Broadening and enriching students' learning experiences through Language/Reading across the Curriculum

3.1 Connecting students' learning experiences across subjects through Reading across the Curriculum

Background

The English Language teachers of CCC Chun Kwong Primary School have endeavoured to optimise their school English Language curriculum in recent years through, for example, engaging students in reading authentic texts, building a coherent link between reading and writing, and promoting self-directed learning and e-learning. Leveraging their experience in curriculum planning and adaptation and seeing the need to broaden students' reading horizons, they made promoting Reading across the Curriculum (RaC) one of their major development focuses in 2020/2021. Through implementing different RaC projects, they aimed to provide opportunities for their students to engage in purposeful and meaningful reading and make connections between their learning experiences across subjects.

This article illustrates how RaC was implemented in the school using one of their RaC projects that involved the collaboration among English Language, General Studies, Visual Arts and Physical Education.

Level
P1

Strategies used
The following strategies were employed to facilitate the planning and implementation of the project:

1. **Identifying common elements across subjects**
   English Language teachers collaborated with non-language subject teachers to identify common elements across subjects and decide on the theme and sub-themes for reading, the learning objectives and outcomes, the learning activities, and the assessment methods. The cross-curricular collaboration aimed at building connections between students' learning experiences.

2. **Organic integration of different curriculum initiatives into the RaC project**
   RaC was used as a vehicle for integrating different curriculum initiatives organically. In the RaC project, multifarious tasks were designed to provide opportunities for students to develop their self-directed learning, e-learning, higher-order thinking and generic skills, and engage in purposeful and meaningful assessment tasks and life-wide learning activities. The aim of implementing the project was therefore not only to help students enhance their reading ability, but also to nurture their learning to learn capabilities.

3. **Adopting the blended learning approach**
   The blended learning approach was adopted to increase the flexibility in implementing the RaC project. The thoughtful fusion of synchronous and asynchronous learning experiences through, for example, the use of the flipped learning method, also ensured that the project could be

effectively implemented during the suspension of face-to-face classes as a result of the Covid-19 pandemic.

What happened

The planning and implementation of the project can be divided into 7 steps.

Planning

Step 1: Conducting curriculum mapping across subjects

Curriculum mapping among English Language, General Studies, Visual Arts and Physical Education was conducted at the planning stage. The common theme, My Favourite Animals, and sub-themes, Animal Names, Animal Body Parts and Animal Body Movements, were identified as the entry points to the project. The common higher-order thinking skill, compare and contrast, and the common generic skills, creativity and communication skills, were also identified as the major learning focuses.
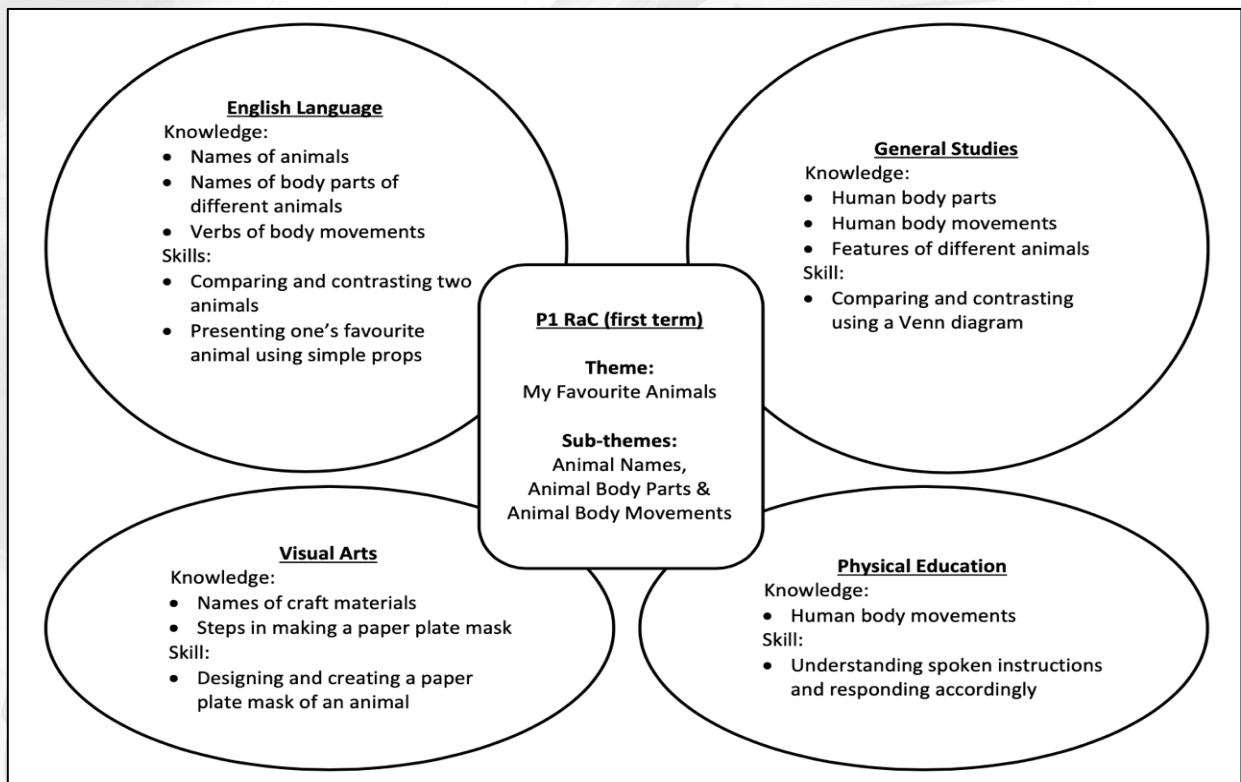
A curriculum map for the RaC project in P1

Step 2: Identifying target reading strategies and choosing relevant texts

Target reading strategies were identified based on the Learning Progression Framework for English Language. Two authentic texts matching the theme and sub-themes of the project were chosen to help students develop these strategies.

Authentic texts	Reading strategies
• "My Zoo" by Rod Campbell	• Mastering basic book concepts • Predicting the content using the book covers and prior knowledge • Decoding words using knowledge of letter-sound relationships • Recognising keywords in a sentence
• "From Head to Toe" by Eric Carle	• Recognising high frequency words • Following predictable texts by recognising the repeated use of sentence patterns

Step 3: Creating space for the implementation of the RaC project

To create space for the implementation of the RaC project, vocabulary and grammar items in the project were matched with those in the textbooks, some reading passages in the textbooks were assigned as self-learning tasks and the teaching schedule of some textbook units was rearranged.

Implementation

Step 4: Fostering self-directed learning

At the start of the project, students completed a variety of pre-reading tasks designed to help them develop their self-directed learning capabilities including setting learning goals and locating and accessing resources to learn. These tasks also aimed at increasing students' interests in the theme, activating their prior knowledge and helping them establish a purpose for reading.

Tasks	Purposes
• Signing a learning contract (Student Name 學生姓名) 1. I will make my best effort to learn. 2. I will try to come prepared to school with all my homework done. 3. I will participate fully in every lesson. 4. I will spend at least 15 minutes reading each day. 　1. 我會盡全力學習。 　2. 我會盡全力完成學習任務。 　3. 我會全情投入參與每一節課堂。 　4. 我會每天最少利用 15 分鐘閱讀課外讀物。 An excerpt of the learning contract to be signed by students	• To help students set learning goals
• Learning background knowledge online Pre-reading WS (2): K-W-L of Zoo Animals Date: _____ Grade: _____ A. Go to the following website and watch a video about zoo animals. You may also scan the QR code to access the website. https://www.youtube.com/watch?v=OwRmivbN gQk&t=73s&ab_channel=SuperSimpleSongs-KidsSongs Scan me B. What animals can you see in the above video? (Circle the correct answers.) I can see __an elephant__ / __a horse__ / __a monkey__ / __a penguin__ / __a rabbit__ / __a polar bear__ / __a snake__ / __a hamster__ in the video. Students learning background knowledge by accessing a link to a song on YouTube	• To help students locate and access resources to learn • To increase students' interest in the theme • To activate students' prior knowledge

