

Suggested Lesson Plans

1. [An Unbroken Chain](#)
2. [The Plastic Drama](#)
3. [Litter Did I Know](#)

Suggested Mini Activities

1. [Ocean Pollution Sensory Bin](#)
2. [Garbage Music: Make a Musical Instrument out of Plastic Rubbish](#)
3. [Having a Plastic-Free SPA Day](#)
4. [Garbage Fashion](#)
5. [Empathy Puppet Show](#)
6. [Making Bioplastics](#)
7. [Understanding Impacts of Plastic Pollution](#)
8. [Modeling Pollution Uptake by Plants Using Celery](#)
9. [Polluted Display Jars](#)
10. [Modeling the Movement of Pollution Through Ecosystems](#)

An Unbroken Chain

Summary

In this activity, students will simulate 'feeding' by animals e.g., birds using their hands on a 'food and trash' mixture. They will observe how such feeding is non-selective and represent this data mathematically by weighing the amount 'fed' on that is food and those that comprise plastic trash. A possible extension of this lesson is the use of different tools to represent different feeding mechanisms and how this impacts the food chain, and explore how plastic can actually end up in our food.

Related Exhibition Section and Artworks

Section 2: The Darker Side of Plastic

- Ref: Pick of the litter (Brian Lehman)
- Ref: The life cycle of disposable plastic (Randy Olson)
- Ref: Surf's up (Zak Noyle/A-frame)
- Ref: Killer plastic (John Cancalosi)

Section 3: The Haunting Art of Plastic Pollution

- Ref: Spill (Mandy Barker)
- Ref: Refused (Mandy Barker)
- Ref: Catch of the day, A harmful hand (David Liittschwager)
- Ref: Dying to eat (David Liittschwager and Susan Middleton)
- Ref: Picturing microplastics (Martin Ogonowski, Christoph Schur)

Section 4: Towards a Cleaner Future

- Practicing correct recycling (fall in recycle rates recorded by NEA, Singapore)
- Adopting a circular economy approach (to close three resources loops)
- Ref: Low tech recycling (Randy Olson)
- Ref: The zero waste lifestyle

Section 5: Science in Action

- Ref: Inventor, Arthur Huang

Objectives

At the end of this activity, students will

1. Apply scientific methods to
 - record data and results
 - create and interpret bar charts, pictograms or pie charts
 - process and represent data in the form of suitable infographics like tables, bar graphs, pie charts etc
2. Report and present findings and conclusions, causal relationships and explanations in oral and written forms such as displays and other presentations
3. To consider the impacts of plastic litter, particularly on marine life

Skills (based on MOE Syllabus)

1. Geography

- Exercising Reasoning Data Presentation
- Organise and present data through maps, tables, graphs, photographs and quotes
- Data Interpretation and Draw Conclusions
- Explain the data meaningfully, draw comparisons and identify relationships in order to arrive at reasoned conclusions.

2. Mathematics

- Being proficient in carrying out the mathematical operations and algorithms and in visualising space, handling data and using mathematical tools are essential for solving problems.
- ICT tools such as spreadsheets, and dynamic geometry and graph sketching software may be used to support the learning
- Ability to carry out abstracting, reasoning, representing and communicating, applying and modelling in expressing one's ideas, solutions and arguments to different audiences

3. Science

- Observing: This is the skill of using our senses to gather qualitative as well as quantitative information about a particular object, event or phenomenon. This also includes the use of instruments to extend the range of our senses.
- Communicating: This is the skill of transmitting and receiving information presented in various forms - verbal, tabular, graphical or pictorial.
- Inferring: This is the skill of interpreting and explaining observations, data or information gathered.
- Analysing: This is the skill of clarifying information by examining parts and relationships contained in the information.

In this lesson, you may choose to adopt the POE (Predict-Observe-Explain) / PEOE (Predict-explain-observe-explain) / POEE (Predict-observe-explain-explore) approach to promote metacognition and modify the following lesson plans according to your needs.

[source: <https://ijern.com/journal/2015/February-2015/04.pdf>]

