Malaysian Independent Chinese Secondary Schools

Junior Middle Level Science Curriculum Standards

Unified Curriculum Committee of
Malaysian Independent Chinese Secondary School
Working Committee

April 2021

Contents

1. Preface

In 2018, the motto “Enjoy teaching, love learning—empower children to attain achievement” was raised as the education reform vision in the MICSS Education Blueprint; it literally translates independent Chinese secondary schools are paradises where teachers enjoy teaching and students love learning. Each and every student who steps into any one independent Chinese secondary school will grow healthily and learn actively; the MICSS education prepares them to find a foothold domestically and brave the world lying ahead as it helps them to achieve in future. Within this vision, the main objectives of the MICSS education reform are as follows: Every student is given the leeway to develop holistically and individually under the umbrella of Morality, Intelligence, Physical Health, Teamwork and Aesthetics, inter alia. They will eventually realise the importance of life-long learning, constant self-improvement, risk taking, innovation, ever-readiness, self-confidence and teamwork in life. That said, they are able to attain personal happiness and willing to strive for harmony, prosperity, advancement, freedom and equality for their family, ethnic group, society and country and contribute themselves successively. Aiming to implement and put the vision and objectives raised in the MICSS Education Blueprint in place, the Unified Curriculum Committee forwarded the MICSS Main Curriculum Standard (simply put as the Main Standard) to concretely push the reform and development of the MICSS Curriculum forward.

The ultimate goal of the MICSS curricular reform is the production of “life-long learners” and thus it endeavours to improve subject curriculums to provide cross subject and interdisciplinary learning opportunities. These are to nurture self-activated learning, collaborative learning and the ability to participate in the society naturally. The curriculum standard of each subject is designed amenable to the principles and direction set forth in the Main Standard to pursue the command of basic notions, objectives, competences, curricular planning and contents of the subjects, let alone pedagogical approaches and assessment recommendations. In terms of curricular practice, there will be allowances for flexibility and options targeting to encourage group learning, task-based learning, inquiry-based learning, etc.; while in matter of the assessment for learning effectiveness, multiple assessment for the development of multiple intelligences is adapted. As such, the design and formulation of each and every subject must correspond to both the vision of the MICSS Education Blueprint and the recommendations of the Main Standard to break new ground for subject advancement.

2. Aims

MICSS education is a sustainable education industry; other than the dissemination of Chinese culture, it also ensures every student in MICSS to develop holistically in terms of morality, intelligence, physical health, teamwork and aesthetics. The students are expected to sustain life-long learning and to strive unremittingly for self-improvement as well as being inquiry oriented, innovative, daring in response to unpredictable change, confident, and willing to work as a team. In this way, the students are capable of achieving their personal happiness,

and willing to strive relentlessly for the harmony, prosperity, advancement, freedom and equality of their family, ethnic group, society and country to contribute successively.[1]

2.1 Junior Middle Level Curriculum Objectives

a. To build up students' foundation on morality, intelligence, physical health, teamwork and aesthetics and to develop their capabilities complying with their own personality in the balance based on these basics;
b. To nurture and train students on the capabilities and habits of learning how to learn, read and think to prepare for self-directed learning/active learning;
c. To ensure students reach the basic level in knowledge, capability and attitude so as to further unleash their potential for distinctive achievements;
d. To build up students' proactiveness and positive values towards living and life; and
e. To create an environment for students to know about the languages, cultures and religions, etc. of the ethnic groups in the country so as to lead students to respect the pluralistic culture, recognise the reality of the country thus opening up a global perspective.

2.2 Senior Middle Level Curriculum Objectives

a. To suitably build up students' foundation on morality, intelligence, physical health, teamwork and aesthetics to get ready for their prospective, career, learning and living;
b. To establish students' foundation on self-directed learning to further build up their capabilities on learning eagerness, independent thinking, critical thinking and innovation;
c. To cultivate students with the will to seek excellence and be altruistic thus creating the prerequisites for greater happiness for oneself, community, country and humankind;
d. To lead students to recognise themselves comprehensively and be confident and assured in the face of their society and era change;
e. To nurture students' responsibility towards their own family, ethnic group, society and country and respect multiple cultures as well as broadening their global perspectives; and
f. To create opportunities for students to partake proactively in various ethnic group activities, and ensure them to be able to interact and learn in cross-cultural environments.

[1] Dong Zong. (2018). Malaysian Independent Chinese Secondary Schools Education Blueprint (p. 49). United Chinese School Committees' Association of Malaysia (Dong Zong).

3. Core Competencies

The *Main Curriculum Standards* is based on the six core competencies[2] proposed in the *MICSS Education Blueprint*, as well as three additional core competencies added to cater to curriculum development needs, forming a total of nine core competencies. Further explanation is given in the design of Junior Middle Level and Senior Middle Level curriculum development. Core competencies emphasise the holistic qualities of individuals and encompass knowledge, skills and attitudes.

Figure 1: Framework for MICSS Core Competencies

Figure 1 shows that MICSS curriculum development cultivates lifelong learners. The structure expanded into three principles that empower children to attain achievement, namely self-directed learning, communication and collaboration as well as societal participation. The outer ring of the core competency structure is presented in a colour spectrum, revealing the integration of nine competencies with the three principles. The misalignment of the inner and outer circle further clarifies that the implementation of each competency incorporates the three major principles. Based on the principle of integration and feasibility, the Main Curriculum Standards promote each competency through three principles. Table 1 presents the core competencies and their definitions.

[2] Dong Zong (2018), *Malaysian Independent Chinese Secondary Schools Education Blueprint*. Kajang: United Chinese School Committees' Association of Malaysia (Dong Zong), 40-41.

Table 1: MICSS Core Competencies and Definitions

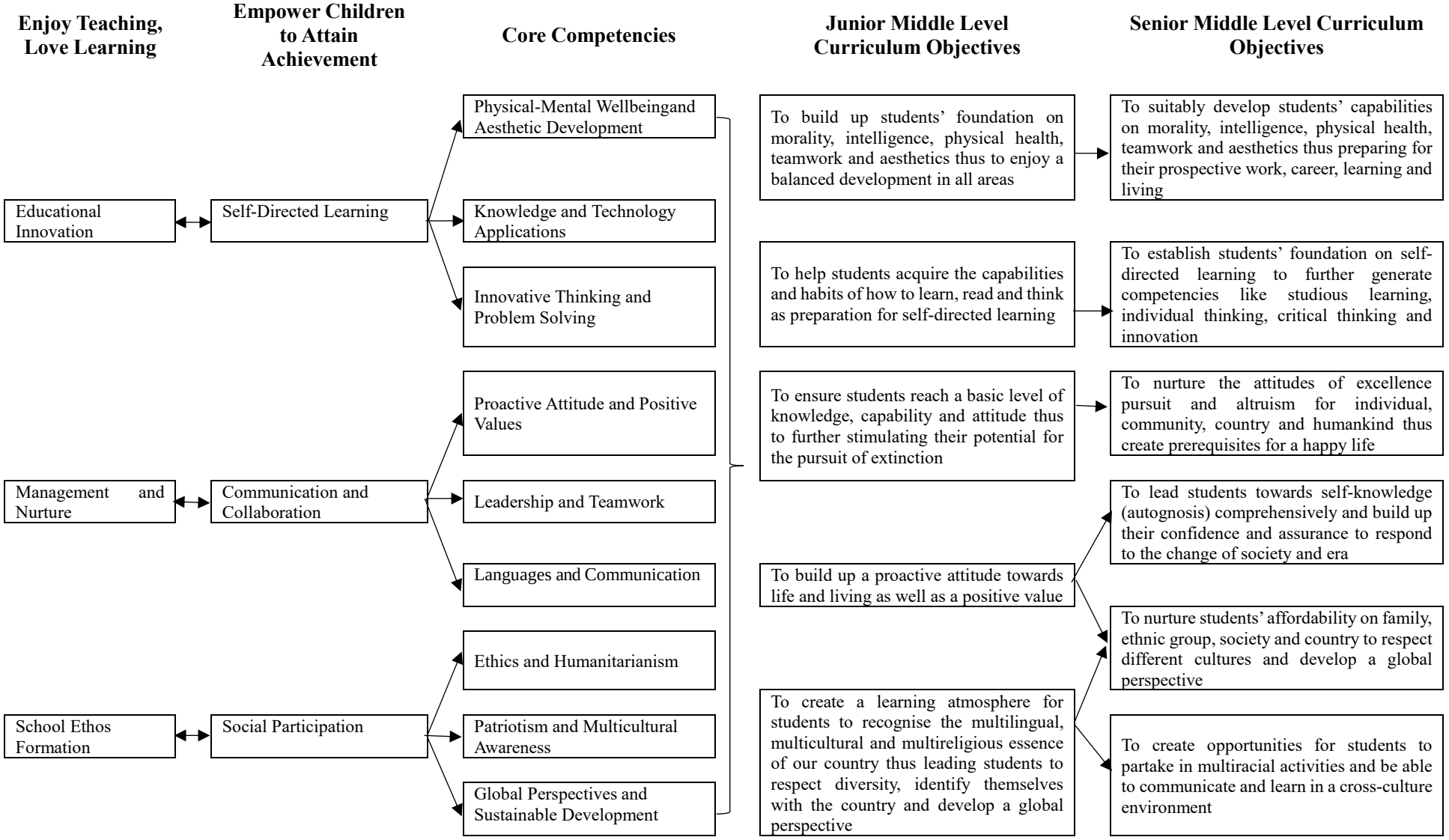
Curriculum Principle	Core Competencies	Definitions	Junior Middle Level	Senior Middle Level	Student Outcome
A. Self-Directed Learning	A1. Physical-Mental Wellbeing and Aesthetic Development	She/He possesses the capability to take care of personal mental and spiritual health and knows how to appreciate the best parts in life, and can reflect on her/his experience in learning and growing thus adjusting stages of pursuits in career development. This way, it not only benefits mental and spiritual growth but also exerts proactiveness in creating happiness for her/his own life.	She/He is well informed of personal mental and spiritual health, knows the uniqueness of aesthetics and can discover personal value in living to exert richness and aesthetics thus experiencing the meaning of life proactively.	She/He possesses the competency and is informed of the approaches to promote her/his physical and mental wellbeing; she/he knows how to appreciate the true goodness of people and entities, affirm the personal value and realise professional pursuits, including how to enrich life by applying aesthetics in daily life, and relentlessly seek self-improvement to transcend herself/himself thus to create a happy personal life.	One who cares about herself/himself
	A2. Knowledge and Technology Applications	She/He possesses literacy and numeracy and living skills as well as acquiring the three languages, core subjects like Mathematics and History, etc. She/He knows and learns knowledge of other domains, leverages Information Technology to communicate, interact and express for comprehensive development; meanwhile, she/he applies these in real life for better learning outcomes thus resolving difficulties in learning.	She/He possesses the fundamentals of knowledge and various symbols and commands the application of Information Technology to sense problems in daily life and is able to communicate, experience and practice in such circumstances.	She/He possesses the ability to make use of various symbols to express and is literate in Information Technology and can focus on and deepen the particular field of knowledge to exchange experience, and express thoughts and values in innovative problem-solving.	One who is knowledgeable
	A3. Innovative Thinking and Problem Solving	She/He possesses inquisitive, critical and inferential capabilities and can use her/his creativity to monitor her/his self-directed learning skills to tackle or solve problems in living and life thus deciding on a response to societal changes.	She/He possesses the capabilities of self-directed learning, inquiry-based learning, critical and inferential and innovative higher-order thinking thus using appropriate strategies to resolve and tackle daily life problems and issues.	She/He can consolidate inquiry-based learning, critical thinking and innovative higher-order thinking, and can practise active learning as well as expressing her/his creativity to further inquire into unknown realms and solve all sorts of issues and challenges in the face of daily life on this basis.	One who can solve problems

