

2025 BIORETS Curricular Materials

Title of the Lesson Plan:

- Dichotomous Deductions

BIORETS Teacher's Name: Robert Teitsma**Intended School Year and Marking Period:** 2025-2026, first marking period**Subject and Grade Level:** 7th Grade - Process of Science**Overview:**

This lesson will be part of the first unit of the year, Scientific Methods. It will introduce and reinforce the concept of deductive reasoning through use of a dichotomous key that sorts to family level. Students will first be placed in heterogeneous groups and given a card with a picture of the top and bottom view of an aquatic invertebrate and a dichotomous key. Groups will determine, through discussion, what they think that organism is using the key. The class will then work through the key together and verify the organism's family. Groups will be given additional cards of organisms and work to identify those. Groups can check their work with the teacher as they go. Finally, groups will be given a bag of assorted office supplies and will be tasked with creating their own dichotomous key for identifying them. Their key must give each item a letter identification "Object A", "Object B", etc. Then groups will trade objects and keys and see if they can identify the objects the same as the original group by only using their key. Discuss results and anecdotally introduce the concept of deductive reasoning. The lesson will then end with a game that illustrates the importance of dichotomous keys.

Essential Standards:

5-PS1-3 Make observations and measurements to identify materials based on their properties.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Learning Objectives:**Students will be able to;**

- Utilize a key to identify an object or organism
- Create a method for differentiating between items of organisms
- Understand the basics of deductive reasoning

Length of Lesson: 50 min**Introduction/Background:**

Scientists classify everything in the universe. The history of classification spans millennia, starting with early descriptive categorizations and evolving into the formal, hierarchical systems used today. Key figures like [Aristotle](#) and [Linnaeus](#) played pivotal roles, with Linnaeus's binomial nomenclature system revolutionizing how we name and organize living things.

Sometimes, things need to be reclassified as new evidence is discovered through improving technology and discovery. When things are classified, scientists start from the most common ground and make differentiations based on form and function.

This lesson allows students to look at how things can and should be grouped. It also helps students understand how scientists disagree about classifications and how important it is to be unbiased about changing them when new evidence contradicts the old taxonomy.

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Key Concepts and Terms Covered:

classification, taxonomy, domain, kingdom, phylum, order, family, genus, species, characteristic, physical, behavioral, deduction, reasoning, dichotomy, dichotomous key, aquatic, invertebrate

Materials:

Aquatic Invertebrate Dichotomous Key (modified for 7th grade level)

Aquatic Invertebrate Cards (4 sets of 5 cards)

- ID# (no name)
- Color picture of invertebrate (top view)
- Color picture of invertebrate (bottom view)
- Color picture of invertebrate (side view)

Answer Sheet

- Items #1-5 listed with blanks
- Items A-H listed with blanks

Bags of Items (6)

- Writing utensils (2)
 - Pen
 - Retractable pen
 - Pencil
 - Mechanical pencil
 - Colored pencil
 - Marker
 - Dry erase marker
 - Crayon
- Buttons (2)
 - Round wooden 4 hole
 - Square wooden 4 hole
 - Round plastic 4 hole
 - Square plastic 4 hole
 - Round wooden 3 hole
 - Square wooden 3 hole
 - Round plastic 3 hole
 - Square plastic 3 hole
- Stickers (2)
 - 8 total (pictures, words, shapes variety)

Activities of the Session:

1. The engagement, as described in the next section
2. Explore
 - a. Students will be put in heterogeneous groups and given a dichotomous key of aquatic invertebrates and card #1
 - b. Students will work through the key and write down on their white board what their group thinks is the order of the organism. When ready, they will show their answer to the teacher.
 - c. Teacher will work through the dichotomous key with the class and reveal the correct answer at the end.
 - d. Groups will then get the remaining cards (#2-5) and will work to identify the remaining invertebrates. They will write their answers on their sheet.
3. Elaborate
 - a. Groups will be given a set of items.
 - b. They will collaboratively and secretly build a dichotomous key to differentiate and identify each of their items to a letter. Example; Item A, Item B, etc.
 - c. Groups will create a secret key of each items identification (Item A = retractable pen, etc)
 - d. Groups will share their dichotomous key and items with a group that has a different set of items and they will NOT share the key.

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- e. Groups will attempt to identify their new items using the provided key. They will record their answers on the sheet. Students will turn in their answer sheets.
 - f. When all groups are finished, the teacher will go through each key to sort and identify the items.
 - g. Groups will reveal their answer keys and class will discuss the keys and their positives and negatives. Students can reflect on how well they used the keys and how well they wrote keys.
4. Game "Survivor"
- a. Students are given a limited Field Guide of plants and animals.
 - b. Individually, they must make decisions on their devices using Quizizz.
 - c. A picture(s) of a plant or animal will come on the screen. Students will use their field guide to determine if it is one of three options; food, danger, or neutral.
 - d. If they choose correctly, they move on. If they choose incorrectly, there are consequences. Accidentally choose food for a danger, you die. Miss 3 opportunities for food, you die. The player who lasts the longest is the "survivor".

Engagement:

Brief anecdote about the history of taxonomy (Aristotle and Linnaeus) and the need to reclassify. Collaborative and competitive efforts to identify initial cards and remaining cards. My classroom has a point system and teams can earn points for good work. Survivor game.

Evaluation:

Students will be assessed on;

- Ability to use initial dichotomous key on cards
- Ability of other groups to use the dichotomous key they create
- Ability of students to use the other student created dichotomous key

Extensions and Modifications:

Students who understand the concept can make additional keys for items sets of their choosing. They can then trade sets to solve as a game.

Students who struggle can be given smaller item sets (remove some of the items from current sets) or item sets with clearer distinctions.

Application:

People must discern the difference between items all of the time. Our mind is always using deductive reasoning to identify items, sounds, tastes, etc. When we observe the world, we naturally run through nearly instant dichotomous keys to evaluate potential threats, benefits, and competitors. This lesson is a basic look at how we do that and why it is so important.

Resources:

Wikipedia, Guide to Aquatic Invertebrates of the Upper Midwest by R.W. Bouchard, Jr.