Tasks	Purposes
• Completing tasks with features of the KWL chart ("K", "W" and "L" stand for "what I know", "what I want to know" and "what I learnt" respectively.) C. K-W-L: What other animals do you know? What other action verbs do you know? Write as many words as you can in the table. | Animals	Action verbs
e.g. giraffe	e.g. read
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8. | Students writing down what they know related to the sub-themes D. K-W-L: You are going to read the book, 'From Head to Toe'. Look at the book cover. What do you **want to know** from the book? (You can choose more than one option and write your own ideas.) I want to know … ☐ What animals can I see in the book? ☐ Are the animals the same as those in the book, 'My Zoo'? ☐ What body parts do animals have? ☐ What can the animals do? ☐ Is 'From Head to Toe' an interesting book? ☐ _____ (Write your question) ☐ _____ (Write your question) Book cover *From Head to Toe* Eric Carle Students indicating what they want to know from one of the texts	• To activate students' prior knowledge • To help students establish a purpose for reading

Step 5: Teaching content knowledge and skills in different subjects

English Language and content subject teachers involved taught different content knowledge and skills related to the theme and sub-themes, and synchronised their teaching as far as possible. Different strategies were also employed to help students develop an interest in reading and enhance their reading ability, acquire and construct new knowledge, cultivate higher-order thinking skills, establish links between knowledge and skills across subjects, and maximise their learning.

Knowledge/skills	Strategies	Purposes
English Language • Words related to different animal names, body parts and body movements • Specific grammar items including "I have …" and "I can …" • Specific reading strategies	• Teaching the words, grammar items and reading strategies in context using the authentic texts What do you think this book is about? / This book is about what animals can do. *From Head to Toe* Eric Carle (front cover) / *From Head to Toe* Eric Carle (back cover) Explicit teaching of the reading strategy – predicting the content using the book covers and prior knowledge	• To help students develop an interest in reading and enhance their reading ability • To help students acquire and construct new knowledge • To help students establish links between knowledge across subjects

Knowledge/skills	Strategies	Purposes
General Studies • Knowledge about human body parts and movements, and features of different animals	• Synchronising the teaching of content knowledge in General Studies and English Language as far as possible • Revisiting the words students had learnt in their English lessons	• To help students acquire and construct new knowledge • To help students establish links between knowledge across subjects
English Language and General Studies • Higher-order thinking skill – compare and contrast	• Teaching the higher-order thinking skill common to both English Language and General Studies Teaching students to compare and contrast two kinds of animals using a Venn Diagram	• To help students cultivate higher-order thinking skills • To help students establish links between skills across subjects

English Language and Visual Arts teachers also employed different blended learning strategies, such as the flipped learning method, to compensate for the reduction of lesson time during the suspension of face-to-face classes.

Knowledge/Skills	Strategies	Purposes
Visual Arts • Words related to craft materials • Steps in making a paper plate mask	• Students watching a pre-recorded teaching video to learn about the craft materials and steps in making a paper plate mask as a pre-lesson task 	• To compensate for the reduction of lesson time • To maximise students' learning by giving them control over the time, place and pace of learning

Knowledge/Skills	Strategies	Purposes
	8. Tie the strings on the animal's face. Excerpts from the pre-recorded teaching video teaching students craft materials and steps in making a paper plate mask	
English Language • Presentation skills	• Students watching a presentation video sample asynchronously to learn some basic presentation skills before meeting with the teacher in the synchronous speaking lesson	

Step 6: Engaging students in purposeful and meaningful learning and assessment tasks

Students completed a variety of purposeful and meaningful tasks to demonstrate their learning outcomes. These tasks aimed at providing opportunities for students to apply what they had learnt in the subjects involved, helping them establish links across subjects, fostering their creativity and communication skills, nurturing their learning to learn capabilities, and promoting home-school cooperation.

Tasks	Purposes
English Language • Students reflecting on their reading experiences by completing a simplified KWL chart E. K-W-L: What have you learnt from the book? Tick ✓ the box(es) and fill in the blanks. ☐ The penguin can turn its _____. ☐ The _____ can bend its neck. ☐ The buffalo can _____ its shoulders. ☐ The monkey can wave its _____. ☐ The seal can _____ its hands. ☐ The gorilla can _____ its chest. ☐ The _____ can arch its back. ☐ The crocodile can _____ its hips. ☐ The _____ can bend its knees. ☐ The donkey can kick its _____. ☐ The _____ can stomp its feet. ☐ Humans can _____. Students reflecting on their reading experiences in a simplified KWL chart	• To nurture students' learning to learn capabilities through conducting self-assessment

Tasks	Purposes
English Language • Students writing about their favourite animals using the knowledge, words and grammar items they had learnt in the RaC project B. What is your favourite animal? Follow Nobita's example and write about your favourite animal. You may use the information on the worksheet 'Post-reading WS (2): Lessons 1 to 4' to help you. Good morning, _____. I have _____. I can _____. _____. Do you like me? Students writing about their favourite animals	• To provide opportunities for students to apply what they have learnt in the subjects involved • To help students establish links across subjects
Visual Arts • Students designing and creating a paper plate mask of their favourite animals	• To foster students' creativity • To help students establish links across subjects
English Language • Students presenting their favourite animals using simple props and videotaping their presentations D. Presentation Steps: 1. Put on your paper plate mask and use the props you have made. 2. Read out what you have written about your favourite animal in Part B. 3. Do the action that you have mentioned in Part B when you are presenting. 4. Record your presentation. (You can record your presentation using a mobile phone or tablet.) Students making a presentation video of their favourite animals	• To foster students' communication skills • To help students establish links across subjects
English Language • Students watching presentation videos created by their peers on Padlet and providing feedback	• To nurture students' learning to learn capabilities through conducting peer assessment

Tasks	Purposes
Physical Education • Students performing different body movements they had learnt in their English and General Studies lessons	• To provide opportunities for students to apply what they have learnt in the subjects involved • To help students establish links across subjects
Life-wide learning activity • Students performing different body movements they had learnt in their English and General Studies lessons with their parents and assessing their own and parents' performance Students recording and assessing their own and parents' performance in a parent-child activity	• To enrich and extend students' learning experiences • To involve parents in their children's learning process and promote home-school cooperation • To nurture students' learning to learn capabilities through a fun assessment task

Evaluation

Step 7: Evaluating the project

An evaluation was carried out after the project was implemented. The teachers involved assessed the effectiveness of the project by looking at different aspects of the project, such as whether the cross-curricular theme and sub-themes were of great interest to students, whether the learning tasks had promoted self-directed learning and maximised students' learning as planned, and whether the

assessment tasks had successfully nurtured their learning to learn capabilities. Student work was analysed to determine how far they had achieved the learning objectives. Suggestions for improving the design of the project and enhancing cross-curricular collaboration were also made.

Impact
Student learning
Through active engagement in the self-directed learning, e-learning, assessment and life-wide learning tasks, students' learning to learn capabilities were enhanced. Evident improvements were found in the following areas:

1. Enhanced reading abilities and enriched reading experiences
Students' reading ability was enhanced because of the explicit teaching of specific reading strategies. From teachers' observations, students had become better at understanding what they were reading as they were equipped with different reading strategies, such as locating key words in a sentence and following predictable texts.

Students' reading experiences were also enriched. Their reading horizons were broadened because of increased exposure to different authentic texts related to the cross-curricular theme and sub-themes. Their knowledge was deepened through the connections made across the subjects involved. This can be seen from students' performance in the final writing task (as shown in the pictures). They successfully applied the knowledge they acquired in different subjects in their writing.

Students describing their favourite animals using knowledge they have acquired across subjects

2. A high level of motivation and engagement
With the interesting theme and quality authentic texts provided, students were highly motivated to read. When evaluating the effectiveness of the project, teachers expressed that students looked forward to reading the texts. A high mean score of 4.25 (five-point scale) was obtained in the survey conducted at the end of the project, reflecting students' keen interest in reading the authentic texts.

A presentation video produced by a student

Students were also very engaged in the learning tasks as they were purposeful, meaningful and fun. These engaging tasks (as shown in the pictures) provided opportunities for students and their parents to be actively involved in the learning process. A high mean score of 4.25 (five-point scale) was obtained in the same survey, showing their high level of enjoyment.