Curriculum Principle	Core Competencies	Definitions	Junior Middle Level	Senior Middle Level	Student Outcome
B. Communication and Collaboration	B1. Proactive Attitude and Positive Values	She/He possesses values like respect, voluntary accountability, studious and positive values to confront challenges generated in daily life and the learning process. She/ He also recognises the importance of fulfilling social responsibility and has the courage to make a clear and appropriate judgement when confronted with dilemmas and can learn to face discrepancies as well managing conflicts.	She/He inquires about the personal and environmental values and senses the discrepancies between them. She/He learns to live with discrepancies and build up respect, responsibility, studious attitudes and positive value in life.	She/He deepens her/his attitudes and values thus to respect, care and appreciate others' discrepancies, and can fumble on the differences of values between oneself and the existence and learn to tackle confrontation, affirm and practise positive value and competency; she/he braves to make a proper judgment in the face of difficulties and challenges.	One who cares about others
	B2. Leadership and Teamwork	She/He possesses the capability to lead and can effectively work and build up an interactive relationships with others thus developing teamwork competencies of communication, negotiation and service.	She/He possesses the basic self-directed capability and good habits and is happy to interact thus building up good collaborative relationships and can complete tasks through collaboration.	She/He possesses compassion, personal judgment, gregarious capability and attitude; meanwhile, she/he develops communicative co-operation and teamwork competency; she/he can get along well with others collaboratively, and is able to complete the assignment well with advanced planning.	One who knows the importance of teamwork
	B3. Languages and Communication	She/He possesses the background knowledge of culture, tradition and religion and can make use of Chinese learned, together with the command of Bahasa Melayu towards patriotism and love for community and is versed in English for international linkage. When it permits, she/he will master more languages and use these languages in different situations for optimal effect.	She/He possesses the background knowledge of culture, tradition, religion and can make use of Chinese learned, together with the command of both Bahasa Melayu and English to make friends from different ethnic groups thus enhancing the four skills in language learning and eventually realise the importance of language as a medium of cultural dissemination and communication.	She/He is well versed in Chinese and possesses appreciative competency to enrich her/his knowledge of local and exotic cultures, lifestyles and religions through the learning of Bahasa Melayu and English. If it permits, she/he will equip herself/himself with more additional languages in the face of academic pursuits and professional development.	One who is skillful in communication

Curriculum Principle	Core Competencies	Definitions	Junior Middle Level	Senior Middle Level	Student Outcome
C. Social Participation	C1. Ethics and Humanitarianism	She/He practices good morality and can manage her/his own behaviours and understand that it is a social responsibility to promote personal competencies. She/He can appreciate, is compassionate and respect others for their freedom of speech.	She/he practices well on good morality and can suitably reflect her/his own behaviours; she/he can likewise sustain and modify her/his initiated voluntary proactiveness and is willing to listen to different views, ways of expression and respect others' decisions.	She/He possesses the correct attitude towards ethical and public issues and presents herself/himself as someone who treats others generously and is severe with herself/himself and expresses her/his care towards society through rational expression and care and learns to judge public issues from different aspects and angles.	One who is open-minded
	C2. Patriotism and Multicultural Awareness	She/He possesses the cultural identity of her/his own culture, understands and respects others' culture thus merging herself/himself in a multicultural environment, recognise the history of her/his country and realise the multiplicity of the country and is proud of herself/himself as a Malaysian who has civic awareness and responsibility safeguarding the harmony of the country for national unity and integration.	She/He is well versed in her/his own culture, understands and accepts the culture of other ethnic groups; she/he respects discrepancies, cares about national issues, and is proactive in community construction and is ready to be of service to others.	She/He identifies her/his cultural identity, respects and appreciates the discrepancies between cultures; she/he has civil awareness and knows her/his responsibilities; she/he safeguards national harmony and promotes the spirit of national consolidation and is proactive in the development of her/his community and country to confer benefits on society.	A patriot and one who loves her/his community
	C3. Global Perspectives and Sustainable Development	She/he has the competency of caring for world issues and international relationships and also cares about the environment, economics and social problems. She/He walks her/his talk in the protection of the environment, her/his and others' living mode and sustains the concept of sustainable development and cherishes resources on earth.	She/He is informed of global issues and international relationships and can express herself/himself on environmental, economic and social problems. She/He cherishes the living of resources appreciation and cares about the environment and social justice-related issues.	She/He possesses the ability to express her/his own views on global issues and international relationships and can debate on the environment, economy and social problems; She/He can keep her/his word and not bring harm to the environment, people and lifestyle; she/he is willing to partake charity campaigns such as environmental protection and social justice.	One who knows the importance of sustainable development

Figure 2

The Relation of Vision, Core Competencies and Curriculum Objectives



4. Fundamental Principles

Science is the result of humans applying the process of scientific inquiry towards the natural environment and existing knowledge. At its core, the motivation of science is peoples' **curiosity** and **quest for knowledge**, in addition to the demands for economic and technological development.

The new Science curriculum, in line with the *2020 MICSS Main Curriculum Standard*, aims to build a **people-centred** curriculum standard, allowing students to become lifelong **independent learners**. This curriculum is intended to develop scientific competencies in junior middle level students. Scientific competencies refers to an understanding of essential scientific knowledge, a good mastery of the scientific thought process, and being equipped with skills and a passion for handling real-world issues.

The study of science should be carried out through **inquiry and hands-on practice**. This not only allows students to gain a deeper understanding of science, but also helps them grasp the skills for nurturing a passion and insight into the scientific spirit.

Through the various activities inside and outside of the classroom, a recognition of the nature of science will be promoted among students. This will enable students to achieve a foundational learning standard in science-related knowledge, guiding them towards the methods of advancing in scientific knowledge and problem-solving abilities, and stimulating their love for and passion towards life and their surroundings.

In this fast-changing, technology-driven era, this aids students in mastering the knowledge and skills in science and technology, as well as the attitudes and values of science. It would enable them to learn how to use the scientific thought process, in order to handle the personal and societal opportunities and challenges of daily life.

This course undertakes the mission of scientific enlightenment, and must carefully cultivate students' innate curiosity and nurture their interest and thirst for knowledge in science, while equipping them with basic scientific competencies to serve as a solid foundation for lifelong advancement.

