Education Bureau
Curriculum Support Division
School-based Curriculum Development (Secondary) Section
School Sharing in 2023/24

Enhancing Values Education through Science Projects on “Balance of Oxygen and Carbon Dioxide in Nature” and “Hydroelectric Power”

Belilios Public School
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27 June 2024

Belilios Public School

- **Establishment of Government Central School for Girls (1890)**
- **Renamed as Belilios Public School (1893)**
- **School motto ‘Climb High See Wide’**
- **Vision:**
  1) To enable every student to acquire a whole-person education
  (In pursuit of knowledge, skills and value);
  2) To nurture our students as future leaders
- **Strong sisterhood relationship**
- **Keen on learning Science**

School Motto

School Vision

It is our vision to enable each and every student to acquire a whole-person education whereby she grows and excels all through her pursuit of knowledge, skills and values. We pledge to nurture our students as future leaders who are competent to face challenges and committed to the betterment of their local, national and global communities.

Pedagogical Design

Topic 1: "The balance of oxygen and carbon dioxide in Nature" and Value Education

Mr. Ma Ho-yee

Students should learn	Students should be able to	Suggested learning and teaching activities
7.5 Balance of carbon dioxide and oxygen in Nature	• Understand that there is a natural balance of carbon dioxide and oxygen in the atmosphere • Recognise some human activities are disrupting the balance of carbon dioxide in Nature • State carbon dioxide as one of the greenhouse gases • Describe the effects of the increasing amount of carbon dioxide in the atmosphere on the environment	• Watch a video clip about the relationship between the trend of carbon dioxide content in the atmosphere and global warming, and the climate change that result • Design a poster or make a video clip to promote low carbon living • Visit the Zero Carbon Building

尊重他人

同理心

承擔精神

Science knowledge

Value education

- Engagement and Relevance

Incorporating role-playing activities, discussions on ethical considerations, and action planning sessions makes the content more engaging and relevant to students.

- Critical Thinking and Problem-Solving Skills

The interactive nature of the lesson plan fosters critical thinking and problem-solving skills among students.

- Promoting Environmental Awareness and Responsibility

Highlight the impact of human activities on the environment and encourage discussions on ethical responsibilities.

Topic 1: "The balance of oxygen and carbon dioxide in Nature" and Value Education

Learning Objectives

- To help students recognize the interdependence of living organisms and the environment. （知）
- To encourage students to reflect on their ethical responsibilities towards the environment. （情）
- To inspire students to take positive actions to address environmental challenges. （行）

Lesson Flow

- Pre-lesson Task
- Introduction
- Role play Activity I
- Role play Activity II
- Reflection and Discussion

Pre-lesson Task - Preparation of roles

Some examples are given to students

Students need to prepare their own role profiles before the lesson

Part B: Preparation of your role

Describe yourself by following information. Examples Role Description are given below:

Group:	Plant
Species:	Tree
Name:	Woody
Age:	Over a hundred years' old
Appearance:	Tall and majestic with branches reaching towards the sky, adorned with lush green leaves
Personality:	Patient, nurturing, and resilient
Role in the ecosystem:	I provide oxygen through photosynthesis and offering shelter to various animals in your branches. I have deep roots that help absorb nutrients from the soil, contributing to the overall health of the ecosystem.
Unique ability:	I can sense changes in the environment and communicate with other plants, sharing knowledge about the importance of oxygen production and the impact of human activities on the ecosystem.

Group:	Animal
Species:	Rabbit
Name:	Bella
Age:	Five years old
Appearance:	Soft fur in shades of brown and white, with long ears and a fluffy tail
Personality:	Agile, curious, and social
Role in the ecosystem:	I rely on plants for food and oxygen. I help disperse seeds as I hop around, contributing to the growth and diversity of plant life in the valley. I also interact with other animals, forming connections and engaging in cooperative behaviors.
Unique ability:	I have a keen sense of smell and can communicate with other animals, sharing information about the availability of food sources and potential dangers

Group:	Human
Species:	Human
Name:	Sarah
Age:	Late thirties
Appearance:	Professionally dressed with a laptop and urban development plans in hand
Personality:	Visionary, analytical, and community-oriented
Role in the ecosystem:	I am a dedicated urban planner with a focus on sustainable development and green infrastructure. I work tirelessly to integrate nature-friendly solutions into urban projects to minimize environmental impact. I engage with local communities to promote inclusive and livable urban spaces that prioritize both human well-being and ecological health.
Unique ability:	I possess strong research skills and expertise in sustainable urban planning practices. I effectively communicates the benefits of balanced development that considers ecological

Pre-lesson Task - Preparation of roles

Students design their own characters/ value

INFORMATION

Group: Human

Species: (Human) Asian, scientist environmental

Name: Nora

Age: 22 years old

Appearance: Curly hair in a gown, wearing safety goggles

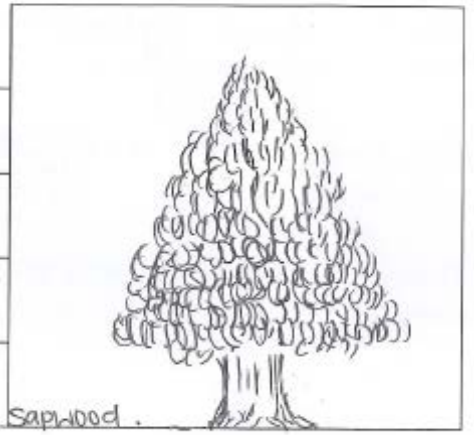
Personality: Curious, passionate and hard-working

Role in the ecosystem: Collecting and analyzing data on the quality of the water, air, and soil. Giving out suitable ways to solve the problem in the ecosystem caused by evil human activities. Developing policies to promote sustainability and protect the environment

Unique ability: Be patient when doing and designing experiments again and again. Thinking method to solve problem in a quick speed and observing phenomina in strange the details. She can convince people in speech in a short time and promote the importance of the extinction of living things.

Suggestion:
The teacher could collect this worksheet before the activity.

INFORMATION



Group: Plant

Species: Pine tree

Name: KC

Age: 137

Appearance: Dark-coloured, with pale and thick sapwood.

Personality: Patient, optimistic.

Role in the ecosystem: To provide shelter and food for local wildlife. I am extremely important to keep the ecosystem balanced and in-check. The dense foliage works to provide protection from sun, inclement weather and predators that pose a threat to local wildlife populations. Also, I am one of the best aids against soil erosion, my roots work to hold the soil in place.

Shows science knowledge

Unique ability: I am known as the symbol of life. I have the unique ability to withstand harsh winds and up to subzero temperatures. My branches are flexible, which allows me to handle a heavy snowfall without the branches snapping off.

Lesson Flow

The students are divided into different roles before the lesson

Pre-lesson Task

Introduction

Role play Activity I

Role play Activity II

Reflection and Discussion

Pre-lesson Task
Part A: Pre-lesson questions

Part A: Pre-lesson question

1. How is the balance of carbon dioxide and oxygen in Nature maintained?

Plants take in carbon dioxide and give out oxygen with (a) photosynthesis.
Plants and animals take in oxygen and give out carbon dioxide with (b) respiration.
Plants then take in carbon dioxide again. Carbon dioxide and oxygen in the atmosphere are recycled.

2. How do human activities impact the environment, and what are some examples of these impacts?

Human activities such as burning (a) fossil fuels and (b) cutting down trees (deforestation) can lead to increase carbon dioxide which is a greenhouse gas in the atmosphere. The increasing amount of carbon dioxide in the atmosphere enhances the greenhouse effect and leads to (c) global warming.

3. What are the harmful effects of global warming?

Melting of ice at Polar Regions: Average sea levels rise, causing (a) flooding in low-lying coastal areas (b) Climate change: more frequent storms, droughts and poor crop growth and food shortage

4. Why is ethical decision-making important in the context of environmental conservation efforts?

(a) Ethical decision-making is important in environmental conservation because it involves considering the well-being of all living organisms and the long-term sustainability of ecosystems. Making ethical choices involves promoting fairness, justice, and environmental stewardship to ensure the protection of biodiversity and the preservation of natural resources for future generations.

The teacher recapped the science concepts and checked answers with students.

Lesson Flow

The students are divided into different roles before the lesson

Pre-lesson Task

Introduction

Recap the science concepts
Introduce the background information

Role play Activity I

Role play Activity II

Reflection and Discussion

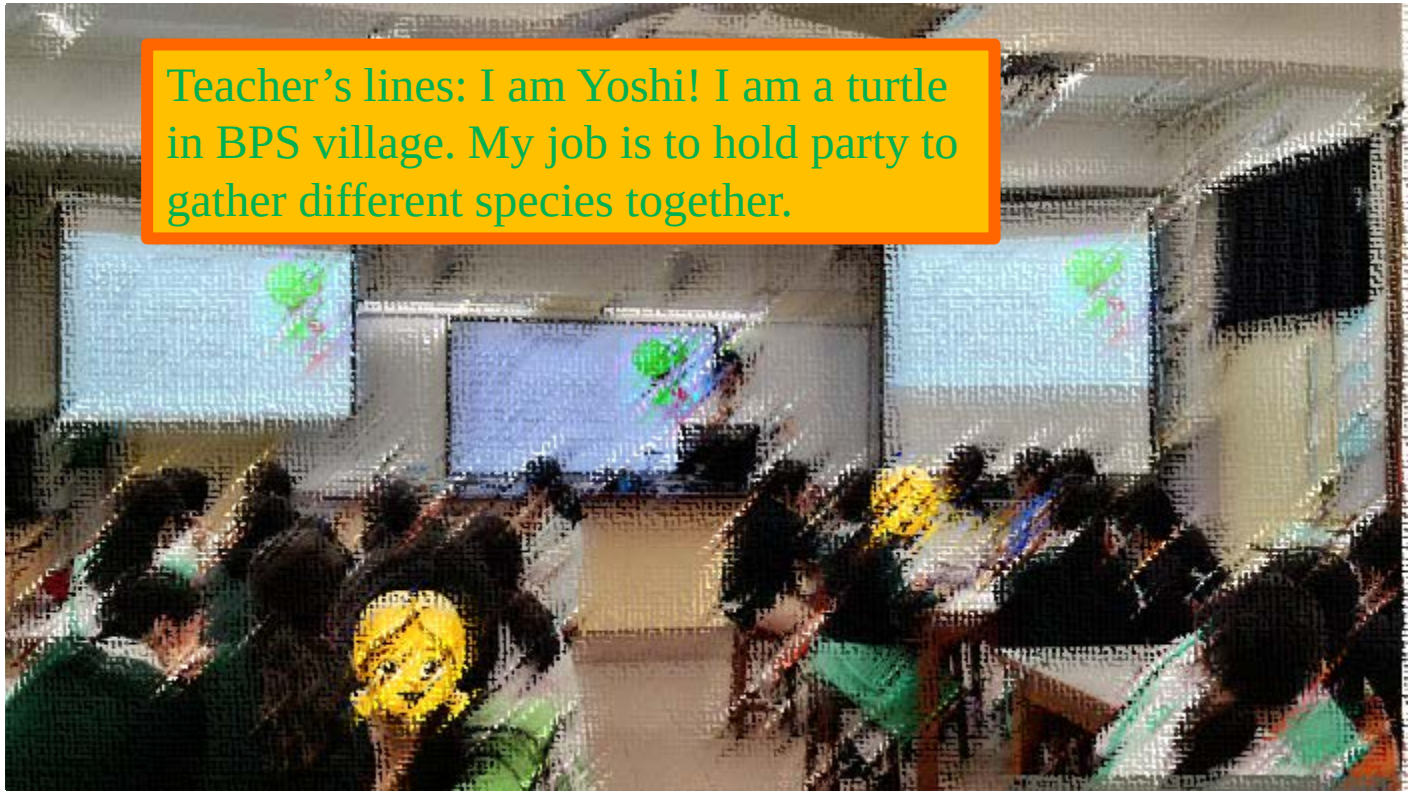
Introduction

Example of Teachers' line:
Every step you take in BPS Valley is like adding to a big, beautiful painting of nature. Today, we'll become animals, plants, and humans in our village. Have fun exploring, working together, and taking care of our special BPS Valley. Let your imagination lead the way on this exciting journey!

