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



Experience 3: Coding the Four Forces in a Flying Machine




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

Overview

Students will develop a coding program that demonstrates one of more of the four forces of flight acting on a flying machine.

<p>Overview of learning experiences</p>	<p>Students will learn about the four forces of air acting in the flying machine process followed by a short activity that is discussed as a class. Students will then use the coding process to create their own flying machine demonstrating one or more of the four forces of air. Students will then share their code with the class.</p> <p>Grade 6 Long Range Model 2L February/March/April</p> <p>Students participate in a coding activity that demonstrates the four forces of flight.</p>
<p>Prior Knowledge / Prior Skill Set(s)</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> A2. Coding and Emerging Technologies: use coding in investigations and to model concepts, and assess the impact of coding and of emerging technologies on everyday life</p> <p>Students can incorporate coding platforms to demonstrate the relationship between the four forces of flight.</p> <p> A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems</p>

	<p> A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials</p> <p>  A1.5 communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes</p>
<p>Overview / Big Ideas/Fundamental Concepts</p>	<p>Overview Students will view a video on designing different types of flying machines and the concept of the four forces of air. A class activity with a paper plane followed by their own activity with paper will further illustrate the four forces of air. Students will complete a worksheet activity (see Appendix A: The Four Forces of Flight) to be discussed as a class.</p> <p>There are two activities that students can engage in next.</p> <ol style="list-style-type: none"> 1. In the first one teachers can decide to model for the class a code on paper. Alternatively, the students can, with their partner/group, develop their own code. They will then introduce a code that demonstrates flight performance considering one or more of the four forces that are acting. Students will then communicate their coded flying machine to the class. 2. The second activity is a ‘Canada Learning Code’ activity whereby the students will be engaged in a lesson using Scratch. Focusing on flying they will explain how it functions in relation to the four forces of flight. <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.</p> <p>Big idea: 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><i>Learning Goals / Success Criteria</i></p>	<p>Learning Goal #1: We are learning to demonstrate how the four forces of flight affect the performance of a flying machine.</p>

	<p>Educators are encouraged to co-create success criteria with students and share “I Can Statements” based on the curricular expectations. See Appendix E: Assessment of Learning for suggestions and worksheets 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 ● 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>Coding: Allows students to explore a wide variety of science and technology concepts and contexts through coding, while also learning valuable skills related to the automation and control of systems.</p>
Learning Experience(s)	<p>The Four Forces of Flight</p> <p>Minds On (20 minutes)</p> <p>Watch the English or French video as a class The Science of Flight, Ontario Science Centre</p>



A.1.4, A.1.5, A.2

THEN

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

Action (70 minutes)

Students develop code for a flying machine that demonstrates one or more of the four forces of flight. This could be using printed code commands (see Additional Resources for bilingual Scratch codes) or a coding program such as Minecraft Education. The Scratch codes can be projected on a screen or printed out for students to arrange on paper to create their program. There are many video tutorials available on how students can create a flying machine and make it fly in Minecraft Education. Scratch also has many examples of how to simulate flight. [Here are some examples of flight simulation in Scratch.](#)

Please refer to [Appendix C: Code a Flying Machine](#) as a guide to be used by students to guide their exploration of the coding process.

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

Note: Teachers could also follow the direction of sourced lessons to model how to code a flying machine demonstrating the four forces of flight. [Canada Takes Flight, Canada Learning Code](#)

The checkbricks in [Appendix B: Suggested Assessment Tools for Action – Coding](#) are examples of how feedback can be provided to students to guide their coding process.

	<p>Consolidation (30 minutes)</p> <p>Each group/partner presents their coded program or the class can participate in a Gallery Walk. This could be a digital presentation, a poster, diagram, video other product of their choice.</p> <p>Students then complete a reflection on their learning (see Appendix D: Suggested Reflection on Learning).</p> <p>Teacher can then assess student achievement using the sample rubric as a guide (See Appendix E: Assessment of Learning)</p>
<p>Science and Technology Expectations</p>	<p>Science - Structures and Mechanisms: Flight</p> <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>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, paper, pencil, poster board</p> <p>Common/Household Items and ‘Specialty Items: not applicable</p> <p>Online Resources LRP Grade 6 Model 2</p>

	<p>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>Mathematics Curriculum (2020)</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 data-bbox="552 955 1226 1081"> <tr> <td>Minds-on</td> <td>20 minutes</td> </tr> <tr> <td>Experience 1 Engineering Design</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 Engineering Design	70 minutes	Consolidation	30 minutes
Minds-on	20 minutes						
Experience 1 Engineering Design	70 minutes						
Consolidation	30 minutes						
<p>Safety Considerations</p>	<p>Safety procedures for this lesson</p> <p>What does the teacher do?</p> <ul data-bbox="470 1344 1396 1543" 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 data-bbox="470 1617 1282 1690" 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) • Safe Activity Foundations in Education Document (SAFEdoc) Science and Technology, Grades 1-8 (OCTE)
<p>Opportunities For Assessment</p>	<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>

