STEAM Environmental Workshop

Facilitator's Guide

THE BRETEAU FOUNDATION

Introductory Note

Welcome to the Breteau Foundation's Facilitator's Guide which will assist you in supporting your students through our series of four STEAM environmental workshops.

Before starting this guide, it is important to note that your role as teacher will shift to that of a facilitator during these workshops; so as to foster the creativity, curiosity and critical thinking that STEAM learning readily offers to students. In this way, the guide will offer suggestions for open-ended questioning, student self-reflection and discussion opportunities. This STEAM project takes on a more guided than free approach to provide you and your students with a first introduction in STEAM learning. The first workshop introduces pollution as an issue, so it is more guided and informative in structure than the other workshops.

Each environmental workshop follows the same structure and begins by indicating the stage of the STEAM process (our complete route) e.g., identifying/exploring problems, planning, creating. The beginning of each session provides the opportunity for students to reflect on what they have learnt so far. The numbers of the videos correspond with their matching 'content explanation'.

At the end of each workshop, a certificate has been provided in the appendix section of this guide which can be given to students to highlight their participation and the skills they may have practised during the session.

The estimated time for each workshop is 1-1.5 hours, however you may wish to revisit or spend longer on certain sections, depending on the requirements of your students' needs. In this way, the 4 workshops may need to be carried over more than four 1-hour lessons.

We hope you and your students enjoy your journey into STEAM education!

Workshop 1

Student Reflection

Ask students to think of possible problems in their local environment; encourage them to think about how these problems might affect natural features such as rivers/lakes, trees/plants, crops, people and animals. Ask students whether they know what might be causing these issues?

Activity (You will discover...)

Explain that these possible issues within their environment are linked to pollution. Encourage your students to search for the definition of pollution; either online or using a dictionary. (Pollution is defined as the presence or introduction of a harmful or poisonous substance into the local environment)
Explain to your students that they will be discovering about different types of pollution – air, water and waste/land. Recap questions from workshop slides (these correspond to the videos).

1. What is air pollution?
2. What is water pollution?
3. What is waste and land pollution?
4. How do these issues affect the world I live in?

Video and Discussion

Explain to your students that they will watch a series of videos on different types of pollution and ask them to listen attentively so they can discuss and share their ideas. In the content questions section below, attached to each question is a content explanation for your reference. Each video has been purified to allow easier viewing and the content question section shows where to pause videos for discussion.

1. **Air pollution**
   http://www.viewpure.com/Yjtgu2CxtEk?start=0&end=0

Pause at 1:00min

Key question:
Why is it important to keep our air clean?

Content explanation:
All living organisms rely on breathing oxygen in the air to keep alive. If the air is dirty, it affects our bodies.

Pause at 1:29 min
Can you name some examples of different air pollutants?

Content explanation:

- Gases with harmful chemicals, sand, dust particles and other materials which evaporate to become pollutants.
- Pollution can travel with the wind and affect the Earth's atmosphere. The atmosphere protects living organisms from the heat of the sun in the day and prevents heat from escaping at night. Air pollution affects the atmosphere by trapping too much heat in the atmosphere and raising the Earth's temperature.

Key question(s):
How might you be affected by air pollution? When breathing in dirty air, the dirt can get trapped in our lungs.

Pause at 4:50
Key question(s):
What type of human inventions burn gas and oil creating air pollution?

Content explanation:

- Different types of transportation and factories.
- One of the effects of air pollution includes acid rain. This is when rain mixes with air pollutants and can affect trees, animals and other living organisms. It can also make it harder for crops to grow.

Key question(s):
How might you be affected by air pollution?
Content explanation:
When breathing in dirty air, the dirt can get trapped in our lungs. This can cause breathing problems such as asthma. Other ways in which we can be affected is by having headaches or allergies.

2. **Water pollution**
http://www.viewpure.com/A3rLfrIUzY4?start=0&end=0

Pause at 1:28 mins
Key question:
In what ways can humans pollute water?

Content explanation:
There are two ways in which humans can pollute the water: either by throwing rubbish/litter into the water or by leaking invisible chemicals into the water. Water can also be polluted naturally by for example volcanoes or floods.

Pause at 2:08 mins
Key question:
What are the different man-made causes of water pollution?

Content explanation:
Some examples of different man-made causes of water pollution are sewage, fertilisers, chemicals and litter.

3. Waste/land pollution

Video 3i) http://www.viewpure.com/FVArB2cnB4Y?start=0&end=0

Content explanation:

- Waste pollution and land pollution are caused by the amount of rubbish or litter humans throw away.
- Rubbish or litter that isn't recycled are sent to enormous pits called landfills.
- These landfills can release different gasses and liquids which can be harmful if they interfere with the air or soil.
- The gas that is released from landfills, methane, is a greenhouse gas.
- This means it forms part of a collection of gasses which help to trap heat in the Earth's atmosphere, causing the Earth's temperature to rise.

Video 3ii) http://www.viewpure.com/18FLfQDInI8?start=0&end=0
Key question(s):
Name different ways in which throwing litter can harm animals and people?
What solution did the girl in the video find to help reduce littering and what other ways are there to reduce litter?