The teacher asks students to close their eyes and read lines in order to help them get into their role.

Introduction

Information



Teacher's lines: I am Yoshi! I am a turtle in BPS village. My job is to hold party to gather different species together.

Group: Animal
Species: Turtle
Name: Yoshi

The teacher's role

Appearance: A majestic turtle with a shell adorned with intricate patterns, symbolizing wisdom and guidance.
Personality: Patient, wise, and nurturing.
Role in the BPS Village: I serves as the mediator and facilitator in the village
Unique Ability: I can create a magical aura that enhances communication among the roles in the village.

The teacher created his own role and acted the role to help students act their role.

Role play Activity I (Get familiar with their role)

Role Play Activity 1: Enchanted Haven Crossover: Uniting Beings of BPS Valley

BPS Valley is a magical village where humans, animals, and plants all live together happily. BPS village surrounded by hills and forests, where nature and creatures coexist peacefully.

Task: Let's make new friends! Introduce yourself. Ask your new friend questions. You goal is to describe your new friends' characters, role in ecology, unique ability and draw the image of him/ her.

Goal: The goal of this activity is for the diverse inhabitants of BPS Valley to forge connections, build understanding, and promote harmony within the community.

Draw your new friends' appearance. Describe your new friends' personality/ role in ecosystem/ unique ability/ anything you think is important in the space provided.

This task helped students get familiar with their roles.

The teacher prepared the questions to guide students to complete their task effectively.

Enchanted Haven Crossover: Uniting Beings of BPS Valley

1. **What is your role in the ecosystem? Can you share a little bit about yourself and what you represent in our group?**
2. **How does your role rely on or interact with other roles in the ecosystem? - Can you describe any challenges or benefits of working alongside other roles in our group?**
3. **Have you faced any challenges or conflicts in interacting with other roles in the ecosystem? How did you resolve them? - What are some innovative solutions we can implement to enhance cooperation and harmony within our group?**
4. **How can we develop a better understanding of each other's perspectives and experiences within the ecosystem? - What can we do to show empathy towards each other's needs and challenges as we work together in our roles?**

Role play Activity I: (Get familiar with their roles)

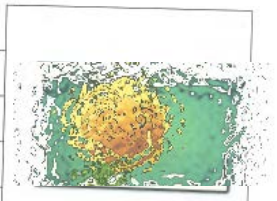
INFORMATION

Group: plant

Species: Sun flower

Name: Solara

Age: 3 years old

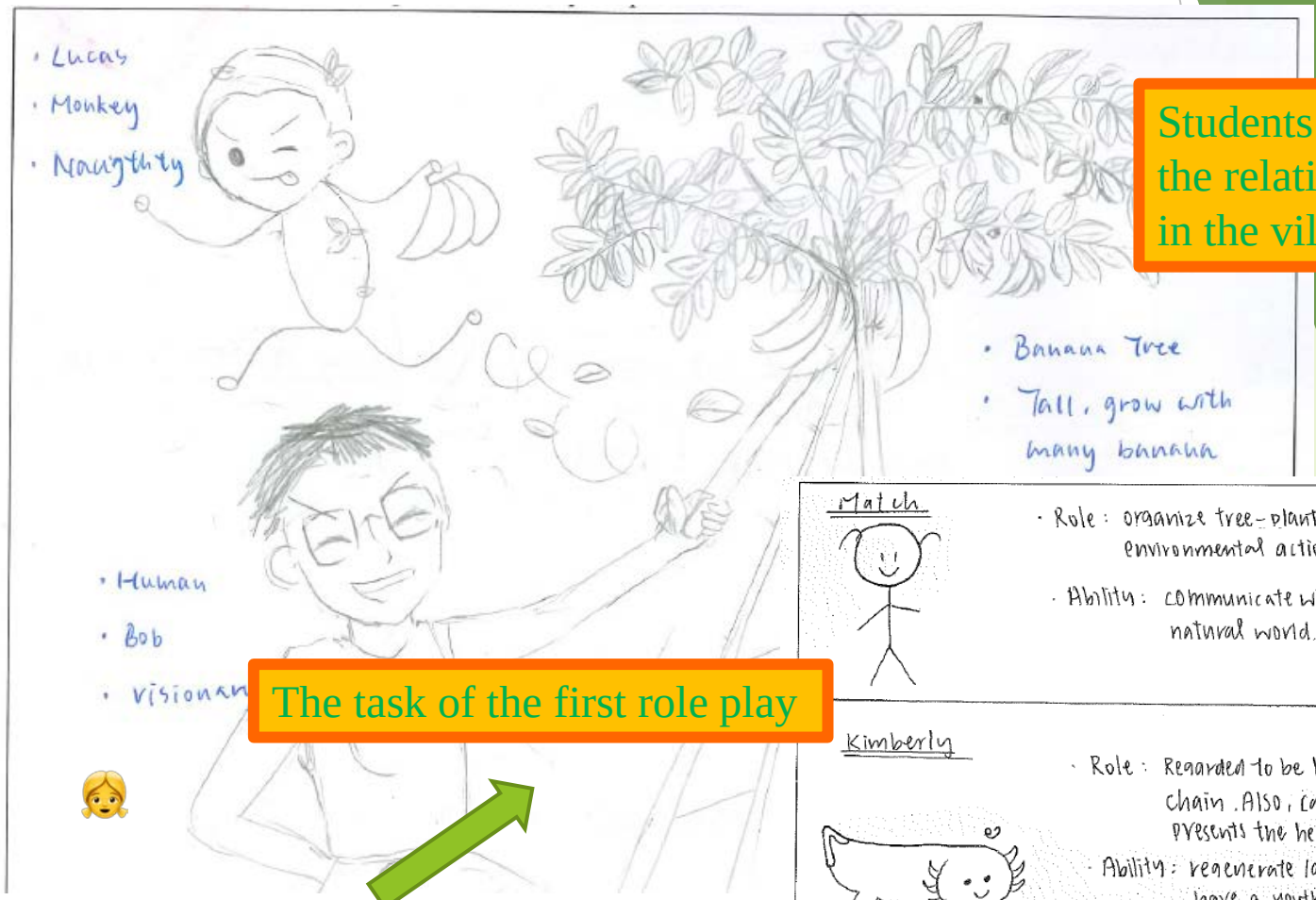


Appearance: have vibrant petal with a radiant golden-yellow colour

Personality: lively, charismatic, full of warmth and optimism

Role in the ecosystem: I play a vital role in the ecosystem as a primary producer. Through the process of photosynthesis, I absorbed change sunlight into energy, and convert carbon dioxide I breathe in into oxygen for human and animals. My tall stature and broad leaves can offer protection and moistur to surrounding plants and insects.

Unique ability: When I absorb a certain amount of sunlight, I can channel my creative energy into producing stunning patterns on my petals. It not only let human to know that they must protect the beautiful plants on Earth, but also attracting pollinators, like butterflies and bees, so that the biodiversity of overall ecosystem



Students are able to state the relationship of each role in the village

Match

- Role: Organize tree-planting and recycling activities to spur environmental actions and protect the environment.
- Ability: communicate with the animals and plants of the natural world..

Kimberly

- Role: Regarded to be both predators and prey in the food chain. Also, can be served as an indicator that presents the health of the water body.
- Ability: regenerate lost body parts have a youthful look

Susan

- Role: Volunteer in various environmental activities Deeply recognize the importance of environmental protection.
- Ability: communicate effectively with other people.

Pre-lesson task

The task of the first role play

Exchange the information of role

Lesson Flow

Students are divided into different roles before the lesson

Pre-lesson Task

Introduction

Recap the science concepts
Introduce the background information

Role play Activity I

Warm-up activity
Get familiar to the roles

Role play Activity II

Reflection and Discussion

Role play Activity II (Challenge Round)

Promotes empathy and a deeper understanding of the interconnectedness of life on Earth.
By incorporating this role-play scenario into the lesson, we can create a dynamic and interactive learning experience that not only reinforces scientific concepts but also fosters values such as cooperation, empathy, and environmental stewardship in students.

Role Play Activity 2: Electric Evolution: Navigating Change in Blossom Valley

Instructions: Imagine that a power plant has been established in the BPS Village recently. As a member of your role group (Plants, Animal and Humans) reflect on the following questions and discuss with your group members.

1. How do you feel about the establishment of the power plant in BPS Village?
2. How do you think this change will impact you and the overall ecosystem of BPS Village?
3. What concerns or challenges do you anticipate as a result of the power plant's presence in the village?
4. What opportunities or benefits do you see arising from the establishment of the power plant?
5. How can your group adapt to this change and continue to fulfill its role in maintaining the ecosystem balance and well-being of BPS Village?

*6. What actions can your group take to address any negative impacts of the power plant and promote sustainable living in the village?

*7. How can different role groups collaborate to address environmental challenges and foster a healthy coexistence with the power plant?

The teacher prepared the questions to guide Students to complete their task effectively.

Role play Activity II (Challenge Round)

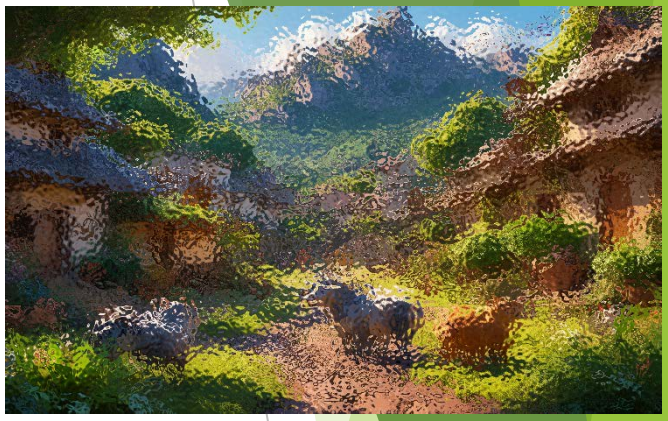
Feeling of your friends:

Impact of your friends:

Challenges/ benefits of your friends:

How can different role groups collaborate to address environmental challenges and foster a healthy coexistence with the power plant?