5. Curriculum Objectives

Table 2: Correspondence of Science Curriculum Objectives to Core Competencies:

Core Competencies		**Curriculum Objectives** After having completed the Junior Middle Level Science programmem, students are able to:	
A Self-Directed Learning	A1 Physical-Mental Wellbeing and Aesthetic Development	CO1	Take care of physical and mental wellness while engaging in balanced development; appreciate the beauty of people and things in everyday life; and use science as a basis for creating a satisfactory life
	A2 Knowledge and Technology Applications	CO2	Make use of foundational scientific knowledge; understand and grasp the use and development of science in everyday life; and master the use of technology for various stages of study, applying it in a suitable way for solid, realistic learning
	A3 Innovative Thinking and Problem Solving	CO3	Possess inquisitive thinking skills to observe issues in everyday life, and make use of suitable scientific techniques to solve problems or tackle current issues
B Communication and Collaboration	B1 Proactive Attitude and Positive Values	CO4	Cultivate an excitement for learning science and an attitude of perseverance; gain the ability to learn and think independently; and be enthusiastic about understanding the significance of science
	B2 Leardership and Teamwork	CO5	Understand the impact of science on ethics, economy, society and environment; build cooperative learning relationships for a harmonious life; gain skills in communicating and collaborating; and cultivate team spirit in order to complete tasks
	B3 Languages and Communication	CO6	Possess the ability to listen, speak, read and write, and be capable of describing issues, the investigative process, and observed results, among others
C Social Participation	C1 Ethical Quality and Humanistic Care	CO7	Be proactive in caring for the natural environment and social issues; respect different opinions; and understand the importance of life

	C2 Patriotism and Multicultural	CO8	Be concerned about national affairs; develop scientific practices beneficial to society and the environment; and participate actively in community-building
	C3 Global Perspectives and Sustainable Development	CO9	Gain a recognition of social and environmental issues facing the world; inculcate a lifestyle of protecting the environment and cherishing the world's resources; and put the idea of sustainable development into practice

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CO: Curriculum Objective

6. Curriculum Design

The crux of current education reforms in various countries lies in pursuing holistic development. Besides the dissemination of knowledge, it is also required to impart skills, attitudes and values. Therefore, the curriculum framework uses "scientific competencies" to cover these three broad aims. These aims are critical to the practice of science, and will enable students to view the pursuit of science as a meaningful and useful process.

The knowledge fields of science, technology, engineering and mathematics (STEM) emphasise the importance of science towards society and the environment through the advancement of technology and engineering. This provides an all-rounded knowledge of science, and a broader understanding of the environment. Scientific knowledge will provide students with a foundation for further studies.

Scientific competencies encompass the **skills** of reading, investigation, argumentation, problem-solving, expression and collaboration, which directly influence the effectiveness of scientific activities. This shows scientific competencies being put into action, and will enable students to formulate concepts and explain phenomena in their surroundings.

The **learning attitudes and values** of science (including curiosity, openness, critical thinking, confidence and ethics) affect how students embrace the scientific study process. This allows students to cultivate responsibility towards the environment and society, and treat the learning of science as an essential tool in exploring the world.

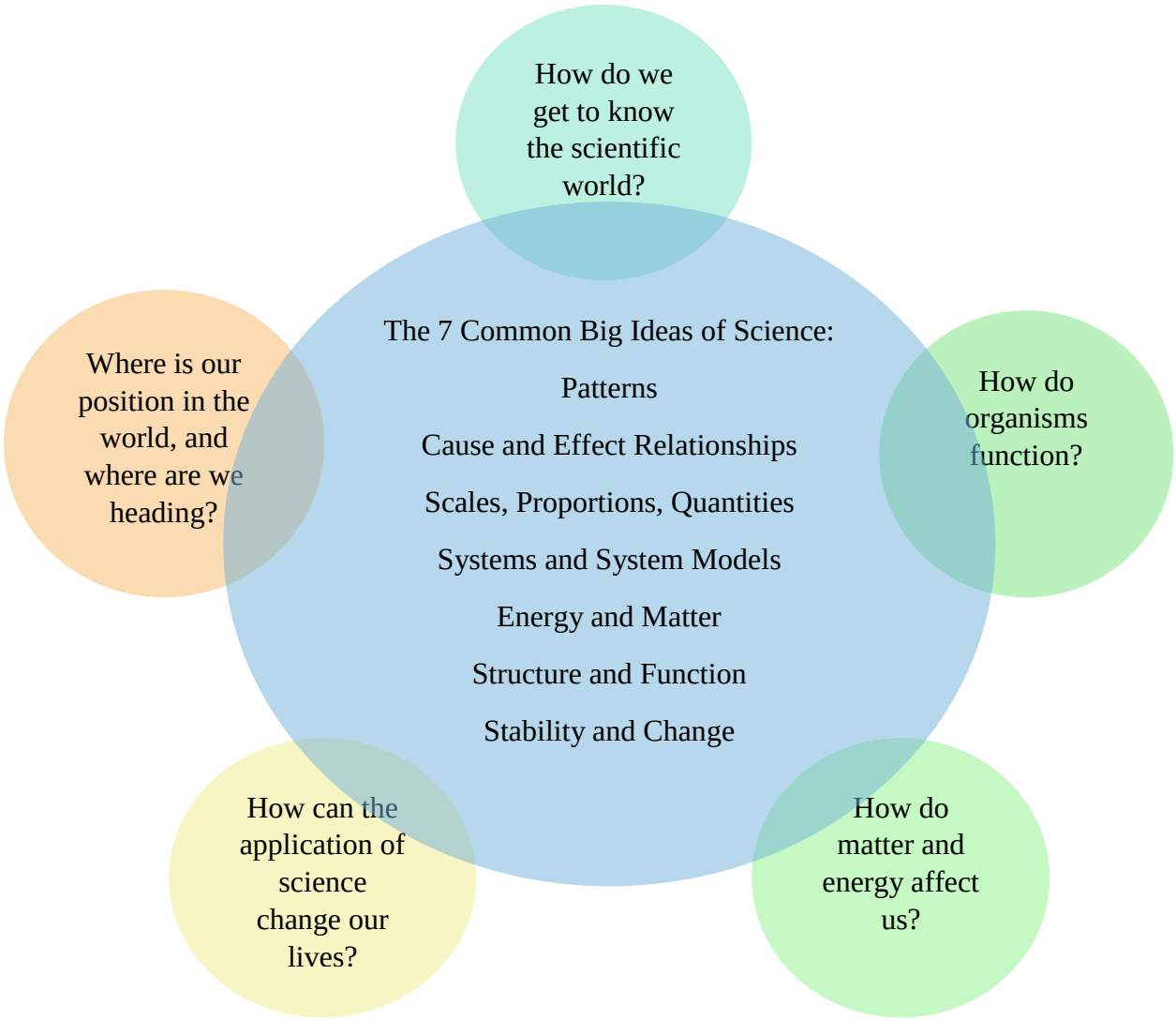
This curriculum emphasises the integration and cross-application between different subject fields. It is important to focus on core concepts and principles when evaluating natural sciences, guiding students to recognise the inter-connectedness of the natural world. By integrating various parts of the curriculum content, students will gain a broad understanding of science.

The curriculum design places importance on students' i**nnate interest and inquiry into their surroundings**, allowing them to experience learning activities centred on investigation. Teachers serve as facilitators and guides, building a foundation for students' lifelong learning and holistic development.

6.1 Figure 3: Scientific Big Ideas and Core Questions

The scientific big ideas[3] is a universal approach across disciplines. This may be used to develop various science curriculum content, considering that the different science subjects will have relevance to one another.

Besides, the core questions are built on scientific knowledge, issues and analytical questions[4] as seen in daily life, society and the environment. The five major themes expressed in the new curriculum (presented in question format), allow students to consider the most fundamental questions within each theme.



6.2 Table 3: Allocation of Class Hours

Junior Middle Level Science is a compulsory subject in the MICSS education curriculum. The Junior Middle Level Science duration will be for three years, with each school year comprising of 40 weeks; each level will have 5-6 periods per week, and each period will take up 40 minutes.

Type	Subject	Junior One Number of Periods	Junior Two Number of Periods	Junior Three Number of Periods	Weekly Lesson Hours
Compulsory	Natural Science	5-6	5-6	5-6	3 hours 20 minutes - 4 hours

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[3] National Research Council, US (2013) Crosscutting Concepts in the Next Generation Science Standards. In *Next Generation Science Standards: For States, By States*, pp. 413-423. Washington, DC: The National Academies Press. Accessed via: https://www.nap.edu/catalog/18290/next-generation-science-standards-for-states-by-states *(Appendix 4)*

[4] Ministry of Education, Singapore (2012) Science Syllabus: Lower Secondary E/ N(A), pp.1

7. Curriculum Content

7.1 Table 4: Learning Content Framework

Core Question	Junior One Topics	Junior Two Topics	Junior Three Topics
How do we get to know the world of science?	**Foundational Knowledge** • Scientific competencies • Scientific skills • Basic laboratory know-how	**Science and Matter** • Elements • The Periodic Table of Elements • Mixtures and compounds	
	Science and Matter • The structure of matter • Basic properties of matter	**Chemical Reactions** • Changes in matter • Chemical reactions • Combustion	
How do organisms function?	**The Basics of Life** • The phenomenon of life • The concept of cells • Single and multicellular organisms	**Coordination and Homeostasis** • The human nervous system • The human endocrine system	**Food and Nutrition** • Nutrients • A balanced diet
	Reproduction • Significance of reproduction, and reproduction methods • Human reproduction • Reproduction in plants • Genetics and heredity	**Respiration** • The human respiratory system • Respiration • Health of the respiratory system	**Digestion and Absorption** • The human digestive system • The digestion and absorption process

Core Question	Junior One Topics	Junior Two Topics	Junior Three Topics
How do organisms function?	**Movement** • Movement of organisms		**Transportation and Excretion of Matter** • The human circulatory system • Blood • Excretion of waste in the human body • Transportation in plants
How do matter and energy affect us?	**Heat** • Thermal energy • Thermal conductor • Expansion and contraction	**Water and Solution** • Characteristics of water • Water purification • The concept of solutions	
	The Phenomenon of Light • Characteristics of light transmission • Reflection • Refraction • Dispersion • The colour of objects	**Acids and Bases** • Properties of acids and bases • Neutralisation reaction • Indicators of acids and bases **Gases** • Properties of gases • Composition of air • Air pollution	
	The Phenomenon of Sound • Sound waves • Echo • Music and noise	**Pressure and Air Pressure** • The concept of pressure • The concept of air pressure	