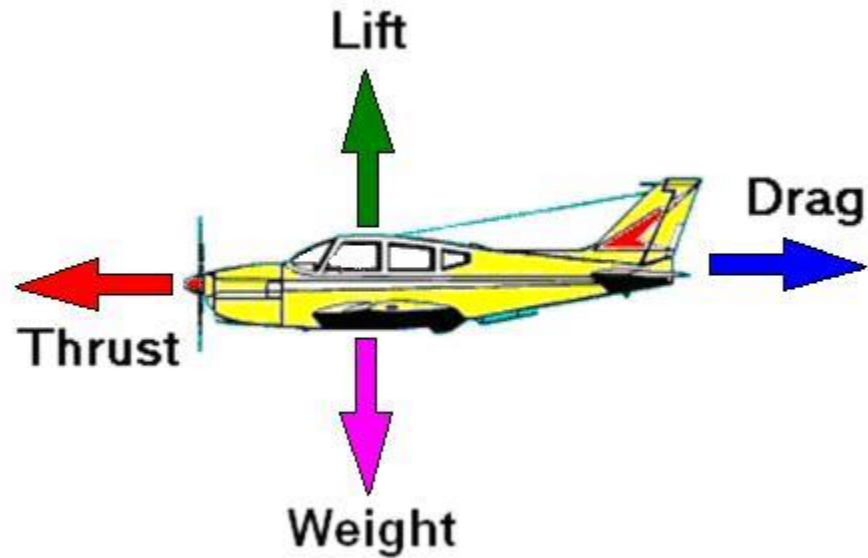
	<p>Consult the Sample Achievement Charts and Growing Success https://www.dcp.edu.gov.on.ca/en/assessment-evaluation/sample-achievement-charts https://www.edu.gov.on.ca/eng/policyfunding/growsuccess.pdf</p>
<p>Instructional Strategies and Adaptability</p>	<p>Instructional Strategies</p> <ul style="list-style-type: 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
<p>Additional Supporting Resources</p>	<p>Learning games and activities for support</p> <ol style="list-style-type: none"> 1. Grade 6 Flight Activities Science North – Airplane Design Challenge – Coding 2. Scratch Block (English)
<p>Cross-Curricular Opportunities</p>	<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> <p>English Language Curriculum</p> <p>Mathematics Coding - solve problems and create computational representations of mathematical situations using coding concepts and skills</p> <p>Mathematics Curriculum</p>
<p>Future Opportunities / Next Steps</p>	<p>#1 Use code to create a flying machine in Tinkercad #2 Use code to create a flying machine in Minecraft Education #3 Use code to create a flying machine in Scratch</p>

Appendix A: The Four Forces of Flight

Name: _____

The Four Forces of Flight



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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: Suggested Assessment Tools for Action – Coding

Suggested Assessment Tools for Action – Coding

Assessment for Learning

Feedback to Improve Excel	Success Criteria The Student	Feedback to
	Criteria #1 Appropriate science and technology vocabulary.	
	Criteria #2 Flying machine code demonstrates one or more of the four forces of flight.	
	Criteria #3 Completed graphic organizer and necessary information and format for oral presentation	

Assessment as Learning

Feedback to Improve Excel	Success Criteria The Student	Feedback to
	Criteria #1 I can use appropriate science and technology vocabulary.	
	Criteria #2 I can create a flying machine design demonstrating examples of one or more of the four forces of flight.	
	Criteria #3 I can communicate with clarity in written and oral format for specific audiences and purposes.	

Appendix C: Code a Flying Machine

Name: _____

Action – The Four Forces of Flight – Code a Flying Machine

Learning Goal: We are learning to code a flying machine to demonstrate the 4 forces of flight.

1. Design Process

What is the problem?

What do I know? What do I need to know?

How and where will I find it?

2. Possible Solutions

Solution #1	Solution 2	Solution #3

3. Success Criteria – how do we know our chosen solution resulted in coding a flying machine?

I can
I can

4. Record

Test each solution and record issues for further testing.	Results and Issues
Test #1	
Test #2	

5. Modification – what improvement did you make to your flying machine?

6. Communicate Results

Summarize how results will be communicated...

Appendix D: Suggested 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: Assessment of Learning

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: Flying machine code demonstrates the four forces of flight.		Considerable effectiveness in summarizing relevant information.			
Criteria #3: Completed graphic organizer and necessary information and format for oral presentation		Considerable effectiveness in expressing and organizing of information.			