

PART IV

Presenting the Activities

Introducing the Activities to the Class

Once the twenty Workjobs activities are assembled you will be ready to begin using them in your classroom. Open half the boxes one day and show them to the children. As you open each box, ask the children to tell you what the two parts (the counters and the counting areas) are, for example: watermelon seeds and watermelon slices, tiny eggs and birds nests, mice and mousetraps, etc. The language development that results will give the children the appropriate words to use when talking with their friends as they work on their activities. The goal of this first day's lesson is for the children to become familiar with the activities and to learn how to use them correctly. Talk about being careful with the materials so as not to bend the gameboards or drop or step on the boxes, and to insure all the counters are back in the box at the conclusion of the activities. It is helpful to role play putting the individual boxes back onto the storage shelf.

When these things have been discussed, group the children into ten groups of three (if you have more than thirty children in your class, make some groups of four). You may want to demonstrate what you want each group to do before grouping the children. Give each group one box. Ask them to open their boxes, put out the eight gameboards and work together to put five counters on each gameboard. When the class has done this, ask the children to walk around the classroom-very carefully to avoid stepping on any materials-to look at all the different activities. When they have finished, have the class sit down again and take turns sharing with each other what they noticed.

A nice technique to encourage the children to listen to one another is to either write down each child's comments on a separate g" X 12" piece of paper or to tape record them. At the end, shuffle the pages and then hold them up one at a time. As you read the comment ask the class to tell you who said it. Let the children keep their own comments to take home. If a tape was made the children listen to the comment and identify the child who spoke.

"I know why some strawberries were green! They're not ripe yet."

"There were ghosts and pumpkins in the haunted house!"

"Chickens eat corn-my mama feeds our big chickens that same kind of corn!"

"There are eight mouse traps and eight watermelons and eight of all of urn!"

"Did you see those little eggs in the bird nests? We have a nest in the tree by my house and there are some baby birds in it."

When the children are finished talking, have them clean up. Call one child from each group (one at a time) to put the box back on the storage shelf. The class should watch while the teacher reminds the class to notice how carefully the box is carried and put away so the label is visible.

The next day you can open the last ten boxes and repeat the lesson from the day before.

On the third day open all twenty boxes and quickly review the words describing the counters and the counting areas.

Now the children are ready to begin.

For a few days the children can work in pairs with a box between them. They each take four counting areas and put some counters down. Then they tell their partner about their groups:

"I have three orange fish and two yellow ones and one orange one here, and way over there I have two orange and two yellow ones....."

"Three pumpkins were in the haunted house and two ghosts scared the three pumpkins."

"There are five ghosts and two pumpkins in this house . . . over here are three, four . . . four ghosts and. . . ."

During this time, walk around the classrom encouraging the children to discuss their groups with their partner and reinforcing the correct way to handle and return the materials. The children should work for ten to fifteen minutes each day, selecting a second or third activity if there is time. The atmosphere should be relaxed and not rushed, keeping the focus on cooperation and conversation. During these few days the teacher should find a time during some other periods of the day when the children's skills with numbers can be assessed individually. Once the teacher has gathered this information, the children's work with the activities can be individualized and they can work on the skills which are appropriate to their own developmental level.

Assessing the Child's Concept of Number

Set up an area like this on a low table.



Ask the following question of each child in class one at a time.

"Count one of these piles of buttons, please."

By not specifying which pile to count, you will learn something in addition to the child's level of skill in counting. A child who begins with the group of twelve and counts it correctly saves you the time of finding this high level. A child who starts with the pile of twelve but counts it incorrectly gives you a clue as to how far they probably can count (the number at which they first get mixed up) as well as revealing that they may not recognize a task that is too difficult. As each child counts, watch his or her finger carefully, don't just listen. You're looking for information on the child's skill both with the sequence of number names and with 1:1 correspondence. (Resist the urge to ask anyone else to do this assessment for you, for from it you will gain many insignts into the children which are lost to you forever when someone else assesses.)