<table>
<tr><th>Core Question</th><th>Junior One Topics</th><th>Junior Two Topics</th><th>Junior Three Topics</th></tr>
<tr><td rowspan="4">How can the application of science change our lives?</td><td>Static Electricity
The concept of static electricity</td><td rowspan="3">Simple Machines
Commonly-used simple machines
Levers
Pulleys</td><td>Electrical Circuits
Currents
Voltage
Resistance
Diagram of electrical circuits
Ohm’s Law</td></tr>
<tr><td>Sense and Perception
The basic process of perception
The formation of everyday senses</td><td></td></tr>
<tr><td>Forces
The concept of forces
Contact and non-contact force</td><td rowspan="3">Energy, Work and Power
The concepts of energy, work and power
Conservation of energy</td><td>The Application of Electricity
Electric work and power</td></tr>
<tr><td>Movement
The movement of objects</td><td>Electromagnetism
Magnet
Magnetic fields
The phenomenon of electromagnetic induction</td></tr>
<tr><td></td><td>Household Electricity
Household electrical circuits</td></tr>
<tr><td rowspan="2">Where is our position in the world, and where are we heading?</td><td>The Movement of the Earth and Moon, and its Effects
The movement of the Earth and Moon</td><td>Evolution and Ecosystems
Evolution of organisms
Biological diversity
The material cycle
Ecosystems</td><td>The Development of Astronomy and Space Exploration
Advancements in space exploration</td></tr>
<tr><td>The Solar System
The solar system and its constituents
The Sun</td><td>Celestial Bodies and the Universe
Stars
Galaxies
The universe</td><td>Sustainable Development of Earth’s Resources
Sustainable development of resources</td></tr>
</table>

7.2 Table 5: Content Standard

Core Question	Theme	Item	Content
How do we get to know the world of science?	1. Foundational Knowledge	1.1. Scientific competencies	1.1.1. Common traits of scientists
			1.1.2. The steps of scientific inquiry
		1.2. Scientific skills	1.2.1. Skills required for scientific experiments
			1.2.2. Physical quantities and international units of measurement
		1.3. Basic laboratory know-how	1.3.1. Get to know the laboratory and common lab equipment
			1.3.2. Safety precautions and emergency measures in the lab (including fire extinguishers)
			1.3.3. Dangerous chemicals and their safety symbols
	2. Science and Matter	2.1. The structure of matter	2.1.1. Matter is composed of particles
			2.1.2. The three states of matter, including the relationship between the arrangement and motion of particles
			2.1.3. Understanding the atomic structure
		2.2. Basic properties of matter	2.2.1. The general properties of matter
			2.2.2. Physical and chemical changes in matter
		2.3. Elements	2.3.1. Names and symbols of common elements
			2.3.2. The concept of molecules and ions
		2.4. The Periodic Table of Elements	2.4.1. Metals and non-metals
		2.5. Mixtures and compounds	2.5.1. Properties of mixtures and compounds
			2.5.2. The concepts of separating mixtures and compounds

Core Question	Theme	Item	Content
How do we get to know the world of science?	3. Chemical Reactions	3.1. Changes in matter	3.1.1. Physical changes
			3.1.2. Chemical changes
		3.2. Chemical reactions	3.2.1. The occurrence of chemical reactions
			3.2.2. Law of conservation of mass
			3.2.3. Combination and decomposition reactions
		3.3. Combustion	3.3.1. Conditions for combustion (burning)
			3.3.2. Safety precautions for preventing fires

Core Question	Theme	Item	Content
How do organisms function?	1. The Basics of Organisms	1.1. The phenomenon of life	1.1.1. Conditions for the survival of living things
			1.1.2. The structure of the human body (tissues, organs and systems)
		1.2. The concept of cells	1.2.1. The basic structure and function of cells
			1.2.2. The differences between animal and plant cells
			1.2.3. The concept of cell division and differentiation
		1.3. Single and multicellular organisms	1.3.1. Definitions and examples of single and multicellular organisms
	2. Reproduction	2.1. The significance of reproduction, and reproduction methods	2.1.1. The significance of reproduction, and reproduction methods
			2.1.2. The concept of asexual and sexual reproduction
		2.2. Human reproduction	2.2.1. The structure and function of male and female reproductive systems
			2.2.2. The reproductive functions of sperm and eggs (ovum)
			2.2.3. The menstrual cycle
			2.2.4. The process of fertilisation, pregnancy, and childbirth
			2.2.5. Basic knowledge of contraceptives and common sexually-transmitted diseases (STDs)
		2.3. Reproduction in plants	2.3.1. The structure and function of stamens and pistils in flowers
			2.3.2. The fertilisation process in plants, the development of seeds, and fruit formation
		2.4. Genetics and heredity	2.4.1. The relationship between trait and heredity
			2.4.2. The function of and relationship between DNA and chromosomes

Core Question	Theme	Item	Content
How do organisms function?	3. Movement	3.1. Movement in organisms	3.1.1. The composition of the human locomotor system
			3.1.2. Relationship between the muscular and nervous systems
			3.1.3. Tropic and nastic movements of plants (response to stimuli)
	4. Coordination and Homeostasis	4.1. The human nervous system	4.1.1. Composition of the nervous system
			4.1.2. Composition and function of the reflex arc
		4.2. The human endocrine system	4.2.1. Major hormones and their functions
			4.2.2. Maintaining a balanced internal environment (homeostasis)
	5. Respiration	5.1. The human respiratory system	5.1.1. Structure and function of the respiratory system
			5.1.2. Principles behind breathing movements
			5.1.3. The process of gas exchange between the alveoli (air sacs) and lung tissue
		5.2. Respiration	5.2.1. Introduction to the respiratory function in cells
		5.3. Health of the respiratory system	5.3.1. Air pollution and its impact on the respiratory system
			5.3.2. Diseases of the respiratory system
	6. Food and Nutrition	6.1. Nutrients	6.1.1. Sources and functions of various nutrients
			6.1.2. Diseases related to malnutrition
		6.2. A balanced diet	6.2.1. Composition of a balanced diet
			6.2.2. The relationship between a balanced diet and health
	7. Digestion and Absorption	7.1. The human digestive system	7.1.1. Composition and function of the digestive system
		7.2. The digestion and absorption process	7.2.1. The main function of enzymes
			7.2.2. Digestive products of various nutrients, and the absorption process
			7.2.3. Egestion

Core Question	Theme	Item	Content
How do organisms function?	8. Transportation and Excretion of Matter	8.1. The human circulatory system	8.1.1. Composition and functions of the circulatory system
			8.1.2. Types, structure and functions of blood vessels
		8.2. Blood	8.2.1. Composition and function of blood
			8.2.2. The relationship between blood types and blood transfusion
		8.3. Excretion of waste in the human body	8.3.1. The urinary system
			8.3.2. The role of excretion
		8.4. Transportation in plants	8.4.1. The transportation system and transport methods in plants
			8.4.2. The role of transpiration in plants

Core Question	Theme	Item	Content
How do matter and energy affect us?	1. Heat	1.1. Thermal energy	1.1.1. Unit of heat
			1.1.2. Heat transfer
			1.1.3. Common phenomenon of heat transfer in daily life
		1.2. Thermal conductor	1.2.1. Good and bad conductors of heat; insulators
		1.3. Expansion and contraction	1.3.1. The relationship between temperature and particle motion
			1.3.2. Expansion and contraction in solids, liquids and gases
	2. The Phenomenon of Light	2.1. Characteristics of light transmission	2.1.1. Light travels in a straight path
			2.1.2. Speed of light
		2.2. Reflection	2.2.1. Laws of reflection
			2.2.2. Light ray diagram of a plane mirror and its everyday applications
			2.2.3. Principles of concave and convex mirrors and its everyday applications
		2.3. Refraction	2.3.1. The phenomenon of refraction
			2.3.2. Principles of concave and convex lenses and its everyday applications
			2.3.3. Total reflection of light
		2.4. Dispersion	2.4.1. The dispersion of light
			2.4.2. The light spectrum
		2.5. The colours of objects	2.5.1. The cause of colours in objects
	3. The Phenomenon of Sound	3.1. Sound waves	3.1.1. The production of sound waves
			3.1.2. Transmission and speed of sound waves
		3.2. Echo	3.2.1. Causes of echo
			3.2.2. Application and prevention of echo
		3.3. Music and noise	3.3.1. Three components of music: pitch, loudness and timbre (tone quality)
			3.3.2. Sources, dangers and prevention of noise

Core Question	Theme	Item	Content
How do matter and energy affect us?	4. Water	4.1. Characteristics of water	4.1.1. The composition of water
			4.1.2. Physical properties of water
			4.1.3. The abnormal expansion of water
			4.1.4. How impurities affect the boiling point and melting point of water
		4.2. Water purification	4.2.1. The process and methods of water purification
			4.2.2. Ways to prevent water pollution
	5. Solutions	5.1. The concept of solutions	5.1.1. Solvents, solutes, and solutions
			5.1.2. Solubility and solubility graphs
			5.1.3. Dissolution rate and its affecting factors
			5.1.4. Mass percentage concentration
	6. Acids and Bases	6.1. Properties of acids and bases	6.1.1. The function of water in acids and bases
			6.1.2. Common uses and potential hazards of acids and bases
		6.2. Neutralisation reaction	6.2.1. The meaning of neutralisation reactions
			6.2.2. Common applications of neutralisation
		6.3. Indicators of acids and bases	6.3.1. pH values
	7. Gases	7.1. Properties of gases	7.1.1. The properties, preparation and uses of hydrogen, oxygen and carbon dioxide
			7.1.2. Identifying hydrogen, oxygen and carbon dioxide
		7.2.Composition of air	7.2.1. The main components of the atmosphere
		7.3. Air pollution	7.3.1. Sources and effects of air pollution
			7.3.2. The function of the ozone layer
			7.3.3. Causes and consequences of greenhouse effect
			7.3.4. Ways to prevent air pollution

