

3.9 P.O.H. Chan Kwok Wai Primary School – Make a Water Filter and a Light Meter Device with the Process of Engineering Design to Develop Students’Generic Skills and 21st Century Skills

Teacher Name	Mr Tai Yat Wah, Mr Chan Wing Kei
Subject	School STEAM Education Lesson
Subject Level	Primary 4
Learning Objectives	By the end of the learning module, students should be able to: 1. Create a water filter using simple materials such as sand, gravel, and activated carbon. 2. Use a light meter device to test the clearness of the water filter. 3. Develop their problem-solving skills by identifying areas where the water filter could be improved and experimenting with different materials and designs to improve its effectiveness. 4. Develop their generic skills and 21st century skills, such as critical thinking, communication, collaboration and creativity, through the collaborative process of creating and testing the water filter and light meter device, and learn to cherish water and be responsible.
Applied e-Learning platform and tools	Platform: Seesaw, Edpuzzle and Make Code for Micro:bit Tools: Micro:bit, iPad, Light sensors, LED lights, 3D printing shells and a base, batteries, a resistor, crocodile clips with wires, a container, plastic bottles, and different mediums like sands, stones, cartons and gravels.

Introduction

As we all know that clean and safe drinking water is essential for human survival, yet a large portion of the world's population still lacks access to it. Water pollution from industrial and agricultural activities has become a significant problem, and untreated water can contain harmful contaminants such as bacteria, viruses, and chemicals that can cause serious health problems. In response to this problem, it is essential to educate students on the importance of clean water and how to create a water filter to purify contaminated water.



This module aims to teach students how to make a water filter and use a light meter device to test its effectiveness. Through this module, students will learn about the sources of water pollution, the consequences of drinking contaminated water, and the importance of having access to clean and safe drinking water. Students will also develop their problem-solving skills by designing and testing their water filters, experimenting with different materials and designs to improve their effectiveness.

By the end of the module, students will have a better understanding of the importance of clean water and how to create a simple but effective water filter. They will also have developed their generic skills, such as critical thinking, communication, and teamwork, through the collaborative process of creating and testing the water filter and light meter device.

Lesson Design and Assessment

To develop students' problem-solving skills and self-regulated learning skills, I would like to incorporate the engineering design approach for the design of the lessons. The flow of the lessons is shown as follows:

1. Introduction and Problem Identification: Begin the module by introducing the topic of water pollution and its impact on human health and the environment. Discuss the sources of water pollution and the consequences of drinking contaminated water. Students are encouraged to identify the problem of polluted water through watching a video (Picture: Edpuzzle 01) about collecting drinking from the river on Edpuzzle. Students needed to complete some questions based on the content of the video on their own at home. This helps develop their self-regulated learning skills.



(Picture: Edpuzzle 01)

2. Planning and Research: Students are provided with reading resources to research water filtration methods and materials on the platform of Google Classroom. In the classroom, students are encouraged to plan and design their water filters using Seesaw platform (Picture: Seesaw 01), such as drawing or uploading pictures to create virtual prototypes. Students are needed to discuss with peers through collaborative learning, in which they have to explain the reasons why they would like to have such ideas for their designs.

把不同的過濾器材料的圖片擺放先後次序放在過濾器內。



(Picture: Seesaw 01)

3. Prototyping and Testing: Students make their water filters (Picture: Water Filter 01). In the experiment, they can use the materials in accordance with their own design. For the light meter, students are learning to code and make a light meter (Picture: Light Meter 02). The process of coding also boosts their computational thinking skills.



(Picture: Light Meter 01)



(Picture: Water Filter 01)

They then test their water filters using a light meter device to measure the clarity of the water and post the results on Seesaw (Picture: Seesaw 02 and 03). Students are guided to test and refine their water filter designs, experimenting with different materials and designs to improve their effectiveness. For refining their designs, students can choose other material like cottons, coffee filter paper, masks and even other materials that they bring from home. It can help them to think any other materials that can help in our daily life and boost their creativity.

測試過濾器（未經改良）

過濾時間	過濾後的水質	結果 (加 ✓)	
		通過測試	不能通過測試
24.26 秒	依然混濁 / 輕微改善 / 稍為清澈 / 非常清澈 Micro:bit光線感測值： 213	✓	

(Picture: Seesaw 02)

測試過濾器（經改良）

過濾時間	過濾後的水質	結果 (加 ✓)	
		通過測試	不能通過測試
17 秒	依然混濁 / 輕微改善 / 稍為清澈 / 非常清澈 Micro:bit光線感測值： 626	✓	

(Picture: Seesaw 03)

4. Presentation: Students will present their water filter designs, discussing the materials they used and how they designed and created their filters. They will also share their results from testing their filters using the light meter device and reflect on their learning. This will provide an opportunity for students to share their ideas and learn from each other as they can give feedback to each other.

5. Reflection: For the assessment, in addition to the prototype and presentation, students are guided to reflect on their learning and the effectiveness of their water filters and complete their worksheet at home as consolidation work. Also, the importance of clean water and the role of water filters is highlighted for our health.

All in all, by following this engineering design approach with the help of e-learning tools, students will gain a deeper understanding of the problem of water pollution and the importance of clean water. They will also develop their problem-solving skills and their ability to work collaboratively as they create and test their water filters. What's more, presenting their work will provide an opportunity for students to develop their communication skills and learn from each other. Eventually, the message of saving water is everyone's responsibility is also further emphasized as a responsible citizen.

Reflections :

Teaching students how to make a water filter and use a light meter device to test its clearness was an exciting experience for both me and my students. After the initial lesson, students continued to test the water filter repeatedly and identify its design of purification. This allowed us to explore the effectiveness of the water filter and how it could be improved.

Throughout the lesson, I noticed that my students were engaged and excited about the hands-on learning experience. They enjoyed the process of creating the water filter and testing its effectiveness using the light meter device even though the process of coding and connecting wires are difficult to some students. They were also eager to learn more about the design of the water filter and how it worked to purify the water.

As students continued to test the water filter, they were able to identify areas where it could be improved. For example, students experimented with the different types and sizes of materials used in the filter to see how they impacted its effectiveness. Students also discussed the importance of maintaining the water filter and changing the materials regularly to ensure optimal performance.

Overall, I found this lesson to be a great way to teach my students about the importance of clean water and how to create a simple but effective water filter. It also provided an opportunity for them to think critically about the design of the water filter and identify ways to improve its performance.

Moving forward, I plan to continue incorporating hands-on learning experiences into my lessons. This type of learning allows my students to engage with the material in a meaningful way and develop a deeper understanding of the subject matter. I also plan to explore other ways to teach my students about water purification and the importance of clean water, such as through experiments and field trips to local water treatment plants as part of the module.