A picture showing a student and his mother performing a body movement together in the parent-child activity
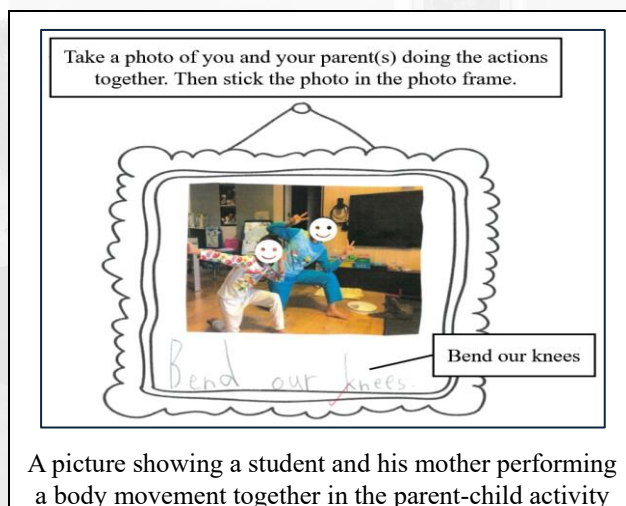
Teachers' professional development

1. Increased knowledge of RaC

Teachers broadened and deepened their understanding of RaC and became more aware of the significance of strengthening connections among students' learning experiences across subjects. They also enhanced their capabilities to integrate RaC into the school English Language curriculum and became more adept at using RaC as a vehicle for integrating different curriculum initiatives. The renewed school English Language curriculum, therefore, not only covered the learning and teaching of English, but also highlighted students' learning experiences across subjects and learning to learn capabilities.

2. An extended teaching repertoire

Teachers' teaching repertoire was extended as they employed a variety of strategies in the RaC project, such as engaging students in tasks that helped develop their self-directed learning capabilities, using authentic texts to broaden their reading exposure, explicitly teaching reading, higher-order thinking and generic skills that could be applied in different subjects, adopting the flipped learning method to maximise students' learning, and engaging students in a fun life-wide learning activity to enrich their learning experiences. Teachers' extended repertoire resulted in a good balance between the teacher-centred and student-centred environments and an increase in learning and teaching effectiveness.

Conclusion

RaC and various curriculum initiatives were successfully integrated into the school English Language curriculum through the implementation of different RaC projects including the above-mentioned P1 project. The success was largely attributable to the collaborative efforts of the English Language and content subject teachers involved. Their accomplishments also came from the teachers' receptiveness to new ideas, creativity and teamwork, and the leadership of the English panel head.

To extend the promotion of RaC and strengthen the connections among students' learning experiences across subjects, further possibilities of cross-curricular collaboration can be explored. A whole-school approach to promoting RaC may even be employed. RaC can also continue to be

used as a vehicle for implementing other curriculum initiatives such as promoting values education and Life Planning Education. Space, however, must be deliberately created in the school curriculum for both teachers and students in order to ensure a high level of learning and teaching effectiveness.

Bibliography

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CCC Chun Kwong Primary School
Max TSANG (Language Support Officer)

3.2 Promoting Reading across the Curriculum in Key Stage 2 to help students connect their learning experiences

Background

Building on the previous years' experience in promoting reading, teachers of CCC Mong Wong Far Yok Memorial Primary School decided to make use of the extra funding provided by the Grant Scheme on Promoting Effective English Language Learning in Primary Schools (PEEGS) to implement a "Reading across the Curriculum" (RaC) project. The RaC project aimed at elevating students' learning, in particular, deepening their knowledge in different subject areas, developing positive values and attitudes that support independent learning and promoting effective English language learning in Key Stage 2. Through holistic curriculum mapping of the school's English Language and General Studies curricula, teachers taught students how to read a variety of fiction and non-fiction books which were closely aligned with the themes of the two subjects. It is hoped that students' learning experiences from different subjects could be better connected and their reading interest could be nurtured through reading a variety of books. All the cross-curricular modules were implemented using a blended learning approach due to the suspension of face-to-face classes. Synchronous and asynchronous learning were strategically adopted to maximise students' learning time and enhance teaching effectiveness.

Levels
P4-6

Strategies adopted

1. **Mapping the General Studies and English Language curricula to identify common themes in the RaC project**
   Teachers from the English and General Studies Departments collaborated to identify common themes with a view to establishing meaningful links between concepts and ideas acquired in the two subjects and providing students with opportunities to demonstrate their ability to use the knowledge gained from both subjects to conduct project work and share reading experiences through different means.

2. **Explicitly teaching students Learning to Read skills to prepare them for Reading to Learn**
   With a variety of theme-related books chosen, including fiction and non-fiction books, English Language teachers taught reading skills explicitly in class to ensure that students could understand and analyse the target language items, text features and text types. Worksheets were designed for guiding students through their reading of multidisciplinary texts. Students were also assigned to read other books of the common themes chosen outside class time to sustain their interest in the themes and motivate them to read to learn through independent reading.

3. **Engaging students in sharing their reading experiences through a variety of tasks and modes of assessment**
   Instead of assigning students to write book reports or respond to questions in worksheets,

General Studies and English Language teachers worked together to design meaningful activities such as making videos, drawing posters, working out do-it-yourself models and doing research for students to share their reading experiences. Teachers used different ways to sustain students' learning interest and empower them to learn independently, especially during the suspension of the face-to-face classes. Formative assessments in class and meaningful homework were assigned to students in order to monitor closely students' learning progress.

4. Infusing positive values and attitudes into different RaC modules

With the use of a combination of fiction books and informational books on selected topics, a lot of discussion points about value judgement were generated as what students had learnt from the books could be linked to their life experiences. Thus, reading a variety of books could give students a lot of food for thought and it created a chance for teachers to promote values education through discussing life events with them.

What happened

English Language teachers implemented RaC through the Reading Workshops with input from General Studies teachers. Fiction and non-fiction books were chosen based on the common themes identified by both English Language and General Studies teachers through curriculum mapping. An RaC Team, comprising six English Language teachers, was formed to plan and implement the project by four stages.

Stage 1: Curriculum mapping and book selection

Teachers aimed to provide broad and balanced reading experiences to students. Similar topics from English Language and General Studies were identified and grouped into two themes. Students read four books in the Reading Workshops per year, including one fiction and one non-fiction book for each theme. For example, P4 students read a story about a little girl in face of water shortage in Africa and they read a non-fiction book about the sources of water and water usage. Students were taught to make a water filter as the final task to apply the knowledge and skills gained from both subjects. Students learnt to save water, protect the environment and eat healthily in the RaC modules and it somehow brought changes to their present practices and encouraged them to look for areas for improvement in their daily life.

Levels	Common themes	Fiction	Non-fiction	Final tasks
P4	Water	"The Water Princess"	"The Question of Water"	Make a water filter
	Healthy eating	"The Queen's New Chef"	"My Body Needs Food"	Make plans for a healthy family meal
P5	Light	"Backstage at the School Play"	"Light"	Conduct an experiment
	Healthy living styles	"Making Good Choices"	"Lungs"	Create a poster to promote healthy living style
P6	Helpers in daily life	"Rocky the Robot Helps Out"	"Simple Machines"	Make a video to introduce a home robot

Levels	Common themes	Fiction	Non-fiction	Final tasks
	Environmental protection	"The King of Waste"	"How Can We Reduce Household Waste?"	----

Common themes were identified from the two subjects and both fiction and non-fiction books were matched with corresponding themes.

