
Grade 6 Learning Experiences: Technology and Its Influence on Flight Machines



Experience 2: Four Forces of a Flying Machine, Skilled Trades and the Environment in Aviation



[Grade 6 Long Range Model 2L](#) February/March/April

Overview

Students will investigate a flying machine and how it relates to the four forces of flight, how skilled trades contribute to the aviation industry and how the industry is involved with addressing climate change.

Overview of learning experiences	<p>Students will use scientific research to identify how the four forces of flight apply to a flying machine, the skilled trades in the aviation industry and the government approach to addressing pollution related to aviation.</p> <p>LRP Grade 6 Model 2 - February/March/April</p> <p>Students investigate the local and global impact of aviation technology on society by researching issues related to aviation and presenting their findings in media works such as posters or presentations.</p>
Prior Knowledge / Prior Skill Set(s)	<p>It is beneficial for students to have already completed the previous Learning Experience in this unit (i.e. Designing and Building a Flight Machine).</p> <p>Background Knowledge and Concepts (Teacher) - Additional teacher concept support</p> <p>Knowledge:</p> <ul style="list-style-type: none"> ● Aware of health & safety procedures (i.e. PPE & MDMS) ● Maintain safe facilities & laboratory equipment ● Identify potential workplace hazards & mitigation measures ● The properties of air that can be related to flight-related applications <p>Concepts:</p>

	<ul style="list-style-type: none"> ● Aware of Global Competencies & Transferable Skills Aware of Culturally Relevant & Responsive Pedagogy ● Understand how to implement the UDL framework ● Understand how to engage in an Engineering Design Process <p>Background Knowledge and Skills (Students) – Addressing misconceptions and preconceptions</p> <p>Knowledge:</p> <ul style="list-style-type: none"> ● The properties of air that can be related to flight-related applications. ● Aware of safety procedures ● Follow safe work or preventative measures as instructed ● Familiar with “Norms of Collaboration” ● The properties of solids ● The concept of forces acting on mechanisms and causing movement <p>Skills:</p> <ul style="list-style-type: none"> ● Research and understand a problem ● Generate possible solutions ● Select an option and develop a prototype ● Test the prototype ● Evaluate and review the prototype ● Communicate the solution or results ● Summarize findings ● Identify and select resources ● Record and analyse information ● Summarize findings ● Critical thinking ● Problem solving ● Creativity ● Self-directed learning
<p>Strand A - STEM Investigation and Communication Skills</p>	<p>STEM Connections</p> <p> A.1.1.Scientific Research - Conduct research regarding the application of the four forces of flight to a flying machine, skilled trades in aviation and the environmental impact of the industry</p> <p> A3 Applications, Connections and Contributions - Identify the contributions to aviation from various communities</p>

	  A.1.5.Communication - communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes
<p>Overview / Big Ideas/Fundamental Concepts</p>	<p>Overview Students will be engaged in a research activity. Focusing on a flying machine of their choice they will explain how it functions in relation to the four forces, they will identify a particular skilled trade engaged in the aviation industry and what is being done in Canada to address aviation’s impact on the environment.</p> <p>Fundamental Concepts Structure and Function: The interrelationship between the function or use of a natural or human-made object and the form that the object takes. Sustainability and Stewardship: Meeting the needs of the present without compromising the ability of future generations to meet their needs.</p> <p>Big idea: D1. Assess the environmental impacts of flying machines D2 Demonstrate an understanding of the ways in which properties of air can be applied to the principles of flight and flying machines</p>
<p>Learning Goals / Success Criteria</p>	<p>Learning Goal #1: We are learning to identify the four forces of flight as they relate to a particular flying machine.</p> <p>Learning Goal #2: We are learning to understand the government’s plan to reduce the impact on climate change in the aviation industry</p> <p>Learning Goal #3: We are learning to identify what skilled trades are involved in flying machines.</p> <p>Educators are encouraged to co-create success criteria with students and share “I Can Statements” based on the curricular expectations. See assessment of learning exemplar (see Appendix E: Sample Rubric) for suggestions for co-creation of success criteria with students.</p> <p>Sharing options can include:</p> <p>In-person:</p> <ul style="list-style-type: none"> • Gallery walk

