Chapter 5

Sorting, Classifying, Expanding Language

Table of Contents

Before We Begin

Terry...

I was born in a town called Fresno. When I was thirteen, my family moved from Fresno to a new home a few hundred miles away. When I was twenty-one, I passed through Fresno on my way to somewhere else. I had not been back to my home town at any other time in the eight years that had passed. I stopped randomly at a Fresno store to pick up an item I needed on my journey. As I walked through the store's front door, the salesperson said, "Bob!" I looked at him and said right back, "Terry!"

Terry and I had not been close friends. He had not seen me in eight years. He did not know that I had come to town. I was eight inches taller. I had added fifty pounds. My face at twenty-one no longer looked thirteen.

With all the height and all the weight and all the facial changes, Terry's mind saw a person walking through the door and my name flashed to his lips. My mind saw Terry and thought of all the people I had known who could grow up to look like that, and Terry's name flashed right back.

Terry had not been a good student when I had known him. School had taught him that he was not smart. Can a not-smart mind, in just one instant, subtract fifty pounds, eight inches and eight years from a person walking through the door and see the man as the child? Or, is "not-smart" a label with no meaning outside of school?

All our minds can do what Terry's mind did in recognizing me. Our minds are lightning-fast detectives, piecing the whole from small parts. We hear a few notes from a forgotten tune and in a flash we recall the verse. We are much better than school taught us we were at thinking and at everything else we do.

Sort and classify...

When do we sort and classify? We do it all the time. Terry's mind was sorting and classifying at great speed as he saw me walking through the door.

Why are sorting and classifying a part of mathematics? Because mathematics is the tool we use to help us think logically and analytically whenever the situation requires logic and analysis. Sorting and classifying are skills we use in thinking and reasoning about nearly everything we see or hear or smell or feel or do. We use the skills of sorting and classifying to help us heighten awareness, focus attention, and verbalize the patterns that we see. Sorting and classifying are a part of mathematics, a part of language arts, a part of science, a part of social studies, and a part of walking through the door. Sorting and classifying are a part of everything we do.

We do not teach our students how to sort and classify. They have been sorting and classifying without our help since they were born. How does a child tell a dog from a cat and a cat from a cow? How does a child tell a car from a truck and a truck from a van? What kinds of definitions of these concepts did we provide for each child to memorize? Could we provide the all-encompassing details of these nouns if we tried?

We point to cars and call them all cars. When the child says "car" and points to a truck, we say, "That's a truck, not a car." We add more attributes. There are kinds of cars. We see a Volkswagen Bug convertible and say "convertible." The child matches "convertible" with the shape of the car. The next Bug the child sees the child calls "convertible." We define: "Convertible means the top comes down. That car is a Volkswagen Bug, but it is not a convertible."

The child looks and listens, thinks and learns, defines and redefines. Attributes are sorted and classified and then sorted and classified all over again. Endlessly. Endlessly. All the time.

Windows...

Mathematics is all around us all of the time. Sorting and classifying are all around us all of the time, as well. To see the math and to see the sorting, we learn to look *at* and not *through*.

There are times when we sit waiting. At home. At school. Our minds wander. If there are windows, we look through them as we wait. But, we can look *at* the windows and not *through* them.

(illustration 5-0-1)
(A collage of windows)

What kind of windows are there?

Translucent windows through which we see or opaque windows that block our view.
Tiny, bumpy bathroom windows or smoothly expansive, expressive bays.
Utilitarian storefront panes or decorative church stained-glass windows.
Many colors or no color at all.
Single layers for the mild climate or double panes to keep out cold.
Made of glass or made of plastic. Rocks bounce off or rocks go through.
Round or square or rectangle or triangle or any shape at all.
Small ones on an antique door or big ones that form a skyscraper's side.
Windows we see everyday or windows that are something new.

Windows at school. Windows at home. Windows in cars and trucks and vans. Windows in stores and buildings and churches. Windows nearly everywhere we go.
Where is the mathematics in looking *at* and not *through*?

For these activities:	We could ask:
Sorting and classification	What kinds of windows are there?
Patterns	Which kinds of houses have which kinds of windows?
Beginning Number	How many can we see? Can we find ones and twos and threes?
Geometry	Can we sort by all the shapes we see?
Beginning Addition	How many are there altogether?
Beginning Subtraction	When we know how many altogether, can we ask how many when we take a group away?
Measurement and Estimation	What sizes are there? How much glass did it take to do the job? How many windows on the other side?
Graphing	We gather data on kinds of windows. Can we present our data in pictorial form?
Probability and Statistics	We look for the windows that are the most common and ask ourselves what "most common" means.
Multiplication	We see windows in 3-by-4 arrangements and see that 3 x 4 = 12. Can we record other window arrangements as rows times columns?
Fractions	We know a single window is one of many. When we call the many "one" what part of "one" is the single window?
Word Problems	We create story problems around our windows and ask our friends to solve the problems that we pose.

If a window breaks, could we replace it? What would it take to put a new one in? If we built a house with many windows, could we calculate the window cost? Which areas of mathematics included in this book would be involved in finding the answers to these window questions? Addition, subtraction, multiplication, division, measurement and estimation, money, decimals and percent, coordinate graphing, algebra, patterns and connections. Would any areas of mathematics not be involved?

We look *through* the windows, and we look through the math as well. We look *at* the windows and we see the mathematics that has been there all along.

Lesson One

Purpose	Learn to sort by attributes.
Summary	Students sort objects into groups in a variety of ways. Teacher or students list the ways.
Materials	Buttons, keys, or any other common objects available in quantity; individual chalkboards.
Topic	Each new material produces a variation of the basic lesson. Lists created by older students are used again in Lesson Seven.
Topic	Sorting buttons, making lists.
Topic	Sorting keys, making lists.
Topic	Sorting whatever else is available in quantity.
Homework	What groups of things do children have at home that they might sort?

Buttons...

Note: Lesson One uses buttons for sorting because they are available inexpensively in large quantities. Any material that is plentiful in a variety of forms and shapes works equally well.

(illustration 5-1-1)
(Two groups of buttons with different attributes, such as shape and number of holes in silhouette on the overhead projector. A container with an abundance of buttons off to one side. The two groups are taken from the second illustration in *Mathematics... a Way of Thinking*, Lesson 13-1. The sort is already in progress.)

Teacher: I am dividing these buttons into two groups by a pattern I have inside my head. Please do not tell me what you think my pattern might be. But see if you can predict where my pattern would tell me to put this next button.

(illustration 5-1-2)
(Four-hole button.)

Student: (Pointing) That group.
Teacher: Which group?
Student: (Pointing more emphatically) That one!

Teacher: I will write the words *left* and *right* by the two groups, so you can tell me if you mean the left or the right group.

Left and *right* are written next to the two groups, regardless of the age or the grade level of the students participating in the activity. Students knowing how to read is not a prerequisite for writing down the words.

Teacher: Do you think my pattern would place this button in the left group or the right group?
Student: The left group.
Teacher: Yes, by the pattern inside my head, this button goes in the left group.

(illustration 5-1-3)
(The two groups of buttons with left and right written by them. The new button added to the left group.)

Teacher: Remember not to tell me what you think my pattern might be. Now, see if you can predict where my pattern would tell me to put this button.

