 Module 8: Science and Society

Depth Study

Inquiry Question: How do economic, social and political influences affect scientific research?

Outcomes:

A student:

* INS11/12-1 develops and evaluates questions and hypotheses for scientific investigation
* INS11/12-3 conducts investigations to collect valid and reliable primary and secondary data and information
* INS11/12-5 analyses and evaluates primary and secondary data and information
* INS11/12- 7 communicates scientific understanding using suitable language and terminology for a specific audience or purpose
* INS12-15 evaluates the implications of ethical, social, economic and political influences on science

Sample depth study 1

Content descriptor

Students:

* evaluate the impacts of scientific research, devices and applications on world health and human wellbeing, including but not limited to:
  + Medical surgical devices
  + Surgical procedures
  + Water purification and wastewater treatment
  + Vaccination programs for the eradication of disease

Time: 8-10 hours

Outline of the study

Students will have the opportunity to further develop their competence and autonomy in designing and developing a research activity, planning and conducting a major research task and communicating their understanding of the impact of scientific research on world health and human wellbeing.

Assessment

All or only the final product of this depth study could be used as an assessment task.

Task Details

Select ONE device or technology from EACH of the following headings (or add one of your own):

* Medical surgical devices:
  + Prosthetic limbs in developing countries
  + Pacemakers
  + Insulin pumps
  + Robotic surgery
  + Anaesthetic machines
  + Orthopaedics
* Surgical procedures
  + Anaesthetics
  + Amputation
  + Cancer removal
  + Grafting
  + Organ donation
  + plastic surgery and reconstruction, incl burns treatments
* Water purification and wastewater treatment
  + Water treatment methods of today
  + John Snow and Cholera
  + Impact on disease
* Vaccination programs
  + Eradication of smallpox
  + Polio campaign
  + Antivaccine lobby and recurrence of ‘old’ diseases
  + Differences between developed and developing countries in disease types and impact

Design a project to investigate each of your chosen topics.

You must include:

* At least one interview with an expert or other person related to these topics (e.g. an organ donor recipient, a surgeon, a volunteer who has worked abroad)
* At least one practical or field trip activity to investigate water treatment and associated report (water quality testing, filtration, visit to water treatment plant)
* At least one visit to a facility where one of these technologies or procedures are available and an associated report (dialysis clinic, blood bank, immunisation clinic, hospital)

You must complete a learning journal of how you have planned your investigation, conducted your research, and reflected on your progress. This is to be submitted with your final presentation.

Your project must include discussion on the impact of these technologies on not only individual patients but on overall human health.

You should also include statistics and information about the technology.

Your project must be presented in a multimedia format and can include infographics, video, audio, text or any combination.

Suggested steps to complete your depth study (these could be scaffolded into a learning journal to provide students with a ‘how-to’ guide for the development of their project):

* Decide which topics you would like to research
* Prepare a hypothesis or initial statement that reflects your understanding of the impacts of these technologies on society.
* Draft a research plan:
  + Who can you ask?
  + Where can you find information?
  + What sites can you visit to find out more?
  + Who do you need to ask for help to complete this task?
* Conduct your research
* Reflect on your findings
* Prepare your presentation
* Discussion of the impacts:
  + How have the technologies you have investigated improved human health?
  + What evidence do you have?
  + Are there any problems that have been encountered?
  + What are some possible solutions?

Sample depth study 2

Content descriptor

Students:

* evaluate how scientific research aids economic development and human progress in relation to, for example,
  + nuclear power generation
  + use of antimicrobial drugs
  + genetically modified foods
  + use of petroleum products
  + robotics and the use of drones

Time: 6-8 hours

Outline of the study

Students will have the opportunity to further develop their competence and autonomy in designing and developing a research activity, planning and conducting a major research task and communicating their understanding of the impact of scientific research on world health and human wellbeing.

Assessment

All or only the final product of this depth study could be used as an assessment task.

Task Details

Part 1

Prepare an 800 word case study in the form of a news article that will report to the public about ONE of the following topics and address the question: Discuss the link between science, economic growth, and human progress?

Topics to investigate:

* nuclear power generation
* use of antimicrobial drugs
* genetically modified foods
* use of petroleum products
* robotics and the use of drones

To complete Part 1 you will need to:

* Devise a series of questions that will guide your research.
* Conduct your research using a variety of sources, collating your notes and sources of information using a collaborative tool such as a shared Google Document or Class Onenote.
* Complete a SWOT analysis to help formulate your ideas about the links between your area of research, economic growth and human progress.
* Prepare a draft of your news report (scaffolding tool could be used to help you) and seek feedback from a peer.
* Complete any editing and write your final report.