4. **Climate change**
   http://www.viewpure.com/IJoAcD0oUww?start=0&end=0

   Content explanation:
   In simple terms, climate can be described as the 'usual' conditions of a place e.g., dry, hot and humid (tropical), snowy (polar).
   Definitions:
   Desertification - This is the process that sees productive land turned into non-productive desert. It usually affects dry areas on the edge of deserts, e.g. The Sahel, south of the Sahara Desert in Africa. It expands desert land into surrounding areas. This process happens as a result of climate change (increased temperature of the Earth).

   Content explanation:
   Global warming and fossil fuels:
   Due to a combination of human actions, our layer of greenhouse gases around the Earth has been getting steadily thicker and, as a result, the Earth has been getting hotter. This is known as global warming.
   Fossil fuels such as coal, oil or natural gas are formed from the remains of dead organisms, known as fossils.
   When fossil fuels are burned, they release large amounts of carbon dioxide, a greenhouse gas, into the air. Carbon dioxide traps the heat around the Earth making the Earth hotter. We use fossil fuels such as coal, oil and gas to heat our homes, fuel our cars and power factories. When fossil fuels are burned, they create energy to do this.
   Renewable energies such as wind power or solar power uses natural energy which means it doesn't pollute the air and release carbon dioxide or other pollutants.

   Pause at 1:06
   Key question(s)
   What are some of the consequences of global warming?

   Content explanation:
   Water shortage, desertification, sea levels rising, disappearance of lakes. Also, natural disasters like droughts, floods, and huge storms have increased.

   Pause at 4:28
   Key question(s)
   What are some of the ways that people can reduce the amount of carbon dioxide they use?

   Content explanation:
   People can reduce the amount of carbon dioxide they use by using renewable energies, reducing the use of transportation which uses petrol, using less plastic, planting trees, trying to always recycle and turn off lights at home when they're not in use.

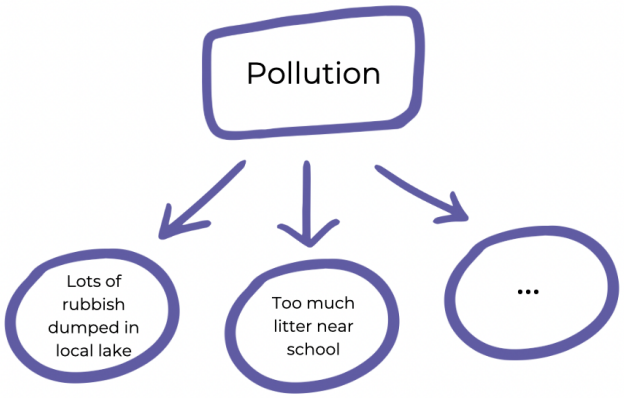
Student Reflection & Activity

Key question(s): How does pollution affect your local environment?

Activity:

Ask your students to create a mind-map which shows different ways they think pollution affects their local environment.

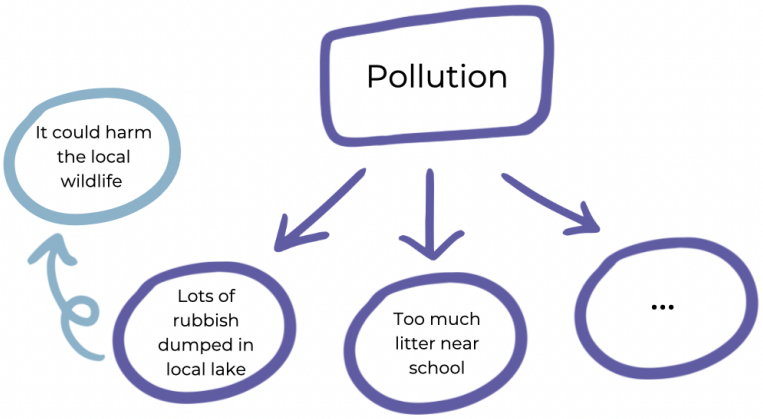
Example:



Key question(s):
What types of pollution have you seen around yourself?
Describe some ways in which this might affect you, your family or your community.

Activity:
Ask students to add to their mind-map the different ways in which these types of pollution might affect them and their community?

Example:



Sharing Responses and Peer Feedback

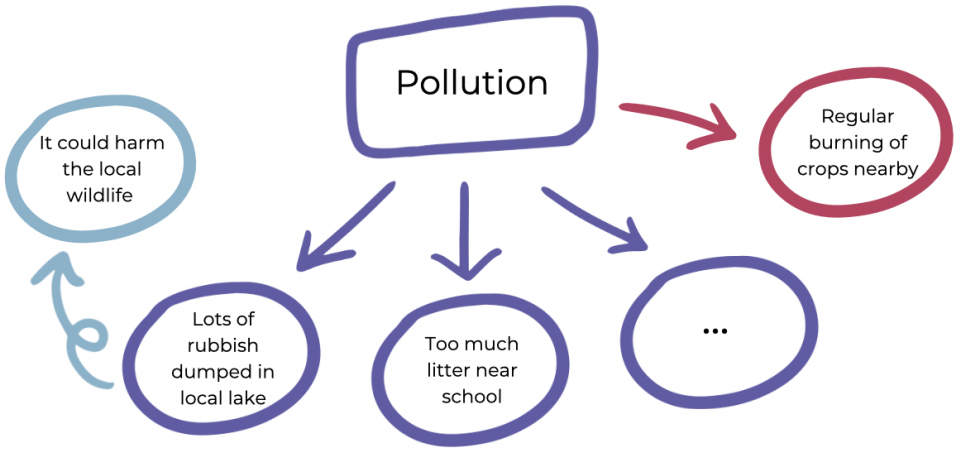
Key question(s):
Which types of pollution has your friend seen around them?
How could we help reduce the pollution around us?