Core Question	Theme	Item	Content
How do matter and energy affect us?	8. Pressure and Air Pressure	8.1. The concept of pressure	8.1.1. The meaning and unit of pressure
			8.1.2. Common applications of pressure
			8.1.3. Causes of atmospheric pressure
		8.2. The concept of air pressure	8.2.1. Unit of air pressure
			8.2.2. Causes and affecting factors of air pressure
			8.2.3. Common applications of air pressure

Core Question	Theme	Item	Content
How can the application of science change our lives?	1. Static Electricity	1.1. The concept of static electricity	1.1.1. The properties and charge of static electricity
			1.1.2. Reasons for and objects of frictional electrification
			1.1.3. Uses and precautions of static electricity
	2. Sense and Perception	2.1. The basic process of perception	2.1.1. The human sensory organs and their functions
			2.1.2. Basic principles of sense and perception in humans
		2.2. The formation of everyday senses	2.2.1. Structure and function of the eyes
			2.2.2. Principles of the sense of sight
			2.2.3. Causes and corrective measures for myopia, long-sightedness and astigmatism
			2.2.4. Structure and function of the ears
			2.2.5. Principles of the sense of hearing
	3. Forces	3.1. The concept of forces	3.1.1. Effects of forces
			3.1.2. Unit and measurement of forces
		3.2. Contact and non-contact force	3.2.1. Friction and gravity
	4. Movement	4.1. The movement of objects	4.1.1. Objects movement and reference objects
			4.1.2. Meaning of speed and velocity
	5. Simple Machines	5.1. Commonly-used simple machines	5.1.1. Types of levers and pulleys
		5.2. Levers	5.2.Principles and applications of levers
			5.2.2. Balance of levers and their balancing conditions
		5.3. Pulleys	5.3.1. Principles and applications of pulleys

Core Question	Theme	Item	Content
How can the application of science change our lives?	6. Energy, Work and Power	6.1. The concepts of energy, work and power	6.1.1. Common types of energy
			6.1.2. The meaning of energy, work and power
			6.1.3. Unit of work and power
		6.2. Conservation of energy	6.2.1. Law of energy conservation
	7. Electrical Circuits	7.1. Currents	7.1.1. The cause of currents
			7.1.2. Unit of currents
		7.2. Voltage	7.2.1. Basic principles of voltage
			7.2.2. Unit of voltage
		7.3. Resistance	7.3.1. Basic principles of resistance
			7.3.2. Unit of resistance
			7.3.3. Factors determining the resistance strength of conductors
		7.4. Diagram of electrical circuits	7.4.1. Simple electrical circuits diagram
			7.4.2. Ammeters and voltmeters
			7.4.3. Series and parallel circuits
		7.5. Ohm's Law	7.5.1. The relationship between voltage, current and resistance
	8. The Application of Electricity	8.1. Electric work and power	8.1.1. The meaning of electric work and power
			8.1.2. The electric power and operating voltage of household appliances
			8.1.3. Power consumption of household appliances
	9. Electro-magnetism	9.1. Magnet	9.1.1. Magnetic poles and interpolar interactions
			9.1.2. Magnetization and demagnetization
		9.2. Magnetic fields	9.2.1. Magnetic field and magnetic induction lines
			9.2.2. Magnetic field directions
		9.3. The phenomenon of electromagnetic induction	9.3.1. Electromagnetism
	10. Household Electricity	10.1. Household electrical circuits	10.1.1. Main wiring and voltage values of household electrical circuits
			10.1.2. Direct current and alternating current
			10.1.3. Composition and functions of wiring systems
			10.1.4. Two-pin and three-pin plugs and sockets

Core Question	Theme	Item	Content
Where is our position in the world, and where are we heading?	1. The Movement of the Earth and Moon, and its Effects	1.1. The movement of the Earth and Moon	1.1.1. The Earth and Moon's rotation and revolution
			1.1.2. Causes of solar and lunar eclipse
			1.1.3. Causes of tides
	2. The Solar System	2.1. The solar system and its constituents	2.1.1. Special features of the solar system and its constituents
		2.2. The Sun	2.2.1. The Sun internal and atmospheric structure
			2.2.2. Solar activities and its impact on the Earth
	3. Evolution and Ecosystems	3.1. Evolution of organisms	3.1.1. The concept of evolution in organisms
		3.2. Biological diversity	3.2.1. Population, community and ecosystems
			3.2.2. The mutual relationships between organisms
		3.3. The material cycle	3.3.1. Conditions for photosynthesis and its products
			3.3.2. The energy flow among organisms in a food web
		3.4. Ecosystems	3.4.1. Mutual relationships between organisms and their environment
			3.4.2. Balance and stability in ecosystems
	4. Celestial Bodies and the Universe	4.1. Stars	4.1.1. Constellations
			4.1.2. The birth and end of stars
			4.1.3. Colour, temperature, and brightness of stars
		4.2. Galaxies	4.2.1. Types of galaxies
			4.2.2. The Milky Way
		4.3. The universe	4.3.1. The concept of light years
			4.3.2. Expansion of the universe
			4.3.3. Different sizes and classes of celestial systems in the universe
	5. The Development of Astronomy and Space Exploration	5.1. Advancements in space exploration	5.1.1. The history of astronomy
			5.1.2. Current developments in space exploration
			5.1.3. The application of technology in space exploration and astronomy research

Core Question	Theme	Item	Content
Where is our position in the world, and where are we heading?	6. Sustainable Development of Earth's Resources	6.1. Sustainable development of resources	6.1.1. The significance of sustainable development
			6.1.2. The sustainable development of organisms, energy and resources
			6.1.3. Renewable and non-renewable sources of energy
			6.1.4. Effective use of resources (including the use of artificial intelligence)

7.3 Table 6: Learning Standard

Bloom's Taxonomy of Educational Classifications divides learning into Cognitive, Psychomotor and Affective domains (Bloom et al., 1956). The Junior Middle Level Science **learning standard** (What can students learn?) are based on various fields of study, in order to achieve a holistic science education. The levels of evaluation for various fields will be explained in detail in *[Part 9: Assessment Recommendation - Table 10]*.

Domain	**Cognition (C)**	**Psychomotor (P)**	**Affective (A)**
Item	Ca Scientific vocabulary, terms, and conventions	Pa Reading skills	Aa Curiosity and empirical research attitudes
	Cb Scientific phenomena, facts, concepts and principles	Pb Experimental skills	Ab Continuous questioning and deduction
	Cc The application of science and technology in daily life	Pc The scientific method and problem-solving skills	Ac Scientific integrity and care
		Pd Presentation and communication skills	

7.4 Table 7: Descriptions of the Items and the Learning Standard

Domain	Item	Content
Cognitive (C)	Ca Scientific vocabulary, terms, and conventions	I. Some scientific vocabulary, terms, and conventions
	Cb Scientific phenomena, facts, concepts and principles	I. Some scientific phenomena, facts, concepts and principles
	Cc The application of science and technology in daily life	I. Examples of scientific applications in society and daily life II. Using and operating technologies suitable for the learning stage
Psychomotor (P)	Pa Reading skills	I. Recognising and perceiving symbols in science II. Correctly interpreting important scientific contents and texts
	Pb Experimental skills	I. Safe and proper handling of chemicals and use of scientific instruments II. Carry out experiment instructions accurately and appropriately III. Careful observation and accurate description of experiment results
	Pc The scientific method and problem-solving skills	I. Handling simple calculations and data II. Proposing suitable questions, suggestions, and making predictions III. Selecting and using scientific methods learnt to solve problems
	Pd Presentation and communication skills	I. Express scientific material through the use of text, speech and body language II. Effectively communicate scientific material, ideas and values
Affective (A)	Aa Curiosity and empirical research attitudes	I. Inculcate curiosity and an interest in science II. A strict review of scientific experiments
	Ab Continuous questioning and deduction	I. Discuss issues related to science, express one's own opinion, and respecting the decisions of others II. Point out arguments for and against the application of science in technology
	Ac Scientific integrity and care	I. Respecting ethical principles in science II. Expressing care towards people, society, and environmental protection

(a) Examples of Inter-relationship of Content Standard and Learning Standard: Teachers may match teaching content with the learning standard (What can students learn?) to design lesson plans.

<Example 1>

Learning Standard / Content Standard	Cognitive (C)	Psychomotor (P)	Affective (A)
	CbI Some scientific phenomena, facts, concepts and principles	PdII Effectively communicate scientific material, ideas and values	AcII Expressing care towards people, society, and environmental protection
3.4.2. Balance and stability in ecosystems	Able to explain various phenomena in ecosystems and understand the concept	Able to present and effectively communicate the phenomena and concept of ecosystems, through the use of various media	Able to understand the importance of ecosystems and show care towards environmental protection

<Example 2>

Learning Standard / Content Standard	Cognitive (C)	Psychomotor (P)	Affective (A)
	CcI Examples of scientific applications in society and daily life	PbII Carry out experiment instructions accurately and appropriately	AaI Inculcate curiosity and an interest in science
5.1.2. Solubility and solubility graphs	Able to apply the concept of solutions in daily life	Able to carry out experiments about solution solubility	Able to maintain curiosity and interest in doing experiments

8. Pedagogical Suggestions

The scientific curriculum emphasises students' investigative ability, and teacher's plan of inquisitive activities has to be in line with students' cognitive situation. Inquisitive activities may start with familiar life settings and areas of interest to students, take care of students' training in basic experimental skills, and develop their ability to conduct scientific inquiry.

