APPENDIX B
CLASSIFICATION

OBJECTIVES

The students

- Use their senses to describe selected objects.
- Identify the different senses used in collecting the information.
- Relate physical properties of things to senses.
- Classify a collection of items according to their similarities and differences.
- Are introduced to two category classification or dichotomous classification.
- Classify objects by their physical properties.
- Identify both similarities and differences in functions of items.
- Classify items by their functions.

BACKGROUND

This start-up activity is designed to introduce students new to DASH to the fundamental science concept and skill of classification. The teacher will need to adapt and modify the suggested procedures depending on the previous experience and developmental level of the students.

Senses and properties

The students first make a concept map about the senses of sight, hearing, touch, smell, and taste. They associate these senses with their sensing organs—eyes, ears, skin, nose, and tongue and identify the properties of objects that can be sensed—color, sound, texture, temperature, odor, flavor, and so forth.

Same and Different game

The students next play the Same and Different game in which they sort items into six or more different major categories. Each major category is made up of some set of common classroom items such as paper clips, books, pencils and so forth. Objects in a category have the same form and function. The *form* of an object refers to its physical properties, what it is made of, and its parts and their organization. The *function* of an objects refers to what it does or is used for.

Kinds of things or categories

The teacher and students work together to create category names such as pencils, rulers, paper clips and so forth as two or three different kinds of things or items are drawn from a container holding a Master Collection. The students then match other items with existing categories or create new categories when different kinds of items are presented. The students can also invent logos to represent each category—example, a picture of a pencil or a ruler.

Building a Master Collection

Most of the procedures in this activity use a master collection of items. It needs to be large enough so there is at least one item per student. Needed for the master collection are 6 or more major categories, each with two subcategories. One of the two subcategories has items that all look the *same*. The other subcategory has the same kind of items but they look *different* from all other items. For

example, the major category pencils could have a *same* pencils subcategory—two brand new white pencils and a *different* pencils subcategory —four to eight used, different colored pencils. See Figure SU.1(1) for some suggestions for a master collection.

Category: Pencils Subcategories: 2 New pencils that look the same. 4-8 Used pencils, each different from all other pencils. (e.g. different colors, lengths)	Category: Paper Clips Subcategories: 2 New paper clips that look the same. 4-8 Paper clips, each different from all other paper clips (e.g. different colors, sizes)
Category: Books Subcategories: 2 New books that have the same title. 4-8 Used books, each with a different title.	Category: Rulers Subcategories: 2 New rulers that look the same. 4-8 Used rulers, each different from all other rulers (e.g.. different colors, materials)
Category: Paper Subcategories: 2 New sheets of paper that look the same. 4-8 Used sheets of paper, each different from all other sheets of paper. (e.g. different colors, sizes)	Category: Crayons Subcategories: 2 New crayons that look the same and have the same color. 4-8 Used crayons, each different from all other crayons. (e.g. different colors, lengths)

Figure SU.1(1) Six possible categories of game items for a master collection.

Physical properties and two category classification

Next the students use the physical properties of size, shape, and other visual and tactical characteristics to separate items into subcategories. To do this they are first introduced to a two category or dichotomous system for sorting or classifying items. Scientists use a simple two category or dichotomous system to sort or classify things. They take a collection of items, inspect it, and divide the collection into two different categories. One category has a distinct characteristic and the other does not have that characteristic.

Name Game

To get a feeling for the dichotomous classification system, start with the Name Game. Select four or five students and group them in the inclusive category *All Students*. For example, *All Students* might be Jan, Jack, Jill, Jo, and Jim. Then divide *All Students* into two categories—*Girls* and *Not Girls.* Next divide *Girls* into two more categories—*Jan* and *Not Jan.* Continue the process with the *Not Girls* until *Jo, Jack* and *Jim* have their own separate categories. See Fig. SU.1(2).