POSSIBLE ASSESSMENT RESULTS



Kelly: "One, two, two, two, two."

1. Counting even the group of four objects is difficult. Kelly needs help learning the order of number names and developing 1:1 correspondence. She should start with the activities outlined in Part II (pages 22-23) as she is not yet ready for any of the activities in this Part.



James: "One, Two, Three, Four." Teacher: "Will you choose another pile to count, please?"







James: "One, two, three, four, five, six, ten,

elevendy."

Melanie: "One, two, three, four, five six, seven, eight, nine, ten, eleven."

Melanie: "One, two, three, four." Teacher: "Will you choose another pile to count, please?"

3. Counting the group of four objects is easy, but using a 1:1 correspondence when counting eight objects is difficult. Melanie knows the order of the number names but needs help with 1:1 correspondence. She should make groups of five with the WORKJOBS II activities. Melanie seemed to have 1:1 correspondence with four objects, and now needs to practice with five.







Bobby: "One, two, three, four." Teacher: "Will you choose another pile to count, please?" Bobby: "One, two, three, four, five, six, seven, eight." Teacher: "Will you choose another pile to count, please?" Bobby: (Counts correctly to twelve.)

4. Counting groups of four, eight, or twelve is easy.

Bobby clearly knows the order of number names and has the skill of 1:1 correspondence firmly established. He is ready for the Connecting Level assessment. (See page 105.)

Compiling an Assessment Record

Record each child's name under the number that identifies the level at which he or she needs help in learning the order of number names.

THE TO CHE COMESTONCEULE WY Hand I & b June James Laky June O James Kelley.	
I & J 10 Joseph Gash Joseph Brown Rouleme In Drace Drace Drace	

This list indicates the number of objects each child should count onto each gameboard regardless of the particular Workjob they choose. The children who can successfully count to ten are ready for the Connecting Level assessment on page 105.

The children who can only count to four need to develop the prerequisite skills described on pages 22–23 before they begin using the Workjobs.

A separate list can be made of the children who would benefit from two to three minutes of oral counting practice in a large group several time a day.*



The class should begin counting to five and after several days or a week of success should count to six . . . gradually adding one new number in sequence. The children needing this practice benefit greatly from group modeling.

Using WORKJOBS II at the Concept Level

SKILLS DEVELOPED AT THE CONCEPT LEVEL

Children exploring number at the concept level with the WORKJOBS II materials develop skill in 1:1 correspondence by having many opportunities to create small groups of four to ten objects. The child builds many groups, each of identical quantity, so she or he may have sufficient practice at an appropriate level of difficulty. In addition to developing skill with 1:1 correspondence, the child discovers the quantitative relationships that exist within and between the numbers from 1–9.

WHAT IS THE CONCEPT LEVEL?

Exploration of number at the Concept Level is an opportunity for the children to discover and think about quantitative relationships in whatever way occurs naturally in their own minds, without any imposed structure from symbols or adult logic. No written symbols are used at this stage of development because written notation will actually cut the child off from his or her unique thinking process. (A symbol confines the attention to a specific numeral view of the material which narrows and limits the child's thinking.)

It is important to understand that children benefit from exploring the small numbers from 4–10 in far greater depth than they ordinarily have the opportunity to do. Within a number like *five* are many manageable relationships which a

^{*}If there are even three or four children in your classroom who need oral counting practice, the whole class should work on counting activities for short periods several times each day. (See pages 92-100 in MATHEMATICS *THEIR* WAY.)

young child's mind can easily grasp. Five contains such number relationships as: four and one, one is three less than four, four is three more than one, four contains one less than five, three is two less than five, two and three combine to make five, four has two twos in it, etc. Every child intuits such relationships if they are allowed the unhurried time they need for exploring number.

It is difficult for young children to make comparisons spontaneously with larger quantities unless they have previously discovered and intuited the relationships within smaller ones. This is why it is so important to insure an atmosphere of acceptance and appreciation of the smaller quantities. The attitude expressed by, "Wow! Now you can count to eight!" hinders the appreciation of the special wonder of four or five in the mad dash for the all-worshiped ten!