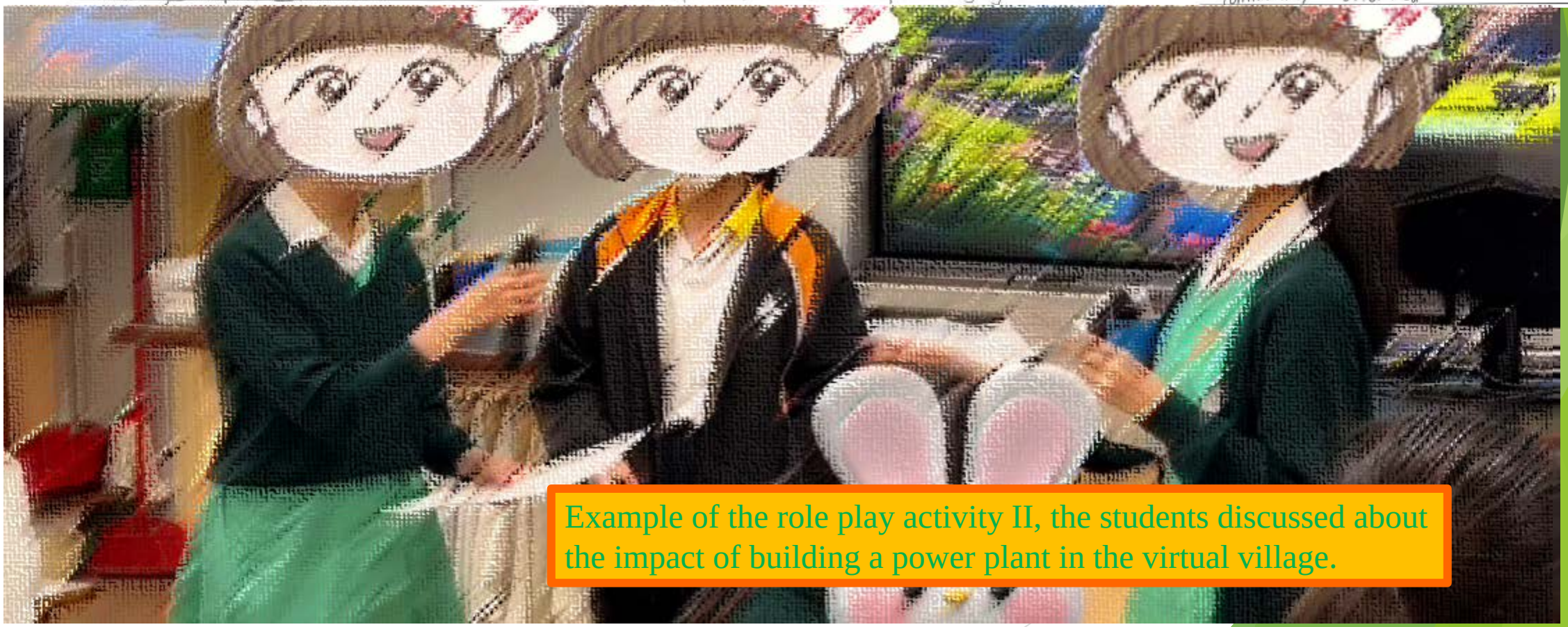
Change of the BPS village



Power plants established

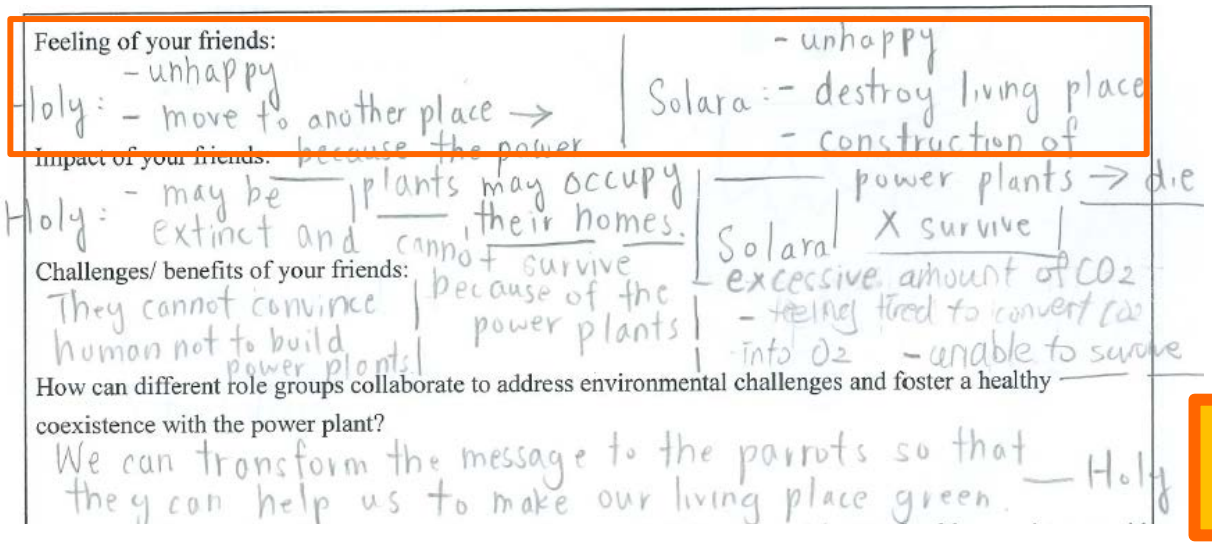
Role play Activity II (Challenge Round)

Group:	Animal	Plant , 4	4
Species:	Earthworm	Tree	Human
Name:	Ruby	Venus	Esther
Age:	1 month	30	mid-twenties
Appearance:	Thin and smooth-skinned	tall and strong, hard to be cut off	urban development plans in hand
Personality:	Nive , helpful and pessimistic	kind , positive , careful , wants to protect everything	community-oriented

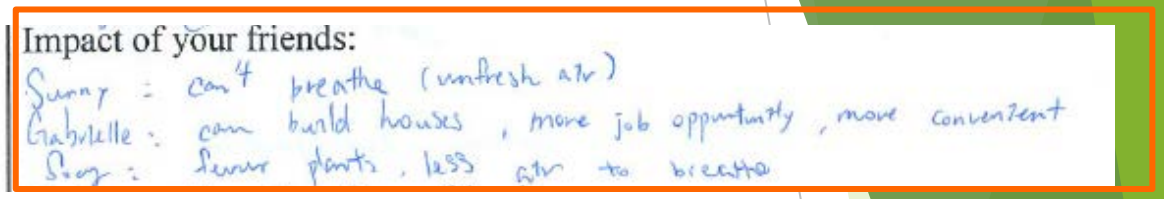


Example of the role play activity II, the students discussed about the impact of building a power plant in the virtual village.

Role play Activity II (Challenge Round)

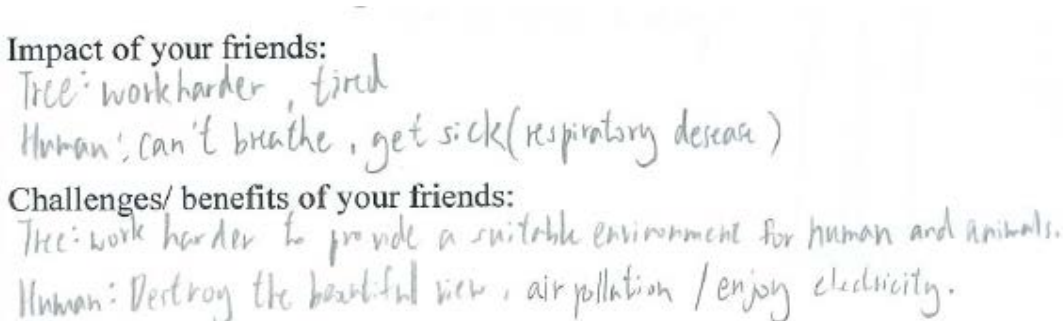


Feeling of your friends:
Holy: - unhappy - move to another place → because the power plants may occupy their homes.
Solara: - unhappy - destroy living place - construction of power plants → die
Impact of your friends:
Holy: - may be extinct and cannot survive because of the power plants
Solara: X survive excessive amount of CO_2 - feeling tired to convert CO_2 into O_2 - unable to survive
Challenges/ benefits of your friends:
They cannot convince human not to build power plants!
How can different role groups collaborate to address environmental challenges and foster a healthy coexistence with the power plant?
We can transform the message to the parrots so that they can help us to make our living place green. — Holy

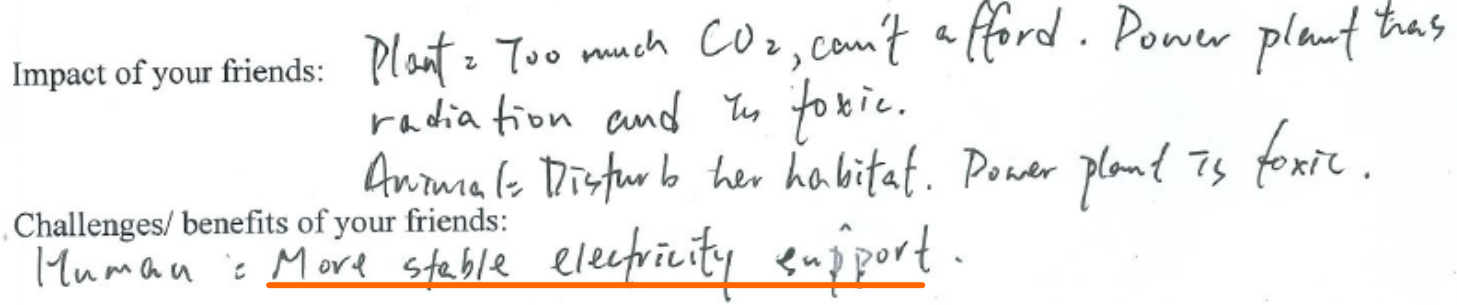


Impact of your friends:
Sunny : can't breathe (unfresh air)
Gabrielle : can build houses, more job opportunity, more convenient
Sing : fewer plants, less air to breathe

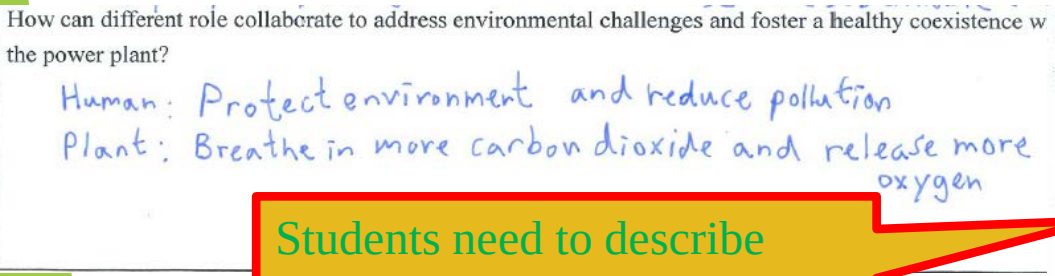
Example of the role play activity II, the students discussed about the impact of building a power plant in the virtual village.



Impact of your friends:
Tree: work harder, tired
Human: can't breathe, get sick(respiratory desease)
Challenges/ benefits of your friends:
Tree: work harder to provide a suitable environment for human and animals.
Human: Destroy the beautiful view, air pollution / enjoy electricity.

