Relating Pipehenge To Your Curriculum

Astronomy is one of the few science topics that studies the same objects wherever it is taught. But because many teachers lack astronomical knowledge they are apprehensive about teaching it.

The outstanding attribute of Pipehenge is to address the astronomy requirements of the science curriculum of most countries, with innovative and interactive experiences during the day, while students are at school.

The range of material available for teachers on Pipehenge is structured to give them confidence and achieve sound educational objectives. It covers all year levels and gives opportunity for students to get recognition for their own research. Because of the nature of the activities there is always more to be discovered when using the structure, irrespective of the level.

Most people think of astronomy as a night-time activity, but the development of Pipehenge in New Zealand, as a hands-on teaching aid for doing practical astronomy during the daytime, is unique.

The activity Resource Book outlines a possible lesson sequence. This should be adapted to satisfy local curriculum requirements.

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Level One - Five and Six Year Olds

Sample Learning Contexts.

1. Shadows.
2. Legends of indigenous people.
3. Night and Day.

Achievement Objectives.

1. Share their ideas about objects in space
2. Observe very noticeable environmental patterns associated with these objects, e.g. day and night, Sun, Moon, stars, seasons.

Possible Learning Experiences.

1. Plot your shadow at different times of the day and year.
2. Watch a half lit globe spinning, while discussing day and night.
3. Talking about seasonal changes in relation to birthdays, holidays, and seasonal events.
4. Talking about and recording the activities that people do in different seasons.
5. Expressing their own ideas about the Moon or Sun and listening to those of others.
6. Talking about seeing the Moon in the daytime.
7. Drawing pictures to show the activities that they do at different times over a twenty-four hour period.
8. Talking about the stars they see in the night sky.

Assessment Examples.

1. Ability to communicate the cause of day and night as being the spin of the Earth.
2. Ability to communicate their ideas about environmental changes, when the students role play the elements that make up winter and summer weather.
3. Awareness of differences between day and night.
4. Students retell indigenous people's stories.
5. Ability to recognise different shapes of the Moon, when they talk about pictures of these.

Pipehenge
framing your place in space

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Level Two - Six to Eight Year Olds

Sample Learning Contexts.

1. Space pictures.
2. Star gazing.
3. Shadows.

Achievement Objectives.

1. Use their ideas to investigate major objects in our solar system; Sun, planets, comets, asteroids, moons.

Possible Learning Experiences.

1. Finding latest planet, comet and asteroid pictures on the internet.
2. Guided reading of children's journal articles to extend their ideas about a planet or the stars.
3. Constructing a simple sundial (Suntracker) and using it to tell the time.
4. Sharing a big book about the planets to help develop research skills and teamwork.
5. Making scale models of the solar system.
6. Making models of the planets.

Assessment Examples.

1. Ability to act out planet orbits to scale on the playing field.
2. Able to describe differences between planets.
3. Ability to explain differences between comets and meteors.
4. Able to describe the difference between the orbits of planets and moons.

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Level Three - Eight to Ten Year Olds

Sample Learning Contexts.

1. Voyages of discovery.
2. Rockets.
3. Satellites.
4. Moon probes.
5. Pipehenge observations.
6. Space.
7. Space exploration.
8. Space travel.
9. Science fiction.
10. Seasons.

Achievement Objectives.

1. Use information obtained from own observations and others' space exploration to clarify, challenge, and extend their ideas about the general nature and behaviour of the Sun, Earth, and Moon, e.g. Moon missions, satellites, space stations, Moon phases, seasons, tides, sun clocks.

Possible Learning Experiences.

1. Using Pipehenge to monitor changes in shadows over a period of time to show the change in the position of the Sun in different seasons.
2. Drawing the shape of the Moon on as many different days as possible over a month, then discussing and comparing their results.
3. Relate tide patterns to Moon phases.
4. Make a model of tidal effects around the Earth.
5. Discussing ideas about what Earth looks like from the Moon or a space shuttle.
6. Viewing a video of a space mission to the Moon to increase awareness of the Moon's landscape and/or viewing a video of a space launch to increase awareness of the use of technology in space exploration.
7. Launching water-powered, plastic soft drink bottle "rockets" with a bike pump and testing variables which affect the flight of such model rockets.
8. Using a globe of the Earth to demonstrate how its turning is responsible for day and night and its tilt and orbit around the Sun causes the seasons.

Assessment Examples.

1. Knowledge about the surface structure of the Moon, when they write questions to use in a role play interview of an astronaut returning from a Moon mission.
2. Observation skills, when the students compare surface features as shown in photographs of Earth and Moon taken from space with features indicated on a map.
3. Ideas relating to the Sun's apparent motion, when the students predict where their shadows will fall in one hour's time, including plotting shadows at Pipehenge.
4. Understanding of the space relationships of the Sun, Earth and Moon, when the students make a model showing their relative positions.

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Level Four - Ten to Twelve Year Olds

Sample Learning Contexts.

1. Space probes.
2. Space travel.
3. Henges.
4. The night sky.
5. Navigation.

Achievement Objectives.

1. Use simple technological devices to observe and describe our night sky, e.g. binoculars, telescopes, simple star maps, Pipehenge, planetarium programs.
2. Use models to simulate how eclipses happen.

Possible Learning Experiences.