Lesson Plan

| Lesson segment | Activity | Rationale | Curriculum LOs | Resources |
|----------------|---|---|--|--|
| Pre-activity | <p>Option 1: Reflect on/refresh experiences of learning journey to <i>Planet or Plastic?</i> exhibition at ArtScience Museum by getting students to share on online platforms like Mentimeter, Nearpod etc. to capture their thoughts</p> <p>Option 2: Show students 'Make the Switch for nature' by Shawn Miller and have them express their opinion or feelings verbally or use the online platforms stated in Option 1.</p> | <p>Reflection allows resynthesis and organisation of thoughts and feelings that prepares the students to ease into the activity / topic so that they feel more connected to the tasks ahead.</p> <p>Starting with open-ended questions also creates space of reconsideration and contemplation.</p> | Can be a follow-up from a Geography, Science, Mathematics, or a Language class. | <p>www.mentimeter.com You may choose word cloud option.</p> <p>OR</p> <p>www.nearpod.com You may choose drawing option with questions e.g., How do you feel after the trip to ArtScience Museum? How do you feel seeing those photographs?</p> <p>https://okinawanaturephotography.com/ Crabs with beach trash homes (National Geographic June 2018)</p> <p>Have students to also reflect on the question by Shawn Miller 'Will this paper wrap save the planet' and get them to share their views.</p> |
| Main activity | <p>Start without explicitly explaining the objectives to students.</p> <p>Students work in groups of 3-4, forming a group of different types of birds each. Begin with a picture / video stimulus.</p> <p>Here, students can be invited to share their explanations for their predictions using the following suggested questions:</p> <ol style="list-style-type: none"> 1. What does the chart represent? 2. What can you infer from the chart? 3. What kind of predictions / possible impacts or outcome can be made from the data? (students can illustrate this using a flow chart to show cause and effect etc.) <p>Steps:</p> <ol style="list-style-type: none"> 1. Prepare about 1.5kg of seeds-plastic mix (50% each i.e. 750g plastic, 750g mixed seeds), depending on size of class. 2. Pour 100g of some seeds and plastic mix on the parchment paper in front of each group of students 3. Instruct students to pick up as much 'food' using their thumb and index finger to pinch it up and place it on the provided plate/petri dish (which represents the stomach of the bird), simulating the feeding action of the birds within 10 seconds. 4. After which, they will record the weight of the 'food mass' they have 'fed on' on the google spreadsheet/document. 5. Instruct students to remove the food portion i.e. seeds etc. and set it aside (representing the idea that the food portion has been digested). 6. Add 20g of seed-plastic mix onto the parchment paper and have the students mix them in briefly. Engage student in a 2nd round of feeding, placing food on the plate or dish (with the remaining plastic trash from the 1st feeding), repeating steps 3 and 4. 7. Add 40g of seed-plastic mix and have students repeat the 'feeding' and steps 3 and 4 8. In the last round, add 80g of seed-plastic mix and repeat the 'feeding' in steps 3 and 4 9. Students are now to calculate the percentage increase in the amount of plastic trash remaining in the digestive systems of the birds 10. They can also be guided to discuss the most appropriate way of presenting their findings/data and justify it and the possible innate error in the experiment's design. <p>To wrap up: What can be concluded from the data?</p> <p>How would the data (percentage increase) be different with each feeding if ocean plastic pollution is not resolved?</p> <p>How does this eventually cause feeling of fullness and starvation and death of these animals?</p> | <p>Prediction requires that the students draw from prior experience, ability to extrapolate details of a circumstance and apply existing knowledge to explain a 'future outcome'. This involves critical thinking especially in cross-referencing different sources of knowledge or what they have learnt in their different</p> <ol style="list-style-type: none"> 4. What does the chart represent? 5. What can you infer from the chart? 6. What kind of predictions / possible impacts or outcome can be made from the data? (students can illustrate this using a flow chart to show cause and effect etc.) <p>Students will learn here that in science, models can be used in scientific research. Students can also reflect on and evaluate the reliability of the data collected and explain.</p> <p>E.g., the amount removed is not replaced equally each time (to stimulate increasing waste production), proportion of food to plastic waste is not 50% in real-life situation (it's an assumed circumstance/event), amount of food also does not always increase proportionally with wastes i.e. 50% increase each round (each feeding) in real-life.</p> <p>Students will start to realize the 'piling up' effect in the stomach of the birds (i.e. the plate/dish)</p> <p>Students can even evaluate the scientific method and credibility of data e.g. importance of repeating, the use of suitable apparatus for degree of precision desired.</p> <p>Students can also be guided to reflect on making sense of their findings through mathematical processes and evaluate suitability of different modes of representation.</p> <p>With increase in plastic waste production, more plastic can end up in the ocean and affect marine life in the form of being passed down the food chain (especially microplastics) and premature death.</p> <p>If plastic wastes continue to increase, percentage increase can escalate.</p> | <p>Possible related content: Primary 5/6: Interactions within the environment Lower Secondary Science</p> <ol style="list-style-type: none"> a. Normal technical Matter around us: Water pollution b. Normal academic/Express Interactions: Interactions within the ecosystems <p>Lower Secondary Geography - Issue 2: Water supply (Water pollution)</p> <p>IB MYP - Interactions between organisms - Additional topics: Environmental Sciences</p> <p>GCE O level Biology (6093)</p> <ol style="list-style-type: none"> 1. Organisms and their environment → (f) evaluate the effects of water pollution by sewage and by inorganic waste | <p>Visual stimulus: plastic waste data</p> <p>*Projection Source: Jambeck et al. Science, 2015</p> <p>CLIMATE DESK</p> <p>A mix of seeds and reused plastic (or straws – if washed thoroughly) shreds: It's important here not to use new plastic resources to avoid generating more wastes. Plastic shreds can be made from clean food wrappers etc.</p> <ol style="list-style-type: none"> a. Electronic weighing scale b. Petri dish / plate c. Google Doc/Spreadsheet - Students can compile their data in this shared document and observe each other's findings <p>Exhibit Section 1: Plastic, a modern marvel → Ref: A secondary economy (Randy Olso)</p> |