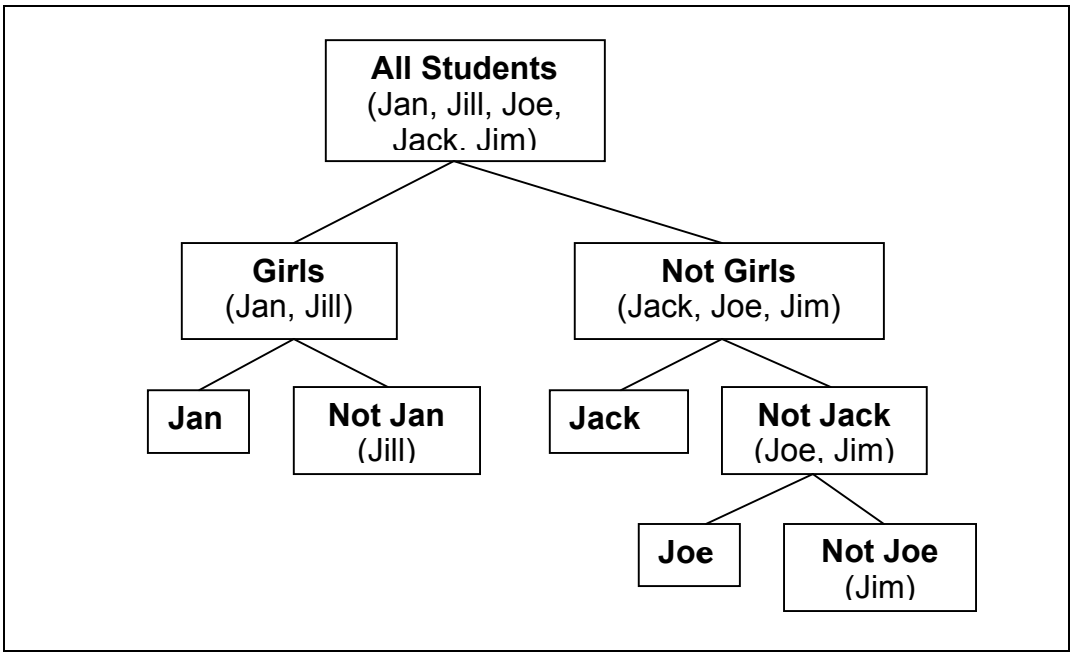

Fig. SU.1(2) A classification tree sorting five students in the Name Game using a two category or dichotomous system.

Classification game

Use the items from the Master Collection for the classification game. Have the students classify the objects by their physical properties or *forms*. First the students work with the teacher on one of the major categories such as pencils. Together they successively divide the items in the major category into pairs of sub-categories using differentiating physical properties. After the students have worked through classification of one major category, have them work in small groups to classify other major categories.

Follow the process used in the Name Game. On a table or the floor put all of the items in a single major category. *All pencils* are shown in the example in Fig. SU.1(3). The first two subcategories of *All Pencils* are *White pencils* and *Not white pencils*. Then the *Not white pencils* are divided into two subcategories—*Yellow pencils* and *Not yellow pencils.* Again the division continues until the items can no longer be separated. Here the pencils were separated by the physical property of color. Multiple physical properties such as color and length, can be used within the same category classification as desired.

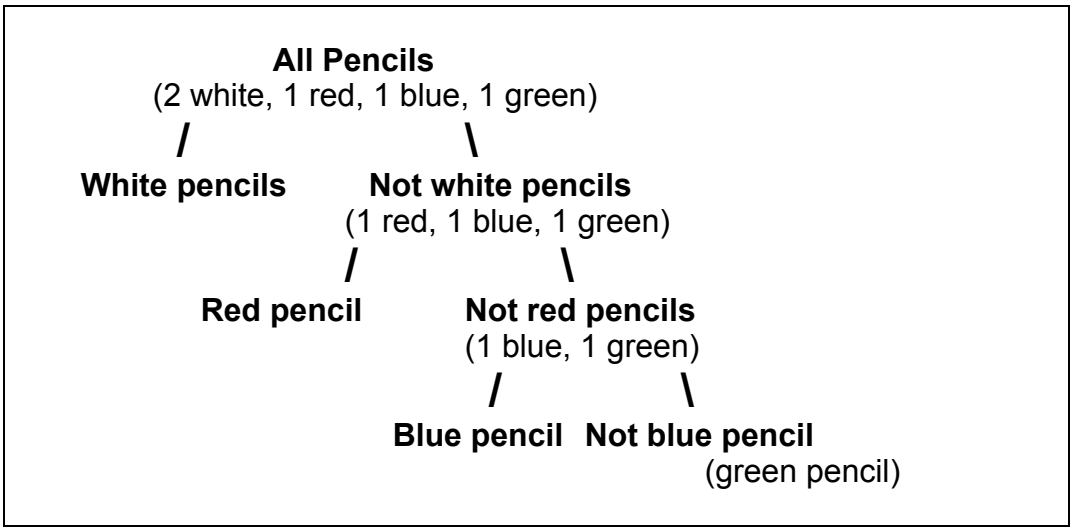

Fig. SU.1(3) Classification of pencils using a two category or dichotomous system and a classification tree.

