Normal (Academic) Course

Implementation starting with
2021 Secondary One Cohort

Ministry of Education
SINGAPORE

CONTENTS

1. INTRODUCTION

1.1 DESIRED OUTCOMES OF EDUCATION, 21st CENTURY COMPETENCIES AND NATIONAL EDUCATION

The Desired Outcomes of Education (DOE) are attributes that educators aspire for our learners. These outcomes establish a common purpose for geography teachers and serve as a compass to steer the teaching and learning process. The syllabuses support students towards developing these attributes in the DOE:

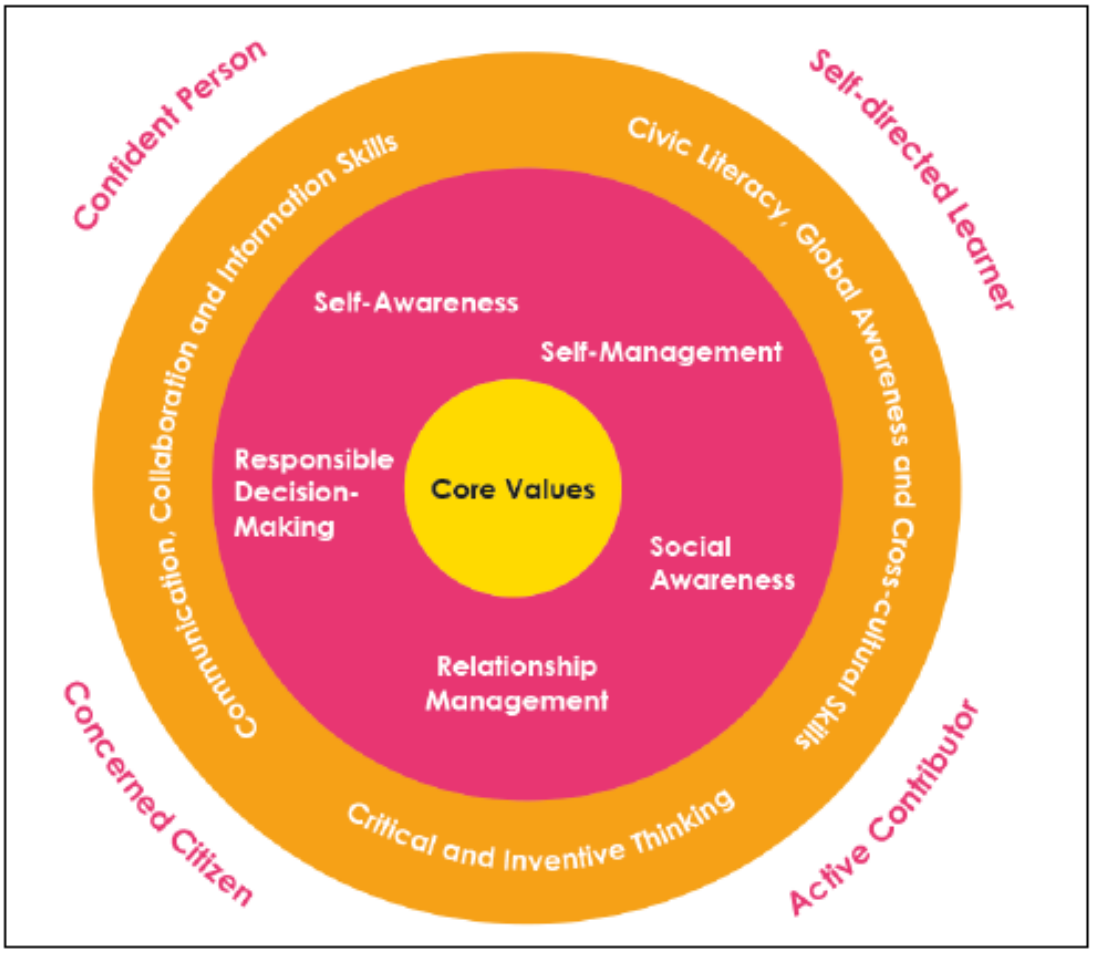
- a **confident person** who has a strong sense of right and wrong, is adaptable and resilient, knows himself or herself, is discerning in judgment, thinks independently and critically, and communicates effectively;
- a **self-directed learner** who takes responsibility for his or her own learning, who questions, reflects and perseveres in the pursuit of learning;
- an **active contributor** who is able to work effectively in teams, exercises initiative, takes calculated risks, is innovative and strives for excellence; and
- a **concerned citizen** who is rooted to Singapore, has a strong sense of civic consciousness, is informed about Singapore and the world, and takes an active part in bettering the lives of others around him or her.

Beyond prescribing geographical knowledge and skills, the syllabuses are designed to enable students' development of important competencies necessary for them to thrive in the globalised and fast-changing world of the 21st century. The syllabus outcomes in Section 1.3 are aligned to the framework of 21CC (see Figure 1). Knowledge and skills acquisition must be underpinned by values, which form the core in the framework.

The middle ring signifies the Social and Emotional Competencies – skills necessary for students to recognise and manage their emotions, develop care and concern for others, make responsible decisions, establish positive relationships, as well as handle challenging situations effectively.

The outer ring of the framework represents the emerging 21CC necessary for the globalised world we live in. These are: Civic Literacy, Global Awareness and Cross-Cultural Skills; Critical and Inventive Thinking; and Communication, Collaboration and Information Skills.

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



1.2 AIM AND OUTCOMES OF LOWER SECONDARY GEOGRAPHY SYLLABUSES

The syllabuses seek to develop students' interest in geography and their understanding of the world. They promote students' growth as informed and concerned citizens who are able to use geographical knowledge and skills to show care and concern for the world they live in and actively contribute towards a sustainable future.

OUTCOMES OF SYLLABUSES

Knowledge and Understanding

The syllabuses seek to equip students with the knowledge and understanding of:

- geographical terms, patterns, processes and concepts associated with selected physical and human phenomena found in Singapore and the world;
- interactions within and between physical and built environments, and their effects;
- contemporary environmental and social challenges that occur at different places in the world; and
- approaches that enhance the sustainability of our world and our way of life at various scales.

Skills

The syllabuses seek to enable students to:

- pose geographical questions to initiate and sustain their learning;
- apply methods of the discipline to investigate physical and human phenomena, processes, and associated issues;
- interpret geographical data to recognise patterns and suggest relationships; and
- analyse physical and human phenomena, processes, and associated issues.

Values and Attitudes

The syllabuses seek to nurture in students:

- respect, care and concern for the environment and people; and
- a sense of responsibility and a desire to contribute towards building a sustainable future.

1.3 KEY GEOGRAPHICAL CONCEPTS AND GEOGRAPHICAL THINKING

Geography comprises a set of perspectives that enable students to meaningfully study different phenomena occurring in physical and built environments.