Therefore, teachers are required to thoroughly understand the objectives of the science curriculum, and emphasise the development of students' core competencies. During the learning process, the student is the learning subject. The teachers' lessons will stimulate students' interest towards learning science from real life examples, and guide students to be independent learners.

Using inquisitive teaching in science is not merely about introducing scientific facts and results, but also about letting students propose issues related to daily life, society, and the environment. In life, the nature-related issues that students encountered are largely interdisciplinary. The teaching of science curriculum should help students to develop an "integrated" understanding of science, forming an accurate view of nature and science.

Besides, teachers should advocate the right scientific attitudes and values, relating modern scientific skills with the history of science. For instance, the accounts of discoveries and inventions by scientists may be used to link science with the human aspect. In the process of teaching, students will be able to appreciate the beauty and wonder of nature and science, and to accept individual differences while respecting the rights of themselves and others.

8.1. Teaching Methods

Curriculum design ultimately depends on its implementation, namely, whether teacher is able to effectively impart the curriculum content in class. There are many teaching methods, and science educators should assist students in understanding the practical applications of scientific study.

Teaching methods may be divided into teacher-centred or student-centred methods:

(a) Lectures (Teacher-centred)

In this teacher-centred method, students are generally passive in writing notes or asking questions related to the lesson. This is a convenient method in situations where there are a large number of students, or when students are required to absorb a large amount of content.

Teachers may make use of software aid for additional participation from students. Interaction and feedback from students could help teachers adjust subsequent lesson plans, in order to suit students' learning needs.

(b) Topic-based learning (Student-centred)

Under topic-based learning, students may take a substantial length of time for exploring topics, designing experiments or models, writing reports, and creating posters, followed by a brief presentation of their findings.

When planning a topic-based project, students may be allocated resources inside and outside the school, enabling them to participate enthusiastically in community building and caring for societal issues. Topic-based learning is usually a component of inquisitive learning.

(c) Flipped classroom (Student-centred)

By providing curriculum content to students outside of curriculum time, students may be able to analyse the topic from a much deeper level of thinking. Teachers may use a series of videos, articles, books, podcasts and surveys to present teaching content.

(d) Online learning (Student-centred)

Online learning is a form of open learning, moving the focus from basic impartation of knowledge to guiding students to be independent learners. Teachers may upload educational and relevant content to online platforms. Students will experience more autonomy in selecting curriculum content suitable for themselves.

8.2 Suggested Teaching Periods for Each Topic

According to the *MICSS Main Curriculum Standard*, the Junior Middle Level Science course structure and class hours are as follows: Each academic year is made up of 40 teaching weeks, with a recommended 6 periods per week; each teaching period takes up 40 minutes.

Approximately 75% of each academic year is allocated for lesson time, with the remaining 25% comprising laboratory or activity periods *(refer to Page 42, Appendix 3: Topic-Based Inquisitive Projects)*.

Table 8: Teaching Periods for Various Topics, Science (Junior Middle 1 to 3) Curriculum
[The figure after "+" indicates laboratory or activity periods]

Level	Topic	No. of Periods	Level	Topic	No. of Periods	Level	Topic	No. of Periods
Jr. 1	Foundational Knowledge	8+8	Jr. 2	Science and Matter	12+2	Jr. 3	Food and Nutrition	8+2
	Science and Matter	10+8		Chemical Reactions	16+4		Digestion and Absorption	12+4
	The Basics of Organisms	10+2		Coordination and Homeostasis	12+2		Transportation and Excretion of Matter	20+4
	Reproduction	22+2		Respiration	14+4		Electrical Circuits	18+6
	Movement (organisms)	10		Water and Solutions	18+6		Applications of Electricity	8+2
	Heat	6+2		Acids and Bases	8+4		Electro-magnetism	14+4
	The Phenomenon of Light	18+6		Air	12+4		Household Electricity	6+2
	The Phenomenon of Sound	10+2		Pressure and Air Pressure	14+2		The Development of Astronomy and Space Exploration	4+2
	Static Electricity	6+2		Simple Machines	8+4		Sustainable Development of Earth's Resources	4
	Sense and Perception	16+2		Energy, Work and Power	8+4			
	Forces	8+4		Evolution and Ecosystems	16+4			
	Movement (objects)	7+2		Celestial Bodies and the Universe	6+2			
	The Movement of the Earth, Moon, and its Effects	7+2						
	The Solar System	6						

The school may be flexible with allocating class hours, **freeing up more curriculum** time, including that of laboratory and activity periods. In this way teachers may have more time in planning more engaging teaching methods, such as scientific inquiry and topical research, design and implementation.

Diverse and flexible teaching and learning, allows more opportunities for students to integrate their knowledge and skills in science and other disciplines. Teachers may arrange the order of topics on their own, based on the teaching and learning arrangements that complement students' needs and the school's requirements.

9. Assessment Suggestions

Assessment is an essential component of the teaching and learning process. Assessment requires the use of different evaluation methods to collect information, in order to make a wise decision. Performance standard needs to fulfil the curriculum objectives and learning standard of the subject. It should provide teachers with information about students' achievements in the process of meeting the curriculum objectives.

According to Bloom's Taxonomy of Educational Classifications (Bloom et al., 1956), students' fields of intelligence are diverse. Therefore, evaluation methods should aim for diversification, making it easy to assess students' Cognitive (C), Psychomotor (P) and Affective (A) domains. Teaching methods may then be improved and students' learning ability strengthened. This will be beneficial to students' holistic development, ensuring core competencies in MICSS.

While adjusting the teaching process, formative and summative assessments may also be provided as feedback to teachers, students, schools and parents.

9.1 Table 9: Performance Standard of Cognitive, Psychomotor and Affective

Domain	Item	Level(appendix 1)	Performance Standard
Cognitive (C)	Ca Scientific vocabulary, terms, and conventions	1 Remember	Recognise common scientific vocabulary, terms, and conventions
		2 Understand	Explain common scientific vocabulary, terms, and conventions
		3 Apply	Make use of scientific vocabulary and terms in the study of science
		4 Analyse	Integrate scientific vocabulary and terms
		5 Evaluate	Accurately decide on the use of scientific vocabulary and terms
		6 Create	Make plans using scientific vocabulary and terms

Domain	Item	Level[(appendix 1)]	Performance Standard
Cognitive (C)	Cb Scientific phenomena, facts, concepts and principles	1 Remember	Recognise scientific phenomena, facts, concepts and principles
		2 Understand	Explain scientific phenomena, facts, concepts and principles
		3 Apply	Make use of scientific phenomena, facts, concepts and principles
		4 Analyse	Infer scientific phenomena, facts, concepts and principles
		5 Evaluate	Decide on scientific phenomena, facts, concepts and principles
		6 Create	Propose hypotheses and design scientific inquisitive projects
	Cc The application of science and technology in daily life	1 Remember	State and give examples of the application of science and technology in daily life
		2 Understand	Explain the application of science and technology in daily life
		3 Apply	Make use of scientific knowledge and technology suitable for the learning stage
		4 Analyse	Attribute the application of science and technology in daily life
		5 Evaluate	Detect the use of scientific knowledge and technology in daily life
		6 Create	Using science and technology, devise various methods of policy-making regarding society, economy, and culture
Psychomotor (P)	Pa Reading skills	1 Imitation	Imitate the use of terms and descriptive methods in scientific content
		2 Manipulation	Read relevant scientific content based on guidance or self-initiative
		3 Precision	Quickly and accurately obtain relevant information from content
		4 Articulation	Adapt and improve reading methods in order to effectively identify detailed information
		5 Naturalisation	Internalise the reading ability and make it a habit

Domain	Item	Level[ap. 1)]	Performance Standard
Psychomotor (P)	Pb Experimental skills	1 Imitation	Observe and imitate methods and skills in running experiments
		2 Manipulation	Follow instructions in running experiments
		3 Precision	Run experiments with as few errors and as high accuracy as possible
		4 Articulation	Adapt and improve experimental skills in order to suit new experiment methods
		5 Naturalisation	Able to grasp and internalise experimental skills, such that it becomes second nature
	Pc The scientific method and problem-solving skills	1 Imitation	Observe and repeat the same solution pattern
		2 Manipulation	Put into practice solutions that have been decided upon
		3 Precision	Display familiarity with using scientific methods to solve problems
		4 Articulation	Adapt and adjust methods to solve problems more effectively
		5 Naturalisation	Able to create suitable solutions effectively
	Pd Presentation and communication skills	1 Imitation	Observe and imitate methods of using text and speech
		2 Manipulation	Use various ways of gathering and expressing scientific material
		3 Precision	Integrate and express scientific material clearly and in an orderly manner
		4 Articulation	Adapt and improve communication skills, in order to interpret and express scientific material more effectively
		5 Naturalisation	Internalise presentation and communication skills, and make it a habit

