How can we help the birds near our school grow up and thrive?

Primary: (ages 7-11)	**Science**

In this unit, students investigate the environmental and genetic factors that influence an animal's characteristics and potential for success. They build a description of a bird with reference to its behavioural and physical traits and make predictions about how these traits might indicate food sources and appropriate environment. Finally, they design and refine solutions to benefit the bird's chances of survival in a given environment.

Time allocation	About 10 lesson periods
Subject content	Native species, variation in traits; specialised traits
Creativity and critical thinking	This unit has a **creativity** and **critical thinking** focus: • Evaluate the needs of a bird and whether the local environment provides for that birds' needs. • Generate solutions to a problem about the birds in a community, evaluate the solution for effectiveness, and determine revisions.
Other skills	Collaboration, Communication, Persistence
Key words	Ornithologist, native and non-native, traits, patterns, environment

Products and processes to assess

Students engage in observation and data collection in fieldwork, record data and then use text and media to determine the birds they see. They learn to compare birds' traits and consider how traits might be specialised for a particular environment. Throughout the lessons, students ask questions, synthesise data, and ultimately design solutions, such as bird feeders, that take into account the physical and behavioural traits of the bird and what the local environment offers the bird. At the highest levels of achievement, their work process shows a willingness to examine a variety of ideas, consider different perspectives and make meaningful connections. They show good awareness of the level of personal novelty and strengths and limitations of their proposed solutions .

Authors: Miller, E., Severson, A., Codere S., Fitzgerald, M., Modaff, M., Easley, K., Palincsar, A., Krajcik, J. (2019) for the OECD for the CERI project *Fostering and assessing creativity and critical thinking skills*.

Teaching and Learning plan

This plan suggests potential steps for implementing the activity. Teachers can introduce as many modifications as they see fit to adapt the activity to their teaching context.

Step	Duration	Teacher and student roles	Subject content	Creativity	Critical thinking
1	Lesson periods 1 and 2	Introduce students to the Driving Question of the unit and have them share their thinking while recording questions that come up during the discussion. Students predict whether birds live outside the school, which ones they might see, and what they will be doing. As a class, go outside to look for birds, carefully describe in notebooks the birds seen, their traits and behaviour, and their location. Use text, photos and media to identify the birds you saw, and use the map to mark where they saw them. Use the resources to determine whether the birds are native or non-native.	Sharing background knowledge. Investigating and identifying birds and recording data using reference materials.	Inquiring: Observe, describe relevant experiences, knowledge and information.	Inquiring: Identify and question assumptions, become aware of gaps in knowledge.
2	Lesson periods 3 and 4	Among the birds you saw in the last lesson, narrow the unit's study to four or five birds observed. Students work in small groups with each group focused on one of the four or five birds. (Each group has a *different* bird). This group will develop expertise in this bird through the rest of the unit. Each group looks again for these birds outside and records new information. The students are introduced to the Shared Trait Chart. Students use observations, photos, text and media to discuss and compare traits of these birds 1. Their own species a male and female bird 2. Across the four species. In groups, students generate claims about patterns they notice across all birds. They add more questions to those generated in Lesson periods 1 and 2.	Gathering information through media and texts. Compare and contrast traits of birds within the same species and across species.	Inquiring: Make connections to other concepts and ideas, integrate other disciplinary perspectives.	Inquiring: Understand the context, frame and boundaries of the problem.
3	Lesson period 5	Interview parents about their favourite bird, and why they chose that bird. One by one, share all interviews, and parents' favourite birds and record them, and look them up in text, or media. Student groups decide if any of the parents' favourites is similar to the bird their group is studying. Add new questions and answer questions that have been answered.	Gathering and presenting information from parents about birds, and synthesizing the information.	Imagining: Explore, seek, generate ideas.	Imagining: Identify and review alternative ideas and compare and imagine different perspectives on the problem.
4	Lesson period 6	Students, in groups, discuss the variety of structures of birds in the Shared Trait Chart and discuss how the structures of a bird might indicate where it lives and what it eats. The students sort photographs of the birds and describe patterns in structures. Students make predictions with reasoning	Predicting the relationship between the bird traits and the environment	Imagining: Explore, seek, generate ideas.	Imagining: Identify and review alternative ideas and compare and