Key geographical concepts of space, place, environment, and scale are central to learning Geography at secondary school level (see Figure 2). They enable students to make sense of and connect disparate ideas in the subject. The concepts can be used individually or in combination with each other.

These concepts are intended as analytical lenses for students to identify geographical aspects of a specific phenomenon and pose questions that probe its characteristics and its processes at work. Students can further explore patterns and relationships that may exist with other phenomena located elsewhere or across time. As students grow in familiarity in applying these concepts, they develop geographical perspectives.

Figure 2: Key Geographical Concepts

Space A space refers to a physical area on the earth's surface. Over a particular space, a range of physical and human phenomena can be observed. The notion of location is often associated with space as it is useful to identify the area where a phenomenon can be found. Geographers make use of space to locate the phenomenon and contextualise their study. They observe spatial patterns and deduce relationships associated with the phenomenon.	**Environment** The environment comprises physical and built environments. The physical environment encompasses all living and non-living things that occur naturally and has features and functions which are the result of natural processes. The atmosphere, hydrosphere, biosphere, and lithosphere are the four main components of the physical environment (e.g., tropical rainforests and water bodies). The built environment (e.g., cities and transport systems) is constructed and managed by people. Geographers examine the opportunities and challenges presented by the environment to people, the ways people change and manage the environment, as well as the approaches to enhance sustainability.
Place A place is an area of the earth's surface with meaning to people. Places can hold significance for people as a result of their interactions with physical and built environments. Meanings attached to places may be altered when people's experiences with the environments change or when places undergo physical transformation. Geographers study people's relationship with the physical and built environments and find out how places are viewed and experienced by (various groups of) people.	**Scale** Scale refers to one or more ways in which physical and human phenomena and processes can be organised for study. Scale can be used to present information associated with a phenomenon in varying degrees of detail when it is represented on a map. It can also be used to discuss phenomena and their associated issues by dividing them into categories such as "local", "national", "regional" and "global". In addition, scale can be used to observe phenomena and processes that occur at a specific point in time or over a span of time. Geographers make use of scale to scope the spatial and temporal extent of study of phenomena and processes. It allows geographers to investigate how phenomena relate to people and the environment at various levels.

2. CONTENT

2.1 ORGANISATION OF SYLLABUSES

The syllabuses are framed by the theme of 'Sustainable Resource Use and Management' underpinned by the overarching concept of 'sustainability'. The prescribed content is organised into two thematic questions (TQs) and four topics that are to be taught over two years (see Figure 3).

Figure 3: Organisation of Syllabuses

Theme: Sustainable Resource Use and Management	
Introduction to Geography	Thematic Question 2: How Can We Sustainably Build Cities?
Thematic Question 1: How Can We Sustainably Manage Natural Resources?	
• Topic 1.1 Water	• Topic 2.1 Housing
• Topic 1.2 Tropical Rainforests and Mangroves	• Topic 2.2 Transport Systems

Each TQ indicates the direction of inquiry in each year of study and is also a content primer. By introducing students to different perspectives and ideas on how natural resources can be sustainably managed in the TQ, students will be able to better understand the topic content and issues when these are taught. Each topic identifies a specific phenomenon that can be observed in the physical or built environment. The phenomenon is explicated through a set of guiding questions (GQs), which systematically explore and examine different aspects of the phenomenon, such as features and location, processes, relationships with the environment and people, and sustainable management strategies.

All students will go through 'Introduction to Geography', which acquaints them with the key aspects of geography and the approaches that geographers use to study the world.

2.2 THEMATIC QUESTION 1, TOPIC 1.1 AND TOPIC 1.2

Economic development and population growth require natural resources. Water (Topic 1.1), and tropical rainforests and mangroves (Topic 1.2) provide people and societies with the essentials for life and other useful materials. However, there are concerns about environmental degradation and its subsequent impact on people and inter-generational equity as the pace of resource extraction today may compromise the ability of future generations to meet their own needs. Within this context, TQ1 ("How Can We Sustainably Manage Natural Resources?") is framed and the prescribed content is outlined accordingly.

2.3 THEMATIC QUESTION 2, TOPIC 2.1 AND TOPIC 2.2

TQ2 ("How Can We Sustainably Build Cities?") focuses on the built environment. The study of cities assumes central importance within discussions of sustainability because the trend of global urbanisation remains unabated. The number and size of cities in the world will only increase, thus increasing people's demand for natural resources as cities are associated with a high consumption of goods and services and densely built landscapes. With growing populations, cities will need to anticipate and find ways to maintain a high quality of life for their inhabitants. Within this context, housing (Topic 2.1) and transport systems (Topic 2.2) have been identified for study.

2.4 GEOGRAPHICAL INVESTIGATION

Geographical investigation (GI) is integral to learning Geography and reflects the importance of inquiry. GI provides students with opportunities to:

- carry out a more student-directed geographical inquiry, and participate in fieldwork, as students are required to go beyond the classroom to actively look for and gather data to address the inquiry;
- apply and transfer what they have learnt from their geography lessons to a real-world issue;
- be assessed more holistically in terms of a wider range of geographical skills; and
- develop the skills and attitudes to work individually and collaboratively in groups as students are required to complete both individual and group components.

Each topic is designed with an accompanying GI. Students work in groups on one selected GI a year.

2.5 SCOPE OF SYLLABUSES

The scope of the syllabuses details the knowledge, skills, and values and attitudes which students are expected to learn and demonstrate. The scope of the syllabuses is presented in subsequent pages of this section. Optional learning outcomes and topical content for Normal (Academic) course are in *italics*.

Introduction to Geography			
Overview: Geography is the study of the world, comprising physical and built environments and the relationships between environments and people. It offers unique perspectives through the four key geographical concepts of space, place, environment, and scale. Through geographical inquiry, students will broaden and deepen their understanding of geographical phenomena as they learn to ask geographical questions and carry out geographical investigation (GI). In this way, geographical inquiry helps students make sense of the world they live in and equips them with the skills to build on the geographical knowledge they have acquired. Through this study, students will learn how to: • respect the Earth as a habitat for living things; and • show care for people and the environment.			
Guiding Question	**Learning Outcome** Students should be able to:	**Content**	**Main Terms**

GQ1 – What is geography and how does it help me understand the world?	• Describe how geographers study the world
	• Describe physical and built environments
		• Geography studies the world and the relationships between people and environments
		  ○ Branches of geography – physical and human
		  ○ Physical environment (i.e., atmosphere, biosphere, hydrosphere and lithosphere) and built environment (e.g., housing, transport systems)
			• Geography
			• Geographer
			• Relationship
			• Physical geography
			• Human geography
			• Physical environment
			• Built environment
			• Atmosphere
			• Biosphere
			• Hydrosphere
			• Lithosphere

		• Geographical concepts as a way of thinking about the world
		  ○ Space
		  ○ Place
		  ○ Environment
		  ○ Scale
			• Space
			• Location
			• Place
			• Environment
			• Scale
			• Map scale
			• Time scale
			• Geographic scale
			• Pattern

		• Geographical inquiry as a way of knowing the world
		  ○ Pose geographical questions about phenomena and their associated issues
		  ○ Carry out an investigation to answer geographical questions about phenomena and their associated issues
			• Geographical inquiry
			• Phenomenon
			• Geographical investigation

Theme: Sustainable Resource Use and Management
Thematic Question 1: How Can We Sustainably Manage Natural Resources?