Key question(s) – student reflection
Could I add any other types of pollution to my answers?
What ideas do others have to reduce the pollution around us?

Activity:

In a different coloured pen/pencil, ask students to add any other ideas to their mind-map that they have thought about after having discussed their answers with a friend.

Example:



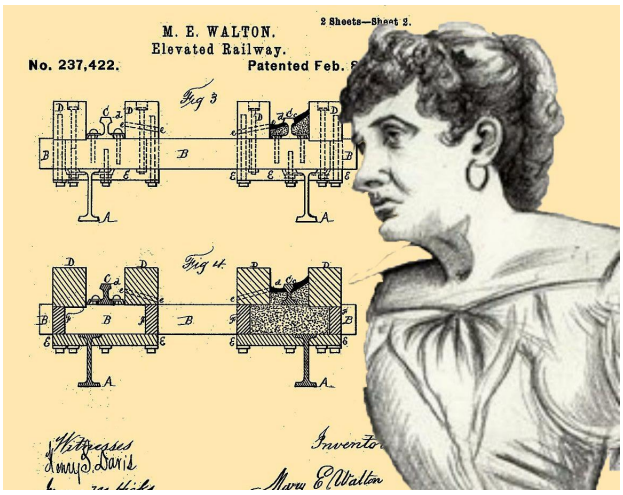
Plenary – Student Reflection

Ask students to write a project log for the session about what they have enjoyed learning and noting down some key words and phrases to help them remember what they have learnt.

Content explanation – use this to help prompt your students if needed:

- The different types of pollution
- How pollution affects their local environment and around the world.
- How to start thinking about solutions to reduce the amount of pollution around them.

STEAM Role Model - Mary Walton



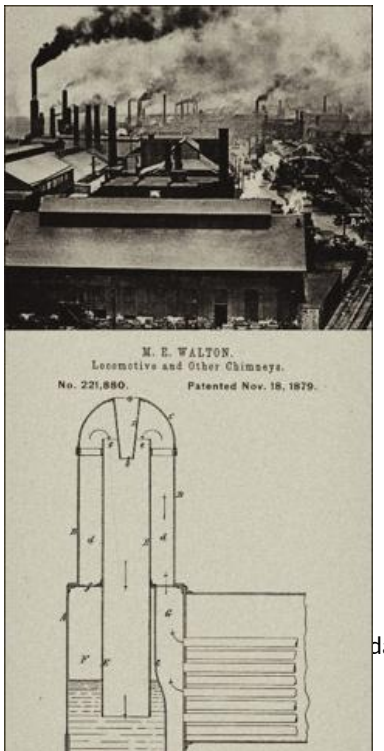
Either as a whole class, in groups or independently, ask your students to read the information on Mary Walton – see link (this is also attached in the appendix for printing). Ask them to highlight or underline any vocabulary they are unsure of.

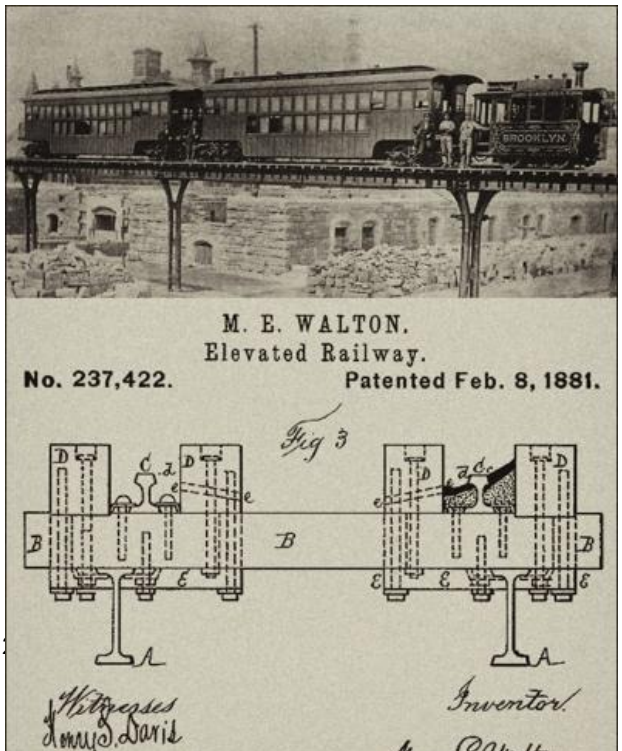
Content explanation:
See below for word definitions within the text.

Emission - a substance that is sent out or given off.
Industrialisation - Industrialization (or Industrialisation) is a process that happens in countries when they start to use machines to do work that was once done by people.
Sewer - a large underground pipe that carries off the liquid and solid waste of a town or city
Sewage - Sewage is the liquid waste produced by us all when using the toilet, having a bath or shower or washing clothes and dishes. In some places it also includes rain-water falling on houses and roads. In big towns and cities it can also have liquid waste from factories.

Activity
Ask children to draw a picture to show how Mary Walton reduced the amount of harmful emissions into the air.

Key question(s):
What else did she invent?
Can you draw a picture of what you think it might look like?
Compare your picture with the given diagrams.