(illustration 5-1-4)
(Square, two hole button, or whatever the actual button may turn out to be when the pictures are taken.)

Student: The right group.
Teacher: Yes, by my pattern this button would go in the right group. This next button.

(illustration 5-1-5)
(A button that has a reason for being in either group. In Lesson 13-1, the right group had both rectangular and two-hole buttons. There were no rectangular buttons shown yet in the four-hole group. So, the button picked for the example was round and had two holes. A child who thought the pattern was rectangular shapes would say "left group," while the child who thought the pattern was two holes would say "right group.")

Student: The left group.
Teacher: I am sure you are thinking of a nice pattern, but by the pattern I have inside my own head, I cannot put this button in the left group. I have to put it in the right group, instead.

To ensure the involvement of every student in class, the teacher can have each student write *left* or *right* on his or her individual chalkboard for each button the teacher shows.

The individual chalkboards are our means of allowing each of our students to be an active participant in the teacher-directed lessons we conduct. Rather than have the teacher call on one student for an answer, all students write their responses to the teacher's question on their chalkboards and then turn their chalkboards face down on their desks. When all students have an answer on their boards, the teacher has everyone in class hold up his or her board.

In many situations, the teacher accepts the most common answer on the boards as the class answer to the problem. Class answers can be changed by anyone with an answer other than the class answer if that person can convince a majority of his or her classmates to vote again for a new answer.

For this activity, however, the students are not voting to place the button in one group or another. They are simply expressing where they think the teacher's unannounced pattern will cause the button to be placed. Since it is the teacher's pattern, only the teacher can know for sure where the button is to go.

Teacher: Use your chalkboards to show me where you think my pattern will put this button. Will it go in the left group or the right group?

(illustration 5-1-6)
(Show a button.)

Teacher: I see that the majority of you think my pattern will put this button in the left group. I am sure that those of you who think this button should go in the right group have thought of very good patterns, but my pattern puts this button in the left group.

The teacher continues sorting the buttons.

(illustration 5-1-7)
(All of the buttons divided into two groups. The buttons should correspond to the dialog that follows.)

Teacher: I am not going to tell you what my pattern is. I am going to leave it inside my head. But, can anyone tell me what pattern you think I might have used to sort the buttons into these two groups?
First student: All the big buttons in one group and all the little ones in the other.
Teacher: Let's see if all the buttons fit that pattern. Are all the big buttons in the left group?
First student: Yes, that group has all big buttons.
Teacher: Are all the little buttons in the other group?
First student: Yes. All the little buttons are in that group.
Second student: No! There are two big buttons in that group, too.
Teacher: (To first student) I thought you said that all the big buttons were in the left group.
First student: That group does have all big buttons!

One student says that one group has all big buttons. Another says that not all the big buttons are in that group. Lesson Eight deals more specifically with sorting out the meanings of the words we use. However, learning does not wait for the right lesson to come along. As is true for all the words our students learn, the more we use *all* in different ways, the more our students will sort for themselves all the meanings *all* can have.

Teacher: Are there any big buttons not in the left group?
Second student: Yes. There are two big buttons in the right group.
Teacher: Then, all of the big buttons are not in the same group.
A pattern must give us a reason for why <u>every</u> button is in its group. If the pattern were all the big buttons in one group and all the little buttons in the other, then these two big buttons could not be with the little buttons.
First student: Move the two big buttons.
Teacher: If my pattern were big buttons and little buttons, I would have to. But by the pattern inside my head, the two big buttons have to stay with the little buttons.
Third student: Round buttons and square buttons.
Teacher: Round buttons and square buttons what?
Third student: Round buttons in one group and square buttons in the other group.
Teacher: What about these triangle buttons?
Third student: Rounds and triangles in one group.
Teacher: Could that be my rule?
Fourth student: No. There is a round button with the square buttons.
Fifth student: Two holes and four holes. All the two-hole buttons in one group and all the four-hole buttons in the other group.
Teacher: Are there any buttons in the group on the right that do not fit that pattern?
Students: No.
Teacher: Are there any buttons in the group on the left that do not fit that pattern?
Students: No.
Teacher: Then does the way the buttons are divided fit that pattern?
Students: Yes.
Teacher: Then the two-hole, four-hole pattern works. What other patterns you can see that might explain how the buttons are divided?

The purpose of this activity is to find patterns that explain the sorting, not just to guess what the teacher's pattern might be. If our students discover the pattern we had in mind for our sorting, a reasonable reaction on our part would be to move on to the next sorting. But, if we stop asking our students to look for patterns once a single way has been found, we are teaching them there is only one way a sorting can be done and that way is the teacher's way. The search continues until the class can find no other way.

Whether our students come up with one pattern, many patterns, or no pattern at all, we do not reveal the pattern that was inside our head. We want our students to think for themselves. If we provide our students with the answers, we teach them that if they wait, their teacher will do their thinking for them.

Teacher: I will now divide these buttons into two groups using a different pattern inside my head. Please do not tell me what you think my pattern might be. But see if you can predict where my pattern would tell me to put this next button.

The teacher sorts the buttons on the overhead three or four more times.

The purpose of sorting on the overhead is to give the whole class a foundation for creating and then using a rule for dividing objects into two mutually exclusive groups. The only way to know if the students really understand the process is to let them begin sorting for themselves. If we find that the whole class does not understand, we can always return to the overhead. As teachers, we are in control of the lessons we teach.

Teacher: Each of your work groups has a container of buttons. I want you to see if you and the other people sharing the container with you can think of a pattern for dividing your buttons into two separate groups.
Student: Do we have to use all of the buttons?
Teacher: No. You can use only a handful or two if you want.

The lesson begins with minimal instruction. The students have already participated in the teacher's sorting at the overhead. Until we learn what students do with what they have seen, we cannot easily anticipate what additional instructions they might need. Once the sorting begins, however, we can clarify our meaning:

Once you have finished sorting the buttons one way, you can push all the buttons back together again and think of another way to do it.
Try to remember all the different ways you do it, so you can share the ways you have thought of with the rest of us at the end of the period.
The buttons are to be shared. Everyone in your group is to work together.
Yes, you can use the word "not" as a sorting category. You may use groups like "red" and "not red."

The teacher visits as many different work groups as time permits. For each group, the questions are the same:

What pattern are you using to divide the buttons?
Why did your pattern put this button in that group?
Where will this next button go?

And, when the group thinks it has found all the ways it can:

Can you divide the buttons a different way?
How many different ways do you think you can find?

Ways shared...

Teacher: I am really impressed with all of the ways you have found to sort the buttons. But your work group does not know all of the ways the other work groups have found. So, one at a time, I will ask each group to tell me a way that you divided your buttons. When your group's turn comes, see if your group can tell me a way that no other group has yet shared. As you tell me, I will write down your way.

The teacher records on a transparency or on a large sheet of paper, so that the list may be saved.

Teacher: Each of the different ways you have described to me is called an attribute. Attributes are the traits or characteristics that we use to describe things. An attribute for me is that I am a teacher. Attributes for you are that you are a boy or a girl, that your hair is a certain color, your eyes are a certain color, you are a certain height, and you like certain foods.

Our definition of the word attribute need not be definitive. As we use the word, our students will sort out its meaning, as they sort out the meanings of all other words they encounter. We introduce the word *attribute* not because there will be a test of meaning at the end of the lesson, but because we will use it in the lesson itself.