Domain	Item	Evaluation Level[ap. 1]	Performance Standard
Affective (A)	Aa Curiosity and empirical research attitudes	1 Receiving	Notice scientific phenomena in daily life and perform experiments earnestly
		2 Responding	Enthusiastically participate in learning activities and complete experiment tasks
		3 Valuing	Express an interest in and pursuit of scientists' inquisitive spirit
		4 Organising & Conceptualising	Plan learning and inquisitive activities
		5 Characterising by Values	Display curiosity and empirical research attitudes towards learning and inquiry
	Ab Continuous questioning and deduction	1 Receiving	Point out doubts and deductions about scientific concepts; be concerned about scientific issues
		2 Responding	Enthusiastically participate in the discussion process, and express an interest towards discussion topics
		3 Valuing	Debate about scientific concepts or the outcomes of discussions
		4 Organising & Conceptualising	Objectively analyse scientific concepts, and form an integrated personal idea
		5 Characterising by Values	Accept differing viewpoints, and display reasonable doubt and logical deductions about scientific concepts
	Ac Scientific integrity and care	1 Receiving	Take note of the required attitude of seeking factual truth in scientific inquiry
		2 Responding	Enthusiastically participate in scientific and community-building activities for the benefit of nature and society
		3 Valuing	Through scientific activities, display responsibility towards the natural environment and society
		4 Organising & Conceptualising	Plan scientific activities in order to solve problems in daily life
		5 Characterising by Values	Able to showcase scientific integrity and proactively care for issues related to the natural environment and society

(a) Examples of Inter-relationship of Content Standard, Learning Standard and Performance Standard: Teachers may design curriculum content based on learning standard, and assess students' level of learning based on the performance standard required.

<Example 1>

Learning Standard / Content Standard	Cognitive (C)	Psychomotor (P)	Affective (A)
	CbI Some scientific phenomena, facts and concepts	PdII Effectively communicate scientific material, ideas and values	AcII Expressing care towards people, society, and environmental protection
3.4.2. Balance and stability in ecosystems	Able to explain various phenomena in ecosystems and understand the concept	Able to present and effectively communicate the phenomena and concept of ecosystems, through the use of various media	Able to understand the importance of ecosystems and show care towards environmental protection
Performance Standard	**C4 (Analyse)** Able to analyse and understand the inter-dependencies and relationship between organisms and their environment	**P3 (Precision)** Able to integrate and express clearly and in an organised manner, the inter-dependencies between organisms and their environment	**A5 (Characterising by Values)** Able to present an attitude of proactive concern towards ecosystems

<Example 2>

Learning Standard / Content Standard	Cognitive (C)	Psychomotor (P)	Affective (A)
	CcI Examples of scientific applications in society and daily life	PbII Carry out experiment instructions accurately and appropriately	AaI Inculcate curiosity and an interest in science
5.1.2. Solubility and solubility graphs	Able to apply the concept of solutions in daily life	Able to carry out experiments about solution solubility	Able to maintain curiosity and interest in doing experiments
Performance Standard	**C3 (Apply)** Able to make use of the concept of solubility to solve problems in daily life	**P2 (Manipulation)** Able to follow instructions in carrying out experiments about solubility	**A2 (Responding)** Able to enthusiastically participate in learning activities, and earnestly complete solubility experiments

9.2. Teaching Assessment Methods

(a) Assessment of scientific inquiry

The emphasis in assessing scientific inquiry lies in a true reflection of students' progress in inquisitive learning. The subject matter of students' inquiry should contain practical investigative value, in line with the chosen science issue. This would demonstrate students' depth of understanding and result in them gaining scientific abilities.

Assessment methods:

- Designing experiments
- Case files about their learning process
- Presentation of reports (oral and textual reports [App. 2]), speeches, and performances
- Raising questions and conducting seminars (Real-life settings or issues related to society and the environment [App. 3])

(b) Assessment of scientific knowledge and skills

According to the requirements set by learning standard, it is important to assess students' understanding, grasp and application of core content in the science curriculum, which will develop their analytical and critical thinking skills. Aims of assessment include observation, experiments, and the ability to handle information. Throughout the entire learning process, students should evaluate and make use of knowledge and skills to solve practical problems.

Assessment methods:

- Classroom performance
- Homework
- Written examinations
- Design of experiments
- Execution of experiments

(c) Assessment of learning attitudes and values in science

Regarding learning attitudes and values in science, the emphasis is on students displaying curiosity and a hunger for knowledge towards natural phenomena and scientific issues. They should also respect objective facts and data from reliable sources, and raise doubts about conclusions and explanations that do not contain adequate evidence.

Next, they should be able to get along and cooperate with others, while maintaining an open attitude towards differing opinions. Finally, they should care for the impacts of science on the natural environment and society.

Assessment methods:

- Self-evaluation
- Peer evaluation
- Questionnaires
- Behavioural tasks
- Outdoor learning

10. Implementation Highlights

10.1 Principles for compiling teaching materials

a) According to the curriculum standard set, the content of teaching materials must be broadly linked to students' life experiences and foundational knowledge, with educational activities that are localized and close to daily life. Teaching materials must be thoughtfully-designed, with students as the focus.

b) Follow the Cognitive, Psychomotor and Affective aims within the course objectives when arranging teaching materials and activities. Arrange activities that are beneficial in guiding students to explore, discover, question and broaden their horizon. Strengthen the enlightening aspect and readability of textbook content.

c) The design of teaching materials should pursue a visual impact. The use of colourful illustrations and a vivid content layout, and the presentation of activity processes with fewer text content, would gradually guide students to grasp the scientific thinking and learning strategy.

d) There are multiple types of teaching materials. Besides textbooks, should also be equipped with handbooks, workbooks etc. With the influence of modern technology, educational content would also encompass multimedia courseware and e-books.

10.2 Recommendations for school facilities

a) Science laboratories are a basic educational facility required in schools. This allows students to carry out practical experiments, raising the atmosphere of learning interest, while nurturing students with independent learning.

b) Sufficient laboratories and lab equipment is required. Further, adequate space should be allocated to safely store equipment and chemicals.

c) Laboratories must be able to safely accommodate every student. The spatial design of laboratories must allow students flexibility in running individual or group experiments.

d) Schools should be equipped with information technology (IT) facilities, enabling demonstrations, simulations, playing of videos, and illustrations.

e) Sufficient outdoor space to conduct outdoor experiments safely.

f) Schools must have a plan for recycling or collection of waste liquids, in order to protect the environment against pollution.

10.3 Recommendations for training teachers

a) Move away from traditional training, with a focus on training teachers to make use of problem-based learning methods in designing the course and changing the teaching model.

b) Training with a focus on experiment-based teaching, providing teachers with large quantities of reference material for scientific experiments and inquisitive learning.

c) Include the participation of technology experts and scientists in training secondary school teachers. The collaboration between scientists and educators would enhance teachers' understanding of science, and result in more effective learning and teaching methods, thereby improving scientific competencies among students.

10.4 Making use of community resources

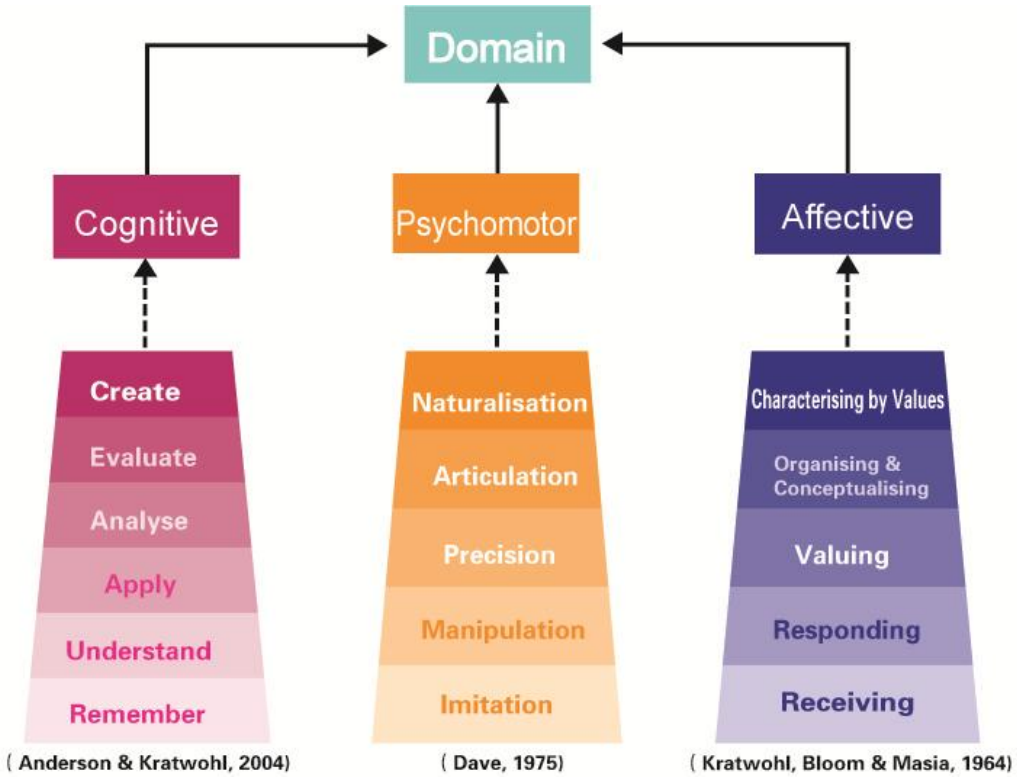
a) Adequately utilise the natural environment and community resources to improve the school's software and hardware facilities, which would broaden students' space for learning, changing the atmosphere for learning and the existing community culture.

b) Make use of the natural environment and community resources as living teaching materials. Recognising various objects in daily life would make learning more vivid, tangible and interesting, and also shape students' sentiments.

c) The reasonable use of household resources would build up parents' and teachers' sense of shared responsibility and mission, enhancing interaction and complementing one another. This creates the atmosphere of partnership between household and school-based education.