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|----------------------|---|--|---|---|
| | <p>Option (for extension):</p> <p>Students can be given a set of different tools to ‘feed’ on the seed-plastic mix e.g., tongs, chopsticks, skewer, spoon, sieve etc. and weigh the ‘food’ collected, segregate them into food and waste and weigh them again.</p> | <p>During feeding, animals can get confused what looks like food and depending on feeding method, they may not be able to discern the differences. Since plastic is not digestible, they remain in the digestive system and cause a false sense of satiation/fullness. The animal ends up not feeding and may die.</p> <p>This is to further deepen the understanding of ocean plastic pollution on the different marine life, evaluate the magnitude of impact on the food chain due to feeding styles etc.</p> | | <ol style="list-style-type: none"> 1. What does recycling as a second economy in some countries tell you about the extent of plastic production and wastes? 2. Do you think it will happen in Singapore when Pulau Semakau is completely filled in 2035? <p>Exhibit Section 2: Darker side</p> <p>➔ Ref: The life cycle of disposable plastic (Randy Olson):</p> <ol style="list-style-type: none"> 1. How is the waste collected at home related to or impact ocean plastic pollution? 2. How do plastic wastes get into our ocean? <p>➔ Ref: Field of plastic (Randy Olson)</p> <ol style="list-style-type: none"> 1. Why should we be concerned about ocean plastic pollution? 2. What does it tell us about the life cycle of plastic? <p>➔ Ref: Hitching a ride (Justin Hofman), Killer plastic (John Cancalosi), Ghost fishing (Jordi Chias)</p> <ol style="list-style-type: none"> 1. How would you describe such impacts? 2. What do you think led to such outcomes? <p>Section 3: The haunting art of plastic pollution</p> <p>➔ Ref: Spill (Mandy Barker)</p> <ul style="list-style-type: none"> - Seeing is believing – what do you think? <p>➔ Ref: Refused (Mandy Barker)</p> <ul style="list-style-type: none"> - Why do you think those plastic represented were ‘chewed on’ by animals? - What is the most prominent item visible on the artwork? Why do you think it was made the most prominent? <p>➔ Ref: Catch of the day, A harmful hand (David Liittschwager):</p> <ul style="list-style-type: none"> - How has this impacted your impression or knowledge of plastic pollution? <p>➔ Ref: Picturing microplastics (Martin Ogonowski, Christoph Schur)</p> <ol style="list-style-type: none"> 1. Can we ever fully quantify plastic wastes? 2. How does this picture change the way you view your role in plastic pollution? 3. How does this display a possible impact of plastics on the food chain and the food we eat? |
| <p>Post activity</p> | <p>Classes can collaborate to curate an ocean plastic pollution awareness week featuring a different topic / issue each day and present it to the school during assemblies or have it showcased in a roadshow.</p> | | <p>Primary 5/6, Secondary CCE</p> <p>➔ LO8: Reflect on and respond to community, national and global issues, as an informed and responsible citizen</p> <ol style="list-style-type: none"> 4. Know that it is important to care for the environment and the lives of others in the world <p>Pre-University CCE</p> <p>➔ Focus area 2: Making a difference</p> <ol style="list-style-type: none"> 5. Theme 3: Advocacy for good 6. Topic: Core of a changemaker | <p>Section 4: Towards a cleaner future</p> <p>What are Citizen-led Campaigns? Interactive space at the exhibit: Trace your trash What does Singapore’s inaugural Zero Waste Masterplan entail?</p> <p>➔ Ref: Low tech recycling (Randy Olson)</p> <ul style="list-style-type: none"> - How sustainable do you think this is? Why? <p>➔ Ref: The zero waste lifestyle</p> <ul style="list-style-type: none"> - A challenge or a goal? <p>Section 5: Science in Action</p> <p>➔ Ref: Inventor, Arthur Huang</p> <ol style="list-style-type: none"> 7. What is upcycling? 8. How do you think Arthur Huang has demonstrated that? 9. What can you do on your part to reduce wastes? <p>➔ Choosing Planet over Plastic: How can we do our part?</p> |

The Plastic Drama

Summary

This lesson introduces the 3 main stages of film-making and can be executed along an arts-integrated curriculum of subjects like English, Literature, Geography, Science etc. In this activity, students will make their own film documenting or presenting issues with plastic pollution. Depending on the level and subject, this can be springboard to introducing media, storytelling, information processing/presentation, narrative writing or can be a platform for consolidation of learning as an AFL (assessment for learning) tool.