Teacher: You have used many different attributes to sort the buttons. Now, think of all the ways you have found and see if your group can find a different way.

Our students already know how to sort and classify. Our purpose is to expand the range of their thinking. No matter how many ways our students find, we can always ask for more, because no matter how many ways our students have already found, they can always find more.

We ask students of all ages and grades to sort and classify. Older students may find more attributes, but thinking is thinking, regardless of age.

For each sorting, the teacher records the ways each group has found. For very young students, the teacher may be the only recorder and the only reader of what is recorded. For younger students using the Reading Program, recording by the teacher is soon replaced with recording by the students themselves. Older students use spelling notebooks (page 048) to make recording possible for all.

Keys, or whatever else we have...

If we have enough buttons, we have our whole class sort buttons. If we have enough keys, we have our whole class sort keys as well.

Use of common materials means that every child in class, regardless of ability, is sharing the same lesson with every other child in class. Our desire is that, within the limits of the materials that may be available, all our students work together. Our purpose is to expand thinking and vocabulary. When we teach the whole class at once, we make the thinking of everyone available to all. Those students with the least developed vocabulary learn from those with the most developed. Those with the best vocabularies learn they do not know it all. None of us is as smart as all of us. Together we know more that any of us knows separately.

Teacher: Today we will sort keys (or whatever material we have).

We sort the keys just as we sorted the buttons. The ways the students find for sorting are recorded either by the teacher or by the students themselves. If the teacher is the recorder, the time for recording is also the time for sharing. If the students are the recorders, time is provided for each group to share their ways with the class. Once they have shared their ways, the groups are asked to discover more.

Buttons may be sorted. Keys may be sorted. Seeds and nuts, nuts and bolts, pebbles and rocks, bottle caps and bottle lids, bits of bark, chicken bones, leaves, fabric scraps, thread spools, wallpaper samples, foreign coins, sea shells, postage stamps, trading cards, Lego blocks. Whatever is around the house. Whatever is around the class. Whatever parents might have to share. Whatever a scavenger hunt can produce. Whatever years of teaching might accumulate. Whatever can be found at water's shore or mountain range or dessert floor or grassy field. Whatever there is from wherever it might come.

Adding to the list...

Teacher: As you find ways to sort your keys (or whatever else you have), **please write down each way you find. Please also write the names of the people in your group on your paper.**

The students work for ten minutes or so.

Teacher: Now, please give your box of keys (or whatever else you have) **and your written list to the next group. Group One, give yours to Group Two. Group Two give yours to Group Three. What is the pattern I am using? To which group will I have Group Three give its box and list?**
Students: Group Four.
Teacher. Yes, that is the pattern I am using. And Group Five gives its box to Group One.
When you get the box and list from the students in the other group, please see if you can add to the ways they have written on their list.

Writing is an integral part of mathematics. Reading what is written is integral, as well. Students for whom the teacher is the only recorder can continue dictating the additions to their whole-class lists. But for students using the Reading Program or for older students writing with the assistance of their spelling notebooks, recordings are in a form readable to other students. Students who can record for themselves, can read for themselves what others have recorded. Since each group has signed its list before passing it on, if no one in the new group can read what has been written, the new group knows whom to ask for help in deciphering the words.

We ask our students to tell the ways they have already found and then find more ways than they already have. The groups sort and write and then pass on to the next group all that has been written. The new groups must read what is written before adding more writing and passing the writing on again.

A soccer story...

Justin was better at soccer than the other children in his class. He was the star of his weekend league. His weekend coach trained Justin to score all the goals he could. When Justin played at school, he could steal the ball and break away to score. No one could chase him down. His presence in the games at school meant others would not even try. He had been coached to score all by himself. He had not been coached to pass the ball or give another child a chance. He had learned that winning was the measure of success.

The coach's rule for weekend games was, "Win and win my praise." But Justin's teacher changed the soccer rules for school to slow down Justin's game. School is not for the glory of one child at the expense of any other. The teacher's school rules said:

> No one can score a goal until the ball has passed three times between teammates.
> The last person to score a goal cannot score again until a different teammate has.

Justin was still better at soccer than the other children in his class. But *better* came to mean learning how to pass and teaching others how to score. Now Justin's presence in the game meant teaching others how to try. Justin learned from the soccer games at school what he had not learned before. There is more to learning how to play than learning how to win.

We, as teachers, are the makers of the rules. We watch our students. We see what they are learning. We see what they are feeling. We know what we want the learning and the feeling to be. If a very verbal child is dominating his or her sorting group, we can change the rules so that each person in the group must come up with his or her own way of sorting before anyone else can suggest a second way. If we cannot visit each group to see if every person is having a chance, we add the rule that each person must sign his or her name on the recording paper next to his or her suggestion. By making the rules for groups and for sorting and for everything else, we have the power to turn each Justin from a person thinking only of himself to a member of a team.

Lesson Two

Purpose	Learn to be aware of attributes everywhere.
Summary	Students take sorting walks to learn to see what is already there.
Materials	The world outside our class.
Topic	Sorting walks. Older students keep written lists of what is seen. Younger students may draw instead of write.
Topic	Each walk taken is a different element.
Homework	Sorting walks can take place while coming to or going home from school each day.

We sort...

What do we sort in life? Nearly everything we see or hear or smell or feel. Nearly everything we do. Things to sort and reasons to sort fill our day, as reasons for using language fill our day. Our role as teachers is to ask the questions that make our students aware of the sorting that we do:

> We sort and classify as we learn new colors, shapes, or words: What things are red? Which are yellow? What are triangles or circles or diagonal lines? What is prehistoric? What is not?
> We listen for the sounds in words. Some children listen only for first sounds. Reading Program students listen for the sounds wherever each appears: Where can we hear the *e* sound?
> We sort by words with silent *e*, or words with double *l*, or words that have two syllables, or words that we can spell, or words that we cannot.
> We identify the emotions in the story: Who was happy? Who was sad?
> We take roll each morning asking: Who is here and who is absent?
> We do our administrative chore for the cafeteria: Who brought lunch today? Who is going to buy?
> We clean up after each lesson by sorting where the items go as our students put each item back: Where does this go and why?
> We send our students off to recess: What game are you going to play? What kind of game is that?
> We prepare our students for the journey home at the end of every day: Who wore a jacket or a sweater on this day and can you find it now? And if you brought a lunch pale, will you take it home as well?
> We line up when the school day ends by how each child travels home: Who will ride the bus? Who will walk? Who will go a different way?

The school day has an end, but sorting never stops.

> How many different kinds of cars can you see between here and home? What shall we mean by *different*? By the car's use or by its name?
> How many different kinds of houses or fences or doors or trees are there in your neighborhood? Or dogs or cats or birds or pets?
> Are there red, blue, green, or yellow things in your home? Are there triangles or circles or squares? Or, are colors and shapes something we only see at school?
> What will you look for today while you are home? What do you think we should sort?

Is there any limit to what we may ask?

At school, we have pattern walks and counting walks and number walks. We have sorting walks as well. The point of the walk is to heighten awareness. If we walk with only one child, we can share with that child whatever we see. When we walk with a class of thirty or more, attentions may wander. We focus attention by providing our students with a means of reporting what they see.