1. Make model Henges e.g. Stonehenge, Pipehenge, Woodhenge, Ha'amonga 'a Maui.
2. Relating the migration trails of sea-going explorers to the ocean currents, winds, and stars.
3. Designing a mobile to show the relative positions of Sun, Moon, and Earth during solar or lunar eclipses, or demonstrating these at Pipehenge.
4. Making a simple needle compass and demonstrating how it is used.
5. Using telescopes or binoculars to find objects in the night sky at a star party.
6. Investigating changing patterns of stars, planets and moons.
7. Using a planetarium program on a computer to recreate the night sky.

Assessment Examples.

1. Understanding the cause of eclipses, when the students use a torch and two balls to simulate an eclipse.
2. Familiarity with the night sky, when the students identify several space objects or patterns.
3. Using Pipehenge as an observatory to plot the movement of stars.

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Level Five - Twelve to Fourteen Year Olds

Sample Learning Contexts.

1. Telescopes.
2. The solar system.
3. The Moon.
4. Space probes or missions.
5. Satellite photography.
6. Comets.
7. Galaxies and universe.
8. Life of stars.
9. Relating Moon phases to its orbital position.

Achievement Objectives.

1. Use simple technological devices, such as telescopes, Pipehenge and star maps, to observe and describe changing patterns in our night sky, e.g. position and phase of the Moon, orientation of circumpolar stars.
2. Use information obtained from technological devices, such as radio telescopes and satellites, to clarify, challenge, and extend their ideas about the general characteristics of some near and far space objects, e.g. structure, size, surface landscape, climate; the Sun and other stars, Earth's Moon, planets, comets, meteors, clusters, galaxies; feasibility of life.

Possible Learning Experiences.

1. Using Pipehenge to plot the changing patterns in the night sky.
2. Making telescopes using lenses, concave mirrors, and cardboard tubes.
3. Using the projection method to record sunspot activity.
4. Researching the latest information available on the internet about objects beyond our galaxy.
5. Demonstrating ability to evaluate the worth of information from the internet.
6. Creating diagrams to show life history of different stars.
7. Using a planetarium program to find planets in the night sky.

Assessment Examples.

1. Understanding the changing position of stars in the night sky, when students identify circumpolar constellations at two different times of the night or the year.
2. Ability to visualise the structure of the solar system, when the students place planet diagrams correctly on to a blank map of the solar system.
3. Ability to understand how space probes provide observational evidence to support ideas about the surface structure of Mars.
4. Ability to relate theory to observation, when students prepare a project on a named celestial body.
5. Awareness of the nature of space objects, when students compare the sizes of planets, stars and galaxies.
6. Ability to manipulate equipment correctly and safely, when students focus a clear projected image of the Sun through binoculars or a telescope on a small screen, taking appropriate precautions.
7. Ability to describe changing patterns in the night sky when using Pipehenge as an observatory to plot the motion of circumpolar stars.

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Level Six - Fourteen to Sixteen Year Olds

Sample Learning Contexts.

1. Evidence for the Big Bang theory.
2. The Universe.
3. The scale of space.

Achievement Objectives.

1. Use information from a range of sources, including their own observation, to explain spatial relationships of objects in the night sky and the challenge such spatial relationships present to space exploration, e.g. distance between and changing positions of objects, theories about the origins of the Universe.

Possible Learning Experiences.

1. Visiting a local observatory or planetarium to view objects in the night sky.
2. Carrying out an information research project on the Big Bang Theory.
3. Discussing theories about the formation and development of the Universe with a local astronomer.
4. Using Pipehenge to observe and record the changing position of the Sun, Moon and stars.

Assessment Examples.

1. Co-operative learning skills, when the students work in groups to construct a model or poster about the Big Bang Theory of the origin of the Universe.
2. Understanding the nature of scientific theory when students evaluate the evidence for and against the Big Bang Theory.
3. Understanding of the scale of space, when the students can express distance in terms of “spacecraft travel time” and “light travel time”.

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Level Seven - Sixteen Plus Year Olds

Sample Learning Contexts.

1. Space exploration.
2. Space stations.
3. Space travel.
4. Planets around other stars.
5. Spectral fingerprints.
6. The life story of a star.
7. Life in the universe.
8. Information skills in science.
9. Telescope technology.
10. Distant galaxies.

Achievement Objectives.

1. Examine evidence from a variety of detectors to reach conclusions about the nature of stars and other celestial objects.
2. Research and present a report on a current astronomical event or discovery.

Possible Learning Experiences.

1. Collecting and summarising media reports of articles relating to space exploration.
2. Carrying out systematic observations of a celestial object such as the Sun, a planet, or a star.
3. Analysing the light curve of a variable star.
4. Debating “money on space exploration is well spent” to highlight an issue involved in space exploration.
5. Collecting and evaluating articles which illustrate conflicting views about space objects.
6. Make and use a telescope to observe objects.
7. Investigate the relationship between new technological discoveries and changes.

Assessment Examples.

1. Ability to reach conclusions from given evidence, when the students prepare a report on recent astronomical discoveries.
2. Willingness to keep abreast of current events, when the students give seminars on current astronomical events, discoveries, or technologies.
3. Persistence, when a student carries out observations of a space object over an extended period of time.
4. Ability to solve problems, when the students present a group report defending the establishment of a human colony away from Earth.
5. Ability to appreciate the uncertain nature of scientific theories, when the students explain in their own words how earlier astronomical theories were shown to be incorrect.

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