	<ul style="list-style-type: none"> ● Presentation ● Video <p>Online:</p> <ul style="list-style-type: none"> ● Presentation ● Poster ● Breakout Room Showcase <p>Ministry of Education Key Points: The key points below will be addressed within these experiences.</p> <p>STEM Skills and Connections – perspectives and approaches that provide opportunities for students to investigate and apply concepts and skills from all areas of learning.</p> <p>Research Process and experimentation processes – provide students with the scientific literacy skills needed to approach scientific questions that are becoming a part of everyday life</p> <p>Engineering Design – provide students with support to plan and build solutions to problems or address needs that connect to the curriculum and the world around them</p> <p>Experiential Learning – engage in a virtual experiential learning experience that includes hands-on opportunities that engage curiosity</p> <p>Skilled Trades – students consider the practical application of skills and concepts within the skilled trades and related occupations</p> <p>Climate Change - students understand the impact of aviation on the environment</p>
Learning Experience(s)	<p>Forces of Flight, Careers and the Environment Related to Aviation</p> <p>Minds On (20 minutes)</p> <p>Watch the video as a class: The Science of Flight, Ontario Science Centre</p> <p>THEN</p> <ol style="list-style-type: none"> 1. Demonstrate for the class a paper plane being sent across the room. Explain how there are 4 forces acting on the plane - drag, lift, thrust and weight. Try taping two different weights that are about the weight of a paperclip on the plane to test again and connect to the four forces. In pairs, students compare an object of their choice and a piece of paper crumpled up to see what happens when they drop at the same time. Discuss what 4 forces are acting on each object.



A.1.1, A.1.5, A3

2. Students have an opportunity to complete the worksheet (see [Appendix A: The Four Forces of Flight](#)) in their group and then take up as a class.

Action (70 minutes)

Each group selects a flying machine to research and describe using the four forces of flight that act on it. Students identify what skilled trades are involved in the production of their flying machines and the impact that their flying machines and/or airports have on climate change. Check out [CareersInTrades.ca What Are the Skilled Trades](#) (English and French) and refer to [Appendix B: Aviation Activity](#).

Possible flying machines - rocket, glider (sailplane), hot air balloon, jet airplane, helicopter, kite, parachute, supersonic airplane, propeller airplane, space plane, hovercraft, drones, dirigibles, sailplanes

This resource from [YouthSpace from the Canadian Council for Aviation and Aerospace](#) has activity books in English and French for students to reference for the skilled trades activity.

This [Government of Canada](#)'s website explains carbon reduction and offsetting of carbon emissions in the aviation industry.

The check bricks in [Appendix C: Assessment for Learning](#) are examples of how feedback can be provided to students to guide their research.



A.1.4, A.1.5

Consolidation (30 minutes)

Each group/partner presents their researched flying machine, skilled trade in aviation, and environmental impact of aviation or the class can participate in a Gallery Walk. This could be a digital presentation, a poster, diagram, video, data graphing or other product of their choice.

Students then complete a reflection of their learning (see [Appendix D: Reflection on Learning](#)).

The teacher can then assess student achievement using the sample rubric as a guide (see [Appendix E: Sample Rubric](#))