Older children can write what they see as they walk. Children who do not yet write can draw pictures. We can also give younger students older companions to whom to report what they see. If we teach a kindergarten or a first grade class, we can take our walks with the fifth grade class down the hall.

We ask our students:

What are the things you see or feel or hear or know?
Which of these things are the same?
Which of these things are different?
How are they the same?
How are they different?
How do you know?

Lesson Three

Purpose	Use sorting and classification knowledge to create informal definitions of words.
Summary	We sort shapes, words, or objects as students create definitions for the sorts.
Materials	Whatever relates to the definition we wish to teach.
Topic	We use this lesson when we have a definition we wish to teach.
Topic	Shapes—quadrilaterals, triangles, squares, etc.
Topic	Nouns, verbs, prepositions, adjectives, etc.
Topic	What other definitions might we choose to use?

Teaching definitions...

We learn definitions in school. We learn *noun* and *verb* and *commutative and associative property of addition*. How often are we taught definitions outside of school? Did anyone ever teach us the definition of *car* or *dog* or *girl* or *house*? Yes, we were taught some definitions and yes we often asked others what the words we heard might mean. But, for most of what we know, we worked out our own meanings from the clues that we could find. We saw cars and we saw vehicles that were not cars and we used our natural ability to sort and to classify to create a definition for ourselves.

Teacher: By what rule or pattern am I sorting all these shapes?

(illustration 5-3-1)

(A sort of Ω of shapes. All the four-sided shapes are in one group and all the other shapes are in the other group. The four-sided shapes should include trapezoids, rhombuses, rectangles, squares and irregular quadrilaterals.)

Student: All the shapes in the first group have four sides. None of the shapes in the other group has four sides.
Teacher: The name of the four-sided shape is quadrilateral. Quad means four. Lateral means side. So quadrilateral means four sides. Sometimes the name given to this pattern is quadrangle. What do you think quadrangle means?
Student. Four angles.
Teacher: By what rule or pattern am I sorting the shapes now?

(illustration 5-3-2)

(Only the four sided-shapes sorted. All the trapezoids in one group, all the other four-sided shapes into the other.)

Our students can see the differences in the sorted shapes sooner than they can verbalize what they see. No one student is as wise as all students together are. Students together find words to describe what they see. As students describe the shapes they see, we can add the word *trapezoid* to their definition. We need not add our own definition to what our students say. Our teaching now is elementary. We need not always be precise. We would rather have our students think than have them memorize.

Teacher: By what rule or pattern am I sorting these words into their separate lists?

house	**run**
car	**walk**
boat	**hit**
pants	**see**
cloud	**feel**

We ask our students to look at what we show them. We ask them to use their natural talents to think about what they see. As our students verbalize the patterns that they see, they provide the definition, we provide the word.

Lesson Four

Purpose	Learn to find relationships between different shapes.
Summary	Students play games with Attribute Blocks that focus on thinking logically and systematically.
Materials	Attribute Blocks, overhead set, blackline recording sheet.
Topic	Pattern sorts, teacher at the overhead.
Topic	Identify the missing piece.
Topic	Which piece does not belong?
Topic	Which piece is missing from the matrix?
Topic	Add a piece to the line that is one different than the piece before.
Topic	If one-different is understood, try two different, then three.

Attribute Blocks...

(illustration 5-4-1)
(A picture of a set of Attribute Blocks.)

The environment in which our students live is already filled with materials for sorting. Why do our students need to sort Attribute Blocks?

In Lesson One, we used our students' sorting skills to have them share with one another their diverse vocabularies and their equally diverse ways of viewing similarities and differences. In Lesson Two, we used our students' sorting skills to heighten their own awareness of the world outside of school. In Lesson Three, we used our students' skills to help them learn the meaning of words not already in their collective vocabulary. In Lesson Four, we use Attribute Blocks to show our students and ourselves that sorting is a part of how we think.

We accomplish all the sortings that confront us on a daily basis without any control over the complexity of the attributes. Attribute Blocks allow us to provide our students and ourselves with a simplified model of reality—sorting in control.

If we have enough Attribute Blocks, we give each group of students a separate set. We ask our questions as they freely explore. If we do not have blocks to share, we substitute "we" for "you" in the questions below, and our students seek answers from a set we display on the overhead.

How many blocks do you see?
What are their names?
Are any pieces the same?
What do you mean by "the same"?
Are any different?
What do you mean by "different"?
How many different shapes do you have?
How many triangles? How many squares?
How many different colors do you have?
How many red? How many blue?
How many different sizes are there?
How many big? How many little?

(illustration 5-4-2)
(Attribute Blocks on the overhead, sorted by the teacher's unannounced rule. Put *left* and *right* on the overhead for identification. One block is separated from the two

groups—for which the class is to predict into which group it should go. It is a left-group block.)

Teacher: I am dividing these Attribute Blocks into two groups by a pattern I have inside my head. Please do not tell me what you think my pattern might be. Use your chalkboards to show me where you predict my pattern will tell me to put this next Attribute Block.
Students: (Chalkboard vote) Left.

The teacher continues to sort. The students continue to predict where each new piece will go.

Teacher: I am not going to tell you what my pattern is. Can anyone tell me what pattern you think I might have used to sort the Attribute Blocks into these two groups?

New games to play...

(illustration 5-4-3)
(All the pieces of one color laid out in a row with a single piece missing)

Teacher: What piece do you think I have left out of this row? Why do you think so?

(illustration 5-4-4)
(Same game, different sort. All the pieces of one shape laid out in a row with a single piece missing.)

Teacher: What piece do you think I have left out of this row? Why do you think so?

(illustration 5-4-5)
(A slightly different game. A row of blocks, no pieces missing. One piece in the row that does NOT belong with the rest.)

Teacher: What piece do you think does not belong in this row? Why do you think so?

(illustration 5-4-6)
(Three-by-three matrix on the overhead, with a piece missing. The matrix has a row for each single color (red row, blue row, green row) and a column for each single shape—circle column, triangle column, parallelogram column.)

Teacher: What piece do you think I have left out of this matrix? Why do you think so?

What block is missing? Which block does not belong? If we have enough Attribute Blocks, our students can make their own rows of shapes or their own rows of colors. They can challenge each other to tell which pieces belong and which pieces do not. The length of the row or the size of the matrix can change as our students grow older and wiser.

(illustration 5-4-7)
(Three different examples. First, a longer row with a piece missing. Second, a two-rule row (two colors or two shapes). Third, a four-by-four matrix with two pieces missing.)

What comes next?...

Teacher: Which Attribute Block have I placed on the overhead?
Student: The big red circle.
Teacher: For this game, the rule is that each block I put in my row can only be one attribute different from the block that is already there. Be patient with yourselves, because you will have to do a lot of thinking to figure out what it means to have only one attribute different.
You said this first block was the big red circle. Big and red and circle are the block's three attributes. In this game, the next block can only change one of the three attributes. It can change only big, or red, or circle.

(illustration 5-4-8)
(A chart. The headings are size, color and shape. *Big*, *red* and *circle* are written in the appropriate columns.)

Would anyone like to try to put a block that is only one attribute different next to this block? Andrew, you may come up to the overhead and show us a block you think might fit my rule.

(illustration 5-4-9)
(Big yellow square placed next to the big red circle)

Teacher: Describe the block Andrew placed on the overhead.
Student: Big yellow square.