Overview:

A natural resource, which may be renewable or non-renewable, is any physical material that people view as valuable in meeting their needs. Its value may differ across societies, change over time and be affected by technological development. The way people view the value of a natural resource affects the way it is extracted and used. For example, a nature-centred view may lead to calls for conservation of the environment, while a human-centred view may lead to over-extraction and subsequent environmental challenges. In striving towards the sustainable use of natural resources, people often exercise ingenuity to develop solutions to ensure the continued availability of natural resources for future generations.

Through this study, students will learn how to:

- respect the different views people have about natural resources; and
- show care for the Earth and the survival of future generations.

Guiding Questions	**Learning Outcomes** Students should be able to:	**Content**	**Main Terms**
GQ1 – What are natural resources?	• Describe the types of natural resources	• Types of natural resources ○ Renewable and non-renewable	• Natural resource • Renewable • Non-renewable

GQ2 – How do people view and use natural resources?	• Describe the ways people view and use natural resources	• Ways people view and use natural resources:
		  ○ Nature-centred: the physical environment is valuable in itself
		  – Preservation of the physical environment
		  ○ Human-centred: the physical environment is valuable because something can be obtained from it
			• Value
			• Nature-centred
			• Preservation
			• Human-centred
			• Extraction
			• Depletion
			• Environmental degradation

		– Extraction leading to resource depletion and environmental degradation	

		• Sustainable use of natural resources to ensure their continued availability for future generations
		  ○ Encourage conservation and sustainable practices to reduce the rate of resource extraction and waste (e.g., 4R's – reduce, reuse, recycle and recover)
		  ○ Develop technologies to manage environmental footprint (e.g., low-flush toilets, solar farms)
			• Sustainable use
			• Conservation
			• Short-/long-term
			• Consumption
			• Waste
			• Technology
			• Environmental footprint

Topic 1.1: Water			
Overview: Water is a precious resource necessary for human survival. Without this resource, life would be impossible. Water is used in many aspects of our daily lives: from drinking to washing, as well as in agriculture and industries. While water is renewable, as it is replaced naturally through the hydrological cycle, it is unevenly distributed in the physical environment. The availability of water can be threatened by events of extended rainfall or droughts, as well as through the contamination of water stores from improper use. To ensure the long-term availability of water to support the natural ecosystem and human lives, sustainable solutions are needed to manage this vital resource. Through this study, students will learn how to: • be responsible users of water; and • show care for the people and environments affected by water pollution.			
Guiding Questions	**Learning Outcomes** Students should be able to:	**Content**	**Main Terms**
GQ1 – What is water and where is water found?	• Identify the physical states of water	• Water in various physical states ○ Water vapour (gaseous) ○ Water (liquid) ○ Ice (solid)	• Physical state • Gaseous • Liquid • Solid
	• Describe the distribution of various water stores using maps or schematic diagrams	• Water stores and their distribution ○ Oceans ○ Glaciers ○ Rivers ○ Lakes ○ Groundwater ○ Soil	• Store • Distribution • Ocean • Glacier • River • River source • River mouth • Lake • Freshwater • Groundwater

			• Soil • Soil moisture • Pore • Bedrock

GQ2 – Why is water available on Earth?	• Explain how the hydrological cycle ensures a continuous supply of water using schematic diagrams	• Continuous supply of water through the hydrological cycle
		  ○ Evaporation
		  ○ Transpiration
		  ○ Condensation
		  ○ Precipitation
		  ○ Infiltration
		  ○ Percolation
		  ○ Surface runoff
		  ○ Groundwater flow
			• Hydrological cycle
			• Process
			• Evaporation
			• Transpiration
			• Condensation
			• Precipitation
			• Infiltration
			• Percolation
			• Surface runoff
			• Groundwater flow

	• *Explain water budget using schematic diagrams*	• *Water budget within a catchment*
		  ○ *Water surplus*
		  ○ *Water deficit*
			• *Water budget*
			• *Catchment*
			• *Storage*
			• *Input*
			• *Output*
			• *Surplus*
			• *Deficit*
			• *Net change*

GQ3 – What relationships does water have with (i) the environment and (ii) people?	• Describe how the availability of water changes due to variations in precipitation using schematic diagrams or texts
	
	• Describe how water supports river ecosystems using schematic diagrams or texts
		• Relationship between water and the environment
		  ○ Changing availability of water due to variations in precipitation
		  – Occurrence of floods due to excessive rainfall
		  – Occurrence of droughts due to lack of rainfall over a prolonged period of time
		  ○ Support of river ecosystems
			• Rainfall
			• Supply
			• Flood
			• Drought
			• Ecosystem

	• Describe how water is used by people using images or texts	• Relationship between water and people
		  ○ Domestic use (e.g., washing, cooking)
		  ○ Recreational use (e.g., water sports, fishing)
		  ○ Agricultural use (e.g., wet rice cultivation, livestock rearing)
		  ○ Industrial use (e.g., hydropower, as a cleaning agent in wafer fabrication)
			• Domestic
			• Recreation
			• Agriculture
			• Industry

	• Explain how human actions have led to water pollution and its associated impact using images or texts	• Pollution of water stores affecting the quality and availability of water ○ Threat to aquatic ecosystems • Reduced availability of water for people's use	• Pollution • Quality • Threat

GQ4 – How can these relationships be sustainably managed?	• Explain the strategies taken to sustainably manage water resources in Singapore and other countries using texts or images
	
	• *Evaluate the strategies taken to sustainably manage water resources in Singapore and other countries using texts or images*
		• Sustainable management of water resources in Singapore and other countries
		  ○ Improve water quality (e.g., anti-pollution laws)
		  ○ Reduce water consumption (e.g., water conservation efforts)
		  ○ Improve water technologies (e.g., desalination)
		  ○ Import water (e.g., international agreements)
			• Management
			• Short-/long-term
			• Quality
			• Consumption
			• Technology
			• Import

Geographical Investigation for Topic 1.1: Water		
Overview: Students will explore and learn about a water store through the application of the GI stages. They will uncover how people's actions and the natural environment affect water quality, how people's use of a water store is affected by its water quality and how people's perception of their roles in managing a water store affect its use and water quality. In striving to sustainably manage the water store, students will reflect on their past actions, develop solutions, and take actions to maintain or improve water quality to support natural ecosystems and people. **This GI seeks to find out:** • the factors contributing to the state of the water quality in a water store; and/or • the stakeholders' (e.g., authorities, businesses, the public) roles and their perception of these roles in managing a water store, and the ways they use it.		
GI Stages	**Learning Outcomes** Students should be able to:	**Content**
Stage 1: Framing the GI	• Pose geographical questions	• Types of question frames (e.g., 5W1H, Neighbour's core questions)