English Language

Water
Final task – Make a water filter and write a diary entry of how to make it

General Studies

✧ Read different text types (a story, an information text, video clips) about the theme
✧ Learn the concepts of fiction and non-fiction texts
✧ Learn different reading skills such as inferencing, prediction, sequencing
✧ Learn to make connections between characters from the story and real-life experience
✧ Compare water supply in Hong Kong and Africa
✧ Learn the different sources of water
✧ Learn the vocabulary of a water cycle
✧ Learn the functions of a water cycle
✧ Learn to write a diary entry

Fiction: "The Water Princess"

Non-fiction: "The Question of Water"

✧ Learn the properties and the uses of water in our daily life
✧ Recognise that the change of states of water is reversible
✧ Know about the sources of water and the history of water supply in Hong Kong
✧ Describe the process of water treatment in Hong Kong
✧ Know about the causes and effects of water pollution
✧ Learn about water shortage in different parts of the world and practise different ways to save water
✧ Use different materials to make a water filter and test its functions

An example of a P4 curriculum map showing how the final task enabled students to enrich and consolidate their learning in both subjects

Stage 2: Explicit teaching of reading skills
Reading skills were explicitly taught in different stages of the reading lessons in the blended learning mode. Some activities were completed by students in their own time and place, while others were conducted by teachers in online or face-to-face lessons. All the reading tasks developed were collated in the reading booklets.

Explicit teaching of reading skills was carried out using different activities and tasks in the lessons. It helped students comprehend the whole text through:
- making predictions on what they would read;
- checking their understanding of the plot development and sequence of events in a story;
- having a deeper understanding of its theme and characters;
- connecting events in the text to prior knowledge or experience;
- working out meaning of unfamiliar words;

- clarifying parts of the text from time to time;
- making inferences; and
- summarising the meaning of the whole text.

Making predictions Teacher elicited ideas students learnt from the General Studies unit using the e-tool "Mentimeter" 	 Students shared keywords on what they knew about "light" - the concepts they learnt in General Studies lessons.
Summarising Students summarised details about the whole story using story maps.	
Sequencing Teacher asked students to show sequence of events in a story using the "chat room" function in a Zoom lesson. 	Students typed their answers in the chat room in response to the teacher's questions.

Inferencing Teacher asked students to infer the personalities of different characters from what they said or did in the story. Students were asked to match the adjectives with the highlighted parts shown using the "remarks" function on Zoom. hours and fifty-one seconds the play would start. He looked over his list. Being director, writer and main actor was a big responsibility, but he knew he could do it. Mr Bracks, Raj's teacher, stood at the door. "You look organised, Raj. I'm in the school office if you need me." Raj nodded, studying his list. "Caitlin, are the costumes ready?" "It must be perfect," said Raj. "Camp Wrong is going to be the best play our school has ever seen." Mia gulped. → demanding / organized / confident	Students were assigned to do a similar exercise at home for consolidation.

Chapter	Adjectives to describe Raj	(page no.) Quotes from the book
1		(p.4) "You look organized, Raj..."
		(p.6) "It must be perfect," said Raj. "Camp Wrong is going to be the best play our school has ever seen."
		(p.4) Being director, writer and main actor was a big responsibility, but he knew he could do it.
2		(p.8) "Are the lights ready?" asked Raj nervously.
		(p.8) Raj ran towards the windows. "Help!" he yelled.
3		(p.14) "No show tonight," said Raj. "Everybody, call your parents to get you." (p.14) "It's dangerous," said Raj. "There might be another thunderstorm." (p.14) "I'm sure the teachers agree with me that we shouldn't have the show tonight." (p.15) Raj said slowly, "But the lightning."
		(p.14) "No show tonight," said Raj. "Everybody, call your parents to get you." (p.14) "It's dangerous," said Raj. "There might be another thunderstorm."

Stage 3: Designing meaningful post-reading activities for students to respond to texts

i. Developing students' positive values and attitudes and critical thinking skills

<u>An example in P4</u>

P4 students learnt about the types and functions of nutrients in General Studies lessons. They identified nutrients in different kinds of food and learnt how to eat healthily. They were taught to read the non-fiction reader, "My Body Needs Food", to learn some of t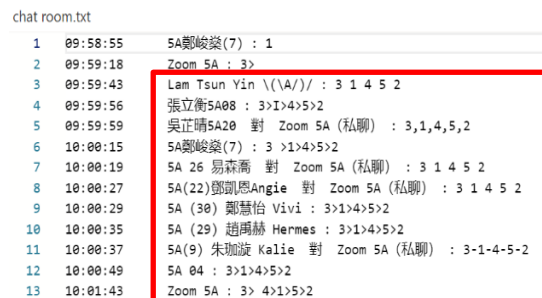he content subject concepts in English Language and enrich their knowledge and vocabulary on the topic. The fiction book, "The Queen's New Chef", was used and students were required to critically analyse the characters' eating habits. By the end of the module, students were asked to do a project on "Healthy eating". They had to design a healthy and nutritious meal for their family with a limited budget. Due to the pandemic, students had to search for the food items and prices online. They applied their I.T. skills to do information search. They also needed to draw upon their Mathematics knowledge to calculate the serving size and use pie charts to show the proportion of food types.

Through mapping the curricula across Key Learning Areas, teachers helped students connect the knowledge gained from different content subjects in the RaC project. This RaC project could also provide a platform for cross-curricular collaboration among different departments.

An example in P5

In the General Studies module, "Love Your Body", students learnt about the effects of smoking on the respiratory system and how drugs and alcohol harm human's health. To match with what students learnt in the content subject, English Language teachers chose the non-fiction book, "Lungs", and fiction book, "Making Good Choices". At the end of the RaC module, students were required to design a poster to remind people to refrain from bad habits. Students were given the choice between drawing a poster and using the app, Adobe Spark, to create a poster during the suspension of face-to-face classes. Students learnt to be responsible for their actions and decisions as well as care for others.

ii. **Enriching students' language skills, grammar knowledge and thinking skills**

In the post-reading stage, students were often asked to share their views, learning and feelings about different topics. Thus, different activities and tasks were designed with the purposes of enriching students' content subject vocabulary, teaching more relevant language patterns and grammar knowledge and developing their thinking skills through using "problem and solution" and "cause and effect" to organise information so that they could have richer language to respond to the texts.

a. Tasks for enriching students' content subject vocabulary
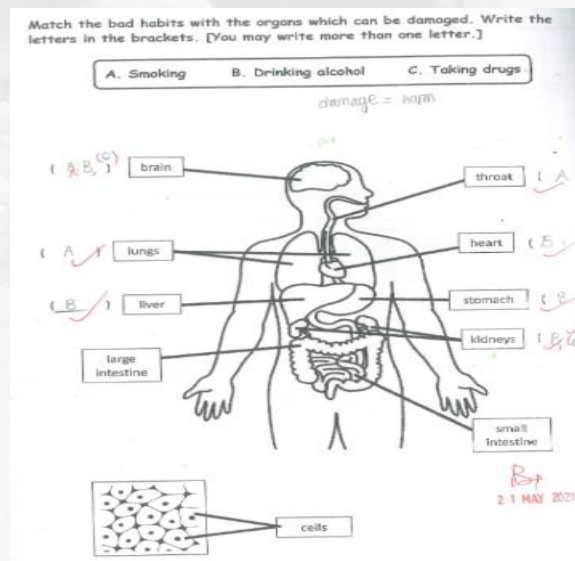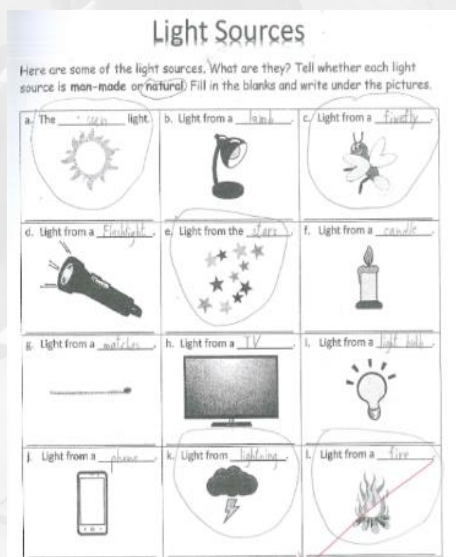
Students learnt about the sources of light and names of different organs in English
Language lessons after they had learnt these concepts in General Studies.