The children should be allowed to stay at the Concept Level for as long as they continue to enjoy and be absorbed in the process of counting out groups of objects. Only when the child counts out ten objects with great ease and confidence, and seems a little bored, is that child ready for the next level. Each child clearly signals readiness through this combination of confidence and slight boredom. The teacher who waits and watches will in time increase his or her receptivity to these signals.

Experiences at the Concept Level provide each child with the basic foundation for all later levels and remain, of all subsequent levels, the most important for the child's conceptual development. The teacher and child should savor this stage for if a child is pressured to move ahead too quickly, the unique value offered by this level will be lost forever. We should wait for the child to push us, rather than us pushing the child.

HOW THE CHILD USES THE WORKJOBS AT THE CONCEPT LEVEL

Each child using WORKJOBS II at the Concept Level should explore at the level which is appropriate for him or her according to the assessment.

A child having difficulty counting to six is asked to count out sets of six on each gameboard.





The child will do this many different times on different days.

A child having difficulty counting to four is asked to count out sets of four onto each gameboard many different times.





A child who counts with ease and confidence to ten may be asked to count out sets of ten objects onto each gameboard and should be given the Connecting Level assessment.



By placing the same number of objects on *each* gameboard the child has many repeated opportunities to practice counting this quantity.

By working at their appropriate level the children do not spend time counting groups that are too easy or groups that are too difficult, but rather, concentrate all their time in practicing counting the quantity they need to practice counting. In this way, 1:1 correspondence is developed efficiently and effectively.

Each level can be thought of as a kind of assessment in itself. If a child is told to work at *five* but makes mistakes (e.g., placing four watermelon seeds on some slices, five on most others, and even six on a few), the teacher should *not* correct it on the spot. It is more effective for the teacher to make a note to ask the child the next day to put four objects, rather than five, on each board (backing up to the success level). When the child has four on each board she or he is asked to add one more object to each board and then to count each group of five with a friend. The time and energy spent reteaching a child *at an inappropriate level* (evidenced by the child making mistakes) does not produce as much gain as when you back up to a more appropriate level and let the child teach himself or herself. The next day, the child should be ready to try counting out five from the start. The child should count five objects, using new materials (airplanes, one day, perhaps, and spaghetti and meatballs the next), but repeating the activity of counting to five for many days in a row. When the teacher feels this work is too easy and the child seems a bit bored the child should be ready to try counting to six.

Using WORKJOBS II at the Connecting Level

SKILLS DEVELOPED

Children exploring number at the Connecting Level with the WORKJOBS II materials develop skill in number-numeral association by building sets of objects with quantities from 1–9 according to the direction of a specific number card or equation card.

WHAT IS THE CONNECTING LEVEL?

At the Connecting Level, the Workjobs link the concepts developed during the earlier Concept Level work with traditional mathematical symbolization. This level is a bridge from the familiar world of concrete materials to the adult world of abstraction and symbolization. The child does no writing at this stage but, rather, uses cards with symbols printed on them.

The child will count out groups of objects in three different ways at this level:

- 1. matching a quantity to a given mathematical symbol (numbers 0-9);
- 2. exploring and experiencing the process of addition;
- 3. exploring and experiencing the process of subtraction.

Each way represents a slightly different type of thinking; all are important and none is much more difficult than another.

Matching a Quantity to a Given Mathematical Symbol

The child counts out the correct number of objects to match a given numeral.



The Process of Addition

The child puts out the correct number of objects to represent a given combination.



The Process of Subtraction

The child puts out the correct number of objects . . . and then removes a portion of that group to show the process of subtraction.



A child at this stage should never be asked, "How many are there altogether?" or "How many remain?" because the emphasis in this stage is on the *process* of the operations. Remainders and totals are a separate step which is appropriate later (at the Symbolic Level), not here.