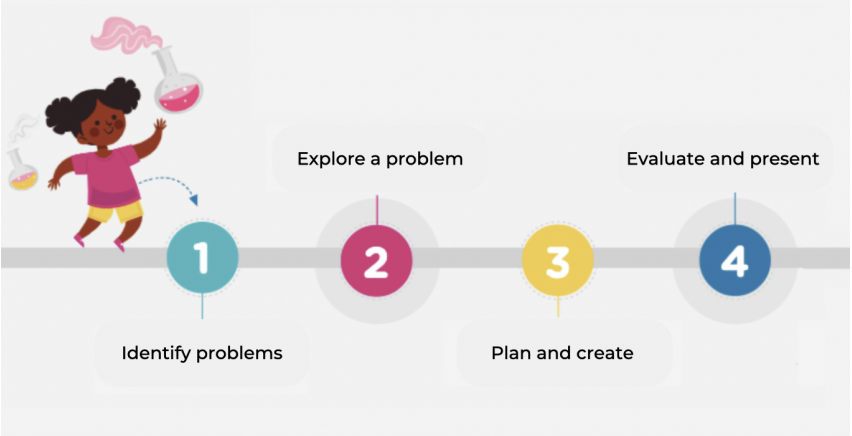




(A full-sized, printable version of these diagrams have been included in the appendix)

Workshop 2

Our Complete Route



Recap:
How are we affected by the pollution around us?

Activity:
Give students 2 mins to record (individually/in pairs/group) as many different types of pollution and their consequences as they can.

Student reflection:
What is waste pollution and how does it affect us?

Activity:
Use the KWL (Know, Want-to-know, and Learned) grid to encourage students to write down what they know and want-to-know about waste pollution. Ask students if they know other words for waste and encourage them to think about different types of waste.

Content explanation:

Explain to students that they will be exploring the following questions in the session:

1. What are the different types of litter?
2. Where does litter go?
3. Why is it important to reduce the amount of litter in my community and the world I live in?

Videos:

1. http://www.viewpure.com/XiRfrRsOkqg?start=0&end=0
2. a)http://www.viewpure.com/zVQUTAJIi8Q?start=0&end=0
   b)http://www.viewpure.com/8-WGCeNSdjc?start=0&end=0
   (this video complements previous one, but doesn't need instruction/guidance)
3. http://www.viewpure.com/4pbXLw6NDBM?start=0&end=0

http://www.viewpure.com/VUUUxOl715s?start=0&end=0
https://www.pbslearningmedia.org/resource/ee18-sci-waterpol/kids-go-green-litter-and-our-oceans/

Key question(s):

Video 1

What are examples of biodegradable waste?
What are examples of non-biodegradable waste?
What are the consequences of burning non-biodegradable waste?

Video 2

In the story, how did waste used to be disposed of?
How did waste get in the ocean?
Where does waste get dumped now?
How does an incinerator deal with waste?
What are cities and towns doing now to reduce the amount of waste going to the landfills?

Video 3

Watch all 3 videos and ask children to respond to the following questions (in order of videos):

- What would happen if everyone threw their litter on the ground?
- Who might be affected by the litter thrown on the ground?
- Plastic is a new material; how long does it take to break down or (degrade)?
- How does plastic affect ocean wildlife?

Content Explanation (if applicable):

Video 1

Radioactivity is simply **when very small particles in objects emit energy or smaller particles**. The energy that is produced can result in cancer, serious environmental damage, or helpful technologies. There are different degrees of radioactivity, and different exposures increase the harm it can cause.

Video 2

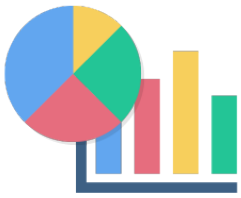
Garbage and trash = waste – explore different terms for waste e.g. litter, rubbish, . Everything is 'waste' in scientific terms.
Video can be stopped at 6:29 mins to focus on the problem.

Student reflection & activity:

Key question(s):
How is my community affected by litter?
Think about some familiar places to you - it could be at home, around your home, at school, walking around your local area.

Activity:
Create and carry out a survey to find out where other people have seen significant amounts of litter within the community. How can you present your results?

Encourage your students to think of 3 main areas within their local community to start with e.g., near public toilets, school, town centre to collect responses about and then collect any other alternative responses e.g., outside shops. After gathering the data, ask them to think of different ways in which they can present the data.



Sharing responses and peer feedback:

What might the consequences of these litter problems be?
Are there any other problems I haven't thought of?
What types of problems have my friends thought of?
Which problems can I start brainstorming solutions for?
If litter is not dealt with, over time how might this affect the health and wellbeing of people and animals around you?

Activity:

1) Share your ideas with a friend and make a list of ways in which you could both reduce the problems of litter.

2) Create your own drama role-play, poster or song to show the effects of littering and waste pollution.

Encourage and model how to create a script for the role-play – students may want to work in pairs or groups. If needed, provide a starting point for the script.

Example:

Ahmed : Hey! You shouldn't just throw your litter on the floor!
Rosie: Why not?

Plenary – student reflection:

Activity:
Ask your students to fill in the last column of the KWL chart (learned) to think about new ideas or concepts they have learned within the session.

Content explanation
Use these prompts to help if needed:

What is litter/rubbish/garbage/trash?
What are the different types of litter or waste?
What are the effects of littering on me, my local community and the world?