(illustration 5-4-10)
(*Big, yellow and square* are written on the chart.)

The teacher adds words to the chart for recording the attributes even if no one in class can read the words on the chart. A child does not have to read to be able to tell if words are the same. The word *Yellow* is longer than the word *red*. The word *circle* looks different than the word *square*. And, the word *big* looks just like the word *big*. Sorting is everywhere, even in reading.

Teacher: (Pointing to the words on the chart) Both blocks are big, so big is one attribute that is the same. One block is yellow and one block is red, so color is one attribute that is different. One block is a circle and one is a square, so shape is another attribute that is different. These two blocks have one attribute the same and two attributes that are different. My rule says we need to find a block that has two attributes the same and only one that is different. I'll have to erase the attributes for the big yellow square from the chart.
Does anyone else have a different suggestion? Julie, you may come up to the overhead and show us what block you think might fit my rule.

(illustration 5-4-11)
(Big yellow circle placed next to the big red circle)

Teacher: Describe the block Julie placed on the overhead.
Student: Big yellow circle.

(illustration 5-4-12)
(*big, yellow and circle* are written on the chart.)

Teacher: (Pointing to the words on the chart) Both blocks are big. So, big is one attribute that is the same. Both blocks are circles. So, shape is another attribute that is the same. One block is yellow and one block is red. So, color is one attribute that is different. These two blocks have two attributes the same and one attribute that is different. The big yellow circle matches my rule because it is only one attribute different from the block already there.
By my rule, the next block we add to my row has to be one attribute different from the block Julie just added. Who can add another block to my row?

When the students understand how to play the *One Different* game with the teacher at the overhead, they may play with (and not against) each other. The students in each group take turns adding a one-different block to the row of blocks in their own sets. The other students in the group act as judges to decide whether or not the added block is only one different.

Each group of students may record the attributes of their blocks on a chart. (Blackline 000.) Older students aided by their spelling notebooks or younger students using the Reading Program may write the words for the attributes on their charts. Students who cannot yet write may record the attributes using colors and drawings for shapes and an agreed-upon symbol for size.

Students who master a difference of one may try a difference of two. Students who master a difference of two may try a difference of three. Students who can do twos and then threes can try making a matrix with multiple rules. Difference of one, difference of two, difference of three. What can be done for rows can be done for columns as well. No matter how much a student may know, there is always another question the teacher may ask.

(illustration 5-4-13)
(Rows of blocks in one-different, two-different and three-different patterns. Two matrices: First one: one different each way. Second one: two different each way.)

Forming categories and dealing with their relationships is an integral part of thinking logically. Sorting and classifying help teach thinking. We use the thinking that we teach in everything we do.

Lesson Five

Purpose	To learn to see the attributes in ourselves.
Summary	Students describe themselves using attributes that define them as unique. For students who can write, we read their descriptions aloud.
Materials	Students in class, writing paper.
Topic	Students descriptions of themselves are read aloud.
Topic	Each new set of descriptions is a separate element.

Descriptions...

Teacher: I am thinking of a child in this room. I am going to tell you who this person is by describing some of his or her attributes. Everyone please stand up. If the attribute I say does not describe you, please sit down.
The first attribute is *boy*.
Who should remain standing and who should now sit down?
Student: All the girls sit down and all the boys stay standing.
Teacher: Is anyone standing who should be sitting? Is anyone sitting who should be standing?

Even though the attribute of *boy* is clearly distinguishable and not subject to a variety of interpretations, we ask the students to examine the people standing or sitting as the teacher says *each* new attribute. We do not decide for our students which attributes are obvious and which are not.

Teacher: The next attribute is *long hair*. No, if you are already sitting, you do not stand back up if you have long hair. The person has to be both a boy and have long hair.
Who should remain standing and who should now sit down?
Student: The boys with long hair should still be standing.
Teacher: Is anyone standing who should be sitting? Is anyone sitting who should be standing?
Student: Chester has long hair and he sat down. Drew has short hair and he's still standing up.

Some attributes like *boy* or *wearing glasses* or *has on long pants* are easier to interpret than attributes, like *tall* or *wearing blue* or *has brown hair*. Whenever we ask who should be standing or who should sit down, the class decides on the interpretation of the attribute under discussion. The child whose attributes are being debated joins in the discussion as well.

The teacher continues to say the attributes of the student being described until that student is the only one still standing. Then, everyone in class stands up again, and the teacher uses attributes to describe someone else.

Once the teacher has provided a few examples of describing by attributes, the teacher gives all in class the opportunity to write their own descriptions.

Teacher: Now I want you to write an attribute description of yourself. See if you can write a description that would leave you the last person standing when I read your description to the whole class.

Older students write their descriptions with the assistance of their spelling notebooks. Younger students using the Reading Program work in groups of twos and threes, helping each other hear the sounds in the words they wish to write.

To allow each student the time to finish composing his or her description, those students who write more quickly occupy themselves with geoboards or Power Blocks or their favorite library books until all have finished describing themselves.

Teacher: Everybody please stand up. I have selected a description from the ones you have written. I will read each attribute written on the page. If the attribute does not describe you, sit down. Let's see if there is only one person left standing when I am through reading.

(illustration 5-5-1)
(Examples of descriptions written by children. Include a cross-section of penmanship. Also include one or two examples of descriptions stamped out from the Reading Program.)

The teacher reads the descriptions. The students listen and decide who should be standing and who should sit down. If a description leaves more than one child standing at the end, the teacher talks

about the many attributes we have that are the same. The teacher and the class together look at the children who remain standing and see what attributes might be used to separate these few.

The teacher does not read the name of the child who has written the description. If only one child is the last one standing, there is evidence enough of who the author was. If the description leaves more than one child still standing, we have nothing to gain by drawing attention to the author. The discussion of how the last few children might be separated will help the child with a description for the next time.

Every child writes, but that does not mean we read aloud the writings of every child in our class. We read only the ones we choose. Our spoken reason for our not reading every paper is that we do not have enough time to read what every child writes. Our unspoken reason is that we do not wish to embarrass any child by reading aloud what is not yet ready to be read. We can see from what we do not read aloud whom to help the next time the class writes attributes.

As our students grow in sophistication, we can change the rules for what to write.

Can you write a description using no more than five attributes to separate you from the other students?
When you've mastered five, can you do it in just four?
What is the smallest number of attributes you can use to cause you to be the last one standing? No, you cannot simply write your name.
Can you write a description that will match you just as well tomorrow as it does today?

If our students learn to describe themselves by the street and number where they live, our rule becomes, "Find a way without using your address." If the only blue-eyed child in the class writes "blue eyes," our rule for describing on a different day is, "Find a different way." We are the teachers. We are in charge of all the rules.

There are values in this lesson. Our students have an opportunity to write. They learn about similarities and differences. They think about the attributes that make them each unique. They learn about the attributes that make them more like their classmates than they thought they were.

Lesson Six

Purpose	Learn the process of using individual attributes to categorize.
Summary	Students use their attributes to develop categories that uniquely describe everyone in class.
Materials	Students in class.
Topic	The teacher leads the class in sorting itself into successively smaller sub-categories.
Topic	New categories are used on subsequent days.

People sorting...