Stage 2: Collecting data	• Use appropriate data collection methods
	• Ensure the accuracy and reliability of data
		<u>Primary data:</u>
		• Map work
		  ○ Location of data collection sites
		• Sampling
		  ○ Spot
		  ○ Transect
		• Surveys or interviews
		  ○ Human uses (e.g., recreational water activities)
		  ○ Strategies taken to ensure cleanliness (e.g., cleansing biotopes)
		• Field notes (e.g., human activities near a water store)
		• Field sketches (e.g., physical and built features around the water store)
		• Images (e.g., photographs of human activities)

		• Water quality tests (e.g., dissolved oxygen)
		
		<u>Secondary data:</u>
		• Online/library research
		  ○ Water quality indicators
		  ○ Changes or improvements made to the water store
		  ○ Strategies taken to ensure the sustainability of the water store

Stage 3: Analysing and presenting data	• Organise raw data • Select appropriate data representations	• Maps (e.g., how water quality varies at different sampling points) • Field sketches (e.g., showing various human activities) • Tables (e.g., showing the water quality indicators at the various sites)
Stage 4: Drawing conclusions	• Provide evidence-based responses	• Spatial patterns (e.g., changes in water quality across a transect of the river) • Temporal patterns (e.g., changes in water quality at a sample site over time) • Relationships between variables (e.g., human actions and water quality) • Reasoned conclusions that answer the questions posed
Stage 5: Reflecting and taking action	• Evaluate data collection methods • Suggest ways to improve the investigation • Propose ways to improve the relationship between the phenomenon and people	• Strengths and limitations of data collection methods • Improvements to the investigation • Proposal or actions (e.g., submission of a report to the water authority to start a school-based effort to monitor the water quality of or clean up a water store near the school)

Topic 1.2: Tropical Rainforests and Mangroves			
Overview: Tropical rainforests and mangroves are evergreen and among the most biologically diverse natural vegetation on earth. They are distinguished by their ability to adapt to their unique environmental conditions in the tropics and along sheltered coasts and river mouths. Tropical rainforests and mangroves are important for their environmental functions, wide range of uses and as natural resources to people. However, the extraction of these natural resources has led to deforestation and an enhanced greenhouse effect. People can ensure that future generations continue to benefit from tropical rainforests and mangroves if they are able to develop sustainable solutions and take actions to protect and grow these two types of natural vegetation today. Through this study, students will learn how to: • respect the worth of tropical rainforests and mangroves to humans; and • show care for the people and environment affected by deforestation.			
Guiding Questions	**Learning Outcomes** Students should be able to:	**Content**	**Main Terms**
GQ1 – What are tropical rainforests and mangroves and where are they found?	• Describe the characteristics of tropical rainforests and mangroves using images or field sketches	• Characteristics of tropical rainforests and mangroves o Evergreen o Diversity of plant species o Structure - Distinct layers (for tropical rainforests) - Horizontal zonation (for mangroves)	• Natural vegetation • Tropical rainforest • Mangrove • Evergreen • Diversity • Structure • Layer • Emergent • Canopy • Undergrowth • Zonation

	• Describe the distribution of tropical rainforests and mangroves using maps	• Distribution of tropical rainforests and mangroves
		  ○ Found in the tropics (for tropical rainforests)
		  ○ Found along sheltered coasts and river mouths (for mangroves)
			• Distribution
			• Tropical climate
			• Latitude
			• Longitude
			• Equator
			• Tropic of Cancer
			• Tropic of Capricorn
			• Coast
			• River mouth

GQ2 – Why are tropical rainforests and mangroves located in the tropics?	• Describe the conditions for the growth of tropical rainforests and mangroves using graphs or tables	• Conditions for the growth of tropical rainforests
		  ○ High annual rainfall
		  ○ High mean annual temperature
		• Conditions for the growth of mangroves
		  ○ Warm waters
		  ○ Sheltered environment
			• Annual rainfall
			• Mean annual temperature
			• Sheltered environment
			• Sediments
			• Salinity

	• *Explain the adaptations of tropical rainforests and mangroves using images or field sketches*
	• *Compare the adaptations between tropical rainforests and mangroves using images or field sketches*
		• *Adaptations of tropical rainforests to the tropical climate*
		  ○ *Leaves (i.e., broad, waxy and drip tips)*
		  ○ *Roots (i.e., buttress)*
		• *Adaptations of mangroves to coastal environments*
		  ○ *Leaves (i.e., salt-secreting)*
		  ○ *Roots (i.e., pencil, cone, prop, and knee-bend; salt-excluding)*
			• *Adaptation*
			• *Broad leaf*
			• *Waxy leaf*
			• *Drip-tip leaf*
			• *Buttress root*
			• *Salt-secreting*
			• *Aerial root*
			• *Pencil root*
			• *Cone root*
			• *Prop root*
			• *Knee-bend root*

			• *Salt-excluding*
GQ3 – What relationships do tropical rainforests and mangroves have with (i) the environment and (ii) people?	• Describe the environmental functions of tropical rainforests and mangroves in the environment using schematic diagrams or texts	• Relationship between tropical rainforests and mangroves, and the environment o Habitat for biodiversity o Carbon storage o Oxygen generation (i.e., photosynthesis) o Protection from soil erosion o Protection from coastal erosion	• Habitat • Biodiversity • Carbon storage • Oxygen generation • Photosynthesis • Erosion
	• Describe how tropical rainforests and mangroves are used by people using images or texts	• Relationship between tropical rainforests and mangroves, and people o Places of habitation (e.g., longhouse, stilt house) o Sources of raw materials (e.g., wood, minerals) o Places for recreation (e.g., trekking, camping) o Sources of food (e.g., hunting and gathering, aquaculture)	• Habitation • Raw material • Recreation
	• Describe the impact of extracting resources from tropical rainforests and mangroves on the physical environment using graphs or schematic diagrams	• Extraction of resources from tropical rainforests and mangroves o Deforestation o Enhanced greenhouse effect	• Extraction • Deforestation • Greenhouse gases • Enhanced greenhouse effect

GQ4 – How can these relationships be sustainably managed?	• Explain the strategies taken to sustainably manage tropical rainforests and mangroves in Singapore and other countries using tables or texts
	