Science and Technology Expectations

Science - Structures and Mechanisms: Flight

	<p>Demonstrate an understanding of the ways in which properties of air can be applied to the principles of flight and flying machines</p> <p>D1. Relating Science and Technology to our Changing World D1.1 Assess the impacts on society of aviation technologies, while considering both local and global perspectives</p> <p>D2 Exploring and Understanding Concepts D2.2 describe the relationships between the four forces of flight - lift, weight, thrust, drag that make flight possible</p>
<p>Science and Technology Vocabulary</p>	<p>Specific vocabulary that will be used and/or covered in this learning experience</p> <p>Force – a push or pull acting on an object Aviation – the flying or operation of aircraft Lift – a force that directly opposes the weight of an airplane and holds the airplane in the air Thrust – the force which moves an aircraft through the air to overcome drag and the weight of a rocket Drag – a aerodynamic force that opposes an aircraft’s motion through the air and is generated by every part of the airplane Weight – the force generated by the gravitational attraction of the earth on the airplane which could include the weight of the plane, fuel, passengers, cargo and crew</p>
<p>Equipment and Materials</p>	<p>Common science lab resources: computer/tablet with access to the Internet, poster board, markers, pencils, erasers</p> <p>Common/Household Items and ‘Specialty Items: none required</p> <p>Online Resources Canadian Aviation and Space Museum Youthspace, Canadian Council for Aviation and Aerospace, Government of Canada, Transport Canada, Carbon Offsetting and Reducation Scheme for International Aviation, LRP Grade 6 Model 2 LRP Grade 6 Model 1</p>

	<p>Science and Technology (2022), Ministry of Education</p> <p>English Language Curriculum, Ministry of Education</p> <p>Assessment and Evaluation, Ministry of Education</p> <p>Health and Safety, Ministry of Education</p> <p>Fundamental Concepts, Ministry of Education</p> <p>The Strands and Topics in the Science and Technology Curriculum</p>						
<p>Timeline and Preparation</p>	<p>Time required for preparation – be ready to teach after the lesson on properties of air and all necessary materials are gathered.</p> <p>Approximate time for the learning experience(s) 120 minutes/3 periods</p> <table> <tr> <td>Minds-on</td> <td>20 minutes</td> </tr> <tr> <td>Experience 1 Scientific Research</td> <td>70 minutes</td> </tr> <tr> <td>Consolidation</td> <td>30 minutes</td> </tr> </table> <p>Can be extended based on student engagement/interest/driving questions/inquiry.</p>	Minds-on	20 minutes	Experience 1 Scientific Research	70 minutes	Consolidation	30 minutes
Minds-on	20 minutes						
Experience 1 Scientific Research	70 minutes						
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<p>Safety Considerations</p>	<p>Safety procedures for this lesson</p> <p>What does the teacher do?</p> <ul style="list-style-type: none"> ● follow established safety procedures and/or safety plan ● identify possible safety concerns ● accommodate or modify program expectations as needed based on student needs ● adhere to student alternative program with alternative expectations <p>What do the students do?</p> <ul style="list-style-type: none"> ● maintain a well-organized and uncluttered workspace ● carefully follow the instructions and example of the teacher <p>Refer to these safety resources:</p> <ul style="list-style-type: none"> ● Safety in Elementary Science and Technology (STAO) 						

	<ul style="list-style-type: none"> • Safe Activity Foundations in Education Document (SAFEdoc) Science and Technology, Grades 1-8 (OCTE)
Opportunities For Assessment	<p>According to the Ministry of Education Growing Success Document (2010) assessment is about improving student learning!</p> <p>Assessment FOR Learning: Occurs frequently and in an ongoing manner during instruction, while students are still gaining knowledge and practicing skills and is used by teachers to monitor students' progress towards achieving the overall and specific expectations, so that teachers can provide timely and specific descriptive feedback to students, scaffold next steps, and differentiate instruction and assessment in response to student needs.</p> <p>Assessment AS Learning: Occurs frequently and in an ongoing manner during instruction, with support, modelling, and guidance from the teacher and is used by students to provide feedback to other students (peer assessment), monitor their own progress towards achieving their learning goals (self-assessment), make adjustments in their learning approaches, reflect on their learning, and set individual goals for learning.</p> <p>Assessment OF Learning: Occurs at or near the end of a period of learning, and may be used to inform further instruction and is used by the teacher to summarize learning at a given point in time. This summary is used to make judgements about the quality of student learning on the basis of established criteria, to assign a value to represent that quality, and to support the communication of information about achievement to students themselves, parents, teachers, and others</p> <p>NOTE: The assessment in the learning experiences are intentionally assessment for learning and assessment as learning. The assessment modality is intentionally conversations and observations. This is to help move away from only product based assessment. Throughout the learning experiences students will have many opportunities to demonstrate their understanding through doing, talking and engaging in self-assessment. By collecting assessment for/as learning data teachers can be responsive and provide meaningful feedback. Teachers have been provided with assessment tools to collect evidence of student learning. Assessment opportunities are embedded throughout the learning experiences.</p>