Teacher: You have sorted buttons and keys and just about anything else we could find. Today, you are going to sort yourselves. What is a way you can think of that you could use to sort yourselves into two groups?
Student: Boys and girls.
Teacher: Okay, let's try it. Everybody stand up. All the boys go to the left side of the room and all the girls go to the right.
How many groups do we have?
Student: Two.
Teacher: I'll write the sorting categories on the overhead.
Now, I want you to think of a way to divide the boy's group in half and the girl's group in half.
Student: The girls can divide by dresses and pants and the boys can divide by long or short hair.
Teacher: That's true. But by the rules of this game, you have to find a way to divide both groups by the same attribute.
Student: Long hair and short hair.
Teacher: Let's try it.

Because the students already sorted themselves in Lesson Five, they have already had practice in deciding which attributes they have in common and which attributes separate them out. They have also already been through the process of deciding what is meant by long and short hair and most of the other attributes they will now suggest.

Teacher: How many groups do we have?
Student: Four.
Teacher: Think of a way to divide each of the four groups into two groups again. How many groups will there be after we divide again?

The attribute of boys and girls divided the class roughly in half. Long hair and short hair split the subgroups of boys and girls nearly in half as well. If there had been many more short-haired boys than long or many more long-haired girls than short, we would have tried and then rejected the category and sought a new division. The goal of each sorting is to divide each group into two subgroups that are approximately half.

In Lesson Five, the students looked for ways to separate themselves from one another. Now they must look for the attributes that separate some, but not yet all.

The sorting continues until the allotted time is exhausted or until the students have managed to find ways to sort themselves into successively smaller groups all the way down to groups of one.

At each new sorting, the teacher records the attributes on the chalkboard or on the overhead. At each new sorting, the students are asked to say how many groups there are now. And, as the sorting progresses, the students must find a place for each new group to stand. The first sorting placed groups left and right. The second sorting may have placed groups left, right, front and back. But where do eight groups go? And where will sixteen stand, so that everyone in class can see the sort? Is there a hall outside the room? Should we sort ourselves on the playground instead? Where can we find the space to spread ourselves around?

Dividing four groups into eight is not easy. Dividing eight into sixteen is harder still. If the students cannot find a way to divide each group using the same rule for all, then the dividing remains undone. Students grow no less wise by not yet finding answers. There will always be another day.

Four into eight. Eight into sixteen. The sortings are hard, but the sortings are possible. After sixteen comes thirty-two. What do we do if we do not have thirty-two children in our room? When we ask our class to divide the sixteen into thirty-two, we ask our students to describe children who are not there.

Teacher: You divided yourselves by shirts or sweaters that pull over and shirts or sweaters that button. But Russell did not have anybody else in his group before we divided up the groups. If a person had been next to Russell, what attribute would that person need in order to be separated from Russell now?
Student: Russell's shirt has buttons on it. The other person would have to not have any buttons.

If the class succeeds in sorting itself into groups of one, the teacher asks the students another question using the recorded list of attributes.

Attributes	
Boy	**Girl**
Long hair	**Short hair**
Shoes with laces	**Shoes without laces**
Wearing red	**No red on**
Shirts or dresses with buttons	**Shirts or dresses without buttons**

Teacher: Look at the list of attributes I wrote as you divided yourselves into groups of one. What do you think would happen if we sorted ourselves again, but this time we started with the attribute at the bottom and went from bottom to top? Would you all still end up in the same groups of one?

There is a boy with long hair, wearing shoes with laces, and a red shirt with buttons. If these attributes describe him as different from anyone else in class, will he still be just as different if we say, "Red shirt with buttons, shoes with laces, long-haired boy"? Is tall, dark and handsome the same as handsome, dark and tall?

Teacher: Today we will sort ourselves again using different categories.

There is always more to do than we have done. There are always more ways than we have used before.

Lesson Seven

Purpose	Expand the process of learning to use individual attributes to categorize.
Summary	Students use lists of attributes developed in Lesson One to describe uniquely objects sorted earlier.
Materials	Objects used and lists created in Lesson One: sorting tree blackline.
Topic	Buttons on a sorting tree.
Topic	Buttons sorted differently.
Topic	Keys on a sorting tree.
Topic	Keys sorted differently.
Topic	Whatever other materials we have.

The sorting tree...

(illustration 5-7-1)
(Sorting tree)

Teacher: This is a sorting tree. We can use it to keep track of the sorts we make. On the first line, we write the name of the objects we are sorting. For this example we will sort buttons, so I write *buttons* here.

(illustration 5-7-2)
(Top part of sorting tree with *buttons* written on the first line.)

Teacher: What is one way we could use to sort these buttons into two groups?

The students already sorted these same buttons in Lesson One. The written lists from Lesson One now help students think of ways the buttons might be sorted into groups of two.

Student: Little and big.

(illustration 5-7-3)
(The buttons sorted into piles of little and big. *Little* and *big* are written on the sorting tree.)

Teacher: What is another sort we could use? The way you tell me has to be a way that divides both groups using the same attribute for each group, like we did when we were sorting ourselves. Try to find a way that divides each group roughly in half.
Student: Buttons with two holes in them.
Teacher: Let's see if that works.

(illustration 5-7-4)
(Buttons sorted by two holes and not two holes. *Two holes* and *not two holes* are written on the sorting tree.)

Teacher: That worked out pretty well. How many groups do we have now?
Student: Four.
Teacher: What attribute can we use to divide each of these four groups approximately in half?

The sorting continues on the overhead until the teacher feels enough students in the class understand the process. Then, each group of students is given its own set of buttons and its own sorting tree for recording the attributes used in the sorts. The assignment is to sort the buttons into successively smaller groups until students reach the bottom of the sorting tree or until the time for the activity has run out.

The sorting we do and the questions we ask are the same for whatever material we sort:

If your group finishes one tree, can you start with a new tree and find a different way to sort the same material?
How many different ways can you find?
If you change the order of how you write the attributes on your sorting tree, is that a different way to sort? Does changing the order put different buttons as the very last group on your tree?
When you have sorted the buttons, can you now sort keys? Or rocks? Or seeds?

Are there branches of trees for which you have no button or key but for which you can describe what the button or key would look like?

We can let the amount to be sorted be large or we can make it as small as we choose. We can say, "Pick only thirty-two buttons to sort for your tree." If a group wants more buttons with two holes and fewer with four, we can say, "It's okay to take and put back as the sorting goes on, as long as your total is still thirty-two."

The sorting tree is a model for sortings we do all the time. From things in the world, which things are living and which things never had life? From things that live, what is a plant and what is an animal? From things that are animals, which are the mammals and which are the other kinds? From mammals, which have four legs and which have but two? Is there another group besides the fours and the twos? From the ones with two, which eat plants and which eat meat? Or, which ones can speak and which cannot?

The sorting tree is a model of the kinds of sortings that scientists and mathematicians use. The path on the tree for a square is:

Geometric figure.
Closed.
Sides with straight lines.
Four sides only.
Opposite sides parallel.
All sides of equal length.
All angles 90 degrees.

We may not always see the sorting tree in our sorts, but our not seeing does not mean it is not there.

Lesson Eight

Purpose	Learn the meaning of selected words.
Summary	In a lesson that takes five minutes now and then, we ask the class as a whole to demonstrate the meaning of selected words. The lesson can be extended with Attribute Blocks.
Materials	Students in class, Attribute Blocks.
Topic	Both-and.
Topic	If-then.
Topic	Either-or, neither-nor.
Topic	Other words we choose.
Topic	"Show me..." with Attribute Blocks.