ADDITIONAL MATERIALS NEEDED

In the appendix you will find the five masters you will need for preparing numeral cards (page 137–138) and the four levels of equation cards (easier addition, page 139), easier subtraction (using only numerals 0–5, page 140), harder addition (using numerals 0–9, page 141), and harder subtraction (using numerals 0–9, page 142). Make ten of each for each classroom.

Each card above should be run off on heavy tagboard, covered with contact paper and then cut apart. The teacher can visually identify the five different levels from one another by rubbing lightly over the face of each set with the side of a crayon (with the paper removed), coloring each of the five sets differently. If the teacher has access to colored tagboard in five colors this would, of course, produce the same results.



ASSESSING THE CHILD'S READINESS

A child who is ready for the Connecting Level can effortlessly and confidently count out ten objects onto each gameboard and seems ready for a new challenge. To place a child suitably at this level, make a dittoed copy of the Assessment sheet on page 152 for each child who is ready to be tested. Point to each number one at a time, circling it if the child names it quickly, correctly, and with confidence.

INTERPRETING AND INDIVIDUALIZING FROM THE ASSESSMENT INFORMATION

1. If the child knows no number, write the numbers one, two, three, four and five on the front of a library pocket that has the child's name on it, and give the child two or three numeral cards each.* (See pages 137–138.)



*Even though, technically, the child only needs eight cards to match with eight gameboards in each Workjob, it is helpful if they have several extra cards. This gives the child more free choice as well as preventing the inevitable problem that arises if a child drops a card or two on the floor and then finds she or he doesn't have enough to put with the gameboards. After a few weeks reassess each child. Assuming they now know the numbers from 1-5, continue to keep one of each number they know in their library pockets, and add two or three numeral cards of each number from 6-9 as well.



When the child knows all the numbers from 0-9, he or she can begin using the equation cards. These do not have dots on them, so the child must know all the numbers before beginning. (See pages 139–142.)

2. If the child knows a few numbers but not all, write the numbers the child needs to learn on the front of his or her library pocket.



Let the child dig through the box of number cards to find three of each number listed on the front of the library pocket.

3. If the child knows all the numbers from 0-9, or all but one, allow the child to select some equation cards to work with.

HOW THE CHILD USES THE ACTIVITIES AT THE CONNECTING LEVEL

Each child needs a library pocket with his or her name on the front. This library pocket can be kept pinned to the bulletin board with a push pin (which young children easily pin and unpin) or they can be collected at the end of each period and stored in a cut-off, half gallon milk carton.



Children working at the Connecting Level can use the Workjobs activities in the ways discussed on the following pages.

Exploring with Numeral and Equation Cards

The child matches either a numeral card or equation card to each of the eight empty counting areas of a Workjob.



Numeral cards are used by the children who cannot yet name all ten numerals (0-9) quickly and confidently. The dots by each numeral enable the children to count to identify the symbol thereby teaching *themselves*, in time, to identify each symbol.



Equation cards are used by the children who can identify all the symbols from 0–9 quickly and confidently.

Then the child fills each counting area with the appropriate counters as directed by the symbol or equation.



At the equation card level the goal is to have the child work like the child pictured above, exploring both addition and subtraction within the same activity. However, to get to this point gracefully usually takes about two weeks. It is best when there are five or six children ready for equation cards at once so they can work together in pairs during this introductory period.

Introducing the Processes of Addition and Subtraction

The children need about ten addition cards and should use these for two or three days, building addition problems on the eight counting areas of many different activities. After several days of addition practice the addition cards should be replaced with subtraction cards which then are used by the child exclusively for three to six days.

Introductory Subtraction Lesson

When first beginning subtraction the children need an introductory lesson (or two) like the following: The teacher demonstrates once and then asks the group to explain the process step-by-step.





The teacher verbalizes and demonstrates the steps in subtraction.

The children retell the subtraction steps to direct the teacher's actions:



The teacher's verbalization and demonstration potentially puts the needed information (the two steps) into the child's mind. Retelling the steps gives the child an opportunity to demonstrate knowledge and understanding of the steps as well as to see the demonstration a second time. The children should now work in pairs and complete one activity. After working in pairs for several days, the children should work independently for two or three days on subtraction.