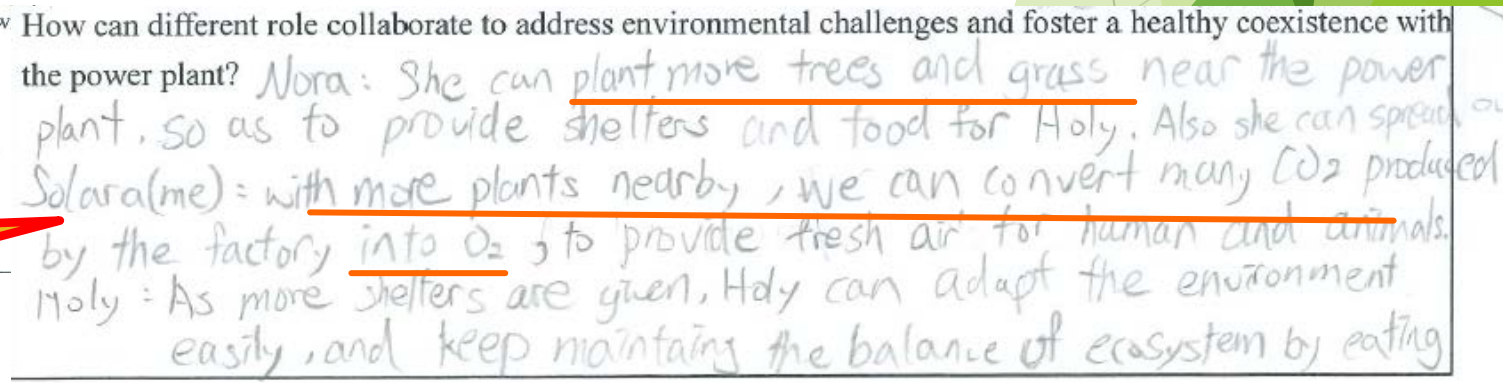


Impact of your friends: Plant: Too much CO_2, can't afford. Power plant has radiation and is toxic.
Animal: Disturb her habitat. Power plant is toxic.
Challenges/ benefits of your friends:
Human: More stable electricity support.



How can different role collaborate to address environmental challenges and foster a healthy coexistence w the power plant?
Human: Protect environment and reduce pollution
Plant: Breathe in more carbon dioxide and release more oxygen

Students need to describe more about the impact of global warming



How can different role collaborate to address environmental challenges and foster a healthy coexistence with the power plant?
Nora: She can plant more trees and grass near the power plant, so as to provide shelters and food for Holy. Also she can spread ou
Solara(me): with more plants nearby, we can convert many CO_2 produced by the factory into O_2, to provide fresh air for human and animals.
Holy: As more shelters are given, Holy can adapt the environment easily, and keep maintaing the balance of ecosystem by eating

Lesson Flow

The students are divided into different roles before the lesson

Pre-lesson Task

Introduction

Recap the science concepts
Introduce the background information

Role play Activity I

Warm-up activity
Get familiar to the roles

Role play Activity II

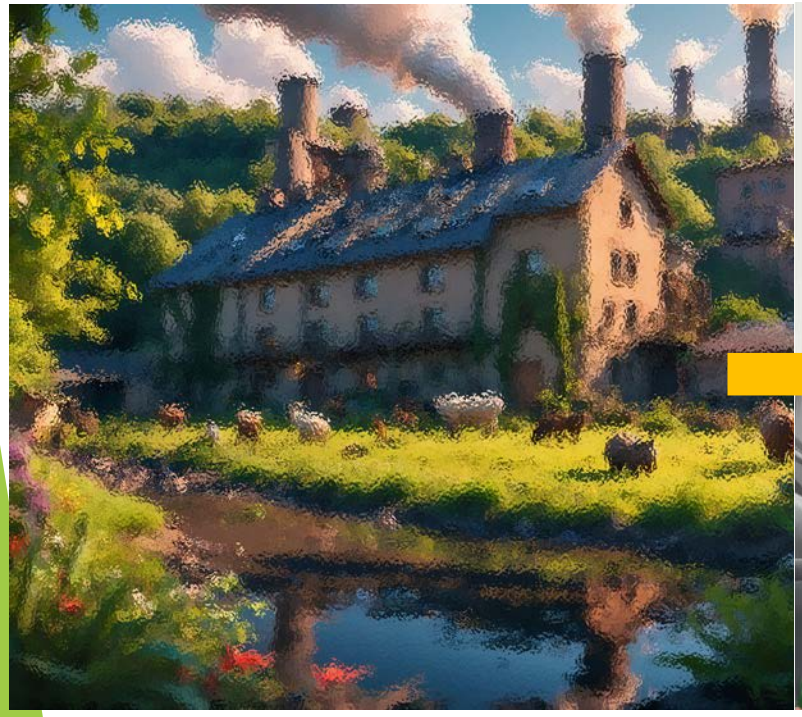
Introduce a challenge
sharing of feelings
Find the solutions

Reflection and Discussion

Summarize key learnings
from the role-play

Reflection and Discussion

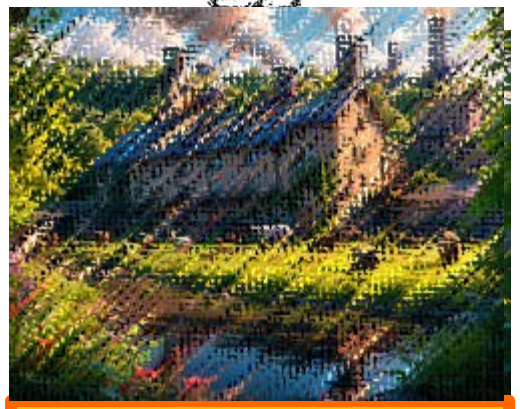
The teacher leads a debriefing session where groups reflected on their experiences. Discuss the importance of cooperation, empathy, and responsible actions in preserving the environment.



BPS Village (Virtual)

BPS (Reality)

Hong Kong (Reality)



BPS Village (Virtual)

Reflection and Discussion (Virtual Village)

What did you learn from the BPS village?

- Think about how the learnings from the role-play activity can be applied to real-life situations.
- Consider ways you can contribute to creating a more sustainable and harmonious environment in their community.

Reflection and Discussion (Apply to reality)

As a citizen, what we can do to reduce green house gas?

Low-carbon living refers to a lifestyle that emits less carbon dioxide.

BPS (Reality)

Reflection and Discussion (Apply to reality)

Ethical Reflection

Teacher leads a class discussion on the ethical considerations related to environmental issues.

Ask students to reflect on questions such as: What ethical responsibilities do we have towards the environment and future generations? How do our actions impact the planet and other living beings?

Assessment: Reflective Essay

Following our engaging role play activities in the BPS Village, write a reflective essay on your experiences and learnings. Share your insights, impressions, challenges faced, and how working with your peers and exploring different roles contributed to your understanding. Express your thoughts on how the discussions and perspectives shared during the activities impacted your views on teamwork and cooperation. Conclude with building up positive values after the activity.

Some suggested content in the essay

1. Introduction: Briefly introduce the activity and its purpose.
2. What did you learn from the role-play activities in the BPS Village?
3. Which aspect of the activities left the most significant impression on you and why?
4. How did working with your peers and exploring different roles contribute to your understanding?
5. Reflect on any challenges faced during the activities and how you overcame them.
6. How did the discussions and perspectives shared during the activities change your views or deepen your understanding of teamwork and cooperation?
7. Conclusion: Summarize your key learnings and insights from the BPS Village role play activities.

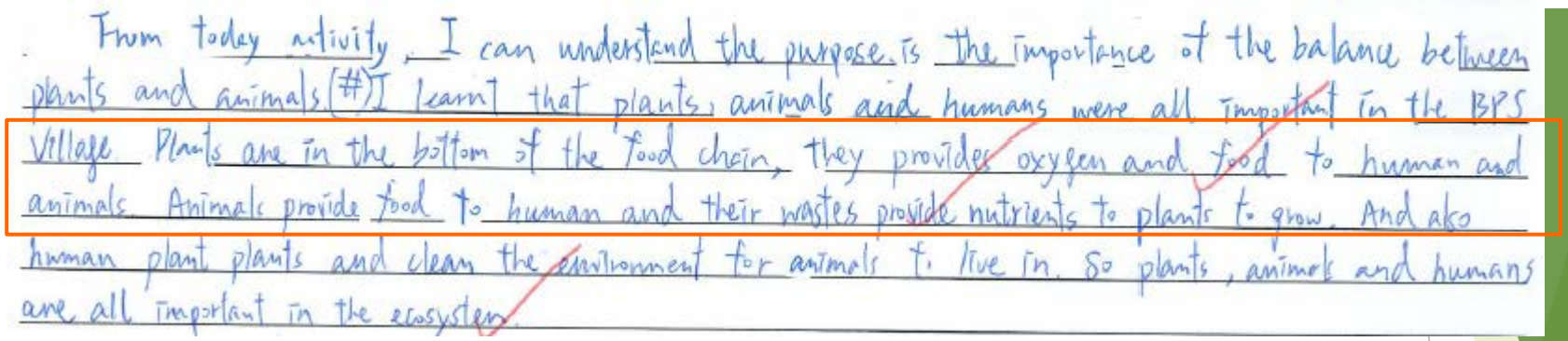
Guidance for students to think

Assessment: Reflective Essay

Students' Work

The learning objective

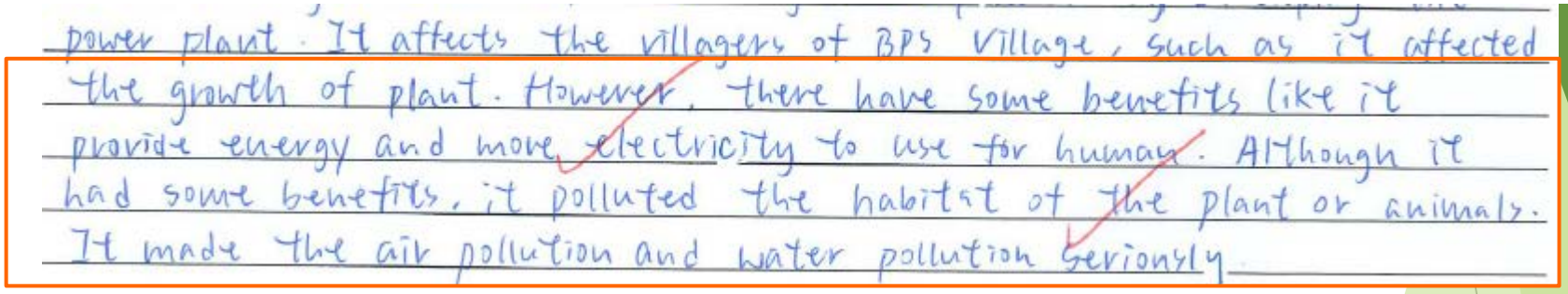
To help students recognize the interdependence of living organisms and the environment.（知）



From today activity, I can understand the purpose is the importance of the balance between plants and animals (#) I learn that plants, animals and humans were all important in the BPS Village. Plants are in the bottom of the food chain, they provide oxygen and food to human and animals. Animals provide food to human and their wastes provide nutrients to plants to grow. And also human plant plants and clean the environment for animals to live in. So plants, animals and humans are all important in the ecosystem.

The learning objective

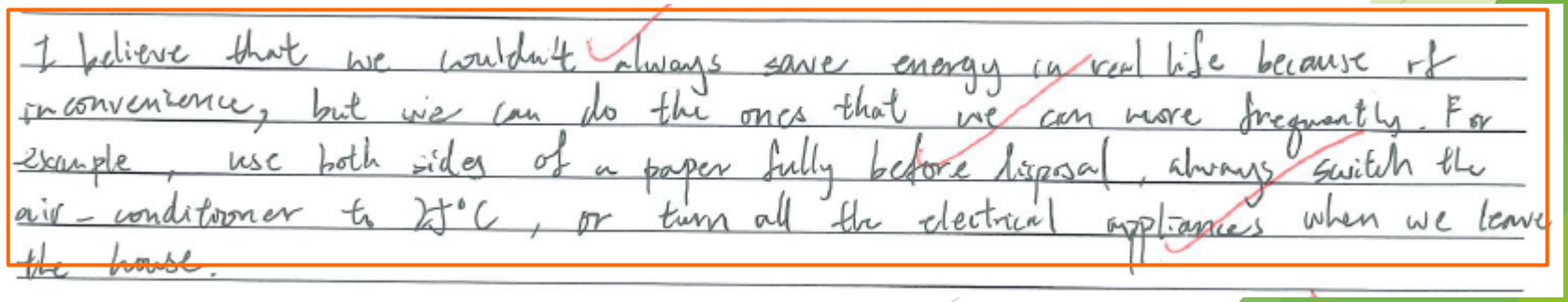
To encourage students to reflect on their ethical responsibilities towards the environment.（情）



power plant. It affects the villagers of BPS Village, such as it affected the growth of plant. However, there have some benefits like it provide energy and more electricity to use for humay. Although it had some benefits, it polluted the habitat of the plant or animals. It made the air pollution and water pollution Gerionsly

The learning objective

To inspire students to take positive actions to address environmental challenges.（行）



I believe that we couldn't always save energy in real life because of inconvenience, but we can do the ones that we can more frequently. For example, use both sides of a paper fully before disposal, always switch the air-conditioner to 25°C, or turn all the electrical appliances when we leave the house.

