Indigenous Astronomy- Beginner Module

Program overview

Lessons required – 3 (a short introductory lesson to Aboriginal astronomy and then two lessons to use the SPIRIT telescopes)

In this sequence of lessons students will begin to learn about how Aboriginal communities used astronomy as a way of storytelling. It will require them to use SPIRIT telescopes to photograph (and compose) important Indigenous astronomy landmarks . The lessons will explore how astronomy has long been used as a way of storytelling, with a focus on Aboriginal communities. This program fits into the year 7-10 Science and Digital Technologies curriculums. It is designed to develop STEM skills through open-ended and real life experience.

Please note that this constellation can only be viewed from October to March in Western Australia.

Skills focus:

- Understanding celestial coordinates and the meridian line
- Intercultural understanding
- Coding (optional- only if using live viewing)
- STEM skills
  - Critical analysis
  - Independent thinking
  - Digital literacy

Required digital resources:

Device (laptop, computer) with internet access

Stellarium – (free software) http://stellarium.org

A FTP program (recommended free software Filezilla https://filezilla-project.org)

FITS liberator – (free software)

https://noirlab.edu/public/products/fitsliberator/

If you are choosing to process your images:

Photoshop or a free photo processing software such as Photopea

Other resources:

The legend of the Seven Sisters – A traditional Aboriginal story from Western Australia

written by May L O'Brien, Illustrated by Sue Wyatt (if you can't find this book it is read aloud here: https://www.youtube.com/watch?v=NAwyCaGxqhw)

Minyipuru Jukurrpa: The Seven Sisters' Story https://www.nma.gov.au/exhibitions/yiwarra-kuju-canning-stock-route/artworks/minyipuru-jukurrpa

Curriculum links:

Science

Energy transfer through different mediums can be explained using wave and particle models (ACSSU182) **Year 9**

Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE119) **Year 7**
The universe contains features including galaxies, stars and solar systems, and the Big Bang theory can be used to explain the origin of the universe (ACSSU188) **Year 10**
Elaboration: researching Aboriginal and Torres Strait Islander Peoples' knowledge of celestial bodies and explanations of the origin of the universe

Science Inquiry Skills – year 7-10

- Questioning and Predicting
- Planning and Conducting
- Processing and Analysing Data and Information
- Evaluating
- Communicating

Digital Technologies – year 7 – 10

- Collecting, managing and analysing data
- Digital implementation
- Creating solutions

General capabilities:
Numeracy
ICT capabilities
Critical and creative thinking
Literacy
Intercultural Understanding
Cross curriculum priorities:
Aboriginal and Torres Strait Islander histories and culture

Lesson 1 (30 minutes)
Prerequisites:

- Internet connected laptop or computer for students
- Stellarium downloaded

Teachers may want to familiarise themselves with the Stellarium program before using in class.

Teacher background information:
Indigenous and Torres Strait Islander peoples used the sky as a way to tell stories, as well as a way the tell the time of year to govern their hunting and gathering activities. The Yoljnu people observed a bright red star, that we called Arcturus, as a way to know when to collect spike rush for baskets and fish traps. Torres Strait Islanders used the Kek star, or the yam star (western astronmers call this star Achernar) to know when to plant yams each year. The coalsack nebula observed in the head of the Emu constellation was used to guide many activities for a lot of Indigenous peoples. Find out more here: http://www.emudreaming.com/Examples/emu.htm

Western name	Boorong	Kamilaroi	Best viewing time with SPIRIT
Pleiades	Girls	Miyaymiyay	Not possible to view with SPIRIT

Coalsack Nebula	Head of the Emu constellation	Head of the Berm-berm-gle constellation	February- May
Arcturus	Marpeankurrk (meat ant constellation)	Not applicable	May- June
Achernar	Yerredetkurrk (owlet nightjar constellation)	Yerredetkurrk	October- April

1. Introduce the idea of Aboriginal astronomy by watching this behind the news video: https://www.abc.net.au/btn/classroom/aboriginal-astronomy/10523908
2. Class brainstorm (either recorded or informal) about what stories students might know about Aboriginal astronomy. Discuss why there might be so many different stories and relate this to the amount of different language groups within Australia.
3. In groups or individually, use the program Stellarium to set the time and place. More information about using Stellarium can be found here. Stellarium has some Aboriginal astronomy information that can be viewed in the sky.
4. Click on 'sky and viewing options' on the left-hand side or press F4. Click on the 'Starlore' tab and choose 'Boorong' from the side menu. There is information that can be read by the students and then tick 'show labels', 'show constellation lines', 'use native names for planets' and 'show art in brightness' before closing the sky and viewing options menu.
5. Students can move the view around the night sky and see the different constellations of the Boorong people and their names. Ask them to find the *girls* constellation, the head of the emu, Marpeankurrk (in the meat ant constellation) and Yerradetkurrk (in the owlet nightjar constellation).
6. Open the 'sky and viewing options' again and choose Kamilaroi/ Euahlayi in the Starlore section. Read the information and make sure the same tick boxes are chosen as before.
7. Look at the Kamilaroi/ Euahlayi constellations. Ask the children to find the *miyaymiyay* constellation, and the head of the Berm-berm-gle constellation and discuss what European cultures call these landmarks. (see the table above)