b. Tasks for developing students' thinking skills to facilitate in-depth analysis of the topics
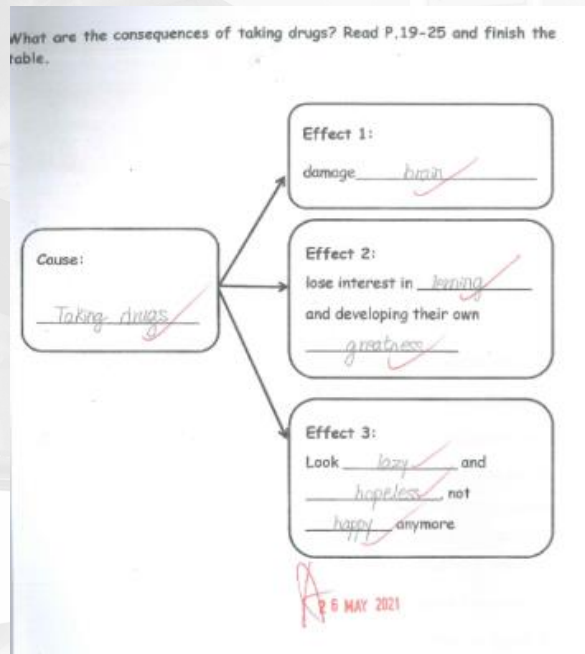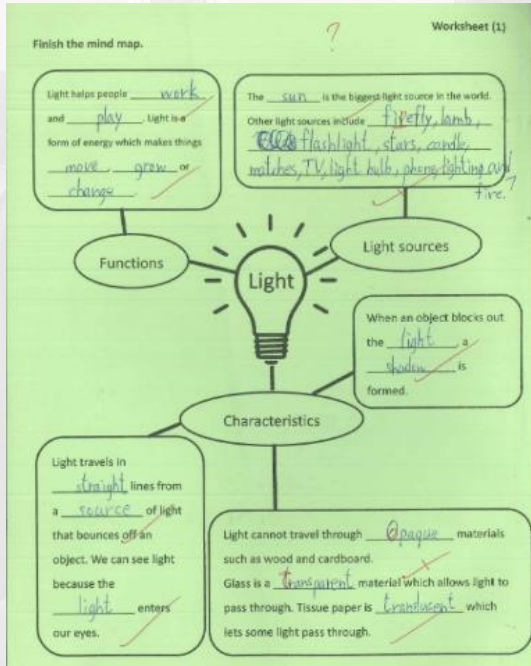
Different graphic organisers were used to help students summarise the importance of light in our daily life and the causes and consequences of taking drugs.

c. Tasks for teaching grammar and relevant sentence patterns

Students learnt to use connectives to talk about the "causes and consequences" of taking drugs.

Students made use of the target grammar structures learnt in the English Language lessons to explain the lever system and presented the information using PowerPoint.

iii. **Engaging students in carrying out self-directed learning tasks to develop them into independent learners**

Students were given more opportunities to work on independent inquiry tasks after reading some non-fiction books and other learning resources suggested by teachers. They were expected to integrate and apply knowledge and skills across different Key Learning Areas in different learning tasks.
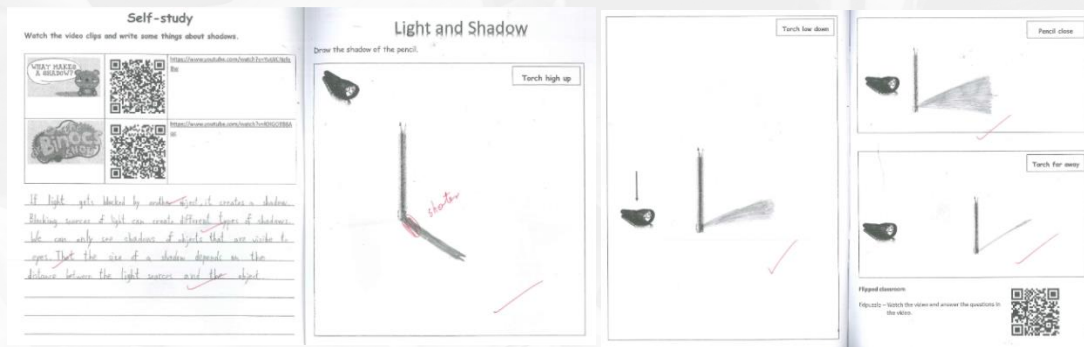
P5 students learnt more about the formation of shadow and they conducted hands-on experiments at home. Through "learning by doing", students were encouraged to actively seek knowledge on their own, thereby preparing them to become curious lifelong learners.

Stage 4: Administering formative reading assessments and self-assessments to monitor students' learning progress

Formative reading assessments were administered after the teaching of each book to see if students succeeded in mastering different reading skills. Students were asked to read texts of similar themes and the questions were set for testing the target reading skills. Self-assessments were also included in the project to allow students to share feedback on the books they read. For example, they shared new words they learnt from the non-fiction books and expressed their likes and dislikes for different characters and the development of the story for the fiction books.
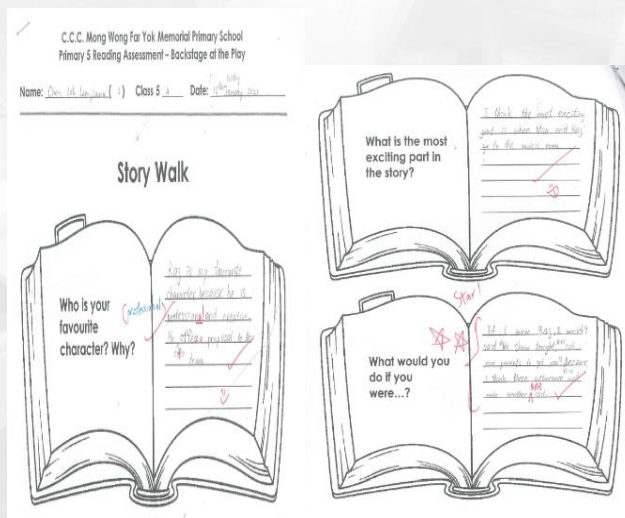
Students were engaged in reviewing and evaluating what they had read.
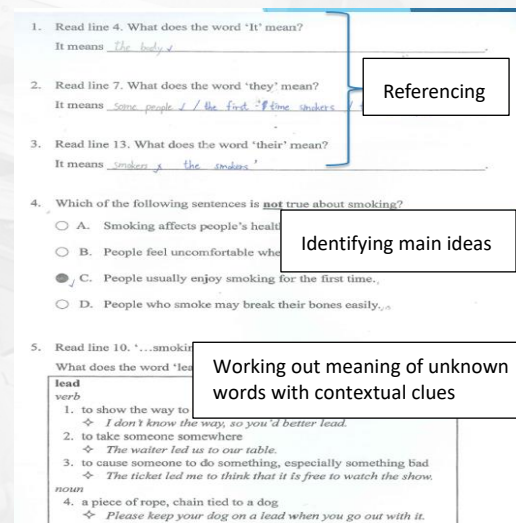
Simple and focused formative reading assessments were administered to assess students' learning of the target reading skills.

Impact
Students

1. **The knowledge gained from General Studies could be consolidated and extended through reading a variety of topic-related non-fiction books in English Language lessons.**

    Teachers chose non-fiction books for students to read so that they could learn content subject knowledge and language skills in English Language. Students were able to gain a deeper

understanding of the General Studies topics through reading different English non-fiction books of the same themes. They were also able to use different language items and thinking skills they learnt in both subjects in different RaC activities such as making a water filter and doing research on the household items to apply their knowledge of the pulley system. The RaC project could help students establish meaningful links between concepts and ideas acquired in different subjects and their life experience.

Students learnt to make a water filter and tested its functions.

2. **Positive values and attitudes were nurtured using a variety of fiction books which are thematically linked to the General Studies topics.**

Teachers made good use of different value-laden fiction books to develop students' positive values and attitudes such as care for others and responsibility. The post-reading activities engaged students in reflecting on different life matters and motivated them to think about the right actions to take. Students were able to see different life events and the world from different perspectives, thus broadening their horizons. For example, through reading the story "Making Good Choice", the P5 students learnt about the risks of taking drugs, smoking and drinking. They created posters to encourage others to refrain from doing all these. The design of the "A balanced diet" project at P4 aimed at raising students' awareness of the importance of food labels, choosing healthy food items for themselves and others and becoming smart spenders. Students' critical thinking skills and positive values of caring for others were developed and nurtured.