Part 2

Review the method you used to complete Part 1 and analyse and evaluate your information sources by completing the following questions/activities:

1. Explain how breaking a topic down into smaller questions can assist or guide the research process.
2. Select TWO sources you used to research your information for Part 1. Review each source, identifying the author/s, the accuracy of the information, and how you validated the information you collected.   
   (A website evaluation tool such as the [one provided on this link](https://libraries.dal.ca/content/dam/dalhousie/pdf/library/CoreSkills/6_Criteria_for_Websites.pdf) may be useful: https://libraries.dal.ca/content/dam/dalhousie/pdf/library/CoreSkills/6\_Criteria\_for\_Websites.pdf)
3. Share your writing with one other person and have them complete a review of your article and submit this with your task.

You will also need to read and review at least one other person’s article, and submit your review with your task.

The peer review should address the following criteria:

* Audience
* Content
* Arguments
* Language
* Format
* Spelling, Punctuation and Grammar

List of useful resources and links:

* [Nuclear power](http://www.world-nuclear.org/information-library/economic-aspects/economics-of-nuclear-power.aspx) http://www.world-nuclear.org/information-library/economic-aspects/economics-of-nuclear-power.aspx
* [Genetically modified foods](Genetically%20modified%20foods) http://www.fao.org/docrep/015/i2490e/i2490e04d.pdf
* [Petroleum products](http://www.aapg.org/about/petroleum-geology/petroleum-technology/petroleum-products) http://www.aapg.org/about/petroleum-geology/petroleum-technology/petroleum-products
* [Products made from petroleum](http://www.earthsciweek.org/classroom-activities/products-made-petroleum) http://www.earthsciweek.org/classroom-activities/products-made-petroleum
* Robotics and use of drones: [Use of drones in agriculture, defence, search and rescue (podcast)](http://www.bbc.co.uk/programmes/p04fdtf9) http://www.bbc.co.uk/programmes/p04fdtf9
* [Way drones will change the world](http://www.ibtimes.com/14-ways-drones-will-change-world-1517486) http://www.ibtimes.com/14-ways-drones-will-change-world-1517486

Teacher notes:

Resources - sample feature articles from popular science press to use as model texts (e.g. Cosmos, New Scientist). A model text could also be prepared for students.

For example; News article - dealing with antibiotic resistance: Lewis, D. (2017) Outsmarting Superbugs. COSMOS, Issue 76, p27-35.

Marking Criteria:

Working Scientifically

| Grade | Low | Satisfactory | High |
| --- | --- | --- | --- |
| Questioning and Predicting  A student develops and evaluates questions and hypotheses for scientific investigation | Attempts to develop a series of questions to research and investigate.  Attempts to develop a plan to identify and seek information from relevant people or organisations | Develops a series of questions to research and investigate.  Develops a plan to identify and seek information from relevant people or organisations | Develops a comprehensive series of questions to research and investigate.  Develops a detailed plan to identify and seek information from relevant people or organisations |
| Conducting Investigations  A student conducts investigations to collect valid and reliable primary and secondary data and information | Attempts to demonstrate ethical and responsible attitudes towards interviews and information gathering via interviews, visits; Attempts to conduct valid and responsible research. | Demonstrates sound ethical and responsible attitudes towards interviews and information gathering via interviews, visits and conducts valid and responsible research. | Demonstrates ethical and responsible attitudes towards interviews and demonstrates extensive skills at information gathering via interviews, visits and conducts valid and responsible research. |
| Analysing data and information  A student analyses and evaluates primary and secondary data and information | Limited attempt to analyse a wide range of data sets and information.  Limited assessment of data sources. | Analyses a wide range of data sets and information.  Assesses data sources. | Thoroughly analyses a wide range of data sets and information.  Assesses data sources thoroughly including relevance and quality of information. |
| Communication  A student  communicates scientific understanding using suitable language and terminology for a specific audience or purpose | Prepares a multimedia presentation with limited information and detail.  Limited use of scientific terminology, illustrations and data to support arguments and evaluation. | Prepares an informative multimedia presentation.  Scientific terminology, illustrations and data used support arguments and evaluation. | Prepares a detailed, informative, multimedia presentation.  Extensive and correct use of scientific terminology, illustrations and data to support arguments and evaluation. |

Investigating Science Outcomes

| Grade | Low | Satisfactory | High |
| --- | --- | --- | --- |
| A student evaluates the implications of ethical, social, economic and political influences on science | Attempts to construct evidence-based arguments and reflection to evaluate the impact of technology on human health. | Constructs evidence-based arguments and reflection to evaluate the impact of technology on human health. | Constructs critical and constructive evidence-based arguments and reflection to evaluate the impact of technology on human health. |