Extra activities:

	a) Watch the documentary Star Stories of the Dreaming: https://vimeo.com/ondemand/starstories (Please note this video needs to be purchased before watching) b) Make and use planispheres that show the night sky from the Kamilaroi and Euahlayi groups. Kamilaroi: http://www.aboriginalastronomy.com.au/wp-content/uploads/2018/05/A3_Kamilaroi_Star_Wheel.pdf Euahlayi: http://www.aboriginalastronomy.com.au/wp-content/uploads/2018/05/A3_Euahalyi_Star_Wheel.pdf Planisphere outer for Perth: https://in-the-sky.org/planisphere/planisphere_parts/holder_30S_en.pdf
Lesson 2 (60 minutes) **Prerequisites:** • Internet connected laptop or computer for students • The legend of the Seven Sisters book (or video) Teachers need to choose between live viewing, scheduling or a mixture of both. **For an object as bright as the Southern Sisters students should start with an exposure time of 1 second or less.**	**Questioning and Predicting:** 1. Read or watch the video of The Legend of the Seven Sisters (story from the Wongutha people from the Eastern goldfields, WA) and the story of Minyipuru Jukurrpa: The Seven Sisters' (story from the Martu people in central northern WA). Discuss the similarities and differences. These are listed in the resources section above. 2. Watch: https://www.youtube.com/watch?v=n9pu4fGOp2Y The story from the Wirangu people as well as stories from around the world. Compare and contrast all the stories. **Follow instructions 3 to 5 if students are completely new to SPIRIT** 3. Introduce students to celestial coordinates. Information found here. A helpful video: https://www.youtube.com/watch?v=WvXTUcYVXzI 4. Introduce magnitude of celestial objects and what it means. Information can be found here. 5. More information on how to use Stellarium and set up the correct place, date and time can be found here. Once the students have set up Stellarium in groups or individually, they should search for the coalsack nebula, Arcturus or Achernar. **Planning and Conducting:** 6. Once students have found Pleiades in Stellarium, make time go forward to discover the best time to view their object. 7. Individually or in groups, students should plan how to image their object. Encourage students to try different types of exposures, filters etc or to take their images on more than one telescope so they have a range to compare and choose from.

	8. Use SPIRIT to get images by: *a) Live viewing- If you are using live viewing and would like students to create a plan to practice their coding skills use the information here.* **Please note: If using live viewing teachers need to book the appropriate time on SPIRIT 2. Students or teachers will need to log in at the requested time to complete their viewing plan and live viewing.** *b) Scheduling- If you are using the scheduler then students should follow the instructions here.* **Please note: Students or teachers will need to include an email address in the schedule browser section of the web interface to make sure they get notified when the images are ready.** **Extra activities:** a) Use a Venn diagram to compare and contrast two stories about the Seven Sisters b) Investigate how many different stories students can find about the Pleiades/ Seven Sisters from around the world.
Lesson 3 (60 minutes) **Prerequisites:** • Internet connected laptop or computer for students • FTP software • If compiling colour images a photo editing software such as photoshop or Photopea is required. If using SPIRIT 4 and 6, teachers will need to ensure that the photos have been taken by checking the	**Processing and analysing data and information:** *1.* Students should use FTP to access their images. Instructions on how to use Filezilla are found here. *If you are composing a colour image use the instructions here for photoshop. Photopea is also an option for free software.* **Evaluating:** 2. Once their images are accessed and compiled, ask students to rate the images using the *SPIRIT image evaluation form*. Focus on critical thinking and ideas on how to improve their imaging. They may ask group members or other peers for feedback. *If there is time in your program students can use the opportunity to reimage their chosen celestial object with the changes they would like to make. Again, encourage them to experiment with exposure times and filters to see what gives the best outcome.* **Communicating:** 3. Class discussion points: -What does the colour we can see in the images tell us? Bluer stars are younger and hotter, whereas red or orange mean older, cooler stars. -What do you now know about how Indigenous Australians use their knowledge of astronomy in day their daily life? Students may share some of the stories they learnt in this unit. At the teacher's discretion students can publish their photos for the wider astronomy community.

scheduler (don't forget to input email addresses so you get a notification when the images are ready)	Some places to do so are: ICRAR's SPIRIT photo of the year competition (watch icrar.org/spirit for more information) Astrofest Astrophotography exhibition and competition (watch www.icrar.org for more information) Astronomy.com's community gallery (http://cs.astronomy.com/asy/m/default.aspx) NASA's Astronomy Picture of the Day website (https://apod.nasa.gov/apod/lib/apsubmit2015.html) **Extra activities:** a) Learn about and image other aboriginal celestial objects. Find a list here from the Boorong people: https://museumsvictoria.com.au/scienceworks/visiting/melbourne-planetarium/fact-sheets/australian-aboriginal-astronomy/ b) Develop a night sky guide using Noongar, or local group, seasons. What objects are visible in different seasons?
What next: Now that your students are familiar with the SPIRIT program you may want to continue on with a research project. If you are looking for ideas or support on how to use SPIRIT in your classroom please contact us at any time at: spirit@icrar.org	