3. **Students' reading interests and abilities were enhanced as they progressed from beginner readers to emergent readers.**

With the use of a variety of text types, and both print and non-print materials carefully chosen for students in the curriculum mapping process, students' motivation to read was enhanced. They were given opportunities to read other materials online for independent reading. They could gradually put the reading skills such as making predictions, making connections and inferencing they learnt to use in order to "read to learn" and perform different self-directed learning tasks set for them.

4. **Students' generic skills and lifelong learning skills were enhanced through their participation in a variety of RaC activities.**

   Students were able to demonstrate their information technology skills, problem solving skills, self-management skills and study skills when doing the RaC activities during the pandemic. For example, students gathered information online to accomplish different post-reading RaC tasks and some had tried using different apps such as Flipgrid and Adobe Spark to produce posters or do oral presentations of their reading experiences.

Teachers

1. **Teachers gained a broader view of the school curriculum.**

   Both language and content subject teachers could see more coherent links between subjects when they did curriculum mapping to align the themes of the two subjects for carrying out the RaC project. English Language teachers took the lead to make such connections across subjects whereas General Studies teachers realised that content and language learning could be integrated to create more coherent learning experiences for students.

2. **Teachers' competence and confidence in managing change were increased.**

   Due to the pandemic, teachers adopted the blended learning approach to implement the RaC project. Teachers had to use a face-to-face mode and an online mode to conduct different lessons and activities. Curriculum leaders were able to strengthen the collaborative culture of their team, in particular when the team had to work closely to resolve issues of implementing the RaC project during the suspension of face-to-face classes.

3. **Teachers' assessment literacy was enhanced.**

   Teachers included a variety of assessment modes in monitoring students' learning of the project. Simple online lesson tasks such as showing answers using the "remarks" and "chat box" functions in Zoom lessons, asking students to answer questions on Google Forms as a kind of summative assessment, having students make videos to share their understanding of different issues, administering competitions on Kahoot! or Quizziz were carried out in the lessons. The data gathered from the formative and summative assessments were analysed systematically to find out students' strengths and weaknesses so as to provide follow-up support.

Facilitating factors

1. **Availability of funding**

   With the extra funding provided, human resources in the English panel were strengthened with an extra English Language teacher recruited. The curriculum leaders' teaching load was lessened and they could focus more on developing the school-based enhancement measures to further promote effective English learning and teaching.

2. **Teachers' readiness**

   The curriculum leaders were willing to change and they were ready to take on the challenge of implementing the RaC project though it was rather new to them. They were receptive to peers' input and comments.

3. Strong leadership

The curriculum leaders in the English Department were able to take the lead in directing the whole RaC project. They were able to set clear goals and directions and plan concrete actions at different stages of the project. They were able to cope with difficulties and uncertainties when implementing the project. Their effective knowledge management enabled the project to operate successfully, in particular, during the pandemic.

Way forward

With the experience gained from implementing the RaC project for two years, teachers would like to further strengthen the cross-curricular collaboration between the English Language Department and other content subject departments to help students integrate language learning and content learning for increasing their exposure to English. Teachers will continue to explore the possibility of making a closer link between RaC and other Major Renewed Emphases such as STEM education, life-wide learning and Life Planning Education to broaden students' learning experiences.

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CCC Mong Wong Far Yok Memorial Primary School
Amy FAN (Language Support Officer)

3.3 Nurturing students' 21st century skills
through integrating English into STEM education

Background

Maximising students' language exposure and developing their 21st century skills such as critical thinking, creativity and problem solving skills across different Key Learning Areas (KLAs) is one of the major concerns of Tak Sun Secondary School. English Language teachers collaborated with Integrated Science (IS) and Information and Communication Technology (ICT) teachers to develop a STEM (**S**cience, **T**echnology, **E**ngineering, **M**athematics) project on making a solar water purifier to raise students' environmental awareness. It is hoped that through engaging students in authentic and meaningful tasks, students' interest in learning English can be boosted and essential skills to cope with 21st century challenges can be nurtured.

Level

S2

Strategies used

1. **Fostering collaborative and systematic planning through a STEM committee**

   To facilitate the collaboration among Integrated Science, Information and Communication Technology and English Language teachers, the school established a STEM committee to plan and monitor the following tasks:

   i)   Establishing cross-curricular links among the three subjects to form a foundation for holistic planning and materials design of the project

   ii) Mapping out the knowledge, skills and values to cover, implementation schedule and tasks to be done by the respective subjects


Content connections

Science: Applying the concept of evaporation and condensation

Technology: Using 3D printing to make the water purifer

Engineering: Applying the Engineering design process

Mathematics: Measuring volumes and time
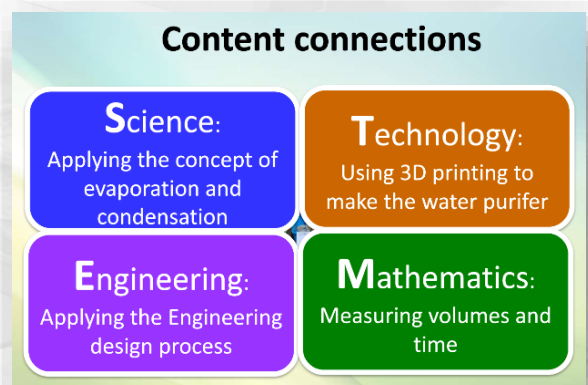
2. **Infusing language elements at different stages of the STEM project**

   While collaborating with the Integrated Science and Information and Communication Technology teachers, English Language teachers played a crucial role by developing students' reading, presentation, discussion and writing skills at different stages of the STEM project in order to remove language barriers to understanding or, as DeBoer et al. (2010) suggests, "communicating facts, ideas and hypotheses" (p.447). With the language input, students were able to apply literacy skills to construct scientific knowledge and advance scientific inquiry. This learning process helped develop their generic skills including creativity, critical thinking and problem solving skills and nurture positive values and attitudes such as perseverance that would facilitate their development as lifelong learners.
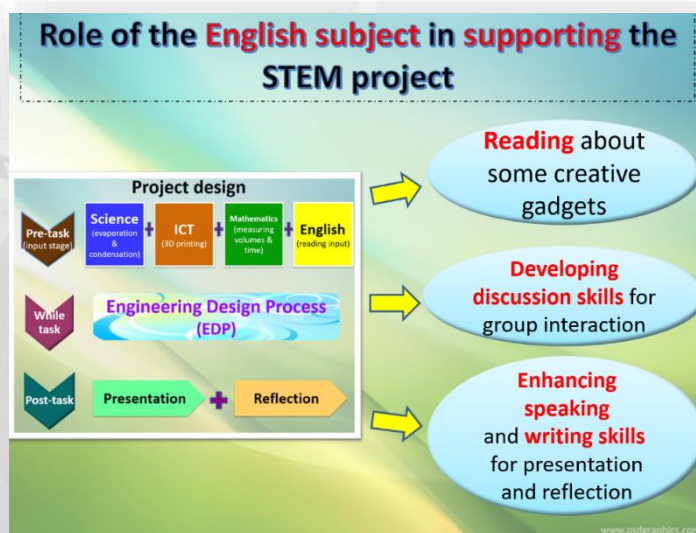
3. **Adopting the Engineering Design Process (EDP) to facilitate planning and implementation of the project**

