

# Lesson Plan

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| <p><b>Description</b></p> <p>In this two-part lesson, students will learn how scientific research is conducted and why scientific integrity is important in determining what sources of information we can trust. They will understand what can happen when a lack of scientific integrity leads to misconduct and explore scientific integrity with a real-world example of how we develop and test new vaccines. They will learn about the importance of understanding history and increasing diversity in science as they explore the contributions of scientists from different communities and backgrounds. Students will also learn the different parts of a research study and the signs of trustworthy research. Each learning objective is followed up by an online game or hands-on activity to reinforce the concepts.</p> | <p><b>Materials</b></p> <ul style="list-style-type: none"> <li>A computer or laptop for each student OR overhead screen to work through as a class</li> <li>The E-lesson file available online</li> <li>Washable Paint (approximately palm full amount required for each person doing experiment)</li> <li>Dish soap (small amount required for each person doing experiment)</li> <li>Sink(s) for applying paint and washing hands</li> </ul>   |
| <p><b>Big Ideas</b></p> <p><b>Module 1: Research integrity and the scientific method</b></p> <ul style="list-style-type: none"> <li>Scientific research is a systematic way of gaining scientific knowledge</li> <li>Research is an amazing tool that teaches us new things, and makes our daily lives better, easier, and healthier</li> <li>6 principles of scientific integrity and definitions: respect, honesty, transparency, rigor, accountability and reproducibility</li> </ul> <p><b>Module 2: Research and Real-Life</b></p> <ul style="list-style-type: none"> <li>Types of research misconduct, definitions and applications: fabrication, falsification,</li> </ul>   | <p><b>Specific Expectations</b></p> <p><b>Grade 9</b></p> <p><b>A1.1</b> Apply a scientific research process and associated skills to conduct investigations, making connections between their research and the scientific concepts they are learning</p> <p><b>A1.2</b> Apply a scientific experimentation process and associated skills to conduct investigations, making connections between their observations and findings and the scientific concepts they are learning</p> <p><b>A2.2</b> Describe how scientific innovations and emerging technologies, including artificial intelligence systems, impact society and careers</p> <p><b>A2.3</b> Analyze how the development and application of science is economically,</p> |

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| <p>plagiarism, breach of duty of care and misrepresentation</p> <ul style="list-style-type: none"> <li>• Scientific integrity in the real world: development of medications and vaccines</li> <li>• Different parts of a research study and the information they give: Introduction, method, results, discussion, conclusion, authors, location of publication, peer-review</li> <li>• Impact of historical misconduct and increasing diversity in science on different communities</li> </ul> | <p>culturally, and socially contextualized, by investigating real-world issues</p> <p><b>A2.4</b> Apply scientific literacy skills when investigating social and environmental issues that have personal, local, and/or global impacts</p> <p><b>A2.5</b> Analyze contributions to science and by people from various communities, including communities in Canada</p> <p><b>Grade 10</b></p> <p><b>A1.1</b> formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research</p> <p><b>A1.5</b> conduct inquiries, controlling some variables, adapting or extending procedures as required, and using standard equipment and materials safely, accurately, and effectively, to collect observations and data</p> <p><b>A1.9</b> analyse the information gathered from research sources for reliability and bias</p> <p><b>A1.10</b> draw conclusions based on inquiry results and research findings, and justify their conclusions</p> <p><b>A2.2</b> identify scientists, including Canadians (e.g., Sheela Basrur, William Richard Peltier, Alice Wilson, Willard Doyle), who have made a contribution to the fields of science under study</p> |
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**Introduction**

Scientists follow the scientific method and scientific integrity to learn new information that we can apply in our daily lives. It’s important for us all to know what this method involves and what scientific integrity looks like, so we know how to interact with the information that comes at us. Understanding scientific integrity gives us a foundational awareness of how scientific information is obtained and can help us distinguish reliable versus unreliable information.



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| <p><b>Action</b></p> <ol style="list-style-type: none"> <li>1. Decide whether there is capacity for students to work through lesson on individual devices/in pairs or whether lesson will be done as a class</li> <li>2. Decide whether there is capacity for every student to do the handwashing experiment, or whether just the teacher or a couple students will demonstrate</li> </ol>   |   |
| <p><b>Consolidation/Extension</b></p> <p>Further discussions can be had about the importance of health equity and the consequences of lack of research integrity in the real world. Students can discuss/write about the importance of access to good health information, reliable sources and diverse science professionals.</p>  |   |
| <p><b>Accommodations/Modifications</b></p> <ul style="list-style-type: none"> <li>• If internet connection is a concern: Click on the button to download lesson so it can be used offline</li> <li>• In the top right corner there is tab labelled “captions” where transcripts of each voiceover can be found</li> <li>• When playing the YouTube videos, captions can be activated by clicking the “cc” button in the bottom right corner</li> </ul> | <p><b>Assessment</b></p> <p>Students can be graded on their scores on the follow up games and activities. Students can also submit a written response or essay to the final activity questions after the science history and diversity exhibit. Students can submit a scientific report outlining their handwashing experiment.</p> |
| <p><b>Additional Resources</b></p> <p>Feedback survey <a href="https://survey.alchemer.com/s3/7094497/IPF-Teacher-Student-Evaluation">https://survey.alchemer.com/s3/7094497/IPF-Teacher-Student-Evaluation</a></p>  |   |