Related exhibition section and artworks

Section 2: The Darker Side of Plastic

- Ref: Pick of the litter (Brian Lehman)
- Ref: The life cycle of disposable plastic (Randy Olson)
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Section 3: The Haunting Art of Plastic Pollution

- Ref: Spill (Mandy Barker)
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- Ref: Dying to eat (David Liittschwager and Susan Middleton)
- Ref: Picturing microplastics (Martin Ogonowski, Christoph Schur)

Section 5: Science in Action

- Ref: Mermaids against Plastic (Sylvia Johnson)

Objectives

At the end of this activity, students will

4. Understand that film making comprise 3 main stages: preproduction, production and post-production.
5. Present thinking, perspectives, notions creatively and clearly using appropriate media, with awareness of target audience
6. To consider the impacts of plastic litter, particularly on marine life

Examples of Skills (based on MOE Syllabus)

Science (Primary)

Observing - This is the skill of using our senses to gather information about objects or events. This also includes the use of instruments to extend the range of our senses

Inferring - This is the skill of interpreting or explaining observations or pieces of data or information.

Communicating - This is the skill of transmitting and receiving information presented in various forms – written, verbal, pictorial, tabular or graphical.

Science (Secondary)

Defining the problem - This is the skill of consciously clarifying situations that are puzzling in some way. The extent, scope and nature of the problem are identified and clarified.

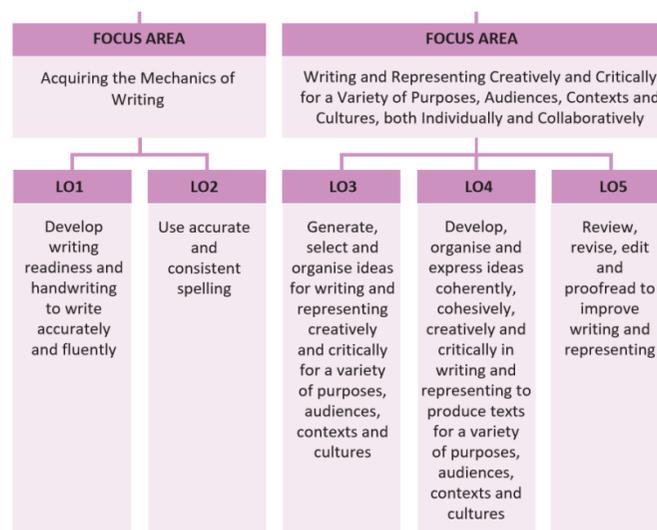
Observing - This is the skill of using our senses to gather qualitative as well as quantitative information about a particular object, event or phenomenon. This also includes the use of instruments to extend the range of our senses.

Communicating - This is the skill of transmitting and receiving information presented in various forms - verbal, tabular, graphical or pictorial.

Examples of Syllabus Aims

English (Primary)

1. Speak, write and represent in standard English that is grammatical, fluent, intelligible and appropriate for different purposes, audiences, contexts and cultures.
2. Use English with impact, effect and affect.



https://www.moe.gov.sg/docs/default-source/document/education/syllabuses/english-language-and-literature/files/primary_els-2020- syllabus.pdf

Lesson Plan

| Lesson segment | Activity | Rationale | Resources |
|------------------------|---|---|--|
| Pre-activity/Lesson 1 | <p>Warmup storytelling class activity</p> <ol style="list-style-type: none"> using a starter sentence e.g., I was on my way home from school one day when I saw... then Using a picture / video prompt to lead the class into the theme 'plastic pollution' <p>This can then be followed by group sharing in a round robin fashion, randomly or by volunteerism.</p> | <p>Collaborative learning</p> <p>Turn-taking</p> <p>Perspective-taking</p> <p>Picture/video prompts serve as preempts</p> | <p>Picture / video prompts of animals + plastic e.g.,</p>  |
| Main activity/Lesson 2 | <p>Key anchor: When we attempt to reason, there must be a question at issue or a problem to be solved.</p> <p>Students continue working in their groups.</p> <p>Part 1</p> <ol style="list-style-type: none"> You can engage students in a mind mapping activity around the theme: plastic or pollution (or any other key words which may eventually lead to it) They can then collectively select an issue to represent or to tell a story about (they can be really creative in the way they choose to present the issue of plastic pollution) Optional: This can be an introduction to Paul's wheel of Reasoning: Points of entry to present their point of view on the selected issue <p>Part 2: Scripting</p> <ol style="list-style-type: none"> Once students are ready (in terms of identifying what they want to present), they can start scripting (after they have developed key characters) You may inform students that one minute of screen time equates roughly to a page of script-formatted text. For 90-seconds of content, they need to write approx. 250 words (with a mixture of dialogue and description) <p>Part 3: Storyboarding</p> <ol style="list-style-type: none"> Students can start storyboarding once their script is ready Show students an example of a storyboard: http://profspevack.com/archive/animation/tech_support/101_storyboard.jpg They can also be given a storyboarding template <p>Part 4: Production</p> <ol style="list-style-type: none"> Students can do this during or outside curriculum time They may then upload their production for sharing by a deadline. | <p>Brainstorming helps make ideas visible and aid idea development.</p> <p>This can serve as a structure / framework to help 'digest' the issue in question or the area intended for exploration, diversifying thinking and perspectives.</p> | <p>Section 2 The darker side of plastics</p> <p>Section 3 The haunting art of plastic pollution</p> <p>Paul's wheel of reasoning http://www.dazleonadime.com/index.php/strategies/richard-paul-s-wheel-of-reasoning/</p> <p>Screenwriting platform e.g., https://www.studiobinder.com/scriptwriting-software</p> <p>Storyboarding platform e.g., https://www.storyboardthat.com/</p> |
| Post-activity | <p>Students can then give structured feedback to each other using a set of prepared rubrics, focusing on</p> <ol style="list-style-type: none"> Learned content Purpose/aim Clarity <p>Or they may reflect on their learning process through this activity using....</p> <p>This can also culminate in a screenplay production week for Plastic pollution awareness or environmental week.</p> | | <p>Section 5</p> <ul style="list-style-type: none"> Mermaids against Plastic (Sylvia Johnson) |

Litter Did I Know...