The EDP is a series of steps engineers follow to come up with solutions to problems. It is one of the strategies adopted by teachers when implementing STEM projects in classroom learning and teaching. The process involves identifying a problem, planning for solutions, creating and testing models, and reflecting on and redesigning the process. Using the EDP, students may actively engage in asking questions, creating and testing the models and reflecting on their trials to make improvements. Through this collective inquiry learning process, students' curiosity about science is translated into critical thinking and a deeper level of understanding, thus enhancing their communication, collaboration, problem solving skills and creativity.
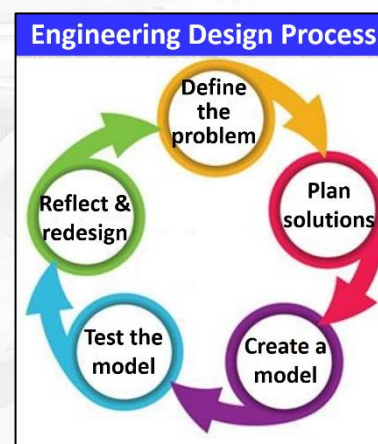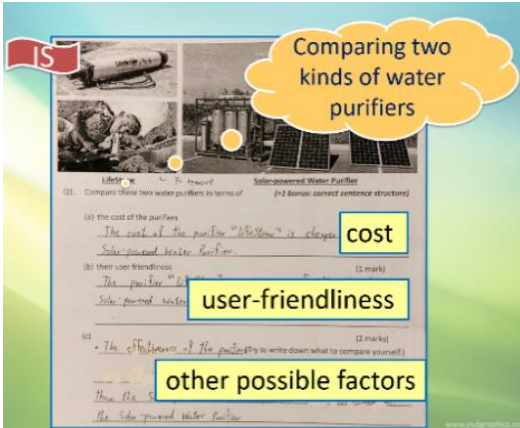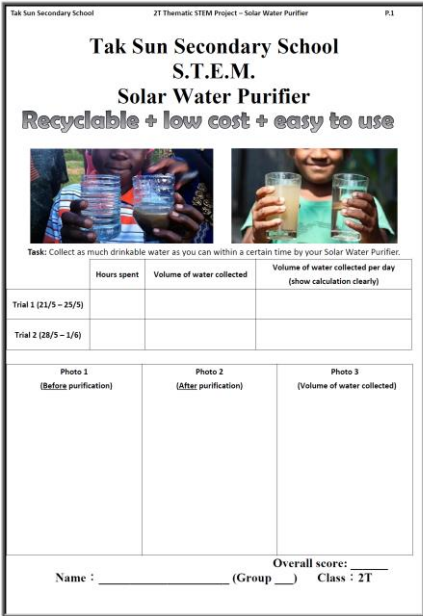
What happened

To raise students' awareness of environmental protection, the importance of clean water to human lives in particular, a STEM project was devised for students to apply and integrate the knowledge and concepts learnt, and solve some real-world problems such as water pollution through designing a water purifier. Curriculum mapping among the themes on condensation and evaporation of Integrated Science, 3D printing and drawing of Information and Communication Technology and creative inventions of English Language was conducted to help increase students' exposure to related themes and language skills.

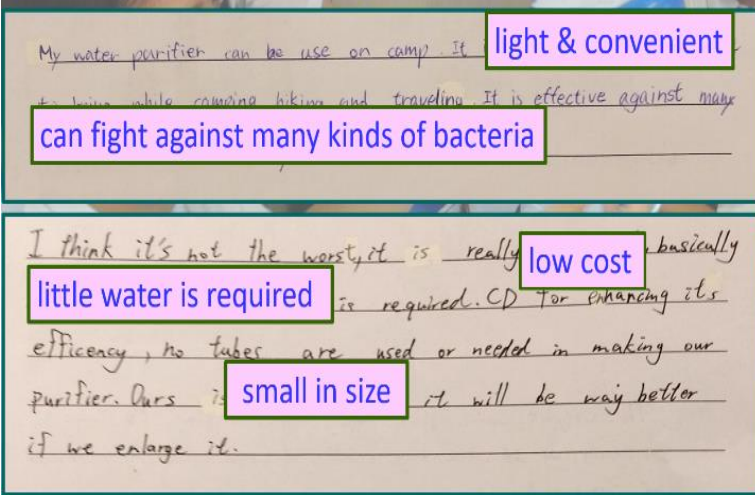**Stages 1 and 2: Define the problem and plan solutions**

Teachers of Integrated Science, Information and Communication Technology and English Language adopted the first two stages of the EDP model to help students define subject-specific problems and plan for solutions, in which process they were able to grasp concepts related to water purification, gain generic skills as well as enhance their language awareness.

Subjects	Problems and coping strategies	Key learning elements
Integrated Science and Information and Communication Technology	**Problem** Students lacked skills to identify the knowledge needed and potential problems when designing the purifier and using 3D printing. **Coping strategies** 1. To develop their problem solving and critical thinking skills, students were asked to make comparison between two kinds of water purifiers based on parameters such as cost, user-friendliness and other possible factors (e.g. effectiveness) 2. Teachers designed a STEM project booklet and guided students to write down the knowledge needed for making the purifier, anticipate problems and propose materials required, as well as the steps of making the product. 	problem solving skills, critical thinking skills

Information and Communication Technology	**Problem** Students lacked a broader understanding about 3D printing technology. **Coping strategies** 1. Students were guided to review the limitations of 3D printing in the school setting and suggest possible solutions. 2. To broaden students' understanding about the wider context of 3D printing, Information and Communication Technology teachers led students to explore how related technology helped solve industrial and real-life problems.	problem solving skills, critical thinking skills
English Language	**Problem** Students were not creative enough throughout the process of problem solving and proposing solutions. **Coping strategies** 1. Students read informative texts to learn about creative gadgets invented to solve daily-life problems. 2. To help consolidate their learning from the reading output, students were required to complete a framework of product review by outlining the features and benefits of the gadgets so as to conceptualise how creative solutions are formulated. This framework would help students work out the features and design of their STEM products at a later stage. <table><tr><td>Name of the product</td><td></td></tr><tr><td>Country of origin, year of creation & inventor</td><td></td></tr><tr><td>Product description: - its design - its purpose - how it works - any special features</td><td></td></tr><tr><td>Benefits</td><td></td></tr><tr><td>Suggestion(s) that can improve the product</td><td></td></tr></table>	creativity, problem solving skills, critical thinking skills

Stage 3: Create a model

With the problem identified and possible solutions proposed, students worked together in groups to create a prototype of the water purifier. While they had to take steps in designing the product in the Integrated Science lessons, they needed to produce the prototype with 3D printers in the Information and Communication Technology lessons.

Subjects	Related activities/tasks	Key learning elements
Integrated Science	Tasks 1. Students needed to consider the materials required to produce the water purifier. During the process, they could think creatively the pros and cons of using different materials. 2. Once the materials were decided, they needed to state clearly the steps of making the product to ensure its quality.	problem solving skills, critical thinking skills, creativity, collaboration, communication
Information and Communication Technology	Tasks 1. Upon confirmation of the materials and production procedures, students proceeded to produce the prototype of the water purifier with 3D printers, making use of their knowledge and skills learnt in the Information and Communication Technology subject. 2. They were also required to list the benefits and strengths of their products in order to enhance its market competitiveness, i.e. to explain to potential customers how their design outperformed those of their counterparts. Therefore, through this activity, students' entrepreneurial spirit was nurtured as they were not only encouraged to look at things from different perspectives, but they also developed a growth mindset to continuously improve their products. 	critical thinking skills, problem solving skills, collaboration, communication

Stages 4 and 5: Test the model and redesign for improvement

Upon production of the prototype, students conducted two cycles of testing of the purifiers to identify areas for improvement in their designs. They also reflected on their learning experiences and presented their products in class.

Subjects	Related activities/tasks	Key learning elements
Integrated Science	<u>Tasks</u> 1. The effectiveness of each water purifier was measured by the amount of clean water collected in a span of five days. 2. After collecting the data, students identified the problems encountered and worked out the improvements needed. For example, some students observed that the dirty water could not reach the collection pipe and bottle for purification, affecting the amount of water purified. As a result, they had to modify their design by adjusting the length of the pipe or improving their techniques in crafting the path of water delivery. Through this process, students' perseverance as well as problem solving skills were nurtured. 	perseverance, problem solving skills, critical thinking skills, collaboration, communication

English Language	Tasks	communication, collaboration, self-reflection
	1. To help students engage in group discussions, reflect on their learning and prepare for a presentation of their products, relevant language items (e.g. language to present the design and features of their products, discussion skills as well as presentation skills) were introduced. 2. Students completed the framework for product review (cf. Stage 1) to outline the product features, problems encountered, proposed solutions, areas to improve and their reflections on the learning process. 3. Each group presented their own water purifier to classmates and received peer feedback.	