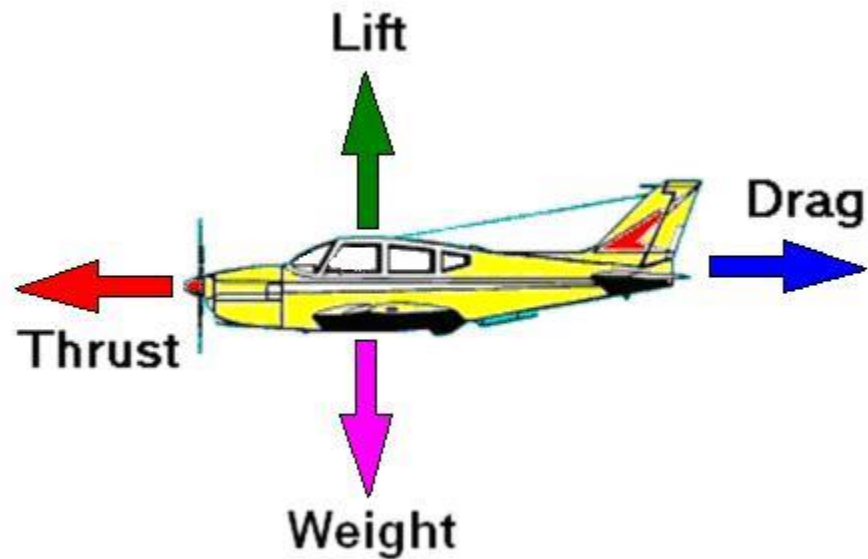
	<p>Consult the Sample Achievement Charts and Growing Success https://www.dcp.edu.gov.on.ca/en/assessment-evaluation/sample-achievement-charts https://www.edu.gov.on.ca/eng/policyfunding/growsuccess.pdf</p>
Instructional Strategies and Adaptability	<p>Instructional Strategies</p> <ul style="list-style-type: none"> • Create a learning environment in which students feel safe, supported, and valued • Embed culturally responsive student-centered instructional practices as well as diverse readings from a variety of voices and perspectives, particularly those voices which may fall outside of traditional canons • Encourage students to ask good questions and give them the opportunity to find answers and/or solutions • Support students as they carry out the engineering design process <p>Transferable Skills – problem solving, innovation, creativity, self-directed learning, collaboration, communication, digital literacy</p> <p>Instructional Adaptability</p> <ul style="list-style-type: none"> • Students work collaboratively with a partner or group that can provide a cross section of skills to support each other (Universal Design of Learning) • Students who have IEP modifications may benefit from a very structured version of the activity with modified worksheets with more intensive support • Students who are ELL may benefit from translated materials and/or images with access to translation software or a peer who can interpret • Students may benefit from accommodations such as extra time
Additional Supporting Resources	<p>Learning games and activities for support</p> <ol style="list-style-type: none"> 1. Activity books can be downloaded from this site - Youthspace - Canadian Council for Aviation and Aerospace,
Cross-Curricular Opportunities	<p>English Language</p> <p>Reading demonstrate an understanding of a variety of literary, graphic, and informational texts, using a range of strategies to construct meaning</p> <p>Writing generate, gather, and organize ideas and information to write for an intended purpose and audience</p> <p>Media Literacy create a variety of media texts for different purposes and audiences, using appropriate forms, conventions, and techniques</p>

	English Language Curriculum
Future Opportunities / Next Steps	<ul style="list-style-type: none"> ● Investigate the impact of the aviation industry on the environment in terms of different sized airports or use of non-renewable resources ● Research members of diverse backgrounds who made contributions to aviation ● Explore what is a wingsuit by Let's Talk Science ● Virtual Learning – Science North – E- Workshops Grade 6 Flight ● Read “Four Forces of Flight” by Let's Talk Science and share new information learned

Appendix A: The Four Forces of Flight

Name: _____

The Four Forces of Flight



[This Photo](#) by Unknown Author is licensed under [CC BY-SA](#)

Answer the following questions with your group or partner.