Summary

In this activity, students will collect and clean (if needed) the trash they produce at home for a week. Working in groups of 3 or individually, they will collate their trash and sort them according to their materials namely: glass, plastic, paper, metal and others. After making count of these objects, they will present their data in the form of suitable graphs/charts. Students will then be led to reflect on the data they have collected and propose strategies to reduce what is most thrown away (instead of being recycled).

Related exhibition section and artworks

Section 1: Plastic - A Modern Marvel

- A secondary economy (Randy Olso)

Section 2: The Darker Side of Plastics

- Ref: The life cycle of disposable plastic (Randy Olson)
- Ref: Field of plastic (Randy Olson)
- Ref: Hitching a ride (Justin Hofman), Killer plastic (John Cancalosi), Ghost fishing (Jordi Chias)

Section 3: The Haunting Art of Plastic Pollution

- Ref: Spill (Mandy Barker): Seeing is believing – what do you think?
- Ref: Catch of the day, A harmful hand (David Liittschwager): How has this impacted your impression or knowledge of plastic pollution?
- Ref: Picturing microplastics (Martin Ogonowski, Christoph Schur) : Can we ever full quantify plastic wastes? How does this picture change the way you view your role in plastic pollution?

Section 4: Towards a Cleaner Future

- Ref: Low tech recycling (Randy Olson)
- Ref: The zero waste lifestyle

Section 5: Science in Action

- Ref: Inventor, Arthur Huang

Objectives

At the end of this activity, students will

7. Apply scientific methods to
 - record data and results
 - create and interpret bar charts, pictograms or pie charts
 - process and represent data in the form of suitable infographics like tables, bar graphs, pie charts etc
8. Report and present findings and conclusions, causal relationships and explanations in oral and written forms such as displays and other presentations
9. To consider the impact of plastic litter (on the ocean) and how such wastes can be reduced

Skills (based on MOE Syllabus)

10. Geography

- Exercising Reasoning Data Presentation
- Organise and present data through maps, tables, graphs, photographs and quotes
- Data Interpretation and Draw Conclusions
- Explain the data meaningfully, draw comparisons and identify relationships in order to arrive at reasoned conclusions.

11. Mathematics

- Being proficient in carrying out the mathematical operations and algorithms and in visualising space, handling data and using mathematical tools are essential for solving problems.
- ICT tools such as spreadsheets, and dynamic geometry and graph sketching software may be used to support the learning
- Ability to carry out abstracting, reasoning, representing and communicating, applying and modelling in expressing one's ideas, solutions and arguments to different audiences

12. Science

- Observing: This is the skill of using our senses to gather qualitative as well as quantitative information about a particular object, event or phenomenon. This also includes the use of instruments to extend the range of our senses.
- Communicating: This is the skill of transmitting and receiving information presented in various forms - verbal, tabular, graphical or pictorial.
- Inferring: This is the skill of interpreting and explaining observations, data or information gathered.
- Analysing: This is the skill of clarifying information by examining parts and relationships contained in the information.

13. English Language (Primary/Secondary)

- Listening and viewing: LO3 Listening and viewing by focusing on implied meaning, higher-order thinking and evaluation
- Reading and viewing
 - ➔ LO2: Process and comprehend age-/year level- appropriate texts by focusing on literal and inferential meaning
 - ➔ LO3: Analyse, evaluate and appreciate age/year levelappropriate texts by focusing on implied meaning, higher- order thinking and judgement
- Speaking and presenting: LO3 Explore, generate, develop and organise ideas respectfully as individuals and collaboratively in planned and/or spontaneous situations for a variety of purposes, audiences, contexts and cultures