Words...

Sorting and classifying activities offer opportunities for students to hear and share the language of other students in the class. As our students study the details in objects all around them, they combine words they know with those of their classmates to identify attributes of things they see.

Other words our students need to know are:

More than or greater than	Less than or smaller than
Both	And
If	Then
Either	Or
Neither	Nor
This and not that	Not this and not that

Teacher: Listen carefully to the words I say and think about what they ask you to do. Everyone who is either a boy or a girl please stand up.
Is anyone standing who should be sitting? Is anyone sitting who should be standing up?

All students discuss who should be up and who should be down.

Teacher: Listen carefully to the words I say this time. Will everyone who is both a boy and a girl please stand up.
Is anyone standing who should be sitting? Is anyone sitting who should be standing up?
What is the meaning of the words I use?

Five minutes now and then...

Whenever we have a few minutes at the end of a period, we can fill the time by saying, "Everyone who is this or that stand up." We ask who should be standing. We ask who should be sitting. We discuss the meaning of words. All we need is five minutes now and then.

Everyone who is more than five and less than ten please stand up.
Everyone who is more than ten and less than five please stand up.
Everyone who is both tall and short please stand up.
Everyone who is wearing both a hair ribbon and a dress please stand up.
If you are here today, then please stand up.
If you are absent today, then please stand up.
If you were absent yesterday, then please stand up.
If you are either wearing red or have on a shirt, please stand up.
If you like either mathematics or reading, please stand up.
If you are neither wearing red nor have on a shirt, please stand up.
If you are wearing shoes and not wearing red, please stand up.
If you do not have black hair and you are in the first row, please stand up.

When we have longer...

When we have longer than five minutes, we use Attribute Blocks to pose the same kinds of questions:

Show me what you think the words ask you to do.
Show me the blocks that are both red and circles.
Show me the blocks that are both red and blue.
Show me the blocks that are either blue or circles.
Show me the blocks that are neither blue nor circles.
Show me the blocks that are blue and not circles.
Show me the blocks that are not blue and not circles.
What "show me" questions can you think of to ask?

Lesson Nine

Purpose	Learn how to communicate more effectively with words.
Summary	We and our students give instructions and discuss how we can make the instructions clearer.
Materials	Pattern Blocks, shield behind which to build, Power Blocks, Attribute Blocks, geoboards, wooden cubes, Unifix Cubes, or other materials with which to build.
Topic	At the youngest ages, the teacher is the only builder in the room.
Topic	Building and instructing with Pattern Blocks.
Topic	Building and instructing with Power Blocks.
Topic	Each new material is a topic.

Building behind the shield...

(illustration 5-9-1)
(The teacher has a shield and a set of pattern blocks at the overhead. The students have shields and sets of pattern blocks at their desks. The shields are folded sheets of 12 X 18 construction paper.)

Teacher: I am going to build something behind my shield. As I build it, I will describe it to you so that you can build it behind your shield at the same time.
Place the yellow hexagon flat on your table so that one of the edges of the hexagon is parallel to the bottom edge of your desk.
Student: What does parallel mean?
Teacher: It means going side by side in exactly the same direction.

(illustration 5-9-2)
(Parallel lines drawn on the overhead or chalkboard.)

Teacher: These two lines are parallel because they are going in exactly the same direction.

(illustration 5-9-3)
(Lines that are not parallel drawn on the chalkboard or on the overhead.)

Teacher: These two lines are not parallel because they are not going in exactly the same direction.

Now, take two orange squares and put one at the top of the yellow hexagon and the other at the bottom of the hexagon. The squares should be lying flat on your table and they should each have one edge or side touching the hexagon.

(illustration 5-9-4)
(The teacher's building has all the pieces flat on the table. The 'top' and 'bottom' in the teacher's description refer to near the teacher and away from the teacher. Show a child's understanding of 'top' to mean 'on top of' and 'bottom' to mean 'underneath.' Also show other interpretations of other ways the teachers words might be construed, including the interpretation the teacher is actually trying to convey.)

Teacher: Now, take two green triangles and put one at the top of the orange square that you have already put at the top of the hexagon and one at the bottom of the other orange square.

(illustration 5-9-5)
(The teacher's building adds the triangles to the top and the bottom of the building. One child's building adds the pieces on top meaning literally 'on top of' the orange square that is already on top of the hexagon. The other triangle is placed beneath the entire building. Also show other interpretations that students will have of the words the teacher is using, including the interpretation the teacher is actually trying to convey.)

The instructions and the building continue.

After a few minutes of building and describing, the teacher lifts his or her shield and has everyone in class lift his or her shield as well.

The lifted shields may reveal nearly as many different interpretations of the teacher's words as there are children in the room.

Teacher: I can see that my words did not describe for you clearly enough the building I was making behind my shield. For those of you who built something different than I did, what do you think I might have said to make my instructions more clear?

When the students begin giving each other instructions for building behind the shield, some may try to assign blame for why all students in the group did not follow the instructions perfectly. The student who is describing may feel the others are no good at following instructions. The student who is building may feel the student giving the instructions was no good at saying what was meant.

The purpose of building behind the shield is to help us all learn how to communicate more effectively with words. This purpose is best served by keeping the goal in mind. There is no blame to assign.

We build and our students follow our instructions. We use our building time to teach new words that they might choose to use. We use words like *parallel* and *perpendicular*, defining as we build. As our students build, they use whatever words they know. They may come to us and ask:

Student: What was that word you used for when things come together like this?

(illustration 5-9-6)
(Perpendicular lines.)

When we feel our students understand the process, we let each group of four or five students try building. Each student in a group takes a turn at building and describing what is built. At the end of each time spent building, the shields are lifted and the members of the group discuss ways to help the building go better when the next child takes a turn. The teacher's assessment for the group is not how well one child gives directions, but how well the students in the group understand each other. Our assessment of their work is how well the group, and not the individual, succeeds.

We alternate turns at building—we, then they, then we, then they. We use our turn at building to model the use of words to make our meanings clear, and to learn for ourselves how to communicate well. Knowing words is not the same as using them effectively.

The materials for building...

The materials for building are Pattern Blocks, Power Blocks, Attribute Blocks, geoboards, wooden cubes and Unifix Cubes. We use materials that are plentiful enough to give the same resources to the students who are building and the student who describes.

The older the students are, the more attributes we provide in the materials. Building with Unifix Cubes means knowing only how to count out numbers and snap together colors in the order given. Building with wooden cubes means counting and stacking and knowing left from right. Building with Attribute Blocks or Pattern Blocks means knowing colors, shapes, numbers and directions. Building with Power Blocks means knowing names for shapes and sizes and knowing numbers and directions, too. Building on a geoboard means counting nails from sides and bottoms to find a point, the same way we find coordinates on a graph.

Rules change...

Our students ask us questions. "Can we do this?" "Can we do that?" Each answer is a rule. We watch as our students are learning. When our students need more or less challenge, we change the rules to whatever we think works best. We are the teachers. We make the rules.

To make building easier, we can say, "Only the instruction giver has a shield. What everyone else builds can be seen by all." The instruction giver may say, "Yes, Amanda is building what I have behind my shield. Everyone else look at what she has done."