	• *Evaluate the strategies taken to sustainably manage tropical rainforests and mangroves in Singapore and other countries*
		• Strategies for sustainable management of tropical rainforests and mangroves in Singapore and other countries
		  ○ Protect areas which contain tropical rainforests and mangroves (e.g., national parks and biosphere reserves)
		  ○ Regulate forestry activities (e.g., controlled logging)
		  ○ Rehabilitate disturbed areas with tropical rainforests and mangroves (e.g., reforestation)
		  ○ Promote public education (e.g., guided nature walks)
			• Management
			• Short-/long-term
			• Conservation
			• National park
			• Biosphere reserve
			• Forestry
			• Controlled logging
			• Reforestation
			• Public education

Geographical Investigation for Topic 1.2: Tropical Rainforests and Mangroves		
Overview: Students will explore and learn about a tropical rainforest/mangrove through the application of the GI stages. They will uncover how the natural environment and people's actions affect the growth of the tropical rainforest/mangrove and how people's perception of their roles in managing the tropical rainforest/mangrove affect its growth and value. Through the investigation, students will reflect on their past actions, develop sustainable solutions, and take actions to protect, conserve or restore the tropical rainforest/mangrove to support the natural ecosystems and needs of the people. **This GI seeks to find out:** • the factors affecting the growth conditions of a tropical rainforest/mangrove; and/or • the stakeholders' (e.g., authorities, businesses, the public) roles and their perception of these roles in managing a tropical rainforest/mangrove.		
GI Stages	**Learning Outcomes** Students should be able to:	**Content**
Stage 1: Framing the GI	• Pose geographical questions	• Types of question frames (e.g. 5W1H, Neighbour's core questions)

Stage 2:
Collecting data
	• Use appropriate data collection methods
	• Ensure accuracy and reliability of data
		<u>Primary data</u>
		• Map work
		  ○ Location of data collection sites
		• Sampling
		  ○ Spot
		  ○ Transect
		• Surveys or interviews
		  ○ Human uses (e.g., recreational activities)
		  ○ Strategies to protect tropical rainforests or mangroves (e.g., construction of boardwalks)
		• Field notes (e.g., human activities)

		• Field sketches (e.g., protection from soil or coastal erosion)
		• Images (e.g., photographs of different plant species)
		
		<u>Secondary data</u>
		• Online/library research
		  ○ Common plant species or organisms found in tropical rainforests or mangroves
		  ○ Uses of resources obtained from tropical rainforests or mangroves
		  ○ Strategies taken to protect tropical rainforests or mangroves

Stage 3: Analysing and presenting data	• Organise raw data • Select appropriate data representations	• Maps (e.g., showing the distribution of plant species at different zones in a mangrove) • Pie charts (e.g., showing the proportion of people's perception of their role in ensuring sustainability) • Images (e.g., photographs showing human activities) • Field sketches (e.g., showing how trees protect an area from erosion) • Tables (e.g., showing the diversity of plant species in an area of a rainforest)
Stage 4: Drawing conclusions	• Provide evidence-based responses	• Spatial patterns (e.g., plant species found at different areas in a forest) • Relationships between variables (e.g., human actions and environmental conditions of the forest) • Reasoned conclusions that answer the questions posed
Stage 5: Reflecting and taking action	• Evaluate data collection methods • Suggest ways to improve the investigation • Propose ways to improve the relationship between the phenomenon and people	• Strengths and limitations of data collection methods • Improvements to the investigation • Proposal or actions (e.g., creation of a plan and educational campaign materials to inform the public about appropriate activities in a forest)

Theme: Sustainable Resource Use and Management Thematic Question 2: How Can We Sustainably Build Cities?			
Overview: By 2030, more than half of the world's population will live in urban areas, and one in every three people will live in cities with at least half a million inhabitants. As cities grow, they require large amounts of natural resources and people to build and maintain infrastructure, develop industries, and provide services to meet the needs and demands of their inhabitants. While these demands exert great pressure on people and the environment, they also offer opportunities for cities to be sustainably built. Ingenuity is essential in developing solutions that can manage urban growth sustainably without compromising the environment while maintaining a high quality of life for its inhabitants. Through this study, students will learn how to: • understand and appreciate the diversity of cultures in a city; and • show care for different groups of people who live in the city and have different needs from them.			
Guiding Questions	**Learning Outcomes** Students should be able to:	**Content**	**Main Terms**
GQ1 – What are cities?	• Describe the characteristics of cities	• Characteristics of cities ○ Large population size ○ High population density ○ Built-up area ○ Range of functions (e.g., administrative, commercial)	• City • Population size • Population density • Infrastructure • Function
	• Describe how cities are related to rural areas	• Relationship between cities and rural areas ○ Rural-urban migration ○ Provision of goods and services (e.g., food, hospitals)	• Rural-urban migration • Push factor • Pull factor • Amenities

GQ2 – How do cities impact the environment and the people living in them as they continue to grow?	• Describe the ways cities impact people and the environment	• Impact of cities on the environment and their inhabitants o Opportunities - Education and employment - Technological innovations (e.g., reduce carbon emissions, improve mobility) o Challenges - Increased environmental pollution (e.g., water pollution, air pollution) - Competition for natural resources (e.g., land, water)	• Education • Employment • Industries • Technological innovations • Environmental pollution • Environmental footprint • Competition
GQ3 – How can people sustainably build cities?	• Describe the strategies used to sustainably build cities	• Sustainable management of cities o Environmental management - Physical environment (e.g., reduce water pollution, minimise air pollution) - Hazards (e.g., use of better-quality building materials, land-use planning) o Improve quality of life - Providing safe housing - Providing a variety of transportation modes - Considering the needs of different groups (i.e., the elderly, persons with disabilities)	• Management • Hazard • Human-induced • Natural • Quality of life • Housing • Transportation mode

Topic 2.1: Housing			
Overview: Housing fulfils the basic human need for shelter. As cities continue to grow in population size, the need to provide housing also increases. This will lead to greater demand for natural resources, amenities and services as more housing developments are undertaken. However, the types of housing, their locations, availability, quality, and affordability differ from place to place. In some places, where housing is unavailable, people may have to build and occupy informal housing in squatter settlements. In other places, where housing is poorly maintained, people may have to live in undesirable living conditions. To better manage the impact of housing on the environment and people, it is necessary for developers, dwellers and those involved in building and maintaining housings to develop solutions and take actions that are sustainable. Through this study, students will learn how to: • appreciate the importance of harmony given the diversity of the people living in an area; and • appreciate the resilience shown by people in improving their living conditions.			
Guiding Questions	**Learning Outcomes** Students should be able to:	**Content**	**Main Terms**

GQ1 – What are the different types of housing and where are they found in cities?	• Describe the different types of housing and their characteristics using graphs or images
	
	• Compare the different types of housing and their characteristics using graphs or images
		• Types of housing and their characteristics
		  ○ Formal housing
		  - Built by government or private developers
		  - Legal right to occupy land
		  - Access to basic services
		  - High-quality building materials
		  ○ Informal housing
		  - Self-built squatter settlements
		  - No legal right to occupy land
		  - Lack of access to basic services
			• Formal housing
			• Government
			• Private developers
			• Legal right
			• Basic services
			• Informal housing
			• Squatters
			• Squatter settlements