Lesson Plan

| Lesson segment | Activity | Rationale | Curriculum LOs | Resources |
|----------------|---|--|--|--|
| Preactivity | <p>Option 1: Reflect on/refresh experiences of learning journey to P or P exhibition at ASM by getting students to share on online platforms like Mentimeter, Nearpod etc. to capture their thoughts</p> <p>Option 2: Show students 'Make the Switch for nature' by Shawn Miller and have them express their opinion or feelings verbally or use the online platforms stated in Option 1.</p> | <p>Reflection allows resynthesis and organization of thoughts and feelings that prepares the students to ease into the activity / topic so that they feel more connected to the tasks ahead.</p> <p>Starting with open-ended questions also creates space of reconsideration and contemplation.</p> | Can be a follow-up from a Geography, Science, Mathematics, or a Language class. | <p>www.mentimeter.com You may choose word cloud option.</p> <p>OR</p> <p>www.nearpod.com You may choose drawing option with questions e.g., How do you feel after the trip to ASM? How do you feel seeing those photographs?</p> <p>https://okinawanaturephotography.com/ Crabs with beach trash homes (National Geographic June 2018)</p> <p>Have students to also reflect on the question by Shawn Miller 'Will this paper wrap save the planet' and get them to share their views.</p> |
| Main activity | <p>Part 1: Why do wastes matter?</p> <p>Start without explicitly explaining the objectives to students.</p> <p>Students can either work individually or in groups of 3 (mixed abilities).</p> <p>Instructions to students:</p> <ol style="list-style-type: none"> 11. Collect and wash/clean trash produced at home for a period of 5 days 12. Collate them and segregate the trash based on their material e.g., glass, plastic, metal, paper, others 13. Count the number of trash in each category 14. Choose the most appropriate way to represent your data i.e. graphs, charts 15. Interpret the data (as a group) 16. Present your data <p>Option: The class can collate their data and compare it with other classes.</p> | <p>This can be a chance to introduce collaborative learning either on-site or online (using online collaborative tools like google doc, spreadsheet etc.)</p> <p>In that period of 5 days, related content can be covered leading up to the actual activity. Not revealing the objectives explicitly may help students to enjoy the activity and fully immerse in it.</p> <p>Along the way, inject reflection moments in the classroom to allow self-monitoring of progress and learning.</p> | <p>Possible related content:</p> <p>Primary 5/6: Interactions within the environment</p> <p>Lower Secondary Science</p> <ol style="list-style-type: none"> c. Normal technical Matter around us: Water pollution d. Normal academic/Express Interactions: Interactions within the ecosystems <p>Lower Secondary Geography</p> <ul style="list-style-type: none"> - Issue 2: Water supply (Water pollution) <p>IB MYP</p> <ul style="list-style-type: none"> - Interactions between organisms - Additional topics: Environmental Sciences | <p>Google Doc/Spreadsheet</p> <p>Exhibit Section 1: Plastic, a modern marvel</p> <ul style="list-style-type: none"> → Ref: A secondary economy (Randy Olso) 3. What does recycling as a second economy in some countries tell you about the extent of plastic production and wastes? 4. Do you think it will happen in Singapore when Pulau Semakau is completely filled in 2035? <p>Exhibit Section 2: Darker side</p> <ul style="list-style-type: none"> → Ref: The life cycle of disposable plastic (Randy Olson): 3. How is the waste collected at home related to or impact ocean plastic pollution? 4. How do plastic wastes get into our ocean? → Ref: Field of plastic (Randy Olson) 3. Why should we be concerned about ocean plastic pollution? 4. What does it tell us about the life cycle of plastic? → Ref: Hitching a ride (Justin Hofman), Killer plastic (John Cancalosi), Ghost fishing (Jordi Chias) 3. How would you describe such impacts? 4. What do you think led to such outcomes? |
| Post activity | <p>Part 1: Is bioplastics is THE solution?</p> <p>A debate can be held in class to discuss the potential of biodegradable plastic as a 'solution'. Allow student to conduct their own research and choose appropriate ways to represent their findings to 'convince' the crowd.</p> <p>Students can also be invited to make their own bioplastics and experiment ways to break it down. They can then evaluate the sustainability of bioplastics and bring it to the table for discussion.</p> <p>Part 2: What can I do?</p> <p>Next steps</p> <p>Ask students to list the objectives of the activities they have carried out so far. Get the class to select, combine or rephrase them to form 3 key objectives.</p> <p>Possible guiding questions:</p> <ul style="list-style-type: none"> • Does everything that we find need to be thrown away? Could it be reused? • How can we re-value our wastes? • How can we play our part to save the planet? | <p>Questioning a presented solution allows students to break down the facts and evaluate possibilities through their own research and findings. This promotes independent and critical thinking.</p> <p>Investigations driven by curiosity and lead to more meaningful outcomes and connections, encouraging deeper learning across the curriculum. These investigations can be tied to regular Science practical lessons if this entire lesson adopts an interdisciplinary approach, involving collaboration between different subject teachers.</p> <p>This is to reinforce the fact that knowledge can become the power to make a change. Encouraging action behind a voice can empower students to become confident changemakers who will strive to constantly do good for their community, society and environment.</p> | <p>English Language (Primary/Secondary)</p> <ul style="list-style-type: none"> ■ Listening and Viewing for Critical Evaluation ■ Critical Reading, Viewing and Appreciation ■ Speaking and Representing to Fulfil Different Purposes ■ Development, Organisation and Expression of Ideas <p>Lower Secondary Science (Diversity of Matter)</p> <p>GCE O level Biology (6093)</p> <ol style="list-style-type: none"> 2. Organisms and their environment → (f) evaluate the effects of water pollution by sewage and by inorganic waste 3. Biological Molecules (Enzymes) | <p>Plastic-digesting enzymes? https://ypte.org.uk/news/scientists-accidentally-create-enzyme-that-eats-plastic</p> <p>Make your own bioplastics (refer to mini activities) or a simple video.</p> <p>Section 3: The haunting art of plastic pollution</p> <ul style="list-style-type: none"> → Ref: Spill (Mandy Barker) 1. Seeing is believing – what do you think? → Ref: Catch of the day, A harmful hand (David Liittschwager): 1. How has this impacted your impression or knowledge of plastic pollution? → Ref: Picturing microplastics (Martin Ogonowski, Christoph Schur) 4. Can we ever fully quantify plastic wastes? 5. How does this picture change the way you view your role in plastic pollution? <p>Section 4: Towards a cleaner future</p> <p>What are Citizen-led Campaigns? Interactive space at the exhibit: Trace your trash What does Singapore's inaugural Zero Waste Masterplan entail?</p> |