STEAM role model – biography of an inspirational person – **Autumn Peltier**

Video and web link:
https://en.wikipedia.org/wiki/Autumn_Peltier
http://www.viewpure.com/A33XRMLBbOc?start=0&end=0

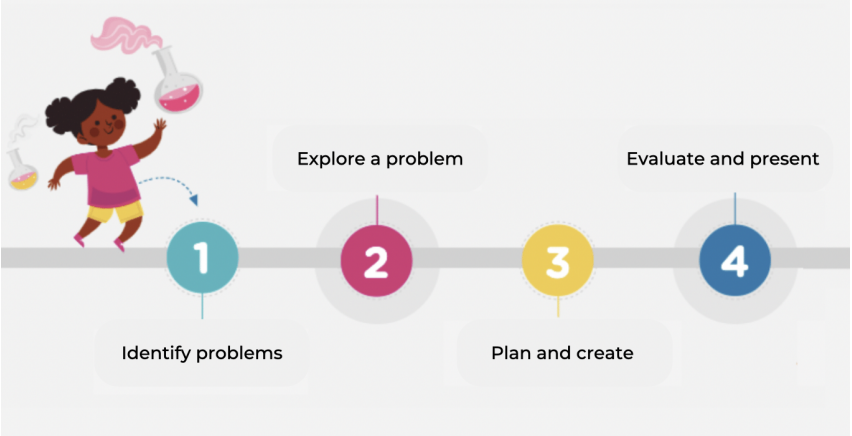
Watch the video of this young activist, Autumn Peltier, and discuss with students what she was campaigning for and why?

Activity:
Like Autumn, is there a problem with litter or waste in your local environment that you would like to campaign against? How could you persuade those around you and your local community to take action?

Encourage them to brainstorm their own ideas in mixed interest groups. Suggest writing letters, creating posters or preparing presentations as prompts if needed. Allow students to explore and take ownership in how they want to relay the information.

Workshop 3

Our Complete Route



Recap/student reflection:

What are some of the litter problems you thought of in the last session? How can we reduce the amount of litter in our environment?

Activity:

Give students 1 minute to write down different ways in which they think they could help reduce the amount of litter in their environment. Share and discuss these responses as a class.

Content explanation (You will discover...):

In the session, students will be exploring:

1. How can I reduce, reuse and recycle my litter?
2. What types of litter could I reuse to design a product to help my family and community?
3. What do I need to plan and design my product?
4. How to build a prototype for your design

Videos:

1)a) http://www.viewpure.com/Yoqivh3GkaE?start=0&end=0
b)http://www.viewpure.com/LxNumOifkT0?start=0&end=0
c)http://www.viewpure.com/SSIVXZrWMK4?start=0&end=0

2)a) http://www.viewpure.com/h0WgF6U8MoQ?start=0&end=0
b)http://www.viewpure.com/-SPh2rF85PU?start=0&end=0
c)http://www.viewpure.com/OJJvghf1E7A?start=0&end=0
d) http://www.viewpure.com/gOy4EH5OFGw?start=0&end=0

3) http://www.viewpure.com/W-eqjMc1Efs?start=0&end=0
http://www.viewpure.com/RM04n0-QtNo?start=0&end=0
https://www.nationalgeographic.org/media/nasa-kids-intro-engineering/

4) http://www.viewpure.com/HaR85ATAdSM?start=0&end=0

Content explanation/Key questions:

1a) Where can litter be put instead of thrown on the ground?
Around the world, countries now separate their rubbish - what types of litter can be recycled?

1b) Recap on the song 'Reduce, Reuse, Recycle' and ask students what they think these terms mean?

1c) Ask students what they think the recycling plant looked like to them. What happened to the waste that couldn't be recycled?

2) There is a selection of videos to choose from and you may want to show all of them or just the ones you feel are more relevant for your class. Use the video content to discuss which types of litter they think might be available for them to reuse.

3) Watch all the videos and explain to the students that there are clear steps to planning an idea or invention.

1. Identify the problem
2. Brainstorm some solutions
3. Imagine your idea/invention/product and research how effective your ideas would be (allow students to carry out independent research into similar designs)
4. Design some ideas by drawing and labelling your designs.
5. Create your chosen design.
6. Evaluate your design.

Organise your students into groups of 4-6 children, ideally with differing strengths and interests. Using a large template of 6 boxes (included in appendix) in comic strip style, as below:

Students work as a group to share their ideas at each step to enable them to see the sequence of their planning. At this point, they will only be completing 4 boxes – corresponding to the points above. After discussing ideas, **they may choose to create their designs individually, in pairs or groups.**
Example:

Box 1 = People where I live throw a lot of plastic bottles on the ground.
Box 2 = With the help of an adult, I could safely pick them up/wash them and see if I can recycle them and convert it into something new. Here are some of my ideas (drawn)
Box 3 = My chosen design is _____.
Box 4 = Here are some possible designs...
Encourage children to label their design, detailing which materials they would need. **Ask students to carry out their own research (online/offline) to find out about their chosen design and its effectiveness.**
With the following sentence starter, 'My research shows this will be effective because_____' - ask children to explain why their idea will provide an effective solution.

4) Ask students to design and make their own prototype using just paper - remembering how, where and by whom the design will be used.

Content explanation:

Reuse - You can "reuse" materials in their original form instead of throwing them away, or pass those materials on to others who could use them too
Recycle - Recycling is the process of taking materials ready to be thrown away and converting (changing) them into reusable materials
Recycling involves collecting used materials, such as metal, glass or paper and using them to produce new samples of the material. The steps usually needed are: collecting used items, transporting the used items to a recycling centre, breaking up the items and sorting the different materials.
Prototype - A prototype is like a model that designers make to take their idea from a flat illustration on a page to a 3D item that you can look at from all angles.