Assessment: Reflective Essay - Extended Learning

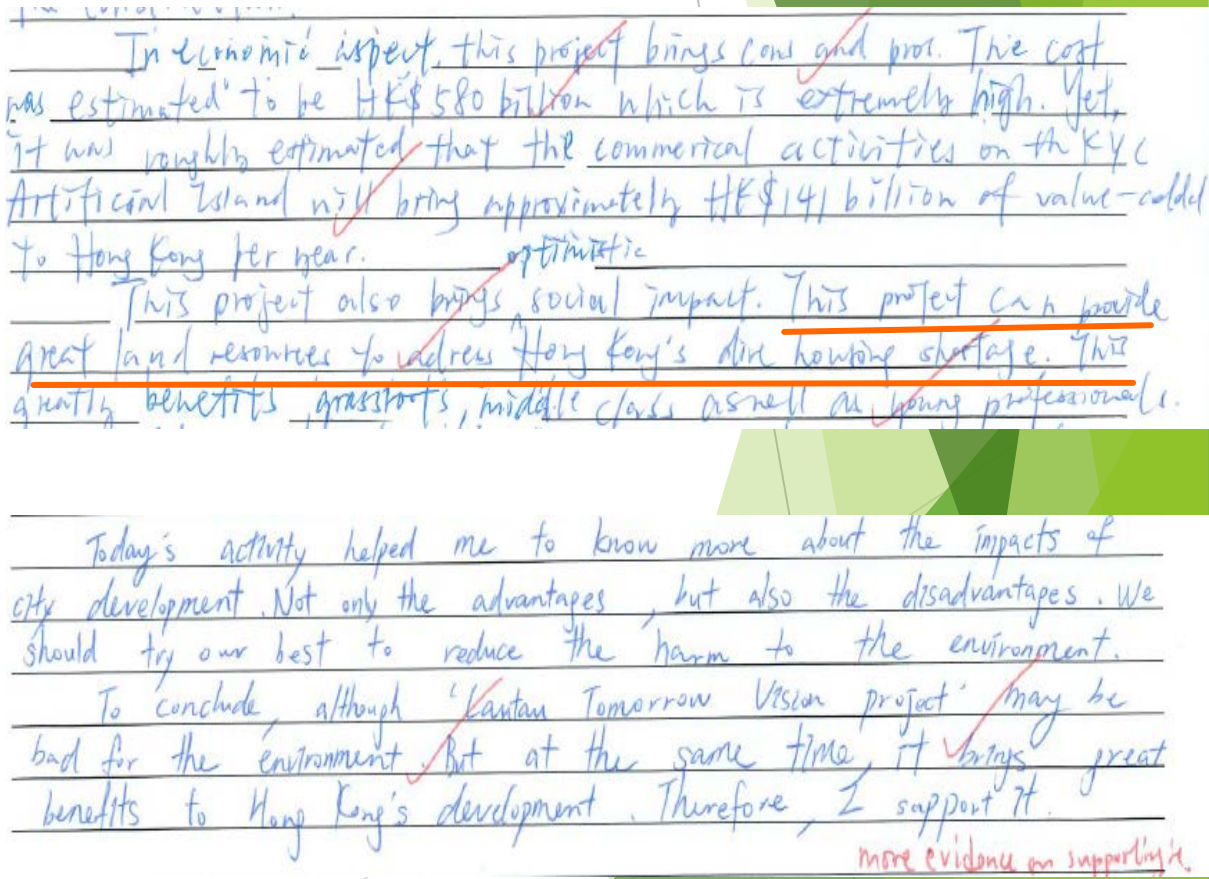
Following our engaging role-play activities in the BPS Village, we found that Hong Kong is facing similar situation. In light of our discussions today regarding the Lantau Tomorrow Vision project in Hong Kong, You are going to write an essay to express your opinions on whether you support or oppose this initiative in your assignment. Please reflect on the project's potential impact on Hong Kong's environment, economy, and society, and share your personal stance with supporting reasons. Provide suggestions or alternative perspectives on how the project could be enhanced or consider proposing better alternatives if you do not fully support it.

Some suggested content in the essay

1. Introduction: Provide an overview of the Lantau Tomorrow Vision project in Hong Kong and its potential impact.
2. Discuss the pros and cons of the Lantau Tomorrow Vision project from your perspective.
3. Analyze the potential benefits and drawbacks of the project for Hong Kong's environment, economy, and society.
4. Share your personal stance on whether you support or oppose the Lantau Tomorrow Vision project and why.
5. Offer suggestions or alternative perspectives on how the project could be improved or if there are better alternatives to achieve similar goals.
6. Reflect on how today's activity helped shape your understanding of urban development projects and the complexities involved in balancing progress with environmental and social concerns.
7. Conclusion: Summarize your thoughts on the Lantau Tomorrow Vision project and reiterate your position on whether you support or oppose it, along with any final reflections.

Guidance for students to think

Students' Work



In economic aspect, this project brings cons and pros. The cost was estimated to be HK$ 580 billion which is extremely high. Yet, it was roughly estimated that the commerical activities on the KYC Artificial Island will bring approximately HK$141 billion of value-added to Hong Kong per year. optimistic

This project also brings social impact. This project can provide great land resources to address Hong Kong's dire housing shortage. This greatly benefits grassroots, middle class as well as young professionals.

Today's activity helped me to know more about the impacts of city development. Not only the advantages, but also the disadvantages. We should try our best to reduce the harm to the environment.

To conclude, although 'Lantau Tomorrow Vision project' may be bad for the environment, but at the same time, it brings great benefits to Hong Kong's development. Therefore, I support it.

more evidence on supporting it.

Reflection (Difficulties)

- Preparation
- During the Lesson
- After the Lesson

Developing engaging role-playing activities, ethical reflection prompts, and action planning materials can be time-consuming

Keeping students focused and actively participating requires effective facilitation and management of group dynamics

Evaluating students' understanding, critical thinking skills, and ethical awareness following the lesson may present challenges in designing appropriate assessment tools that accurately measure the intended learning outcomes.

Reflection (The way forward)

- The design of lessons is in response to the characteristics of our school's students, but they should be modified every year because the characteristics of students change every year.
- The best outcome of role play is when students can apply empathy and scientific knowledge to solve problems if they are truly engaged.
- Using AI can assist in brainstorming and designing prompts or scripts, but extensive modifications are still necessary and can be time-consuming.

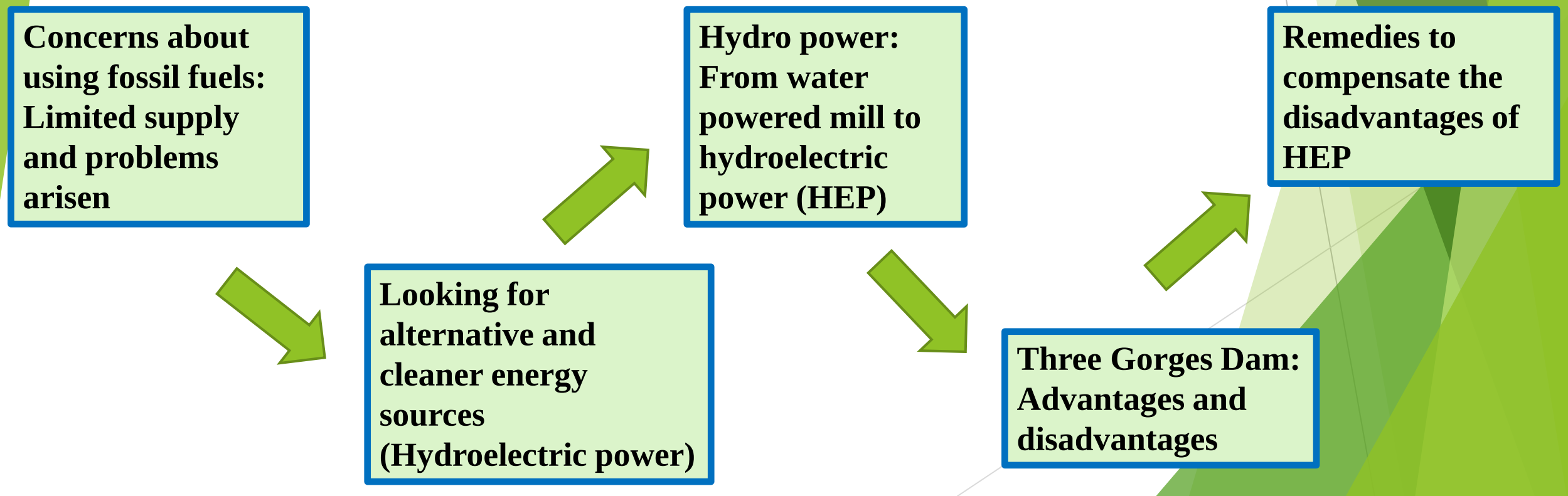
Topic2: Hydroelectric Power (HEP)

Mr. Lau Mei-muk

Considerations

1. The integration of values education and the knowledge of hydroelectric power
2. The implementation of cognition, affection and action related to the values and attitudes (responsibility, care for others and national identity)

Learning Flow



Preparation of Teaching Materials

Framework of the lesson

- Concerns about using fossil fuels
- Hydro power: water powered mill and hydroelectric power (HEP)
- Three Gorges Dam: and its advantages and disadvantages
- Remedies to compensate the disadvantages of HEP

Search information from the textbooks and on the internet

Compile and summarize the information into articles with the help of AI

Set questions for exploration

Design activities and arrange them together

Outline of the lesson

1. Concerns about using fossil fuels
2. To help reduce the use of fossil fuels (citizen and government)
3. Hydroelectric power is a kind of renewable and clean energy sources
4. Energy conversion in a hydroelectric power station
5. Advantages and disadvantages of the Three Gorges Dam in China
6. Suggestions on how to compensate the drawbacks of building the Three Gorges Dam
7. Appreciation on the remedial measures done by the government of China

Questions for exploration

1. What are the problems when we still use lots of fossil fuels? Please specify them?
2. Fossil fuels cause many problems to the environment and our health. For a responsible citizen and government, how can we alleviate (make something less severe) the problems when using the energy?
3. Hydroelectric power is a kind of renewable energy sources. It is also regarded as a clean energy source. Explain briefly.
4. State the energy conversion in a hydroelectric power station.
5. State the advantages and disadvantages of the Three Gorges Dam in China.
6. If you were the policy maker of the China government, what remedies would you suggest to compensate the drawbacks of building the Three Gorges Dam?
7. The Three Gorges Dam provides large amount of electricity to the nearby areas and meet the increasing energy need. However, building a large hydroelectric power station would bring some disadvantages to the environment. There were some remedies, made by the China government, which compensated some damages and problems arisen.
   Choose ONE of the remedies you think it is the most important to do and explain briefly.

