

Teacher Guide

Are Raccoons Smarter Than We Think?

Vocabulary – Blooms Taxonomy

Abstract:

Sage Warner's research explores the cognitive abilities of wild raccoons in response to increasing habitat loss and urbanization. With a 17% decline in U.S. tree cover since 2000, raccoons are adapting to urban environments by altering their behavior and foraging strategies. To investigate their intelligence, sage conducted three tests: mirror self-recognition, bowl puzzle solving, and tool use. The results revealed that raccoons demonstrated problem-solving skills, exploratory behavior, and in some cases, signs of self-awareness. These findings suggest raccoons are more intelligent and behaviorally flexible than commonly perceived. Understanding their cognitive traits can inform conservation efforts and promote coexistence between humans and urban wildlife.

Ohio high school science standards

Biology (9-12):

B.DI.1: Cells and cellular processes: Understanding how raccoons respond to environmental stimuli through behavioral adaptations.

B.EC.3: Interdependence of organisms: Investigating how habitat loss affects raccoon interactions with their ecosystem and human environments.

B.EC.5: Behavior of organisms: Exploring how raccoon intelligence influences survival strategies in urban ecosystems

Environmental Science (9-12):

ES.HE.2: Human impact on ecosystems: Evaluating how urbanization and deforestation influence raccoon habitats and behavior.

ES.BD.1: Biodiversity and species adaptation: Understanding how raccoons adapt cognitively and behaviorally to changing environments.

ES.IE.3: Investigative practices in environmental science: Designing and interpreting field-based studies on wildlife intelligence and adaptation.

Nature of Science (Grades 9–12)

NS.IP.1: Scientific inquiry and investigation: Conducting field experiments to test animal cognition.

NS.DA.2: Data analysis and interpretation: Analyzing behavioral data from raccoon interactions with experimental setups.

NS.CC.3: Communicating scientific findings: Presenting research on raccoon intelligence and its implications for conservation.

Tier 1 – Basic Everyday Terms

These are common words students likely already know.

Food: Something animals eat to get energy and nutrients.

Tool: An object used to help complete a task.

Behavior: The way an animal acts or responds to its environment.

Problem: A challenge or situation that needs to be solved.



Tier 2 – Academic Vocabulary

These words are used across subjects and help students understand concepts more deeply.

Adapt: To change in order to survive or fit into a new environment.

Environment: The surroundings or conditions in which an organism lives.

Observation: The act of watching something carefully to gather information.

Investigation: A careful study or examination to learn facts or reach new conclusions.

Data: Information collected during an experiment or study.

Tier 3 – Domain-Specific Science Terms

These are specialized terms used in scientific contexts.

Cognitive Flexibility: The ability to change thinking or behavior when conditions change.

Self-Recognition: The ability of an animal to recognize itself in a mirror.

Behavioral Flexibility: The ability to change behavior in response to new challenges.

Tool Use: When an animal uses an object to help solve a problem or get food.

Urbanization: The process of land development that turns natural areas into cities or towns.

Answers to Guiding Questions

Guiding Questions for Students:

1. What does it mean for an animal to recognize itself in a mirror?
It means the animal understands that the reflection it sees is itself, not another animal. This is a sign of self-awareness and is considered a marker of higher intelligence.
2. Why might intelligence be important for animals living in urban environments?
Intelligent animals can adapt to new challenges, like finding food or shelter in human-dominated areas. This helps them survive as their natural habitats change or disappear.
3. How does habitat loss affect raccoon behavior?
It forces raccoons to find new food sources and shelter, often in urban areas. They become more nocturnal and bolder, adapting their behavior to survive.
4. Why measure raccoon intelligence?
It helps scientists understand how raccoons learn, solve problems, and adapt to changing environments. Intelligent raccoons may be better equipped to survive habitat loss.

Mirror Test Questions:

5. Refer to the Mirror Behavior Code Key Reference Table, which behaviors suggest that an animal might understand the mirror reflects itself?
Contingency testing and self-recognition suggest the animal understands the reflection itself.
6. Why is self-recognition considered a sign of intelligence?
Because it shows the animal has a sense of self, which is a complex cognitive ability.

Bowl Test Questions:

7. What might partial success tell us about problem-solving ability?
It shows the animal is trying to solve the problem and understands part of the task.
8. How could bowl design affect the results?
If the bowls are too hard to move or stacked in a confusing way, it might prevent success.

Tube Test Questions:

9. What do effective tools use look like in animals?
Using an object in a purposeful way to solve a problem, like retrieving food.
10. Why might some raccoons fail even if they engage with the tube?
They might not understand how to use the tool, or the tool might not be the right size.

Graph Interpretation Questions:

11. Which test showed the highest level of success?

The Bowl Puzzle Test showed the highest level of success with partial success observed.

12. Which test had the lowest engagement?

The Tube Tool Use Test had the lowest engagement and success.

13. What might explain the differences in success across the tests?

Differences could be due to the complexity of the task, the physical design of the tools, or the raccoons' familiarity with similar challenges in their environment.

14. How do these findings challenge the idea that raccoons are pests?

They show raccoons are intelligent and adaptable, not just troublemakers.

15. What could cities do to better coexist with intelligent wildlife?

Create green spaces, secure trash bins, and educate people about wildlife behavior.

Next Step(s) as a Scientist

16. Science is an ongoing process. What new question(s) should be investigated to build on Sage's research? How do your questions build on the research that has already been done?

Possible student responses:

- a) **Do raccoons in rural environments perform differently on intelligence tests compared to urban raccoons?**

This builds on Sage's research by comparing how habitat influences cognitive performance.

- b) **How does age or experience affect a raccoon's ability to solve novel problems?**

This question extends the study by exploring whether learning and memory play a role in raccoon intelligence.

- c) **Can raccoons learn from observing other raccoons solving tasks?**

This would investigate social learning, a higher-level cognitive skill not addressed in the original study.

- d) **What role does food motivation or type of reward play in raccoon problem-solving behavior?**

This builds on Sage's methods by refining the experimental design to test how motivation influences success.

Citation:

Mitchell, H. & Smith, J. (Summer 2024). Beech Leaf Disease. PPT presentation. Brumbaugh Scholar Program. University of Mount Union, Alliance, H 44601