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| | <p>Follow-up:</p> <ul style="list-style-type: none"> • Launch a campaign to reduce the amount of plastic waste in the school. Repeat the litter pick/ sort investigation after a period of time and compare the results. • Present the findings to school leaders with ideas for reducing waste in school. • Launch a bring-your-own campaign | | <p>Primary 5/6, Secondary CCE</p> <p>➔ LO8: Reflect on and respond to community, national and global issues, as an informed and responsible citizen</p> <ul style="list-style-type: none"> - Know that it is important to care for the environment and the lives of others in the world <p>Pre-University CCE</p> <p>➔ Focus area 2: Making a difference</p> <ul style="list-style-type: none"> - Theme 3: Advocacy for good - Topic: Core of a changemaker | <p>➔ Ref: Low tech recycling (Randy Olson)</p> <ol style="list-style-type: none"> 1. How sustainable do you think this is? Why? <p>➔ Ref: The zero waste lifestyle</p> <ol style="list-style-type: none"> 1. A challenge or a goal? <p>Section 5: Science in Action</p> <p>➔ Ref: Inventor, Arthur Huang</p> <ol style="list-style-type: none"> 1. What is upcycling? 2. How do you think Arthur Huang has demonstrated that? 3. What can you do on your part to reduce wastes? <p>➔ Choosing Planet over Plastic: How can we do our part?</p> |
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Suggested Mini Activities