Learning and Teaching

Source 1

Concerns about using fossil fuels

1) Limited supply of fossil fuels

2) Problems of using lots of fossil fuels (Pollution and Health problems)

Revision

Students should be aware of the concerns about using fossil fuels (Value)

Value and attitude:

Show concerns for environmental and health problems

Source 1

Fossil fuels like coal, oil, and natural gas are our main sources of energy, but they take a very long time to replenish once we use them up. When we burn these fuels in power plants, factories and vehicles, they release harmful substances into the air, like nitrogen oxides, sulphur dioxide, lead, and carbon monoxide, which cause many health problems. They also produce a lot of carbon dioxide, which is a greenhouse gas that can trap heat in the atmosphere. This leads to global warming and causes the ice at the North and South Poles to melt, raising sea levels, increasing the risk of flooding in coastal areas, etc. Sulphur dioxide and nitrogen oxides can also dissolve in rainwater to form acid rain, which harms aquatic life, plants, and buildings.

Task 1

Complete a concept map to show the problems of using lots of fossil fuels

Students should be able to link all the concepts about the problems of using lots of fossil fuels in a concept map (Skill)

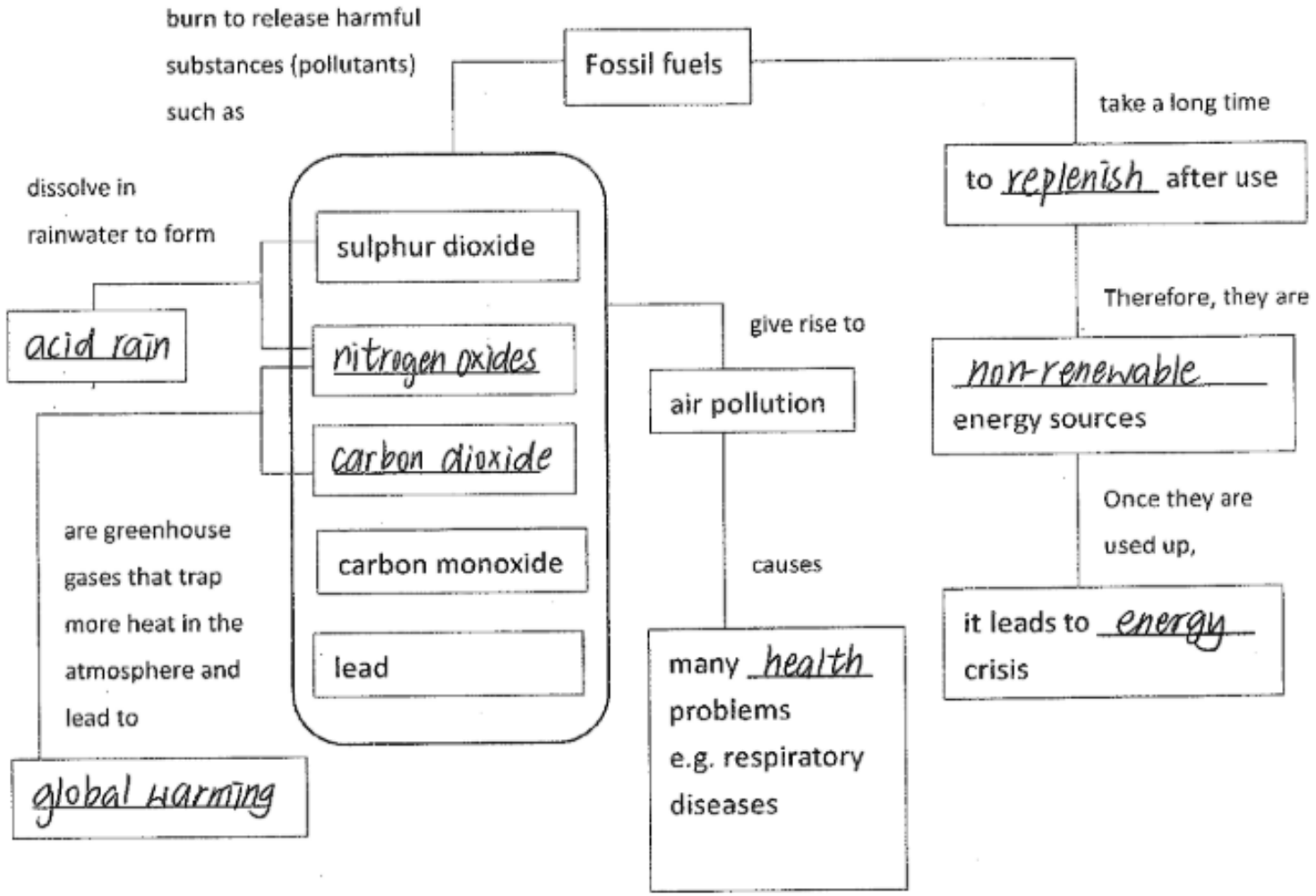
Learning and Teaching

Task 1

Complete a concept map to show the problems of using lots of fossil fuels

Value & Skill

1. What are the problems when we still use lots of fossil fuels? Complete the concept map below.



Learning and Teaching

Source 1

Concerns about using fossil fuels
1) Limited supply of fossil fuels
2) Problems of using lots of fossil fuels (Pollution and Health problems)

Source 1

Fossil fuels like coal, oil, and natural gas are our main sources of energy, but they take a very long time to replenish once we use them up. When we burn these fuels in power plants, factories and vehicles, they release harmful substances into the air, like nitrogen oxides, sulphur dioxide, lead, and carbon monoxide, which cause many health problems. They also produce a lot of carbon dioxide, which is a greenhouse gas that can trap heat in the atmosphere. This leads to global warming and causes the ice at the North and South Poles to melt, raising sea levels, increasing the risk of flooding in coastal areas, etc. Sulphur dioxide and nitrogen oxides can also dissolve in rainwater to form acid rain, which harms aquatic life, plants, and buildings.

Task 2

Suggest some methods to reduce the use of the fossil fuels (Responsibilities of a citizen and government)

Students will be the future leaders. One day they may become the policy makers. They should bear more responsibilities

Students should be able to suggest some methods to reduce to use the fossil fuels from the role of a citizen and from the role of government (Action and Value)
Action, value and attitude:
Take up responsibility and care for others

Learning and Teaching

Source 1

Concerns about using fossil fuels

1) Limited supply of fossil fuels

2) Problems of using lots of fossil fuels (Pollution and Health problems)

Action & Value

Task 2

Suggest some methods to reduce the use of the fossil fuels (Responsibilities of a citizen and government)

i) For the role of citizens

- Use the water that have washed rice to irrigate the plants
- Better not turn on the air conditioner. If you really feel hot, turn on the fan instead.
- Better not travel by the cars that are powered by fuel, travel by electric car instead.
- Turn off electrical appliances when not in use.
- Do not waste food.
- Reuse items and recycle resources.
- Eat more fruits and vegetables, less meat.
- Travel by public transport that can carry multiple people at the same time, instead of private cars.

ii) For the role of government

- Set laws to control pollutants.
- Encourage people to save energy by advertising, distributing ∧ promotional leaflets and strengthening education.
- Afforestation. It is an effective way to capture carbon dioxide, absorbing large amounts of carbon dioxide and reducing greenhouse gas concentrations in the atmosphere.
- Build green infrastructure. Green infrastructure can reduce flooding, mitigate climate change, and improve the ecological environment.
- Encourage companies to develop low-carbon industries such as energy conservation and emission reduction through tax exemptions and loan support.

Source 1

Looking for alternative and cleaner energy sources (Hydroelectric power)

Students should be able to recognize the need for developing alternative energy sources (Value)
Value and attitude:
Recognize the importance of sustainable development

Task 3

Explain why an HEP is a clean and renewable energy source

Students should be able to explain why an HEP is a clean and renewable source (Knowledge)

3. Hydroelectric power is a kind of renewable energy sources. It is also regarded as a clean energy source. Explain briefly.

Hydroelectric power makes use of running water to work. The running water will not run out. When it generates electricity, it causes less pollution.

Knowledge

Source 1

Hydro power:
In the past, water powered mill in China
At present, hydroelectric power
(clean and never runs out)

Knowledge & Value

Students should be able to recognize how the water powered mill worked in ancient China (Knowledge and Value)
Value and attitude:
Realize Chinese in the past knew how to adopt sustainable energy source to do work → Proud of our country→ A sense of belonging → National identity

Source: Chinese Water Mills
https://www.youtube.com/watch?v=gfk8qJpno8k

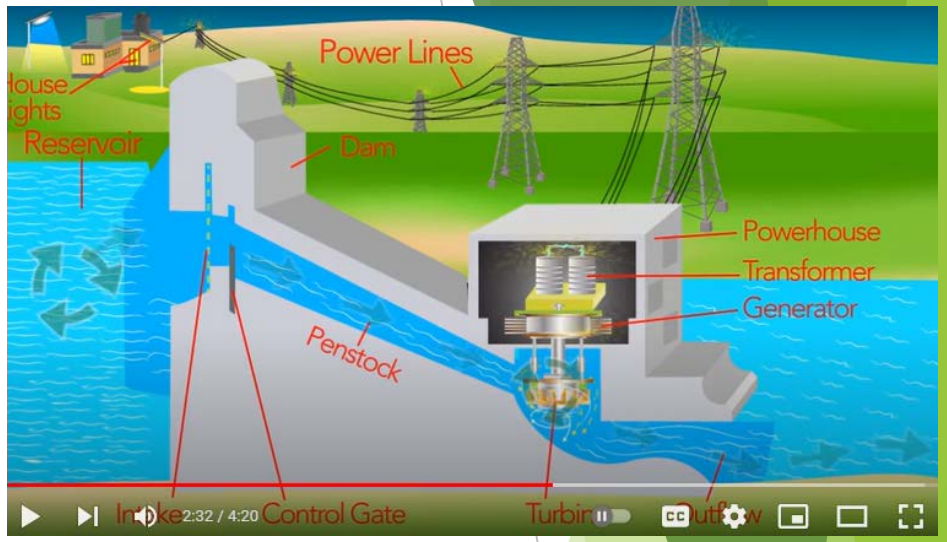
Source 1

- **Principle of energy conversion of a hydroelectric power station**
- **Energy conversion at the Three Gorges Dam**

Task 4

State the energy conversion in an HEP station

Students should be able to state the energy conversion in an HEP station (Knowledge)



How a Hydro Electric Dam Works
https://www.youtube.com/watch?v=Qk2op7ErigU

4. Fill in the blanks to show the energy conversion in a hydroelectric power station.

Potential energy of the water stored in the reservoir at a higher position
↓
kinetic energy of the flowing water
↓
kinetic energy of the turbine and generator
↓
electrical energy produced by the generator and transmitted along the electric cables

Knowledge

Source 2

- **Three large hydroelectric power stations in the world:**
  Hoover dam, Itaipu dam, Three gorges dam (The largest one)
- **Advantages and disadvantages of HEP in general**
- **Conditions for building HEP**
- **HK : very small-scale hydro power systems at Tuen Mun Water Treatment Works and Sha Tin Water Treatment Works**

Source 2

Hydroelectric power stations like the Hoover Dam, Itaipu Dam, and Three Gorges Dam are built in big rivers with lots of water. The water flows fast enough to make a big wheel called a turbine spin, and that's how electricity is made. Hydroelectric power is great because it never runs out, and it's very reliable. It doesn't cost too much to run, and it's really good at making electricity, almost 90% efficient! Big dams can also store water for farms and help prevent floods in nearby areas. They look amazing and attract many tourists, which helps the local economy.

