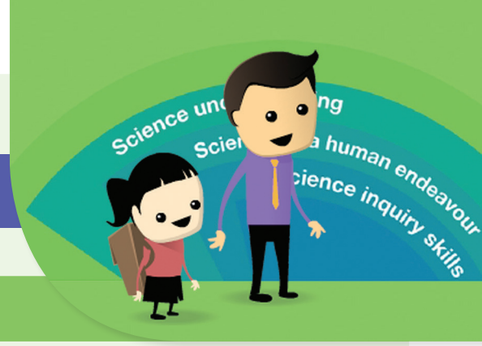
The BitL tool – science years 11–12



Science: Years 11–12

Communication and Collaboration

- Science is a global enterprise that relies on clear communication, international conventions, and review and verification of results.
- Collaboration between scientists, governments and other agencies is often required in scientific research and enterprise.

Development

- Development of complex scientific models and/or theories often requires a wide range of evidence from many sources and across disciplines.
- New technologies improve the efficiency of scientific procedures and data collection and analysis. This can reveal new evidence that may modify or replace models, theories, and processes.

Influence

- Advances in scientific understanding in one field can influence and be influenced by other areas of science, technology, engineering, and mathematics.
- The acceptance and use of scientific knowledge can be influenced by social, economic, cultural, and ethical considerations.

Application and Limitation

- Scientific knowledge, understanding, and inquiry can enable scientists to develop solutions, make discoveries, design action for sustainability, evaluate economic, social, and environmental impacts, offer valid explanations, and make reliable predictions.
- The use of scientific knowledge may have beneficial or unexpected consequences; this requires monitoring, assessment, and evaluation of risk, and provides opportunities for innovation.
- Science informs public debate and is in turn influenced by public debate; at times, there may be complex, unanticipated variables or insufficient data that may limit possible conclusions.

Pedagogical questions:

- What might happen if scientists communicate without using international conventions?
- How do scientists communicate with each other?
- Do scientists only communicate via a scientific report?
- Scientists ask lots of questions of each other and they can appear to be too critical to non- scientists. Why is this essential during peer reviews?
- How does the science community contest and refine ideas and/or claims? Why is this important?
- How can a scientific discovery be reproduced?
- Why might a scientist want to repeat and build on someone else's investigation?
- How does the science community develop a shared understanding?
- Why is it important to develop a shared understanding?
- Has there been an increase in the collaboration between countries to address this large-scale science project or issue?
- Why couldn't it be achieved in Australia alone?

Pedagogical questions:

- How do scientists work across disciplines to produce complex models and theories?
- How might collaboration across disciplines be beneficial for scientists seeking an answer to a question?
- How can a model influence the way we think about science and help develop scientific theories?
- How does this generalisation change over time?
- How have the models of.....changed over time? Is this beneficial? Why is this process an important part of the scientific process? Could this be better communicated to the general public?
- How has the model or theory been contested over time? Why is this important?
- What refinements have occurred or was the model replaced with another?
- What evidence was used to change the model or theory at each point in time?
- What changes over time and/or geographically?
- What do you observe at a range of scales?
- How reliable is the temporal data?
- How might you increase the accuracy of the data?
- What equipment could have been used to improve the accuracy in the data?
- How might technology contribute to our understanding of science?
- What technological changes have occurred as a consequence of this research?
- What technology would enable you to see the phenomena from a range of perspectives?
- What if a particular technology had not been available?
- How has technology changed the way we think about this scientific idea?

Pedagogical questions:

- How might the advances from scientific understanding in one field influence other areas of science, technology and engineering?
- Do you think this scientific knowledge will always be accepted? Why?
- How might some not in this science discipline explain or interpret this same phenomena?
- Just because we can do this science, should we?
- What ethical considerations might need to be considered with this scientific knowledge?
- Is the ethics for this science investigation the same or different in other countries? How might the hypothesis change as a result of the ethical issues if the investigation was completed in Australia?
- Scientists' values and beliefs are influenced by the larger culture in which they live. How might such personal views influence the questions they choose to pursue and how they investigate those questions?
- Was the scientific research focused on an issue with the potential to help meet societal needs or for economic reasons? How might these influence the scientific knowledge being accepted?
- Who decides what is valued to investigate?

Pedagogical questions:

- How did the originator come up with this idea? Did serendipity play a role in the scientific breakthrough? Was it curiosity, through observing something unusual that lead the scientist to drive them to answer their questions? Did society influence what science was to be investigated?
- How does scientific knowledge enable scientists to offer valid explanations?
- How does scientific knowledge enable scientists to make reliable predictions?
- What changes can we predict with accuracy?
- How might the scientific knowledge you are investigating be beneficial for society?
- How might the scientific knowledge you are investigating be harmful for society?
- Can you think of any unintended consequences for how this scientific knowledge might be used?
- How might this scientific knowledge be used to develop and evaluate economic, social and environmental impacts?
- How might this scientific knowledge be used to design action for sustainability?
- How might this scientific knowledge be used to inform the monitoring, assessment and evaluation of risk?
- How can scientists communicate the uncertainty of the data available while still supporting the public with debate over an issue?
- How can scientists support the interpretation of the data to the public to reduce it being open to question?
- Who might need to know this science and why?
- Who decides how the science is used?
- Who might benefit? What is the 'cost'?
- What would our lives be like if we didn't know this science?