Student reflection:

How effective is my design?
Who am I making this for and how am I solving the problem of litter?
What 3 things do I like about my design?
After building my prototype, are there any improvements I could make to the final design?

Activity:

Ask students to complete sentences either written/verbally using the following sentence starters:

I am making my design for _____ (person/people) because _____.

The favourite features of my design are:

1.
2.
3.

Before I start making my design, using my illustration and prototype, I would improve my design by _____.

Sharing responses and peer feedback:

What do I really like about my friend's design?
What ideas do I have that could help improve my friend's design?

Discussion:

Encourage students in groups to share one thing that they learnt/was new for them from the session.

Content explanation – use the following prompts to help if needed:

How litter can be reduced, reused and recycled
What problem I could solve by reusing a piece of litter
How to plan and evaluate my design

STEAM role model – biography of an inspirational person –
William Kamkwamba – (inventor, engineer and author)

Student videos:

http://www.viewpure.com/0gtfZ2-SMJE?start=0&end=0 –
The Boy Who Harnessed The Wind – (children's book written by Kamkwamba – read aloud)

http://www.viewpure.com/arD374MFk4w?start=0&end=0
Moving windmills – his personal story

(Facilitator reference - http://www.viewpure.com/6QkNxt7MpWM?start=0&end=0 – TED talk)

Plenary & student reflection:

Ask students to watch the narrated story of 'The Boy who Harnessed the Wind.'

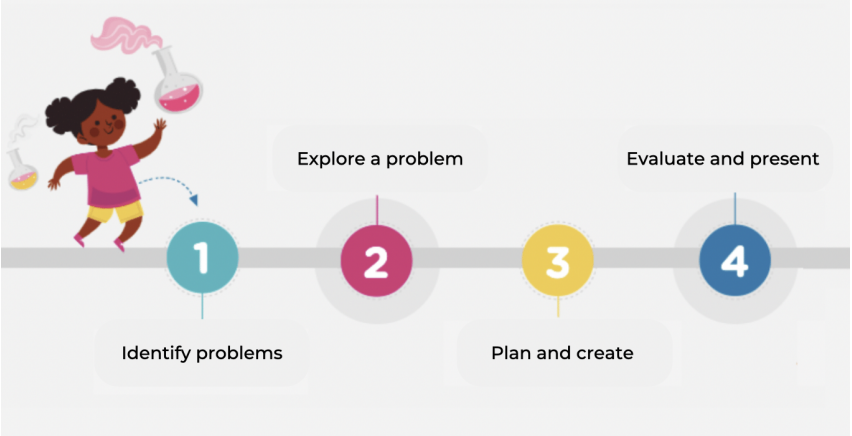
Key questions:

If they met William Kamkwamba, what would they ask him about how he planned and created his design?
What similarities do they think they share with William in how they are designing their product?
What problem would they like to solve to help their community?

If students find difficulty in finding similarities to Kamkwamba's design process and theirs, support them by recapping the STEAM learning process – identify problems, plan, create, evaluate and present.

Workshop 4

Our Complete Route



Note: This workshop involves the children creating their actual designs and practising their evaluation skills whilst making their design and once the product is finished.

Student reflection:

How will I use my plan to create my design?

Activity:

Students to organise themselves back into their previous groups and ask them to recap on the work completed from the last session.

Key question:

Is there anything I would add or take away from my design sequence (planning sheet with comic-strip style boxes)?

Content explanation (You will discover...) :

Outline what students will learn during this workshop.

1. What design skills can I include in my product?
2. How can I use self-assessment to evaluate my final product?
3. How can I present my final product to an audience?

Videos:

1.http://www.viewpure.com/SinLvPGySmQ?start=0&end=0
https://www.bbc.co.uk/teach/class-clips-video/design-and-technology-ks2-making- structures-stronger/z626hbk
http://www.viewpure.com/bhLQYt_0EMQ?start=0&end=0
http://www.viewpure.com/q4OW63FH88g?start=0&end=0

2.http://www.viewpure.com/RSoIgPMT9AE?start=0&end=0

3.http://www.viewpure.com/8IbheB2-ixM?start=0&end=0
http://www.viewpure.com/PX_DAFXQxpc?start=0&end=0
Content explanation:

1. Watch all the videos and ask them to add to their planning sheet/prototype any design skills they might like to add to their design.

At this point, ask children to start making their designs, using the collected materials.

Evaluation/self-assessment skills:

2. After watching the video, ask students whether they use self-assessment in any other subjects they learn?
   Explain that they can use these skills when creating a product with a scientific or engineering focus.

   Key question:
   What different ways could you self-assess your design at this point?

3. Ask students to prepare a short presentation on their final design using the prompt questions below and the video to help them deliver the presentation.
   - What have you created?
   - Who have you created this for? Who else might benefit now you have made it?
   - Why have you created your design?
   - How does your design work?
   - What did you use to make your design?
   - Describe any changes you made to your design and why.
   - Why does your design help the problem of littering?
   - What are the main advantages of your design?