Impact

**Student level**

1. **Students' language skills developed through engaging in an authentic STEM project**
   The STEM project provided ample opportunities for students to use English in an authentic context. During the process, students used English actively to read texts, write plans, discuss problems, design the steps through trial and testing, present their ideas and the final product systematically as well as evaluate their learning.

   The post-project questionnaire findings showed that over 80% of the students thought that they could use English to hold discussions in groups and over 97% of the students reported that they could use English to write the steps of making the water purifier. Over 85% of the students reflected that they could use English actively for discussion and presenting ideas. The data revealed that students have broadened their use of English to serve different academic purposes authentically through engaging in the STEM project.
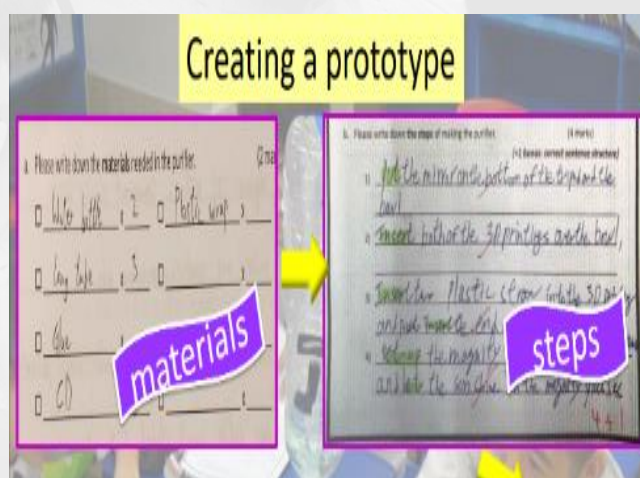
Students discussed the materials used and steps
required for making the product.

2. **21st century skills and positive values and attitudes cultivated**

Students were actively engaged in a series of problem solving tasks while making the STEM product. During the process, students were able to do systematic planning; apply literacy skills to construct knowledge; identify problems; find possible and creative solutions through trial and error and evaluate their own learning.
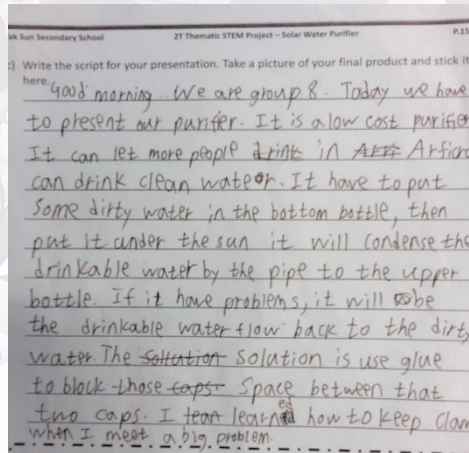
Student work showing the design and features of the water purifier

Over 90% of the students indicated in the post-project questionnaire that they learnt how to collaborate better with their classmates and think more critically when making the product. Over 80% of the students indicated that their creativity was nurtured while making the water purifier. In terms of the development of positive values and attitudes, over 91% of the students agreed that they learnt to be persistent and not to give up easily whereas about 94% of the students reflected that they learnt how to respect other people when working collaboratively with classmates. These encouraging findings indicated that students were equipped with the lifelong learning skills needed and have developed positive values and attitudes for coping with upcoming challenges and excelling in their future lives.

3. **Students' learning motivation developed through cultivating a sense of ownership of learning**

   Teachers observed that students were highly engaged in the project as they were given autonomy to generate and organise ideas, explore different possibilities and use their imagination to create the product to solve problems. A stress-free environment provided opportunities for students to share ideas and give each other constructive feedback without anxiety and pressure. This not only helped deepen students' understanding of the relevant topics, but also developed their passion for exploration of new knowledge in the course of learning.

   Students have gained more confidence and courage to go beyond their comfort zone, apply the knowledge and skills learnt through trial and error, and accept the diversity among themselves. This helped prepare them as lifelong learners for their future studies and career.
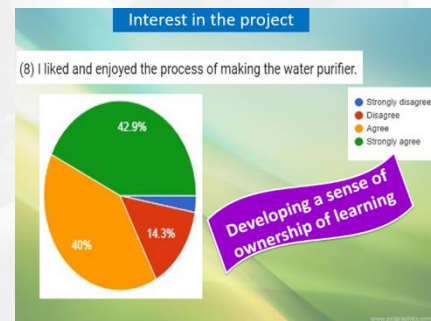
   Students participated actively in the group work to discuss with peers how to design the product in a cost-effective and creative manner.

Teacher level

1. **Infusing language elements into STEM education**

   To help students make connection between their learning in different subjects for the STEM activities, curriculum mapping was conducted to enhance cross-curricular collaboration. At the pre-project stage, some multimodal texts on creative gadgets were incorporated into the modular design to arouse students' interest in the topic and stimulate their creativity. At the while-project stage, to support students to communicate and collaborate in the STEM project, some key discussion skills were taught to help students talk about the aim, design and function of the STEM product, problems encountered and possible solutions. At the post-project stage, students introduced their final products to their classmates collaboratively and applied relevant language skills for an effective presentation. The English Language teachers used a framework for product review to guide students to present systematically. Through such systematic planning and mapping, students could apply their literacy skills in a real-life situation with the knowledge and concepts acquired in different KLAs.

2. **Cross-subject collaboration enhanced**

   The STEM project provided a platform for inter-departmental collaboration among teachers of Integrated Science, Information and Communication Technology and English Language.

The English Language teachers learnt how to develop students' literacy skills through integrating English Language elements into the STEM project, whereas the content subject teachers have become more aware of utilising English to support students in the construction of knowledge and concepts and applying them in real-life situations.

3. **Teachers assumed new roles from being an instructor to a facilitator**

In the past, both content subject and English Language teachers played the role of instructors and content providers in learning and teaching. Through this STEM project, they have experienced a conceptual change from "delivering learning" to "enabling learning to happen". Teachers became facilitators and mentors, guiding students to construct and apply the knowledge and skills through a series of problem solving tasks during the EDP. As facilitators, teachers created a stress-free and authentic learning environment to encourage students' active participation, promote mutual understanding and learning through trial and error and cultivate shared responsibility. Through engaging students in the experiential learning process, teachers were able to equip them with a solid foundation of generic skills such as critical thinking, problem solving, collaboration and creativity.

Facilitating factors

1. **Clear school development goal and implementation plan**

The school has a strong dedication to implementing Language across the Curriculum and Reading across the Curriculum in the past years to develop students' ability to learn and use English confidently in different KLAs. To further stretch students' ability and equip them with 21st century skills, the principal and vice-principal showed strong support to the project by giving autonomy to the panel heads of different subjects to adapt the school curriculum. In addition, they created space for the implementation of the project through rescheduling the timetable of Information and Communication Technology and Integrated Science. This allowed teachers of different KLAs to try out different innovative strategies to increase students' language exposure both inside and outside the classroom.

2. **Cultivation of a learning culture among the teacher team**

Teachers of different subjects in the project were willing to go beyond their comfort zone to try out innovative ideas and explore a wide repertoire of strategies in the EDP model to broaden students' knowledge base and experiences beyond classroom learning. In addition, they developed an intra-school learning community to share the difficulties encountered, exchange ideas and experiences and explore effective ways to maximise students' opportunities to use English to learn the subject knowledge and skills.

3. **Strategic and systematic planning**

Knowing the fact that it was the first time the school has integrated English into STEM education, the officer and teachers made early planning in the first term by researching on the topic, mapping the curricula of different KLAs and exploring innovative and practical strategies such as adopting the EDP model. This certainly helped smoothen the implementation of the project.

Conclusion

The concerted effort made by language teachers and content subject teachers of different KLAs created a good opportunity to broaden students' knowledge, skills and strategies and provide meaningful learning experiences for them to apply their learning in an integrative manner, thus preparing them for future challenges of work and study.

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Tak Sun Secondary School
Shirley LEUNG (Language Support Officer)

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