Source: Top 10 Largest Hydroelectric Power Stations in the World
https://www.youtube.com/watch?v=zHCpWyvAAqw

Students should be able to

- recognize Three Gorges Dam is the largest HEP in the world (Value);
  Value and attitude:
  Appreciate the achievement of our country in engineering and technology → Proud of our country → A sense of belonging → National identity
- recognize the advantages and disadvantages of HEP in general (Knowledge);
- recognize the conditions for building HEP (Knowledge)

Source 2

Advantages and disadvantages of HEP at The Three Gorges Dam in our home country

Source 2

Hydroelectric power stations like the Hoover Dam, Itaipu Dam, and Three Gorges Dam are built in big rivers with lots of water. The water flows fast enough to make a big wheel called a turbine spin, and that's how electricity is made. Hydroelectric power is great because it never runs out, and it's very reliable. It doesn't cost too much to run, and it's really good at making electricity, almost 90% efficient! Big dams can also store water for farms and help prevent floods in nearby areas. They look amazing and attract many tourists, which helps the local economy.

Task 5

Matching:
Find out the advantages and disadvantages of the Three Gorges Dam

Students should be able to distinguish the advantages and disadvantages of HEP at the Three Gorges Dam (Knowledge)

Discussion

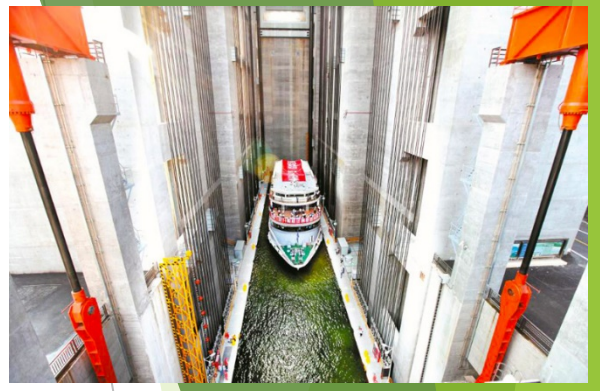
Refer to the source 2, answer the questions (1) to (2).

1. Match the following sentences with the advantages and disadvantages of the Three Gorges Dam in China by writing the corresponding letters in the spaces below.

A. The hydroelectric power station can generate a huge amount of electricity.
B. The dam blocks the way of the fish to find food and lay eggs. (e.g. Chinese sturgeons migrate to the river to spawn and then return to the sea.)
C. Some historical sites and valuable artifacts were lost underwater.
D. It is a clean and renewable energy source. Therefore, large amount of greenhouse gases is reduced and better air quality is created.
E. The dam protects people and their homes from dangerous floods.
F. The dam reduces the amount of water flowing downstream. This can affect the plants and animals that rely on that water to live.
G. The dam's impressive structure attracts many tourists, boosting the local tourist industry.
H. The dam can store water for people to use, e.g. drinking, farming, etc.
I. The Dam raises the water level in its upper stream and greatly improve the waterway. Boats and ships can navigate through the river safely.
J. The dam changes the animals and plants' habitat and makes it harder for them to survive, thus destroying the natural balance of the ecosystem in the river.
K. Many people had to move away from their homes.
L. The dam has created many jobs for people living nearby, e.g. construction, maintenance, tourism, etc.
M. The dam traps the sediment carried by the river, making the water in the reservoir dirty. This pollution can harm the plants and animals that depend on clean water. On the other hand, there is not enough sediment in the lower stream to replace the land that is washed away at the river's mouth (estuary).
N. The dam can help fight against drought in Yangtze River Basin. In the dry season, stored water in the reservoir is discharged downstream to supply for farm irrigation, industrial production and the daily uses by people and animals.

Advantages	Disadvantages
A, D, E, G, H, I, L, N	B, C, F, J, K, M

Five-stage Ship Locks



Three Gorges Dam Ship Lift

Source: Three Gorges Dam-World Largest Water Control Project
https://www.chinadiscovery.com/yangtze-cruises/three-gorges-dam.html

Knowledge

Source: China Three Gorges
https://www.ctg.com.cn/ctgenglish/business/ecological_protection/rare_anim_and_plants_prot/index.html

Source 2

Drawbacks of building the Three Gorges Dam

- The dam blocks the way of the fish to find food and lay eggs. (e.g. Chinese sturgeons migrate to the river to spawn and then return to the sea.)
- Some historical sites and valuable artifacts were lost underwater.
- The dam reduces the amount of water flowing downstream. This can affect the plants and animals that rely on that water to live.
- The dam changes the animals and plants' habitat and makes it harder for them to survive, thus destroying the natural balance of the ecosystem in the river.
- Many people had to move away from their homes.
- The dam traps the sediment carried by the river, making the water in the reservoir dirty. This pollution can harm the plants and animals that depend on clean water. On the other hand, there is not enough sediment in the lower stream to replace the land that is washed away at the river's mouth (estuary).

Task 6

Suggest remedies to compensate the drawbacks of building the Three Gorges Dam

Students should be able to suggest some measures to compensate the drawbacks of building the Three Gorges Dam (Value)

Value and attitude:

Take up responsibility and care for others

Source 2

Drawbacks of building the Three Gorges Dam

- The dam blocks the way of the fish to find food and lay eggs. (e.g. Chinese sturgeons migrate to the river to spawn and then return to the sea.)
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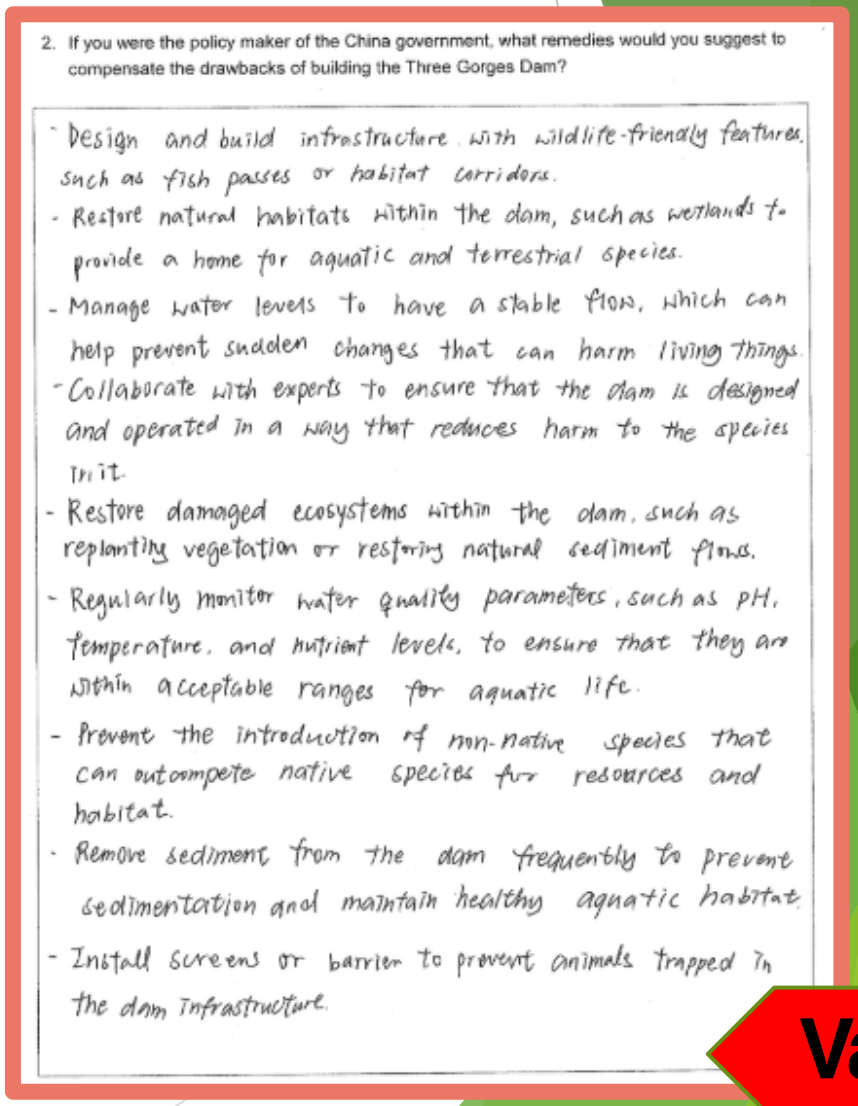
Task 6

Suggest remedies to compensate the drawbacks of building the Three Gorges Dam



2. If you were the policy maker of the China government, what remedies would you suggest to compensate the drawbacks of building the Three Gorges Dam?

- Design and build infrastructure with wildlife-friendly features, such as fish passes or habitat corridors.
- Restore natural habitats within the dam, such as wetlands to provide a home for aquatic and terrestrial species.
- Manage water levels to have a stable flow, which can help prevent sudden changes that can harm living things.
- Collaborate with experts to ensure that the dam is designed and operated in a way that reduces harm to the species in it.
- Restore damaged ecosystems within the dam, such as replanting vegetation or restoring natural sediment flows.
- Regularly monitor water quality parameters, such as pH, temperature, and nutrient levels, to ensure that they are within acceptable ranges for aquatic life.
- Prevent the introduction of non-native species that can outcompete native species for resources and habitat.
- Remove sediment from the dam frequently to prevent sedimentation and maintain healthy aquatic habitat.
- Install screens or barrier to prevent animals trapped in the dam infrastructure.

Value

Source 3

- The Three Gorges Botanical Garden was established to protect rare and endangered plants (560 rare plant species were preserved)
- Construction of fish migration passage and artificial breeding and releasing (100 species of rare fish were successfully bred, and over 10,950,000 fish were released)
- Increased fish populations are seen such as Chinese sturgeon, endangered species like the yellow-breasted bunting and black stork.
- Forest cover rate of 68.6% and water quality meeting Class II standards in the Yichang section.
- Improvements were shown in important ecological areas, ecological connectivity, coastline retention, plant coverage, water and atmospheric environment, biodiversity, and reduction of human impact.
- The experience gained from the project was recognized and selected as a typical case for promoting major ecological projects.

Sources 3

The Three Gorges Dam is a big structure that has been both praised and criticized. Some people have concerns about how it may have affected the environment. However, it's important to know that during the construction of the dam, measures were taken to protect the ecology of the area.

To protect the plants in the Three Gorges region, the Three Gorges Botanical Garden was established. It helped rescue and preserve rare and endangered plants in the area. By the end of 2018, 560 rare plant species were protected, and none of them faced extinction. Over 8,000 individuals of more than 100 rare plants were saved.

Task 7

Choose ONE remedy done by China government and explain why it is the most important

Students should be able to judge which remedy done by China government is the most important (Value)

Value and attitude:

Appreciation, take up responsibility and care for others

Source 3

- The Three Gorges Botanical Garden was established to protect rare and endangered plants (560 rare plant species were preserved)
- Construction of fish migration passage and artificial breeding and releasing (100 species of rare fish were successfully bred, and over 10,950,000 fish were released)
- Increased fish populations are seen such as Chinese sturgeon, endangered species like the yellow-breasted bunting and black stork.
- Forest cover rate of 68.6% and water quality meeting Class II standards in the Yichang section.
- Improvements were shown in important ecological areas, ecological connectivity, coastline retention, plant coverage, water and atmospheric environment, biodiversity, and reduction of human impact.
- The experience gained from the project was recognized and selected as a typical case for promoting major ecological projects.