| Activity | Level (suggested) / Subject links | Description | Exhibition links |
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| Ocean Pollution Sensory Bin | Preschool | <p>You can use the following suggested items to make the bin: Sensory Table or Large Plastic Bin/Tub, Water, Plastic Ocean Animals, Seashells, Toy Boat, Cocoa Powder, Vegetable Oil, Plastic Bags, Random trash, Coffee Grounds, Sponge, Dish Soap. Small Scrub Brush, Plastic Tweezers / cotton buds</p> <ul style="list-style-type: none"> Let your child examine what has happened to the water. Discuss the pollution in the ocean and how pollution works. Shred plastic shopping bags and add the plastic to the water and stir it around. The plastic has polluted the water. It's around the animals' necks, arms and legs now. Discuss what happens when an animal gets stuck in plastic waste. Take a sample of the polluted water by filling a small glass or plastic bottle with a lid. Set that bottle or glass next to the clean water bottle. Use plastic tweezers or scoops to remove the plastic from the water. Untangle any plastic from the animals. | <p>Section 2: The Darker side of plastic</p> <p>Related Artworks:</p> <ol style="list-style-type: none"> Pick of the Litter (Brian Lehman) A plastic filled sea (Nick Pumphrey) Nature finds its way (Shawn Miller) Hitching a ride (Justin Hofman) Killer Plastic (John Cacalosi) <p>Section 3: The Haunting Art of Plastic pollution</p> <p>Related Artworks:</p> <ol style="list-style-type: none"> Refused (Mandy Barker) Spill (Mandy Barker) Shoal (Mandy Barker) Curl (Mandy Barker) Dying to eat (David Liittschwarger and Susan Middleton) |
| Garbage Music: Make a Musical Instrument out of Plastic Rubbish | Preschool / Lower primary / PYP <ul style="list-style-type: none"> Music/Dance Art | <p>Encourage your children to use (clean) plastic rubbish to make their own instruments. They can even put on a concert for you or for social media</p> <p>Some instruments that can be made: https://www.youtube.com/watch?v=K_FDf1o7w2Y</p> | <p>Section 4: Towards a cleaner future</p> <p>Related Artworks:</p> <ol style="list-style-type: none"> The zero waste lifestyle (Timothy Archibald) Low-tech recycling (Randy Olson) Reuse (Randy Olson) |
| Having a Plastic-Free SPA Day | Primary / PYP / Lower Secondary <ul style="list-style-type: none"> Science Geography | <p>Share with your children/students the invisibility of microplastic pollution: https://www.blue-growth.org/Plastics_Waste_Toxins_Pollution/Microbeads_Plastics_Waste_Pollution.htm</p> <p>You can show your students/children how to make great natural plastic-free scrubs from coconut oil, sugar and salt, and you can also make face masks from honey and bananas.</p> <p>Coconut/salt scrub: https://www.youtube.com/watch?v=lyDhWRTkeo (Science i.e. solubility: What makes salt a suitable combination with oil to create a scrub?)</p> <p>Coconut coffee body sugar scrub: https://www.youtube.com/watch?v=krDMrUnOevs (Science i.e. solubility: E.g., What makes salt a suitable combination with oil to create a scrub?)</p> | <p>Section 3: The Haunting Art of Plastic Pollution</p> <p>Related Artworks:</p> <ol style="list-style-type: none"> Catch of the day (David Liittschwarger) A Harmful hand (David Liittschwarger) Picturing Microplastics (Martin Ogonowski and Christoph Schur) |
| Garbage Fashion | <ul style="list-style-type: none"> Art Science (Diversity of Matter) | <p>Upcycling—or “making new furniture, objects, etc. out of old or used things or waste material”—is one of the best fashion trends for the environment</p> <p>https://www.youtube.com/watch?v=9vCstrZ7ilk</p> | <p>Section 5: Science in Action</p> <p>Related Artwork: Short film featuring Arthur Huang, Inventor</p> |
| Empathy Puppet Show | Primary / Lower Secondary <ul style="list-style-type: none"> English (writing skills, text types, genre etc.) Literature | <p>Make your own ocean creatures puppets using recyclable and</p> <ol style="list-style-type: none"> write a short skit (younger children/students) https://youtu.be/SYwW79P7PDM?t=108 hold a debate/roundtable (between ocean puppets) about impact of plastic pollution in the ocean to demonstrate what they have learnt e.g., from visiting the exhibition. | <p>Section 3: The Haunting Art of Plastic Pollution</p> |
| Making Bioplastics | Primary / Lower Secondary <ul style="list-style-type: none"> Art Science | <p>Making Bioplastics</p> <ol style="list-style-type: none"> https://theearthproject.com/how-to-make-biodegradable-plastic/ https://www.youtube.com/watch?v=nr6Ks4R3aAM https://www.youtube.com/watch?v=bnlBnnlpfoY (using banana peels) <p>Extended activity: Problem with Bioplastics</p> <ul style="list-style-type: none"> https://ypte.org.uk/news/scientists-accidentally-create-enzyme-that-eats-plastic | <p>Section 4: Towards a cleaner future</p> <p>Related Artwork:</p> <ol style="list-style-type: none"> All together now (Randy Olson) |
| Understanding Impacts of Plastic Pollution | Primary/Lower Secondary Science | <p>Activity resource from WWF: https://www.wwf.org.uk/sites/default/files/2019-08/WWF_Oceans_and_Plastics_KS2_Activities.pdf</p> | <p>Section 3: The Haunting Art of Plastic Pollution</p> |

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| Modeling Pollution Uptake by Plants Using Celery | Science | Pollution can end up in our own food chains and can present a negative effect on health and wellbeing. This activity can be used to kick off a discussion about pollution and food chains. It involves using celery as a simple model (representing food in the food chain) to demonstrate how contaminants in water (in the case of water pollution) can be drawn up into plants. Simply place a piece of celery in petri dish half filled with water that has a red/blue food dye added. After 20-30min, have students observe how the coloured water has moved up the celery stalk first observing the cut end and then using a scalpel to cut the celery transversely and longitudinally. Engage the students in discussing what the dye represents and the impacts on the different trophic levels of the food chains. | Section 3: The Haunting Art of Plastic pollution |
| Polluted Display Jars | Art | Play the video https://www.youtube.com/watch?v=4qGzZQ9Vh60 and have students reflect on it before making their own water pollution 'display'. Have students think of the message they want to bring across through their display. Using trash collected from school or classroom, or even places near their homes, students can collect those samples and use them for their artwork. This can be done during environmental week or as part of curriculum theme to raise awareness in the school community. | Section 3: The Haunting Art of Plastic pollution |
| Modeling the Movement of Pollution Through Ecosystems | Science | Through this activity, students can gain understanding and empathy of the environmental impact of pollution and how pollution is transferred through ecosystems, and eventually affect living things. Play the video: https://www.youtube.com/watch?v=cwTDvqagPIM and have students reflect on the content presented, focusing on the 1) what (is happening) 2) why (is it happening) 3) how (do I feel). After the video, students engage in a role-play game where the class can be divided into five groups 1) humans; 2) marine plants; 3) marine plant-eating animals; 4) marine non-plant eating animals. Use different coloured board/fridge magnets to represent water pollutants such as microplastics, fuel etc. Students can form marine food chains that they have been taught or are aware of and kick start the game by passing on magnets depending on the represented food relationships. Students will also be able to understand the idea of bioamplification in this activity. Wrap up the activity by having student discuss the impacts of 'unseen' and 'seen' pollution and the impacts of such pollution when it ends up in marine (and our) food chains. | Section 3: The Haunting Art of Plastic pollution |