James Webb Space Telescope
DEEP SPACE DIARY

ACTIVITY 2.4
INFRARED SELFIE!

From Chapter Two of the Deep Space Diary discoverydiaries.org/activities/infrared-selfie/

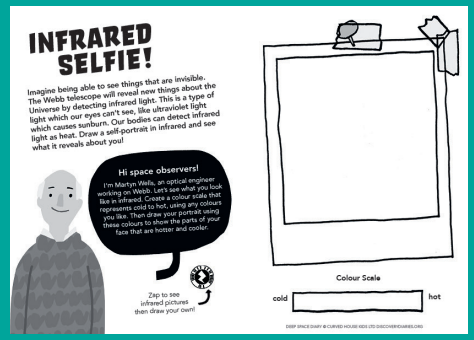
LEARNING LEVEL

KS2, P5-7, Y4-6

CURRICULUM LINKS & DIFFERENTIATION IDEAS

View detailed curriculum links for England, Scotland, Northern Ireland and Wales in the Teacher Toolkit, plus differentiation ideas for your region and year level.

discoverydiaries.org/resources/teacher-toolkit/



Learning Objective

To create a colour scale and use it to visually represent different temperatures.

Resources Required

- Smartphone/device or computer to access Zap code (optional)
- Colouring pencils

Background to this Activity

The James Webb Space Telescope detects infrared light, which can penetrate thick clouds of space dust. This means that with Webb, we can see things that are otherwise hidden, like protostars (baby stars).

Infrared is a form of light that human eyes can't see but which we can feel as heat. Everything in the Universe that is warm – from stars and planets to animals, microbes and even non-living things like a lump of charcoal – emits thermal radiation/light. How much thermal radiation they emit depends on how hot they are. The majority of thermal radiation for things of 'normal' temperature are in the infrared spectrum, meaning they will be detected by infrared (IR) cameras, like those on Webb.

Infrared technology can also tell us about the temperature of the object. Generally, the settings on IR cameras will depict hot objects (or regions/areas/parts) as bright and cold objects (or regions/areas/parts) as dark. Thermal-imaging cameras, such as night-vision cameras, use infrared technology.

Before conducting the activity, ask your school administration if they have an IR camera for thermal testing. Alternatively, schools in Scotland can borrow a thermal camera from their local authorities, for in-class demonstrations. For more information about this scheme, contact SSERC (www.sserc.org.uk).

Running the Activity

Students should have prior knowledge of portraiture and be familiar with blending techniques using colouring pencils. Students will need a selection of colouring pencils for this task. Students can base their colour scale on a traditional cold to hot/blue to red scale, or they can invent their own scale.

Begin by asking students if any of them know what 'infrared light' is. Ask them if they know any other forms of light (visible light, ultraviolet (UV) light etc). Tell them that some animals can see different wavelengths of light that we can't see (bees can see UV light and snakes can see IR light). TV remotes use infrared light which we can't see but this can be picked up on some phone cameras. (If you point the remote at the camera and press a button, you may see the bright infrared beam through the phone screen but not with your own eyes.)

Look at the example provided by the iTunes link in Useful Links below and discuss how infrared has been used in space research. Pause the footage at 2min 45s to discuss the various features on the presenter's face. As a class, discuss the colour range within the infrared camera (from black through to bright white and moving through a spectrum of blue, purple, red, orange, yellow as temperature increases). Have students colour in the colour scale bar either to represent this, or ask them to create their own scale from cold to hot.

When everyone has created their scale, it will be time to introduce students to infrared images. Start by showing them some images of animals, taken with an infrared camera (see Useful Links). Note which animals have fur and which don't. How do these images compare? What differences do students notice when an animal is warm-blooded or cold-blooded? And what happens if a person is wearing glasses, which block infrared light?

Students can now begin drawing their selfies. Establish the relatively warm and cool parts of their face. Ask

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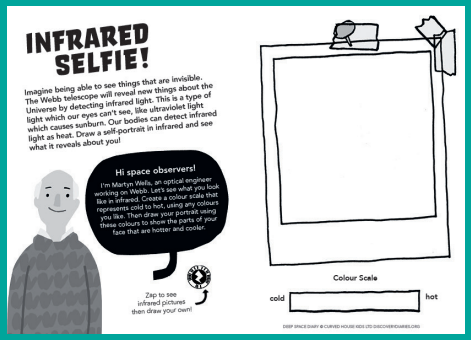

students to think about which parts of their faces are warmer than others. Typically, ears and noses will be cooler and eyelids, mouths and lips will be warmer. Using their fingertips, can students detect which areas of their faces are warmer and cooler? Once students have spent some time exploring, they can then use this information to sketch out their face and begin to shade it with their colouring pencils, carefully blending from cool to warm through the spectrum of colours in their scale. Students who wear glasses can choose how they represent themselves. Other students might like to draw themselves wearing sunglasses.

At the end of the lesson, ask students what they have learnt about infrared light.

Questions for the Class

- What type of light can humans see?
- What other types of light are there?
- How can infrared light help us in the study of space?
- Based on the colour scale a student has chosen, what colour would something cool show up as on an infrared camera? What about something warm?

Additional Challenges / Extension Activities

Explore infrared light through this experiment: https://www.exploratorium.edu/snacks/infrared-remote

Ideas for Differentiation

Support:

- Create the colour scale together and model the task on the board.
- Demonstrate blending techniques and allow students to practise blending colours together before they start.

Challenge:

- Students create the colour spectrum more independently, with less teacher input.
- Students could use watercolour pencils.

Useful Links

How infrared works and is used by astronomers (please note this clip was made in 2007, before the referenced Spitzer telescope was launched): https://itunes.apple.com/de/podcast/infrared-more-than-your-eyes-can-see/id83226711?i=1000088349329&l=en&mt=2

This clip explains infrared and includes examples of how glasses block infrared light: https://www.youtube.com/watch?v=zmiU5tJRJd4

For images of animals in IR, visit this NASA site: http://coolcosmos.ipac.caltech.edu/image_galleries/ir_zoo/zoo.html

Clip about how Webb uses infrared (please note this clip was made before Webb was launched): https://youtu.be/C0unmfkTlG8

ZAP! Students can independently access multimedia resources using the Zappar mobile/tablet app. See Zappar instructions at the link below and note that the mobile/tablet will need to be on a WIFI connection: discoverydiaries.org/toolkit/discovery-diaries-zappar-instructions/

If you don't have access to the internet in the classroom, all Zap code content is available to download on the activity's web page (see link to the left) as a PowerPoint presentation or as bundles of images.

zappar
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ZAP THE CODE
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Find more great space-themed STEM resources at https://www.stem.org.uk/esero