Showing steps in the classification

The students are then asked to help draw a diagram showing the steps they went through to identify different objects as in Figures. SU.1(1–2). This creates a *classification tree* by connecting the words or boxes with lines to show the division of categories. The students record their categorization on a class chart. Then they work in small groups to classify other major categories and record their work on SP SU.1 CLASSIFICATION TREE. Trees and collections can be traded between groups as a skill assessment.

Function classification game

Next the students are introduced to classification by *function*. First they work with the teacher to classify items and to get an idea of the meaning of the function of a thing or what it does or is used for. Then they work in small groups to classify sets of items by function.

Function game

The function game is played with one item from each of four of the major categories from the master collection. These are put on the table and the students find a functional category name that will fit them all. For example, for a collection of a pencil, ruler, crayons, and a piece of paper, the functional category could be *Things used in drawing* or *Classroom tools*. The students then classify the set into a pair of function subcategories labeling the function of one item and labeling the other as not having that function. For example; *Thing used in measuring* (ruler) and *Things not used in measuring* (all other items). Words or logos are used to identify the function categories. Figure SU.1(4) shows some possible functions for items in the master collection. With the teacher, the students separate the remaining three items into functional subcategories. For example: *Things used to write on* (paper) and *Things not used to write on* (crayons and pencils). See Figure SU.1(5).

Item	Possible Function
Book	Items used to read, to hold printed words and pictures, to press flowers, etc.
Crayon	Items used to color paper, to batik, to color candles, etc.
Paper	Items used to write on, to make airplanes or spitballs, etc.
Paper clip	Items used to hold papers together, to release computer disks, etc.
Pencil	Items used to write on paper, to poke holes, to hold doors open, etc.
Ruler	Items used to measure distance, to draw straight lines, to make ramps for marbles, etc.

Figure SU.1(4) A list of some possible functions for the master collection.

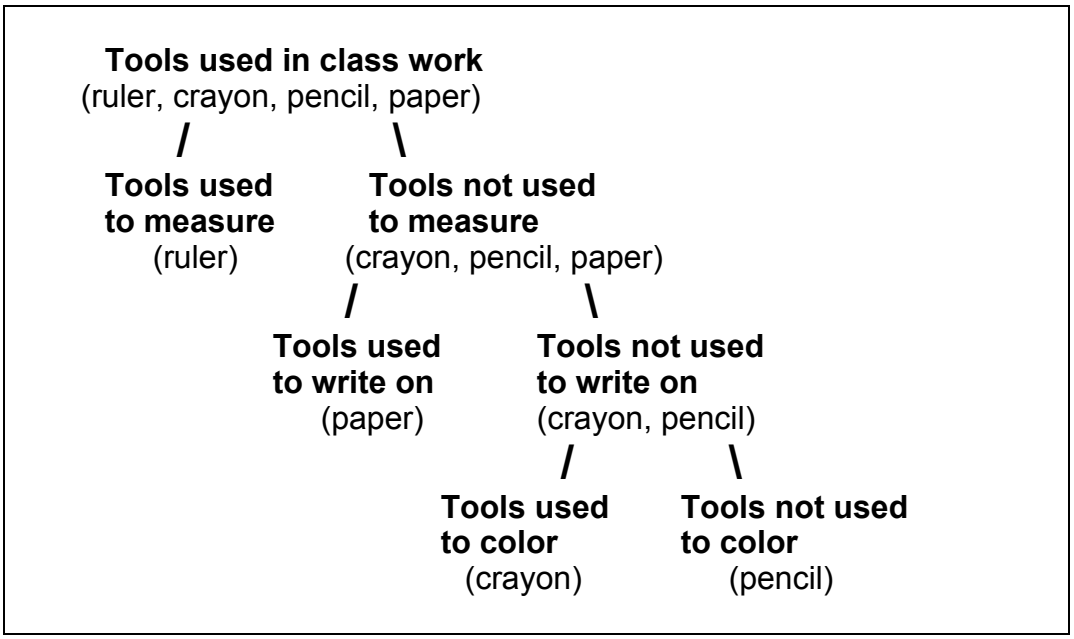

Fig. SU.1(5) A classification tree using function.