(illustration 5-9-7)
(Illustration of a group of students in which only one child has a shield. The child giving the instructions is pointing at the building of a girl. The girl has the same building as the child giving the instructions.)

If everyone has a shield, we can add more challenge to the building by saying, "No one may ask any questions at all. You must build just from what you hear."

Writing words...

We build behind the shield to improve our ability to use language to make our meaning clear. If our students become experts with the words they say, we ask them to become experts with the words they write.

Teacher: Today, I want you to write directions for how to build a building that the class will make. When everyone is finished writing his or her set of instructions for making a building, I will collect what you have written and select some of the directions to read to the whole class. Then we will see if the whole class can build just what you have described. Two or three of you may work together in groups to decide how to write the instructions for your building.

The lesson goes like this:

The teacher decides on the material for the building.
The class divides itself into groups of twos and threes.
The building and describing begin.
The groups use spelling notebooks to help them spell the words that describe how to build.
The teacher provides other work for the groups that write more quickly so that every group has time to finish writing before the reading begins.
The teacher collects the sets of directions.
The students listen and build behind their shields as the teacher reads aloud selected sets of instructions. The authors build as well.
The teacher does not explain the meaning of what he or she is reading. The author's words must stand alone.
At the end of each set of directions, the shields are lifted and the class sees how well it did at understanding the instructions.
The class discusses the sets of instructions.
What might have been written to make the meaning clearer?
What was written that made the meaning easy to comprehend?

If we are not sure that our students understand enough to try writing, we let our students write to help us know. The way to find out if our students are ready is to have them show us what they can or cannot do. Any lesson we decide to do on one day, we can also decide not to do the next.

Summary

We can be thankful...

Sorting and classifying skills are a part of language arts, science, logical thinking, reasoning and so much more. We use the skills from the time we were newborns through all of our lives.

Which sounds are words? Which sounds are not?
Which face is Mommy's? Which faces are not?
What is a cow? What is a cat?
What to call "doggie"? What to call "horsie"?
Why is a truck not a car and a van not a truck?
How can we tell a *b* from a *d*?
What is a fruit? What is a vegetable?
What is a bush? What is a tree?
Which people do I know? Which ones are new?
How can we code all the books in the library so that we tell by a number which book is where?
How do we sort ourselves, so that my address is not yours?
How can I phone you where you live, so it's your voice I'll hear and not the voice of someone I have not yet met?
What makes my fingerprint different from yours? How do we know no two are the same?
What kind of goods are in which kind of store?
What makes my blood match hers and not his?
Which diseases can be cured with penicillin? Which take a different drug?

How could we manage it all without sorting? We can be thankful we do not have to try. We think of mathematics as numbers and operations, but numbers and operations are arithmetic. Mathematics is a way of thinking. Sorting and classifying are a part of thinking logically.

Questions from Teachers

1. How do we assess that a child is learning what he or she is supposed to be learning as we are teaching about sorting and classifying?

How do we assess the child who is learning to talk? We listen to what is said. We continue to encourage the child to talk and we continue to listen to what the child says. There are no tests. There are no checklists for us to complete. We just listen and talk and listen and talk some more.

Similarly, we assess the student who is learning to sort by listening to what is said. We continue to provide the student with opportunities to sort as we continue to talk and listen to what the student says. We give no tests. We have no checklists to complete. Our students have been sorting and classifying since they were born. We assist this natural learning. We keep our assessment as natural as the learning itself.

When we assist a child in learning how to talk, we ask ourselves:

Is the child learning words?
Can the child use these words once learned?

When we assist our students in improving how they sort, we ask ourselves:

For noticing and describing similarities and differences:
Can our students see things to sort—not just in school but everywhere?
For Attribute Blocks:
Can our students put blocks in a row of attributes, each *one different* from the last?
For our students about themselves:
Can they see characteristics that make them all the same and make each one unique?
For the sorting tree:
Do our students understand the process of describing things in smaller and smaller groups?
Do they know that tall, dark and handsome is the same as handsome, dark and tall?
For words like *more* and *less* or *if* and *then*:
Can our students think about what words are asking them to do?
For building behind the shield:
Can our students say (or write) with words what they want the builder to do?

How specific does an assessment need to be? Do we need to know whose vocabulary has grown the most, or how many words each has learned? Do we need to know who is best at giving or following

instructions or who sees the most new ways to sort? What would we change if we knew? Do we measure the words that the infant is learning to decide what words we should say next? Or do we just keep on talking and keep on listening and keep on enjoying the learning that is taking place?

2. You refer to the sortings or the rules for sortings as "patterns." Isn't this confusing? When my students and I use the word *patterns*, we mean things like A-A-B, A-A-B and not two-hole, four-hole sorting.

Seeing a pattern means being able to tell from what we see now, what we can expect to see next. Patterns are in history, in behavior, in print, in weather, in sounds and in the ways atoms link together to form molecules. Patterns are everywhere. A-A-B, A-A-B is a pattern because we expect another A-A-B to follow. We use the word *pattern* in sorting to help students understand that seeing a pattern means being able to predict—for squares, for cubes, for buttons, for weather, for anything, anywhere.

3. It seems that all of the sortings in this chapter use only two groups. When do the students sort into groups of threes and fours and fives?

The lessons in this chapter sort in groups of twos and sometimes threes. When students begin their graphing (*Graphing,* page 000), they use groups of threes, fours, fives and more. The difference between a sort and a graph is often only in how we choose to record the sort. The thinking is the same.

For example, we might ask our students to bring their favorite kind of fresh fruit for a snack. We have our students place their fruit on a graphing canvas and sort the fruit by each kind of fruit the students brought to school.

(illustration 5-Q-1)
(Fruit graph on the graphing canvas. All the fruits laid out in the appropriate squares. More than two kinds of fruit represented. Maybe apples, oranges, bananas, grapes, pears.)

How many groups are in this sort? Which kind is the most well liked? When we put the fruits on the graphing canvas, we have a graph. We also have a sort. The sorting lessons are a starting point. They are not a limit we impose. We use two groups for the beginning. More groups are in the chapters that lie ahead. Sorting is not a set of lessons—sorting is a part of life.

4. When would you use Venn diagrams?

Venn diagrams are for sortings that do not divide neatly into separate and distinct groups. A Venn diagram shows this kind of grouping:

(illustration 5-Q-2)
(Venn diagram for attribute blocks sorted by blue, circles, blue circles, all other blocks.)

We use Venn diagrams whenever we feel the need. They allow us to deal with sets of attributes that simultaneously include and exclude. If the need arises, we add Venn diagrams to the sorting techniques our students have at their command.

Some questions in Lesson Eight can lead to Venn diagrams:

Everyone who is wearing both a hair ribbon and a dress please stand up.
If you either are wearing red or have on a shirt, please stand up.

The need for a Venn diagram comes if these questions are asked in a different way:

Sort yourselves into groups of those students who are wearing a hair ribbon, those who are wearing a dress and those who are wearing neither. How many groups will you need? Where will we put the people who are wearing a ribbon and wearing a dress?
Sort yourselves into groups of students wearing red, wearing a shirt and neither of the two. Where does the person with the red shirt stand?

Our year of teaching is not our students' only year in school. If we do not present Venn diagrams to this year's students, next year's teacher may choose to add them in.