Allow students to choose how they would like to present their design. You may want to provide the following resources for them to choose from, if available:
- Tablets/laptops/computers (for presentation apps) can be linked to digital board/projector
- Large paper & pens/markers
- Flipchart paper
- Whiteboard/mini whiteboards

Student reflection & activity:

Key question(s):
Does my invention look different to my original plan?
What changes did I make as I was creating it?

Activity 1:
Using a two-box template (included in appendix), ask students to create a before and after picture of their design. Ask them to list what they changed and why.

Before	After

Activity 2:
Encourage students to consider the following questions:

What am I most proud of with my final product?
Are there any improvements I would make?
Do I think my product could help someone else, apart from the person/people I made it for?

Using the 'Wow and Now' template (attached in the appendix), ask students to write down what they like or are most proud of about their design ('Wow section). In the 'Now' section, ask students to write down anything they would like to improve about their design or has the person/people that would benefit from the design changed. Explain that the example questions are to help prompt their ideas.

Wow!	Now...
What am I most proud of with my final product?	Are there any improvements I would make? Do I think my product could help someone else, apart from the person/people I made it for?

Sharing responses and peer feedback:

All students share their final designs with a friend and inside a large 'star' template (attached in appendix), students write any positive feedback they received from their friends. In a different colour within the star, ask students to write emotion words about how they felt designing, making and presenting their final product e.g., proud, excited, relieved. Some examples of emotion words have been provided in the appendix.

Key questions:

What positive feedback did my friend give about my design?
How does making and presenting my ideas make me feel?
What positive feedback could I give about my friend's invention?
How could I help my friend improve their design?

Plenary:

Recap with students the journey they have taken in making their products, discussing the points below. You may choose to do a class collage with small cards/pieces of paper where students write down one word/phrase to sum up their experience of the project.

How to use a plan to create a product to provide everyday solutions using litter
How to overcome any problems I had during the making process
How to make improvements to my design
How to present my ideas to others

STEAM role model – biography of an inspirational person – ***Nzambi Matee***

Student video - http://www.viewpure.com/iFcPqXxAUWM?start=0&end=0
Teacher reference - https://en.wikipedia.org/wiki/Nzambi_Matee

Key question(s):

Nzambi Matee is a young activist, engineer and environmentalist. Which of these roles would you want to find out more about?

If you could recycle any waste material to make it into something beneficial to you and your community - what would you make?

Appendix - resources

Certificates to follow...

THE BRETEAU FOUNDATION

Congratulations!

On completing the 1st STEAM session and showing excellent participation!

You have demonstrated the following STEAM skills and mindset:

Curiosity

Communication

Critical thinking

Collaboration

THE BRETEAU FOUNDATION

Congratulations!

On completing the 2nd STEAM session and showing excellent participation!

You have demonstrated the following STEAM skills and mindset:

Curiosity

Creativity

Problem-solving

Analysis

THE BRETEAU FOUNDATION

Congratulations!

On completing the 3rd STEAM session and showing excellent participation!

You have demonstrated the following STEAM skills and mindset:

Research

Team-working

Problem-solving

Creativity

THE BRETEAU FOUNDATION

Congratulations!

On completing the 4th STEAM session and showing excellent participation!

You have demonstrated the following STEAM skills and mindset:

Flexibility

Team-working

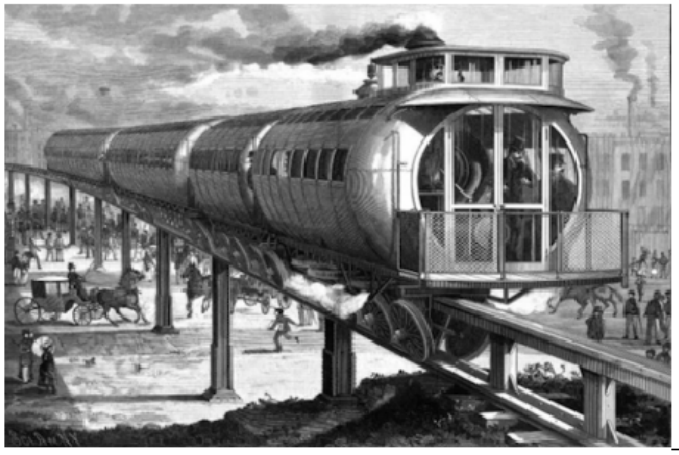
Evaluating

Communication

Mary Walton, the Woman Who Tamed Pollution

August 4, 2014 (https://kidsdiscover.com/quick-reads/mary-walton-woman-tamed-pollution/) by Kids Discover

Share


(http://www.kidsdiscover.com/wp-content/uploads/2014/07/Mary_Walton.png)As bad as smoke and noise are now, they were much, much worse during the Industrial Revolution. Fortunately, an inventor named Mary Walton figured out a way to reduce both kinds of pollution, and our big cities became much more livable because of her.

Industrialization has transformed our world in many positive ways, but pollution has always been one of the heavy prices we pay for progress. This was even truer in the days shortly after the U.S. Civil War, when factories were luring people away from farms and into fast-growing cities. Back then, folks had not yet even discovered just how toxic air pollution really was, but they could see how dirty it made the air and land.

