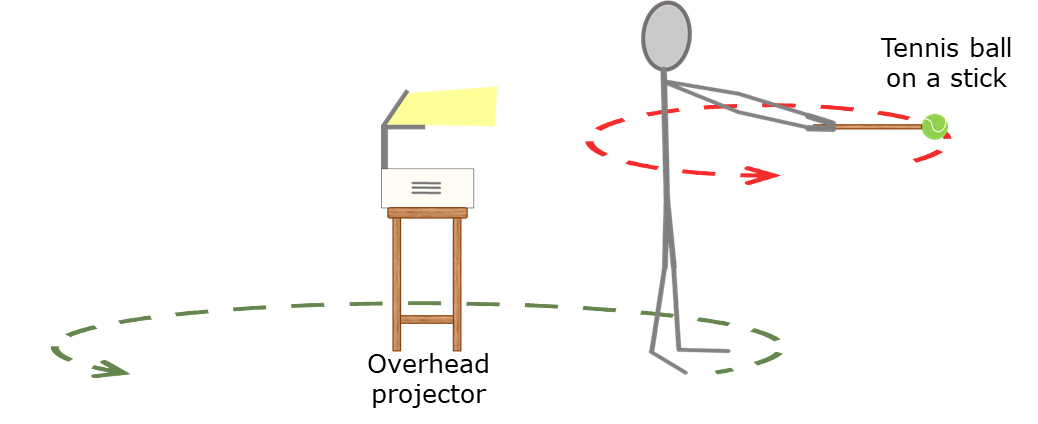
**Modelling the Moon**

A group of students make a model to show how the Moon and the Earth move around the Sun.



**To answer**

1. What do the tennis ball and the overhead projector represent?
2. What represents the Earth?
3. How is this model *similar* to what happens when the Earth and Moon move around the Sun?
4. How is this model *different* to what happens when the Earth and Moon move around the Sun?

*Physics > Big idea PES: Earth in space > Topic PES1: Solar System and beyond > Key concept PES1.1: Planets and the Solar System*

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| **Response activity** |
| **Modelling the Moon** |

**Overview**

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| Learning focus: | In the Solar System: eight planets orbit a star called the Sun; moons orbit most of the planets; and the planets spin on their axes. We live on the Earth where: a year is defined as the time for the Earth to orbit the Sun; a day as the time it takes the Earth to spin on its axis; and the Moon orbits in about 28 days. The planets are very small compared to the huge distances between them. |
| Observable learning outcome: | * Describe how the Moon orbits the Earth and explain what a lunar month is. |
| Activity type: | Response, critiquing a representation |
| Key words: | Earth, Sun, Moon, orbit, year, lunar month |

This activity can help develop students’ understanding by addressing the sticking-points revealed by the following diagnostic question:

* Diagnostic question: Sun, Moon and Earth

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| **P** | **PRIOR UNDERSTANDING**  This activity explores ideas that are usually taught at age 5-11, to aid transition from earlier stages of learning. |

**What does the research say?**

A study of thirty-two Tasmanian students identified a progression in students’ thinking from a model with the Earth at the centre, which was held by about three-quarters of the 9- and 10-year-olds, to a model with the Sun at the centre that is understood by the majority of the 11- and 12-year-olds (Jones, Lynch and Reesink, 1987). To correctly explain observable phenomena that are caused by movement of the Earth, Sun and Moon students need to understand the correct scientific model. If they are using a model that is incorrect students are likely to form further misunderstandings and about a quarter of 11- and 12-year-olds are using incorrect models.

One of the key findings of Lelliott and Rollnick's (2009) review of astronomy education research (1974-2008) was the need for teachers to use physical models both to scaffold learning and to challenge misunderstanding. This question can be used to identify which model different students are using.

**Ways to use this activity**

Students should complete this activity in pairs or small groups, and the focus should be on the discussions. It is through the discussions that students can check their understanding and rehearse their explanations.

Philosophically science can be said to be a description of the ‘best model’ we have for the world. In this activity students should identify ways in which this particular model is a good representation of the real world, and ways in which it is not.

Students should work together to follow the instructions on either the worksheet or the PowerPoint. Giving each group one worksheet to complete between them is helpful for encouraging discussion, but each member should be able to report back to the class. Listening in to the conversations of each group will often give you insights into how your students are thinking.

In this activity it can be helpful to take feedback whilst using the model to demonstrate what makes it a useful model and perhaps the ways in which it is less good. A good approach might be to encourage your students to suggest their ideas, and make clear their reasons and to demonstrate how this works with the model. You might ask other students why they think it was a good contribution, or when appropriate, if they can improve on the idea’s clarity.

Ending with the students completing the worksheet or questions from the PowerPoint individually, might help them to consolidate their learning.

*Differentiation*

You may choose to use simplified worksheets for some students, for example with gaps to fill in so they can focus on the science. In some situations it may be more appropriate for a teaching assistant to read and/or scribe for one or two students.

**Expected answers**

1. Tennis ball is the Moon and the projector is the Sun
2. The person is the Earth – their head (as the Earth) would be on the same scale as the tennis ball
3. The way the model shows the Moon orbiting the Earth and the Earth orbiting the Sun are the same types of motion as reality. The Earth and Moon in the model are roughly to scale.
4. The Earth here is spinning at the same rate as the Moon orbits – the Earth should spin once a day and the Moon orbit the Earth about once every 28 days.

The Earth in reality takes a year to orbit the Sun, in the model this is a lot quicker.

The Sun is too small in this model – its diameter should be about a hundred times bigger than that of the Earth.

The distances are far too short – on the scale of a tennis ball sized Moon, it should be about 8 metres from the Earth, and the Earth should be about 3 kilometres from the Sun!

In the model the moon is held by stick, in reality it is held by gravity.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: Peter Fairhurst (UYSEG).

**References**

Jones, B. L., Lynch, P. P. and Reesink, C. (1987). Children's conception of the Earth, Sun and Moon. *International Journal of Science Education,* 9(1)**,** 43-53.

Lelliott, A. and Rollnick, M. (2009). Big Ideas: A review of astronomy education research 1974-2008. *International Journal of Science Education,* 32:13**,** 1771-1799.