	• Describe the distribution of housing locations within cities using maps	• Location of formal housing in cities
		  ○ Found on desirable land (e.g., away from pollution, away from heavy industries)
		• Location of informal housing in cities
		  ○ Found on locally unwanted land-use (LULU) (e.g., near landfills, near sewage treatment plants)
			• Desirable land
			• Locally unwanted land-use

GQ2 – Why are different types of housing located where they are in cities?	• Explain the factors affecting the locations of formal and informal housing in cities using texts or maps	• Factors affecting the location of formal and informal housing
		  ○ Land-use planning (e.g., restrictive land use, zoning)
		  ○ Developers (i.e., government and private developers)
		  ○ *Land price (i.e., cost of land for formal housing)*
		  ○ *Housing financial support (i.e., finance schemes for the poor, improved access to finance for developers)*
			• Land-use planning
			• Housing shortage
			• Government
			• Private developers
			• *Financial support*
			• *Finance schemes*
			• *Affordability*
			• *Cost*

GQ3 – What is the relationship between housing and (i) the environment and (ii) people?	• Describe the impact that housing has on the environment using images or schematic diagrams	• Relationship between housing and the environment
		  ○ Use of natural resources (e.g., forests, water)
		  ○ Environmental pollution (e.g., land, water)
			• Natural resources
			• Pollution
			• Waste

	• Describe the impact that housing has on people	• Relationship between housing and people ○ Provision of basic needs (e.g., shelter, sanitation)	• Basic needs • Amenities

	using images or schematic diagrams	○ Presence of amenities (e.g., grocery shops, clinics) ○ Presence of communities (e.g., interactions with neighbours, sense of belonging)	• Social • Communities
GQ4 – How can these relationships be sustainably managed?	• Explain the strategies taken to sustainably manage housing in Singapore and other countries using texts or images • *Evaluate the strategies taken to sustainably manage housing in Singapore and other countries using texts or images.*	• Sustainable management of housing in Singapore and other countries ○ Integrated land-use planning (e.g., by urban development authorities) ○ Provision of inclusive public housing (e.g., by housing development authorities) ○ Environmental features in buildings (e.g., zero energy building design) ○ Improvements to the conditions of slums (e.g., through government funding)	• Management • Short-/ long-term • Integrated land-use planning • Inclusive public housing • Slums

Geographical Investigation for Topic 2.1: Housing		
Overview: Students will explore and learn about living in a neighbourhood through the application of the GI stages. They will uncover why certain features in a neighbourhood are used more than others and how the provision and use of these features impact the environment and the people living there. By considering the impacts of these features and their related activities on people living in the neighbourhood and the environment, students will recommend sustainable solutions, and take actions to maintain or improve people's quality of life, and the quality of the environment. **This GI seeks to find out:** • the factors affecting the use of different features (e.g., parks, playground, markets) found in a neighbourhood; and/or • the impact of different features (e.g., parks, playground, markets) on people and/or the environment.		
GI Stages	**Learning Outcomes** Students should be able to:	**Content**
Stage 1: Framing the GI	• Pose geographical questions	• Types of question frames (e.g., 5W1H, Neighbour's core questions)

Stage 2:
Collecting Data
	• Use appropriate data collection methods
	• Ensure accuracy and reliability of data
		<u>Primary Data</u>
		• Map work
		  ○ Location of data collection sites
		• Sampling
		  ○ Convenience
		  ○ Simple random
		  ○ Systematic random
		• Surveys or interviews
		  ○ People's perception of the quality and range of features available
		  ○ Improvements that can be made to the neighbourhood
		• Field notes (e.g., nature of activity)
		• Field sketches (e.g., market)

		• Images (e.g., photographs of convenience stores)
		
		<u>Secondary data</u>
		• Online/library research
		  ○ Strategies taken by authorities in Singapore (e.g. town councils)
		  ○ History of the neighbourhood

Stage 3: Analysing and presenting data	• Organise raw data • Select appropriate data representations	• Maps (e.g., location of features) • Graphs (e.g., a simple bar graph showing the results of survey questions) • Images (e.g., photographs of sites within the neighbourhood) • Field sketches (e.g., drawings of selected features) • Texts (e.g., survey responses from the residents)
Stage 4: Drawing conclusions	• Provide evidence-based responses	• Spatial patterns (e.g., location of different features in the neighbourhood) • Relationships between variables (e.g., impact of features and needs of residents) • Reasoned conclusions that answer the questions posed
Stage 5: Reflecting and taking action	• Evaluate data collection methods • Suggest ways to improve the investigation • Propose ways to improve the relationship between the phenomenon and people	• Strengths and limitations of data collection methods • Improvements/enhancements to investigation • Proposal for use of data (e.g., creation of posters to be shared with residents through the school's Values-In-Action/community programme)

Topic 2.2: Transport Systems			
Overview: Transport systems facilitate movement of people, goods and services in cities. As cities develop and the lifestyles of people change, the demands on and expectations of transport systems have also become more complex. While a city's transport systems are expected to be efficient and effective, their development and maintenance can have a significant impact on people and the environment. To better manage the impact of transport systems on the environment and people, it is necessary for people to develop solutions and take actions that are sustainable and can lead to an improvement in the quality of life. Through this study, students will learn how to: • understand the efforts of the stakeholders involved in planning and managing an urban transport system; and • show care for groups of people with different mobility needs.			
Guiding Questions	**Learning Outcomes** Students should be able to:	**Content**	**Main Terms**
GQ1 – What are transport systems and where are they found in the cities?	• Describe the characteristics of transport systems in cities using images or schematic diagrams	• Characteristics of transport systems in cities ○ Density of transport network (i.e., nodes and routes) ○ Quality of transport infrastructure (e.g., paved roads, maintenance of facilities) ○ Variety of transport modes (e.g., rail, air)	• Transport • Transport system • Network • Location • Node • Route • Infrastructure • Mode
	• Describe the locations of transport nodes in cities using maps	• Locations of transport nodes in cities ○ Concentration of activities ○ Level of accessibility	• Accessibility • Terminal

GQ2 – Why are transport systems located in cities?	• Explain the reasons for a transport system in cities using texts or schematic diagrams	• Reasons for a transport system in cities ○ Movement of people ○ Movement of goods and services ○ *Intermodal connectivity* ○ *Connectivity to other cities*	• *Intermodal* • *Connectivity*
GQ3 – What relationships do transport systems in cities have with (i) the environment and (ii) people?	• Describe the impacts of transport systems on the environment using images or schematic diagrams	• Relationship between transport systems in cities and the environment ○ Changes to physical environment (e.g., clearing of natural vegetation, modification of landforms) ○ Increased carbon footprint	• Physical environment • Carbon footprint
	• Describe the impacts of transport systems on people using images or schematic diagrams	• Relationship between transport systems in cities and people ○ Health and safety risks ○ Traffic congestion ○ Improved mobility for different groups of people (i.e., elderly and persons with disabilities)	• Health risk • Safety risk • Traffic congestion • Mobility
GQ4 – How can these relationships be sustainably managed?	• Explain the strategies taken to sustainably manage transport systems in Singapore and other countries using texts or images	• Sustainable management of transport systems in Singapore and other countries ○ Laws and policies on transport (e.g., road safety) ○ Integrated land-use and transport planning (e.g., terminals that serve as multi-purpose hubs)	• Management • Short-/long-term • Land-use planning • Transport planning • Mobility research and development