1. How do these four forces enable a flying machine to move through the air?

Drag

Thrust

Lift

Weight

2. What role does a propeller have in the flying machine moving through the air?
3. How is flight a push and pull force?
4. What force is acting when a parachute is falling through the air?

Appendix B: Aviation Activity

1. Name: _____

Aviation - Skilled Trades and Aviation Climate Action

Learning Goal #1: We are learning to identify the four forces of flight as they relate to a particular flying machine.

Learning Goal #2: We are learning to understand the government's plan to reduce impact on climate change in the aviation industry

Learning Goal #3: We are learning to identify what skilled trades are involved in flying machines.

Success Criteria – how do we know you identified the following related to aviation – the four forces of a flying machine, environmental impact and a relevant skilled trade?

I can
I can
I can

Questions

1. The flying machine to be investigated:

2. Describe how your flying machine is affected by the four forces of flight.

<http://youthspace.avaerocouncil.ca/resources/educational-materials>

Drag

Thrust

Lift

Weight

3. Select one of the skilled trades from "Careers in Aviation & Aerospace" that would be involved in the manufacturing and/or maintenance of a flying machine. Explain what the job is and what training you need to complete it. <https://careersintrades.ca/what-are-the-skilled-trades>

4. The aviation industry contributes to climate change through aircraft emissions. Go to this link to review what the government has agreed to do to address this problem.

<https://tc.canada.ca/en/aviation/carbon-offsetting-reduction-scheme-international-aviation-corsia>

Summarize what 13 Canadian airlines are expected to do to reduce their carbon footprint.

Identify impacts of how urban or rural airports affect the local citizens, species and environment.

5. These are the sources I used to find out about my flying machine.

Title	Web link/Book/Media	Author

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Appendix C: Assessment for Learning

Suggested Assessment Tools for Action

Assessment for Learning

Feedback to Improve	Success Criteria The Student	Feedback to Excel
	Criteria #1 Appropriate science and technology vocabulary.	
	Criteria #2 Flying machine research explains the four forces and skilled trades in aviation.	
	Criteria #3 Researched necessary information and selected format for oral presentation	
	Criteria #4 Relates impact of aviation to the environment.	

Assessment as Learning

Feedback to Improve	Success Criteria The Student	Feedback to Excel
	Criteria #1 I can use appropriate science and technology vocabulary.	
	Criteria #2 I can investigate with depth a flying machine's application of the four forces of flight and skilled trades in aviation..	
	Criteria #3 I can communicate with clarity in written and oral format for specific audiences and purposes.	
	Criteria #4 I can provide a thorough explanation for what actions the government has for aviation and the environment.	

Appendix D: Reflection on Learning

Suggested Reflection

3-2-1 Four Forces Reflection

Name:

Three significant ideas that I took away about aviation.	
What is squared away in my mind?	
One questions that is still circling in my head.	

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Appendix E: Sample Rubric

Assessment of Learning

Student Criteria	Level 4	Level 3 (success)	Level 2	Level 1	Feedback
Criteria #1: Appropriate science and technology vocabulary.		Considerable effectiveness in science terminology.			
Criteria #2: Research demonstrates how four forces of flight occur and the skilled trades in aviation.		Considerable effectiveness in summarizing relevant information.			
Criteria #3: Gathered all necessary information and format for oral presentation		Considerable effectiveness in expressing and organizing of information.			
Criteria #4: Identified why the aviation industry needs to have environmental controls		Considerable effectiveness in explaining key facts.			