Task 7

Choose ONE of the remedies you think it is the most important to do and explain briefly.

Tick (✓) one box.

- ☐ Increasing the plant coverage and protecting rare and endangered plants
- ☐ Protecting the aquatic life and breeding and releasing rare fish, e.g. Chinese sturgeon
- ☐ Coastline and wetland retention
- ☐ Improving the water quality

Task 7

Choose ONE remedy done by China government and explain why it is the most important

Choose ONE of the remedies you think it is the most important to do and explain briefly.

Tick (✓) one box.

- [ ] Increasing the plant coverage and protecting rare and endangered plants
- [ ] Protecting the aquatic life and breeding and releasing rare fish, e.g. Chinese sturgeon
- [ ] Coastline and wetland retention
- [x] Improving the water quality

The Three Gorges Dam, while providing numerous benefits such as flood control and hydroelectric power, also has significant disadvantages to the environment. Improving water quality is crucial as it directly affects the health of ecosystems and the well-being of communities that rely on the river for drinking water and agriculture. By addressing this issue, we can help restore the balance of the ecosystem and ensure the sustainability of the region for future generations. It is essential to prioritize efforts to improve water quality in order to mitigate the environment damage caused by the Three Gorges Dam.

Value

Task 7

Choose ONE remedy done by China government and explain why it is the most important

Choose ONE of the remedies you think it is the most important to do and explain briefly.

Tick (✓) one box.

- [✓] Increasing the plant coverage and protecting rare and endangered plants
- [ ] Protecting the aquatic life and breeding and releasing rare fish, e.g. Chinese sturgeon
- [ ] Coastline and wetland retention
- [ ] Improving the water quality

Reasons why I think it is important to increase plant coverage:

1. Plants are very important for life on Earth because they provide oxygen.
2. Plants are necessary for the food chain because they provide food for animals and humans. They are a major source of vitamins, nutriens and calories.
3. Plants create habitats and shelters for a wide variety of animals, insects and microorganisms. They provide nesting sites, hiding places and food sources for many species, helping maintain biodiversity.
4. Plants play a crucial role in regulating the Earth's climate. They absorb carbon dioxide, a greenhouse gas and help with global warming.

Reasons why I think it is important to protect rare and endangered plants:

1. Each species plays an unique role in the ecosystem and the loss of these species can have negative effects on the entire ecosystem.
2. Many of these plants have yet to be throughly studied, they may hold undiscovered potential for human use, such as in medicine, or agriculture. Protecting these plants means that we don't lose these potential benefits.

How to achieve this:

1. Reforestation: Plant more trees and restore degraded and deforested areas.
2. Habitat conservation: Identify and protect the specific habitats where rare and endangered plants are found.

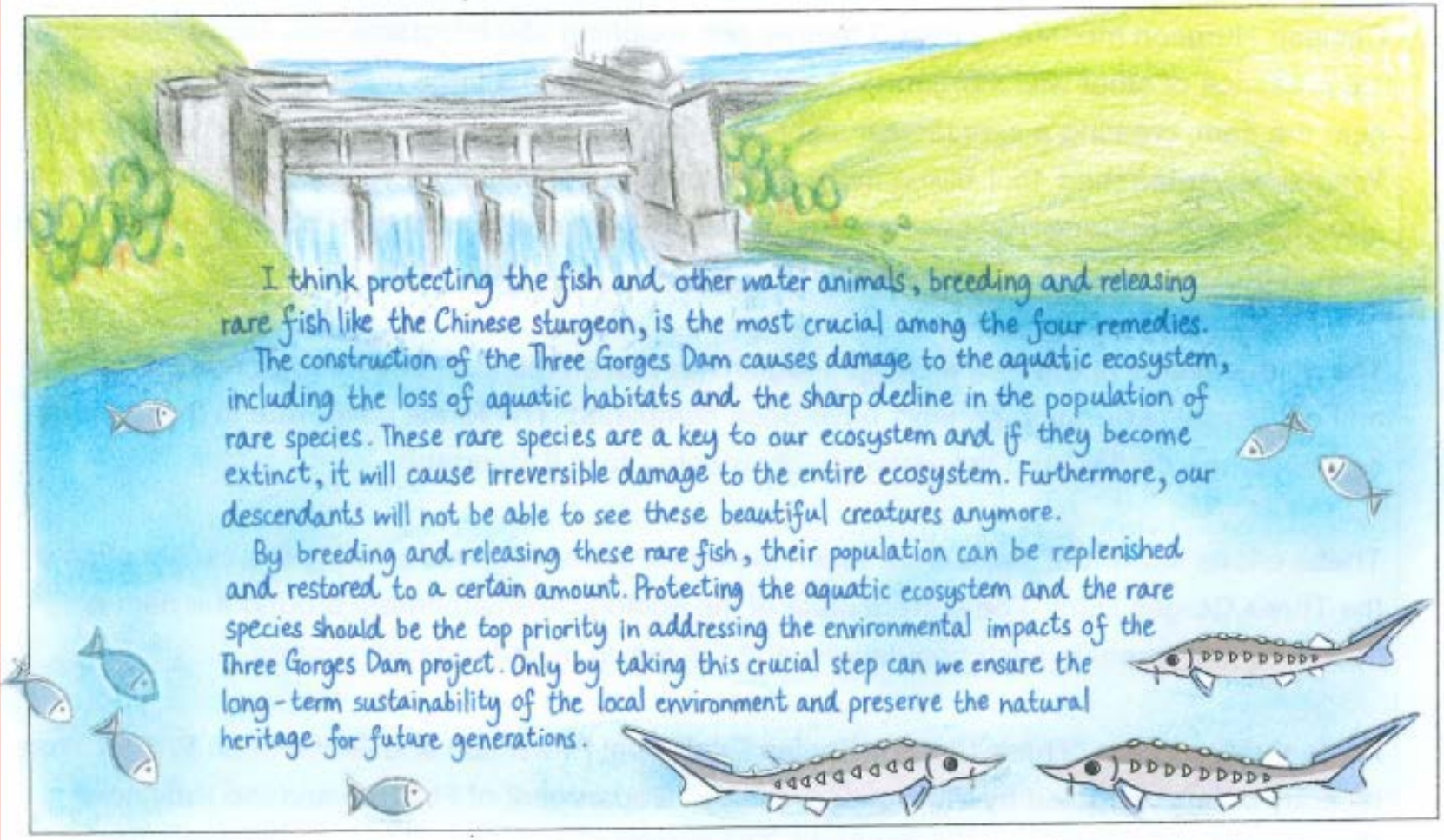
Task 7

Choose ONE remedy done by China government and explain why it is the most important

Choose ONE of the remedies you think it is the most important to do and explain briefly.

Tick (✓) one box.

- [ ] Increasing the plant coverage and protecting rare and endangered plants
- [x] Protecting the aquatic life and breeding and releasing rare fish, e.g. Chinese sturgeon
- [ ] Coastline and wetland retention
- [ ] Improving the water quality



Reflection and the way forward

- Students needed the prerequisite knowledge of Unit 2 (Water) and Unit 3 (Looking at Living Things). It is better for them to have a revision before the lesson
- The learning content was a bit lengthy
- Some videos and websites can be sent to students for lesson preparation beforehand
- Using videos and visuals can easily explain complex concepts related to hydroelectric power generation
- Students showed interest in learning about the environmental and social impacts of the dam
- Students actively participated in group discussion
- Some students could not express their ideas well with English. Teacher needs to give appropriate guidance
- Make good use of AI (A helpful teaching assistant)

- By means of this activity, I hope our students can
  1) explore the impacts of other energy sources and find out some solutions to tackle them
  2) build up positive values and attitudes to take up responsibility and care for others
  3) appreciate all the achievements of our country in engineering and technology
  4) be proud of our country and enhance the sense of national identity

我们的收获及思考

黃菊
香港教育局中學校本課程發展組內地專家教師

- "知" "情" "行" 如何進行評價
- 價值觀教育內容與知識的有機結合
- 如何在科學課設計融入價值觀教育的專題研習

『知- 情- 行』评价

S.2 Science
The balance of oxygen and carbon dioxide in Nature with Value Education
(Understanding Our Impact: Interconnectedness and Responsibility)

Areas	Learning objectives	Mode	Learning outcomes		
			Basic performance	Satisfactory performance	Good performance
Cognition	了解人類的一些活動可干擾自然界中二氧化碳的平衡	工作纸 反思文章	能从角色出发说出该角色在生态系统中如何影响自然界中二氧化碳的平衡。	能从角色出发说出其他角色在生态系统如何影響自然界中二氧化碳的平衡，理解角色在生态系统中的作用。	運用同理心及責任心由個人到社會的個人活動, 建議人類如何做到減少二氧化碳排放。
	描述生物体与环境之间相互依赖	观察学生汇报	大概能说出自然界中二氧化碳与氧气的平衡与全球变暖的关系。	基本理解自然界中二氧化碳与氧气的平衡与全球变暖的关系，理解人类活动会影响大气变化。	能详细说出自然界中二氧化碳与氧气的平衡与全球变暖的关系，理解人类活动影响氧气、二氧化碳和气候稳定的微妙关系。
Affection	关注科学发展，培养社会责任	工作纸；汇报	能说出将人类该负担的环境保护的道德责任	能说出将人类该负担的环境保护的道德责任；能联系香港环境、经济和社会其中一方面的潜在影响，与他人分享。	能说出将人类该负担的环境保护的道德责任；能联系香港环境、经济和社会的潜在影响，与他人分享。
	认同协作交流的重要性	学生讨论；工作纸	能提出自己的认识，通过讨论能优化自己的方案。	能提出自己的观点或见解，通过讨论能优化自己的方案。能认真倾听他人的观点。	能提出自己的观点/见解/认识，通过讨论能优化/修正/融合自己的方案。能认真倾听他人的观点，尊重每个人的发言，在交流中寻求一致。
Action	履行人人有环境保护的责任	观察小组讨论；汇报；工作纸	用角色扮演的方式进行互动，说出自己的行动策略。	用角色扮演的方式进行互动，说出自己的行动策略。小组认同人人要有保护环境的责任。	用角色扮演的方式进行互动，说出自己的行动策略。小组之间达成一致，认为人人要有保护环境的责任，需积极推动生物与自然的生态平衡。
	积极行动，应对环境挑战	工作纸	设计行动方案解决生物与环境之间的平衡问题。	设计行动方案解决生物与环境之间的平衡问题；提出实际行动支持环境保护工作。	设计行动方案解决生物与环境之间的平衡问题；提出实际行动来减少碳足迹和支持环境保护工作。

价值观教育内容与知识的有机结合

➢ 创设情境策略

- 策略一：从虚拟情境—半虚拟情境—真实情境
- 策略二：真实情境（科学历史——现代科技——**未来科技**）

➢ 科学知识与价值观融合策略

- 在中国传统优秀文化中选材，以科学史讲述古人的聪明智慧
- 教学材料的有机整合及精心编排，采用AI方式组织故事，从正反两面培养学生的明辨性思维
- 引导学生关注社会热点问题，用科学知识解决社会环保问题
- 通过问题/ 任务之间的进阶设计，引导学生思维的进阶，学生经历认知冲突、接纳观点、寻求认同
- 通过小组研讨达成一致愿景，形成一份小组成员认同的解决方案
- 评价促进知- **情**- 行目标达成，促进教师进行教学反思

在科学科设计融入价值观教育的专题研习

感谢各位老师聆听！