Jockey Club STEAM Education Resources Sharing Scheme

Teacher's Guidebook
for Using
STEAM Learning and Teaching Materials

Hong Kong Metropolitan University

February 2024

Preface

Over the past five years, the Jockey Club STEAM Education Resources Sharing Scheme (the Scheme) has developed over 40 sets of multidisciplinary STEAM learning and teaching materials and has used these materials to conduct STEAM activities for over 10,000 students and teachers.

To further promote STEAM education in Hong Kong, the Scheme is now offering a guidebook to help teachers effectively use these materials in their classrooms.

This guidebook is designed to provide teachers with a comprehensive understanding of the STEAM learning and teaching materials available through the Scheme. It also offers practical guidance on how to incorporate these materials into their lesson plans and classroom activities.

We believe that this guidebook will be an invaluable resource for teachers looking to enhance their STEAM teaching skills and provide their students with a high-quality, multidisciplinary education. We hope it will inspire teachers to explore new and innovative ways to teach STEAM subjects and help to create a brighter future for Hong Kong's next generation of innovators and problem solvers.

The Materials

Learning Modules

Learning modules are developed to strengthen students' ability to integrate and apply their knowledge and skills across different subject disciplines, with a special focus on the use of innovative teaching pedagogies for STEAM education. These modules target students of average ability to solve authentic problems in daily life.

Each learning module focuses on a main theme and covers different key learning areas related to Hong Kong secondary school curricula. It consists of multiple units and provides 4 to 40 contact hours of students' activities. For each module, a teacher's guide and a set of learning and teaching materials for each unit are developed.

Teachers' Guide

The teachers' guide for each module includes:

- Introduction to the topic,
- Module aims and learning outcomes,
- Learning and teaching approaches,
- Key learning areas mapping,
- Structure of the module,
- Lesson plans for each unit in the module.

Learning and Teaching Materials

The type and quantity of the learning and teaching materials for different modules vary, depending on the nature of the module. Typically, they include:

- Teaching PowerPoint for lecturing,
- Laboratory manual,
- Student handbooks for lessons,
- Exercise and assessment examples.

The learning modules are developed with a key consideration for their flexibility to be used by secondary school teachers. Teachers can use the whole modules as a complete learning experience on a specific real-world topic, select any unit as the learning activity for knowledge in the curriculum, or integrate or rearrange units from different modules to form a new structure for school-based learning.

Student Workshops

Student workshops are developed to provide students with hands-on and minds-on experiences in a shorter time. These workshops aim to foster students' interest in STEAM learning, strengthen students' ability in knowledge and skills integration, and enrich students' practical experience.

Each student workshop focuses on a real-life problem. It consists of an introduction to related basic knowledge and hands-on activities. The duration of each workshop does typically not exceed 4 hours.

Use Cases

Situation 1:

A teacher wishes to teach holographic projection to a class of students from scratch.

Resolution 1:

The teacher can refer to the materials in the learning module “Hello Holo”, read the teachers’ guide for lesson preparation, and use the PowerPoint materials in teaching.

Situation 2:

A STEAM coordinator wishes to organise a learning experience related to cosmetic products.

Resolution 2:

The coordinator can refer to the materials in the learning module “Beauty and the Skin”, gather teachers from different disciplines, perform collaborative lesson preparation and teaching load allocation, and schedule the teaching sequence to align with the school’s academic calendar.

Situation 3:

A Physics teacher wishes to look for supporting materials when teaching electromagnetic waves.

Resolution 3:

The teacher can refer to the materials in the learning modules “Beauty and the Skin” and “UV and You and We” and look for suitable content to assist his/her teaching.

Situation 4:

A STEAM coordinator wishes to organise a telescope-making event for a whole form.

Resolution 4:

The teacher can refer to the materials in the student workshop “Telescopes for the Moon”.

Situation 5:

Two teachers wish to collaborate on a STEAM project that involves coding and scientific experiments.

Resolution 5:

Many of our resources are related to coding using Micro:bit and experiments. The teachers can refer to the materials in the learning modules and workshops and develop their own project framework based on the resources.

List of Learning Modules

	Learning Modules	Description
1.	Beauty and the Skin	Understand the mystery of cosmetic products
2.	Confusing the Wind	Test the drag coefficient of rocket cars using a wind tunnel testing system
3.	CUBrodic Table	Make and solve a Rubik's Cube
4.	Dive in Virtual World	Make simple VR goggles
5.	Hello Holo	Design holograms and make projection pyramids
6.	The Next MasterChef	Create and make printed food
7.	To be a Food Detective	Test the food DNA
8.	To be a Doctor in Cooking	Prepare soufflé pancake and basic molecular cuisine
9.	Water You Drink	Design water filtration and water pumping stations using micro:bit
10.	Water You Know	Participate in a field trip and explore more about water quality assessment
11.	WE Speak Louder	Test a loudspeaker using an oscilloscope and signal generator
12.	Wind Powered Car	Assemble a wind-powered car
13.	Photo in a Coffee Can	Use instant coffee to develop photos
14.	Eternal War	Make disinfectant hand gel, spread plate technique, and coding using micro:bit
15.	Science Experiments x Micro:bit	Use micro:bit to measure variables in science experiments
16.	UV and You and We	Build a UV disinfection box
17.	Exploring the Magic of Solar Energy	Perform hands-on activities related to solar energy
18.	Dancer in Water – Microalgae	Learn the properties of microalgae and perform related laboratory techniques
19.	Micro:bit Invention	Learn the principles of invention with micro:bit

List of Student Workshops

	Workshop	Primary Subject
1.	Cal “U” Later	Chemistry
2.	Guardian of BB	Physics
3.	My Cell, Myself	Biology
4.	My DNA in the Bottle	Biology
5.	The Pain“Q”iller	Chemistry
6.	Hello ‘Holo’	Arts and Physics
7.	Dive in Virtual World	Physics and Biology
8.	Colourful Lab	Chemistry
9.	Understanding Molecular Cooking	Chemistry
10.	Making Disinfectant Hand Gel	Biology
11.	Is It Really “Clean”	Biology
12.	Building a Solar Car	Physics
13.	Algae Cultivation	Biology
14.	Making a Rubik’s Cube	Arts and Maths
15.	Water Quality Test Part 1 (Field Trip)	Biology
16.	Water Quality Test Part 2 (Laboratory Works)	Biology
17.	DNA Extraction & Gel Electrophoresis	Biology
18.	Introduction on Biosafety	Integrated Science
19.	Beauty and the Skin	Biology and Chemistry
20.	Micro:bit Kart Live	Physics and ICT
21.	Micro:bit Sensors for Aquaponics System	Biology and ICT
22.	Telescopes for the Moon	Physics and IS
23.	Message from Your Heart	Biology
24.	Semi-radiography Art	Biology
25.	Locating in Darkness	Physics
26.	Generating Electricity	Physics
27.	Catapult in Battle of Guandu	Physics
28.	The Myth of RAT	Biology
29.	Building a Wind-powered Car	Physics
30.	DNA Fingerprinting	Biology
31.	Moon Exploration	Physics