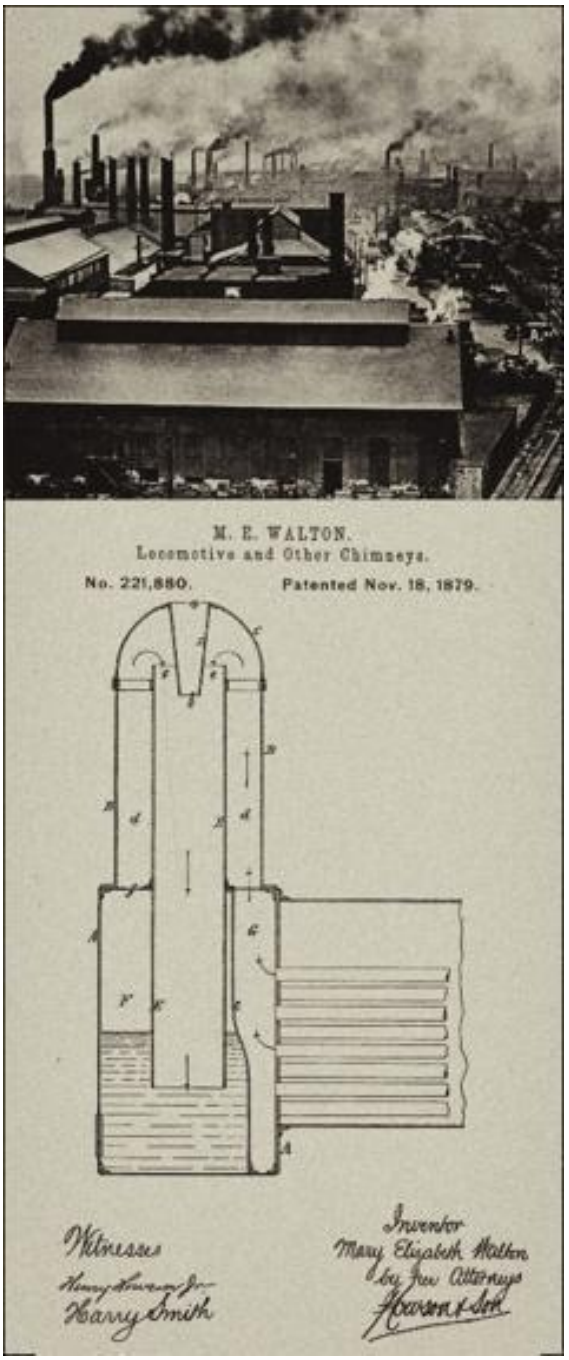
Walton's idea was to force smoky emissions through water tanks before releasing them into the sky. Pollutants were trapped in the water, which was dumped into the city sewers. In 1879, she secured a patent for her idea, which went on to be very popular and helped clear up the skies.

Later, this anti-pollution pioneer found the noise of New York City's elevated trains so unpleasant that she decided to reduce that too. Picture a train rolling or braking above you, metal wheels screeching on metal tracks, and you can imagine how deafening those trains must have been.

Walton created a model railroad in her Manhattan basement and used it to experiment with noise-reduction systems. Eventually she came up with a box-like track casing made of wood. It was painted with tar and filled with cotton and sand, which absorbed most of the noise.

Then she set up a bigger version on a life-sized train, and it worked. Walton was granted her second patent in 1881, and she sold the rights to New York's railroad system, which used it to make trains quieter and the city more livable.

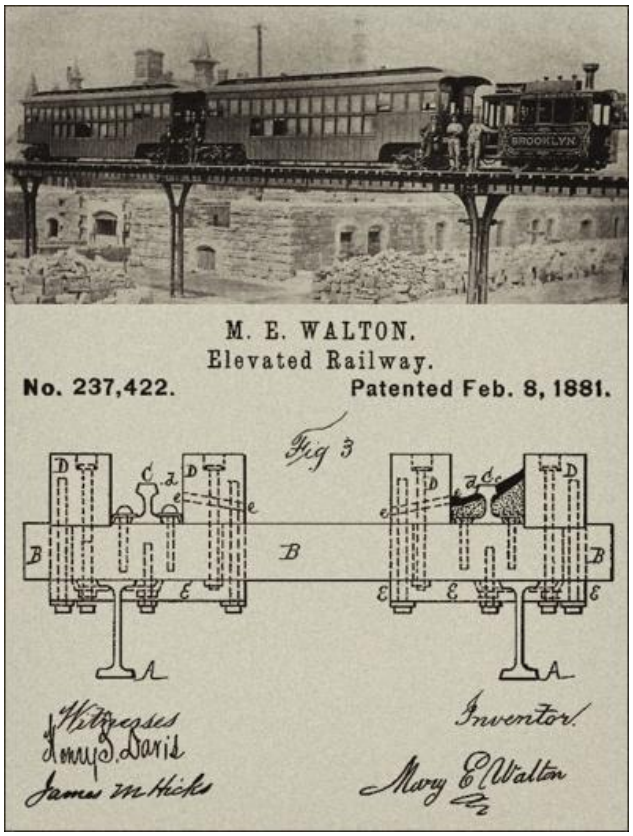
Mary Walton became a hero and also a feminist. In an age when men did most of the inventing, she rose above tradition to stand out and make a difference.



M. E. WALTON.
Locomotive and Other Chimneys.
No. 221,880. Patented Nov. 18, 1879.

Witnesses
Harry Smith

Inventor
Mary Elizabeth Walton
by her Attorneys
Howson & Sons



Taken from (Mary Walton: Female inventor where Edison failed, S. Levin May 30 2018, Wednesdays Women, https://wednesdayswomen.com/mary-walton-female-inventor-who-succeeded-where-edison-failed/)