	• *Evaluate the strategies taken to sustainably manage transport systems in Singapore and other countries using texts or images*	○ Provision of a range of mobility options for different groups of people (e.g., wheelchair-friendly buses) ○ Research and development in transport (e.g., mobile applications for navigation and location-based services)	

Geographical Investigation for Topic 2.2: Transport Systems		
Overview: Students will explore and learn about different mobility options in an urban area through the application of the GI stages. They will uncover how the mobility of different groups of people can be affected by where they live, and how the provision and use of different mobility options can impact the environment and people living there. Students will consider the impacts of mobility options on people and the environment, develop solutions and take actions that are sustainable to improve people's quality of life, and the environment. **This GI seeks to find out:** • the factors affecting the mobility of different groups of people; and/or • the impact of different mobility options on people and/or the environment.		
GI Stages	**Learning Outcomes** Students should be able to:	**Content**
Stage 1: Framing the GI	• Pose geographical questions	• Types of question frames (e.g., 5W1H, Neighbour's core questions)

Stage 2:
Collecting Data
	• Use appropriate data collection methods
	• Ensure accuracy and reliability of data
		<u>Primary data</u>
		• Map work
		  ○ Location of data collection sites
		• Sampling method
		  ○ Convenience
		  ○ Simple random
		  ○ systematic random
		• Surveys or interviews
		  ○ People's awareness and use of different mobility options
		  ○ Impact of mobility options on people
		  ○ Improvements that can be made to the mobility options
		• Field notes (e.g., types and level of activity at a train station during peak periods)

		• Field sketches (e.g., features of new concept bus stop) • Images (e.g., photographs of activities in town on a car-free Sunday) <u>Secondary data</u> • Online/library research ○ Strategies taken by authorities or service providers in Singapore (e.g., Land Transport Authority)
Stage 3: Analysing and presenting data	• Organise raw data • Select appropriate data representations	• Maps (e.g., by marking out sustainable transport features) • Graphs (e.g., simple bar graphs showing the results of survey questions) • Images (e.g., photographs of activities during car-free Sunday) • Field sketches (e.g., features along a park connector) • Texts (e.g., survey responses from the residents)
Stage 4: Drawing conclusions	• Provide evidence-based responses	• Spatial patterns (e.g., location of specific transport nodes) • Relationships between variables (e.g., use of a mobility option and the carbon footprint arising from its use) • Reasoned conclusions that answer the questions posed
Stage 5: Reflecting and taking action	• Evaluate data collection methods • Suggest ways to improve investigation • Propose ways to improve the relationship between the phenomenon and people	• Strengths and limitations of data collection methods • Improvements/enhancements to investigation • Proposal for use of data (e.g., sharing a report on utilisation rate and residents' perception of various mobility options with the transport authority)

Geographical Data Skills and Techniques	
Overview: Geographical data skills and techniques are essential to the work of geographers. They help geographers gather, analyse, present and interpret information about the characteristics, patterns and processes of the phenomenon/phenomena they are investigating. They also facilitate geographical thinking and decision-making. As students learn about a range of geographical data types such as graphs, maps and images through the topics, they will acquire the skills necessary for them to read, construct, analyse and interpret the data in context.	
Data Types	**Learning Outcomes** Students should be able to:

Graphs
• Line graphs (simple and comparative)
• Bar graphs (simple and comparative)
• Pie charts
 	
Note: Climographs will be used to show rainfall and temperature patterns of tropical areas in Topic 1.2.
	• Read graphs
	  ○ Identify elements in a graph (i.e., title, variables on the x-axis and y-axis, variables in the sectors of a circle, scale of values, units and legend)
	• Calculate mean, total and range of values
	• Present data using graphs
	• Analyse graphs
	  ○ Identify the largest and smallest values
	  ○ Describe the trend (i.e., positive/increasing, negative/decreasing, constant and fluctuating) and anomalies
	• Interpret and draw conclusions based on information found in graphs

Maps
• Reference maps (i.e., atlas, topographic maps, street maps)
• Thematic maps (i.e., proportional symbol maps, choropleth maps)
	• Read maps
	  ○ Identify elements of a map (i.e., title, reference/key/legend and scale)
	  ○ Locate human and physical features using:
	  – Latitude and longitude
	  – Cardinal (i.e., North, South, East and West) and inter-cardinal directions (i.e., Northeast, Northwest, Southeast and Southwest)
	  – Four-digit and six-digit grid references
	  – Symbols and place names
	  ○ Calculate straight-line distance between two points on a map
	• Present data using maps
	• Analyse maps
	  ○ Organise and present data using an appropriate map type
	  ○ Describe spatial distribution and patterns presented in maps

Images
• Aerial (i.e., satellite, remote sensing)
• Landscape
	• Read images
	  ○ Identify elements of an image (i.e., title, date, time, location, scale and source)
	• Analyse images
	  ○ Locate features in an image using the terms “foreground”, “middle-ground” and “background”
	  ○ Identify and describe features found in an image
	• Present data using images
	• Label or annotate features found in images

Field sketches	• Draw field sketches
	  ○ Observe and locate features in the field
	  ○ Draw relevant features
	  ○ Label or annotate characteristics of features
	• Analyse field sketches
	  ○ Locate features in field sketches using the terms “foreground”, “middle-ground” and “background”
	  ○ Identify and describe features found in field sketches

Tables	• Read tables
	  ○ Identify elements of a table (i.e., title, name of row, name of column, scale of values and units)
	• Calculate the mean, total and range of values
	• Present data using tables
	• Analyse tables
	  ○ Identify the largest and smallest values
	  ○ Describe the trend (i.e., positive/increasing, negative/decreasing) and anomalies.
	• Interpret and draw conclusions based on information found in tables

Texts	• Read texts
	  ○ Identify elements of a textual source (i.e., author, title, date of publication and source)
	• Present data using texts
	• Analyse texts
	  ○ Identify the issue being presented in a textual source
	  ○ Extract relevant information from a textual source
	• Interpret and draw conclusions based on information found in texts