11. Appendices

Appendix 1: Cognitive, Psychomotor and Affective Domains



(Anderson & Kratwohl, 2004) (Dave, 1975) (Kratwohl, Bloom & Masia, 1964)

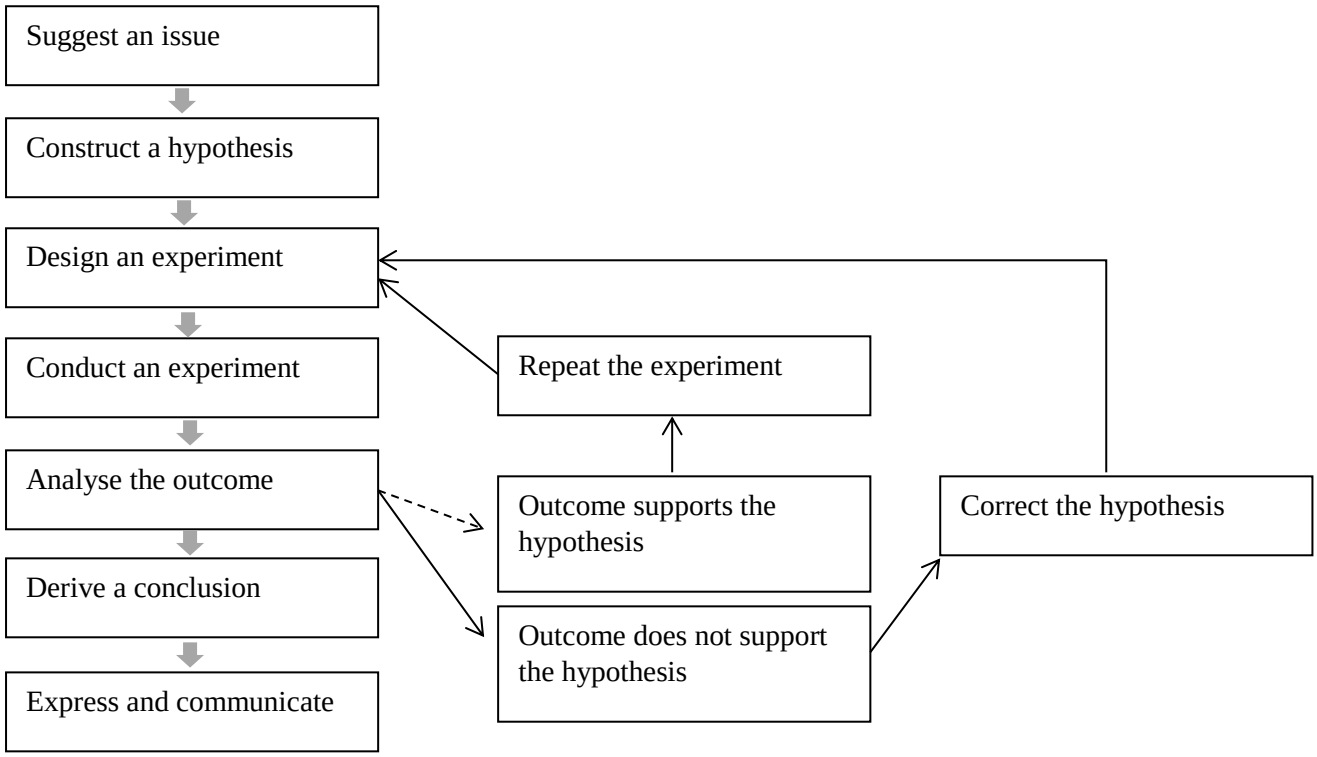
Appendix 2: Inquisitive Report

Inquisitive activities focus on daily life scientific issues in the community. Starting from the scientific issues in life, the chosen inquisitive topics will mainly revolve around the curriculum levels of junior middle level science.

Questions will be designed to guide students to perform analyses and reflect on their learning outcomes. This helps students to analyse the entire scientific inquiry process, giving them space for independent learning.

Every step has a specified aim, so as the degree of independence increases, students will be able to continuously perform analyses, experiencing the practical significance of scientific inquiry.

(a) The Scientific Inquiry Process (from Textbook 1, Dong Zong Senior Middle Level Secondary Biology)



(b) Structure of an Inquisitive Report

Regarding the format of experiment reports, there are usually the following items:	
Inquisitive objective(s)	Motive for the inquiry
Inquisitive issue	Raise suitable questions based on the objective(s)
Suggested hypothesis	Make a prediction based on existing scientific knowledge
Design of experiment	Each attempt should only compare one variable
Analysis of experiment outcomes and data	Ideally, there should be a theory to support the experiment outcomes
Conclusion	Connect the inquisitive issue, hypothesis and experiment outcomes with one another
Comment	Comment on strong points and make improvements, or suggest a more in-depth inquisitive issue

Appendix 3: Topic-based Inquisitive Projects

Environmental studies are the responsibility of the entire education world. This can build students' critical thinking, sense of citizenship, and personal responsibility. Topic-based inquiry that emphasises on environmental issues could enrich the teaching of science. This provides students with the opportunity to build deeper connections between themselves, their role in society, and their interdependencies with nature.

***United Nations Sustainable Development Goals**	**Customised Topics**
Goal 2: Zero Hunger (Eliminate hunger, achieve food safety, improve nutrition situation and develop sustainable agriculture)	A balanced and nutritious diet
	Food safety (pesticide pollution and genetic modification in the agricultural industry)
	Food production (Diversity of agricultural biology)
Goal 3: Good Health and Well-being (Ensure a healthy lifestyle, promote well-being among people of various age groups)	A positive health education
	Access to universal and reproductive healthcare
	Reduce dangerous chemicals and air, water and soil pollution
Goal 6: Clean Water and Sanitation (Provide clean water and sanitation for every person, and undertake sustainable management in these areas)	Improve water quality
	Holistic management of water resources (Seawater desalination, disposal of wastewater, and water recycling)
	Protect and restore ecosystems related to water
Goal 7: Affordable and Clean Energy (Ensure every person receives affordable, reliable, and sustainable modern energy resources)	Raising the efficiency of energy sources
	Promote the generation of clean energy (The uses and challenges of nuclear energy)
	Increase the use of renewable energy
Goal 11: Sustainable Cities and Communities (Build inclusive, safe, disaster-resistant and sustainable cities and settlements)	Management of city waste (Garbage collection)
	Air quality (Carbon dioxide emissions)
	Reducing damage from disasters, such as floods (Mitigate climate change, develop and protect the environment)
Goal 12: Responsible Consumption and Production (Utilise sustainable consumption and production methods)	Plan, reduce, recycle and reuse
	Sustainable management and efficient use of natural resources
	The environmentally-friendly management of chemicals and waste products throughout their entire life cycle

Goal 13: Climate Action (Take urgent action to deal with climate change and its effects)	Strengthen education and publicity of climate change mitigation
	Plan for reducing carbon (Carbon dioxide and other greenhouse gases)
	A green environment
Goal 14: Life Below Water (Protection and sustainable use of the oceans and their resources, in order to promote sustainable development)	Protection of oceanic resources (Regulated fishing activities)
	Safeguard against and reduce various types of oceanic pollution (Litter and plastic pollution)
	The importance of diversity among oceanic organisms
Goal 15: Life on Land (Sustainable management of forests, protection against desertification, stop and reverse land degradation, guard against loss of biodiversity)	Stop deforestation (Global reforestation)
	Protect mountain ecosystems (Biodiversity)
	The problem of illegal wildlife (Combating illegal hunting and trade in endangered species)
	Safeguarding against invasive species

*Obtained from the United Nations 17 Sustainable Development Goals

Appendix 4: U.S. "Next Generation Science Standard": Inter-Disciplinary Concepts

Inter-Disciplinary Concept	Specific Content	Examples
Patterns	Models observed from the natural world, and organising and classifying them; also address their internal relationships and root causes	The symmetry of flower petals and snowflakes; the passing of seasons; the repeating base pairs in DNA
Cause and effect relationships	Everything has a cause, which could be a simple factor or multiple factors. A core practice in science is to explain cause and effect relationships and their regulatory mechanisms	An infectious disease is spread from one infected person to another through microorganisms
Scales, proportions and quantities	When considering phenomena, recognize that related issues, including differences in size, time, and energy scales, are crucial. With changing dimensions, identify the ratios between different quantities and measurements	Speed is the ratio between distance and time; density is the ratio between mass and volume
Systems and system models	Systems are a way of organizing related objects or components. Models can be used to understand and predict the behaviour of systems	Natural predator relationships in ecosystems; living organisms' production of carbon dioxide through respiration
Energy and matter	Tracing the process whereby energy and matter flow into, out of and within a system, aids in understanding the behaviour of systems	Without the intake of energy (from the sun) and matter (carbon dioxide and water), plants are unable to grow
Structure and function	The method in which matter is shaped or formed determines its nature and function	The structure of atoms and molecules determines the nature and function of objects
Stability and change	For man-made or natural systems, conditions influencing stability and factors controlling change are key areas to consider and understand.	The Earth's rotation, the Moon revolves around the Earth, and the Earth revolves around the Sun