STUDENT ROLES
Observer
Classifier
Taxonomist

MATERIALS
chart paper
markers
items for the master collection

PRODUCTS
Class charts of classification using form and function
Completed Student Pages

PROCEDURES

1. Have the students construct a concept map about physical properties and the senses.

Help them to include such ideas as these by asking questions about

- The sense of sight.
  - ✔ Work to the idea that the eyes provide the sense of sight.
  - ✔ Include sight associated physical properties such as color, size, shape, pattern and so forth.
- The sense of hearing.
  - ✔ Work to the idea that you hear things with your ears.
  - ✔ Include hearing associated physical properties such as pitch (high/low), intensity or amount (soft/loud/painful), beat (fast/slow), and so forth.
- The sense of touch.
  - ✔ Work to the idea that you feel things with the skin.
  - ✔ Include touch associated physical properties such as feeling texture (rough/smooth, soft/hard, sharp/dull, others), pressure (heavy/light/pain), temperature (hot/cold), and so forth.
- The sense of smell.
  - ✔ Work to the idea that you smell things with the nose.
  - ✔ Smells are described as being like something known–like fruit, perfume, or foul odors.
- The sense of taste.
  - ✔ Work to the idea that you taste things with the tongue.
  - ✔ Include touch associated physical properties such as sweet, sour, bitter, and salty.
  - ✔ CAUTION: Remind students that it is dangerous to taste things that are not foods.

2. Introduce the Same and Different game using items from the master collection. See Background. Keep items in a container so that they are seen only when pulled out. Have the students focus on the major category names (pencils, paper clips, paper, and so forth). Do not worry about subcategory differences at this time.

- Pull an item from the container and ask the students to give it a name.
  ✔ Ask, What is this? or what do we call this? The name they suggest will usually tell what kind of thing the item is and be its category name.
- Draw a box or circle on chart paper and put the item in it. Label the box with the category name.
- Show the students another item and ask them if it is the same or different from the one already out in the circle or box.
- If different, draw and place it in a different box or circle. Label the box with the new category name.
  ✔ Start using the term *category* to describe the box or circle and the items in it.
- If it is the same, place it in the box with the similar object.
  ✔ Start using the term *category* to describe the box or circle and the items in it.
- Ask why they put the item where they did?
  ✔ Usually students will say they look alike or do the same things.
- Ask why they didn't put the items in some other category?
- Continue until the students are reasonably fluent with the ideas of same, different, and category.
- Summarize the activity by asking what they mean when they say something is in a *category*. Ask them to give examples of categories and things that could be included in them.
  ✔ Work to such things as new, old, and used pencils are in the category pencils; new, old, and beat-up cars are all in the category cars. In each case members of the category share some properties and do the same thing.
- Help the students to understand the importance of knowing about physical properties by asking them how they tell one object from another.
  ✔ Work to describing the physical properties of the objects.

3. Introduce the students to playing a Name Game. See Figure SU.1(2).

- Draw a large circle on chart paper and give it the name *All Students*.
  - ✔ Ask for volunteers and select 4-6.
  - ✔ Have the students write their initials in the circle.
  - ✔ Announce that this is the *All Students* circle and label it.
- Draw another circle outside the big circle. Put the initials of Student #1 in the circle.
  - ✔ Announce this is *Student #1's* circle. Label it.
  - ✔ Ask if the big circle still has the correct name now that Student #1 is not in it.
  - ✔ Work to the idea that they need a new circle that does *not* include Student #1.
- Draw a *Not Student #1* circle at the side of the *Student #1* circle. Have the remaining students put their initials in the new circle. Ask what a name for the circle might be.
  - ✔ Work to the response the *Not Student #1* circle. Label it.
- Draw another circle below the *Not Student #1* circle. Put the initials of Student #2 in the circle.
  - ✔ Announce this is *Student #2's* circle. Label it.
  - ✔ Ask if the *Not Student #1* circle still has the right initials now that Student #2 is not in it.
  - ✔ Work to the idea they need a new circle that does *not* include Student #2.
- Draw a *Not Student #2* circle at the side of the *Student #2* circle. Have the remaining workers put their initials in the new circle. Then ask the students to name the circle and label it.
  - ✔ Work to the response the *Not Student #2* circle.
- Draw another circle below the *Not Student #2* circle. Put the initials of Student #3 in the circle.
  - ✔ Announce this is *Student #3's* circle.
  - ✔ Ask if the *Not Student #2* circle still has the right name now that Student #3 is not in it.
  - ✔ Work to the idea they need a new circle that does *not* include *Student #3.*
- Draw a *Not Student #3* circle at the side of the *Student #3* circle. Have the remaining student put initials in the new circle.
  - ✔ Ask if is it fair to call this circle *Not Student #3* since all other students have their own circle.
  - ✔ Work to the response that since only *Student #4* is in the circle it could also be called *Student #4's* circle.
- Continue with student # 5 and/or student #6 if appropriate.
- Help the students add connecting lines to the chart to show how the classification of students was accomplished. Introduce the term *classification tree* for this type of chart.
- Ask the students to tell what they think a classification tree tells them.
  - ✔ Work to the idea that it shows how you think as you make selections of things or people.