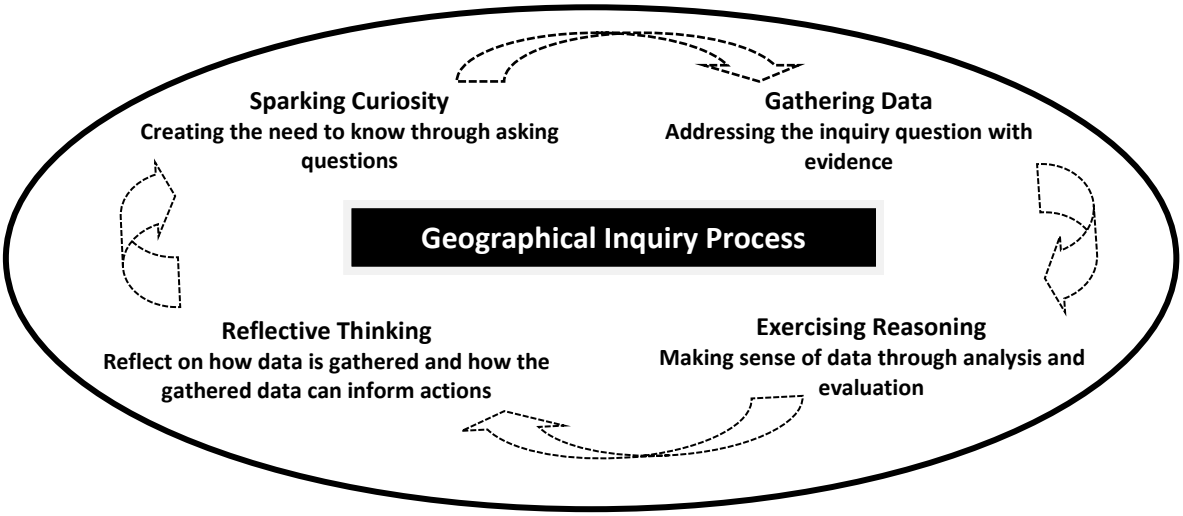
Schematic diagrams	• Read schematic diagrams
	  ○ Identify elements of a schematic diagram (i.e., title, labels)
	• Analyse schematic diagrams
	  ○ Identify features, processes, flows and linkages in a schematic diagram
	  ○ Describe relationships between elements in a schematic diagram
	• Interpret and draw conclusions based on information found in schematic diagrams

3. PEDAGOGY

3.1 LEARNING THROUGH GEOGRAPHICAL INQUIRY

The recommended approach to the teaching and learning of geography is through the Geographical Inquiry Process[1] (GIP). It empowers students in their own learning and stimulates an interest in the subject. The process comprises four stages of inquiry (see Figure 4): sparking curiosity, gathering data, exercising reasoning and reflective thinking.

Figure 4: Stages of the Geographical Inquiry Process



The GIP begins with sparking curiosity using stimulus materials to challenge students' assumptions and habitual responses and invite posing of questions. Thereafter, through library research and fieldwork, geographical data is gathered. As students systematically organise the information they have collected, they will need to exercise sound reasoning to analyse and make connections between pieces of information they have, and thereby construct new knowledge and understanding for themselves. They will analyse the information in context of the question posed to arrive at a conclusion to the question before reflecting on their learning based on the inquiry process or conclusion drawn. Through the inquiry process, students will be challenged to examine their own thinking, feeling and doing and become reflective thinkers and self-directed learners.

[1] The Geographical Inquiry Process is informed by the work of Roberts, M. (2013). Geography Through Enquiry. Geographical Association: Sheffield. Roberts highlighted four elements of an inquiry-based approach: (i) inquiry is question-driven, (ii) inquiry is supported by evidence, (iii) inquiry requires thinking geographically, and (iv) inquiry is reflective.

3.2 USE OF GEOSPATIAL TECHNOLOGY IN GEOGRAPHICAL INQUIRY

The advancement in and availability of hardware and software have made geospatial data and technologies more accessible to students and teachers. Geospatial technologies (e.g., remote sensing, geographic information systems (GIS), internet mapping technologies and Global Positioning System (GPS)) are used to collect and process data that are associated with locations on Earth[2]. Geospatial data and technologies can be used together with web-based learning and communication applications to greatly enhance the learning experience for both students and teachers. For example, students can access rich digital data such as images, statistics and graphs in interactive digital maps available in MOE-EduGIS and MOE Library when learning about a place, phenomenon or issue. The use of 360^{o} virtual reality technology can also provide students with immersive experience of a field site prior to the conduct of fieldwork. When appropriately applied, learning with technology will contribute towards students achieving the standards and benchmarks of the 21st Century Competencies 'Critical and Inventive Thinking' and 'Communication, Collaboration and Information Skills'.

[2] American Association for the Advancement of Science. (n.d.). *What are Geospatial Technologies?* Retrieved from https://www.aaas.org/sites/default/files/GTHR_2_What_Is_Geotech.pdf)

4. ASSESSMENT

4.1 PURPOSE OF ASSESSMENT

Assessment is aligned to the key beliefs of the Singapore Curriculum Philosophy which is encapsulated in the Singapore Teaching Practice. It is integral to the learning process and helps students become self-directed learners. Assessments are designed with clarity of purpose, to provide students with feedback that they can use to address learning gaps and move them towards attainment of the intended learning outcomes.

4.2 ASSESSMENT OBJECTIVES

In the syllabuses, the geographical knowledge and skills to be assessed are defined in the Assessment Objectives (AOs). AOs in *italics* are meant for Express course only.

AO1: Knowledge
Students should be able to demonstrate knowledge of:

- geographical terms, facts, processes, concepts and phenomena;
- geographical data types, skills and techniques; and
- geographical investigation skills.

AO2: Critical Understanding and Constructing Explanations
Students should be able to apply geographical knowledge to:

- select and organise the content learnt;
- perform analysis and produce explanations;
- *evaluate data collection methods and generate solutions; and*
- *evaluate strategies.*

AO3: Interpreting and Evaluating Geographical Data
Students should be able to apply geographical knowledge to:

- select and organise relevant information;
- observe patterns and deduce relationships; and
- draw conclusions based on evidence.

4.3 RECOMMENDED ASSESSMENT MODES

To promote greater self-directed learning, foster the spirit of inquiry and develop collaborative and communication skills, as well as lay a strong foundation of knowledge in our students, a variety of assessment modes is used (see Figure 5).

Figure 5: Recommended Assessment Modes

Assessment Mode	Purpose
Class Test	Students will be given opportunities to • provide descriptions, explanations and analysis to questions on geographical phenomenon learnt, and • apply knowledge and understanding to interpret and analyse geographical data.
Examination	
Response to Geographical Issue (RGI)	Students will be given opportunities to • apply knowledge and understanding in response to a selected geographical issue reported in the news.
Geographical Investigation (GI)	Students will be given opportunities to • participate collaboratively to investigate an authentic geographical phenomenon/issue which involves the following five stages: framing the GI, data collection, data analysis and presentation, drawing conclusions, and reflection and taking action.