		about how birds' beaks, feet, colours, or shapes are associated with certain sources of food. The teacher reminds students to check if they have assumed that anything is true without knowing for sure that it is true and record areas of uncertainty or where further research is needed. Students review the questions collected in prior lessons, and check to see if any of them have been answered, and they add more questions if needed. When a question gets answered, write the answer next to the question, or remove the question.	where they live and the food they eat.		imagine different perspectives on the problem, identify and check assumptions
5	Lesson period 7	Have student groups use text, media and observational data to record the foods their bird eats and where their bird lives. They ask, "Is the food available around our school?" They do a habitat inventory in the area around their school, looking for food resources that they have on the Shared Trait Chart. They ask if there's a resource missing that their birds need. They write a resource problem they want to solve about a focal bird not having access to a resource, including water or shelter materials. Each group defines a problem centred on the group's bird.	Investigating and conducting field observations, collaboration creating a problem statement for a bird that can be resolved related to thriving.	Doing: Designing solutions based on criteria and constraints using non-traditional materials.	Doing: defining a problem and justifying a solution based on reasoning based on logical solution.
6	Lesson periods 8 and 9	Students construct an artefact to solve their problem, for example, a bird-feeder with water. They engineer the designs using new observational data or information gathered from text or online resources. (The solution might be to raise money for a plant that their bird needs, or a letter to parents about the importance of protecting wetlands.) Students are encouraged to develop several ideas for novel and original appropriate solutions and discuss as a group the criteria they will use to decide which ideas to elaborate, before making their final selection. Students build and revise their solutions and share with the class, explaining their bird, its features and behaviour, and how they will gather evidence of whether their solution worked. Students who made bird feeders hang their bird feeders.	Constructing engineering solutions based on criteria and constraints	Doing: Designing solutions based on resolving a problem related to a bird thriving in an environment.	Doing: Reflect on the chosen scientific solution and consider possible alternatives
7	Lesson period 10	Students check on their solution and record whether their solution worked as intended, to help their bird. For example, go outside to observe evidence of birds having been at their bird feeders. Students discuss different solutions or modifications to the solutions, if needed.	Evaluating engineering solutions and revision if necessary	Reflecting: Revising solutions based on outcomes.	Reflecting: Evaluate and acknowledge the uncertainty or limits or the solution.

Resources and examples for inspiration

Web and print

- Shared Trait Chart.

Other

- Bird Feeder supplies (recycled materials -- containers, perches, twine, tools for making feeders)

Opportunities to adapt, extend, and enrich

- This mini-unit is based on portions of the three learning sets in a sequence of six learning sets. Remaining learning sets have students compare female and male birds of the same species and describe physical traits, then compare those physical traits with another bird species. They examine behaviors of some birds such as migratory and non-migratory birds. They read texts about hawks in different environments (plains and old-growth forest) who differ in size and wingspan. They learn about heredity and traits, and argue that these physical changes provided an advantage over thousands of years.
- Remaining learning sets, along with additional STEM project-learning units and related resources can be found at https://sprocket.lucasedresearch.org/course/science3/birds and https://mlpbl.open3d.science/

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Creativity and critical thinking rubric for science

Mapping of the different steps of the lesson plan against the OECD rubric to identify the creative and/or critical thinking skills the different parts of the lesson aim to develop

	CREATIVITY Coming up with new ideas and solutions	Steps	CRITICAL THINKING Questioning and evaluating ideas and solutions	Steps
INQUIRING	Make connections to other scientific concepts or conceptual ideas in other disciplines	1, 2	Identify and question assumptions and generally accepted ideas of a scientific explanation or approach to a problem	1, 2
IMAGINING	Generate and play with unusual and radical ideas when approaching or solving a scientific problem	3, 4	Consider several perspectives on a scientific problem	3, 4
DOING	Pose and propose how to solve a scientific problem in a personally novel way	5, 6	Explain both strengths and limitations of a scientific solution based on logical and possibly other criteria (practical, ethical, etc.)	5, 6
REFLECTING	Reflect on steps taken to pose and solve a scientific problem	7	Reflect on the chosen scientific approach or solution relative to possible alternatives	7