4. **Use the items from one of the major categories in the Master Collection and introduce the Classification Game. See Figure SU.1(3) for an example with pencils. Place all items on a piece of chart paper on a table or the floor and go through their classification with the students.**

   Ask such questions as these:

   - What is the name of the category?
     ✔ Write the name of the category in a box or circle containing all items.
   - Can you divide these things into two categories so that things in one category will have a property and all the things in the other category will not have that property?
     ✔ Draw boxes or circle around the subcategories and help the students identify them with labels.
     ✔ The same name or logo is used for pairs of categories. Run a diagonal line through the *not* logo.
     ✔ Continue the subdivision and labeling as far as possible.
     ✔ Post the drawing showing the steps in subdivision.
   - What did you use to separate one category of things from another?
     ✔ Work to the idea of using different properties of items.
   - What kinds of properties did you use?
     ✔ Get at such things as differences in shape, color, materials, weight, size, and others.
     ✔ Give these things the names *physical properties* and *form*.
   - How is this classification similar to the Name Game?
     ✔ Get at the idea that they are the same only one used people and the other objects.

5. **Organize the class into teams of 4–5 students. Give each team one of the major categories of things from the master collection. Have them classify the items, recording the steps and categories on a classification tree.**

   Have the students

   - Divide their major categories into two subcategories so that things in one subcategory have a property and things in the other category do not have the property.
   - Draw boxes, connecting lines to show steps, and create identifying names or logos.
   - Continue the subdivision as far as possible.
   - Exchange classification sets and repeat the process.

6. **Use the master collection of items and introduce the Function Game to the class. Put four items from four different major categories on chart paper on a table or the floor. See Figure SU.1(5).**

   Ask such questions as these:

   - What do you use these things for?
     ✔ Get at such things as using them as classroom tools, using them to do work at school, or using them as tools in an office.

- Does anyone know a word for the *uses of things*?
  ✔ Get students suggestions and home in on *function.*
  ✔ Draw a box or circle around the items and label the collective function category.
- Can you divide these things into two categories so that things in one category have a special function and things in the other category do not have that function?
  ✔ Discuss possible divisions. If the students do not come up with an idea suggest one yourself. See Figure SU.1(4).
  ✔ Draw boxes or circles around the subcategories and help the students identify them with function names.
  ✔ Continue the subdivision as far as possible.
- Can someone draw lines to show the steps used in the classification?
  ✔ Help the volunteer draw lines between the boxes or circles.
  ✔ Post the chart showing the steps in subdivision using function.

7. Organize the class into teams of 4–5 students. Give each team four to six items from the different groups and a sheet of paper on which to draw their classification steps or tree. Have them play the Function Game.

- Help them give their total collection a category name based on function.
  ✔ It can be the same as the one used in the introduction.
- Help the students divide their categories into two subcategories so that things in one subcategory have a function and things in the other category do not have that function**.**
- Help them draw boxes or circles, connect lines to show steps, and create identifying names as needed.
- Help the students continue the subdivision until each item has its own functional subcategory.
- Summarize the game.
  ✔ Ask if they have seen other trees like the one from the Function Game. Bring out the Name Game and physical properties classification trees.
  ✔ Ask how the trees are alike. Get at the idea that they are all used to sort and classify.
  ✔ Ask them what is meant by *category*. *Form*. *Function*.
- Summarize the importance of knowing about form and function.
  ✔ Ask the students how they use function in making their selection of items needed to go back to school. Work for selecting items to write with such as pens and pencils, things to write on such as paper and notebooks, and so forth.
  ✔ Ask the students how they use form in making their selection of items needed to go back to school. Work for selecting colors of pens, shapes of erasers, sizes of paper, and so forth.