When the teacher senses that the children clearly understand the process, they are ready to select six addition and six subtraction cards and put them in their library pocket. These children are now ready to explore both addition and subtraction within the same Workjob activity.

A Photographic Collage of the Connecting Level

Activities with Numeral Cards





Easier addition equations (using only the numerals from 0-5)



Easier subtraction equations (using only the numerals from 0-5)



Harder addition equations (using numerals from 0-9)



Harder subtraction equations (using numerals from 0-9)



Using WORKJOBS II at the Symbolic Level

SKILLS DEVELOPED

Children exploring number at the Symbolic Level with the WORKJOBS II materials develop skills in symbolizing their own mathematical experiences. At this level children concretely represent and then record the experience in three different ways:

- 1. Using one numeral to identify a set of objects.
- 2. Using two numerals and the appropriate sign to identify the process of addition and subtraction.
- 3. Recording the process and the resulting solutions for a variety of addition and subtraction equations (the focus is on the totals or remainders).

ASSESSING THE CHILD'S READINESS

When a child has worked for several weeks with the easier addition and subtraction equation cards, and then for several more weeks with the harder addition and subtraction equation cards and can correctly and effortlessly write the numbers from zero through nine (see page 23) the child is ready for the additional challenges provided at the Symbolic Level.

ADDITIONAL MATERIALS NEEDED

The teacher will need to prepare three additional materials:

1. Small pieces of paper, cut from $8\frac{1}{2}'' \times 11''$ newsprint as shown here



2. Tiny book covers

3. Tiny book tally charts

1. The teacher should cut 50-100 $(8\frac{1}{2}'' \times 11'')$ sheets of newsprint (or some other inexpensive paper). These can be stored in a box and should be placed where the children have easy access to them at all times.

2. Book covers: The children need access to a stapler and dittoed copies of the "tiny book covers" (masters are on pages 150 and 151). The cover has a place marked for stapling. This guides the child to fasten the book together with only two staples. (Teachers who have had their stapler repeatedly jammed or seen their children delightedly perseverate and staple their material completely closed using ten to one hundred staples will appreciate this simple, foolproof innovation.)

The teacher runs the tiny book covers off on regular ditto paper, cuts them apart and stores them in a plastic bag fixed to a bulletin board (for easy access by the children).



3. Tally charts: The teachers should make the following charts on butcher paper or tagboard as the children move into the Symbolic Level and begin making "tiny books." The children's names are added to the chart one at a time when they complete their first tiny book. Each time another book is completed the teacher puts a tally after the child's name, making a simple and informal record of the work that has gone home.

Tiny Number Books	Tiny Equation Books
TLAQ attight KTIS EIISA Mudal Agenta	V a + numunan V a + numunan B a r ry Am
Norma Trany Sandy Karf at	Ronnie II Shaman Urzenue Kilan Churzenue II
NEADUR 35.1 177 Algebre 177 540ar 1984 1	Becky Mrt Mit I Reday The Life Jone K

WHAT IS THE SYMBOLIC LEVEL?

The Symbolic Level provides many opportunities for children to make written records using traditional mathematical symbols.

Except for writing a single numeral to identify a set of objects, the Symbolic Level is not appropriate for kindergarten and should not be begun until first grade. Kindergarten teachers will want to offer activities to broaden the experiences of their advanced children rather than getting more abstract.* This is especially critical because once our advanced kindergarten children reach first grade they will be given only activities requiring progressively greater abstraction. If we don't broaden their understanding, who will?

There are three different steps at the Symbolic Level:

- A. Making numeral cards and equation cards
- B. Recording addition and subtraction equations with the totals and remainders
- C. Making up problems

Step A: Making numeral cards

The children either: 1) write a single number on a piece of paper and then put out the appropriate number of objects on each counting area from one of the Workjobs; or 2) first set up their boards with counters and then record the descriptive number.



When the children finish they gather up their papers and put a "tiny *number* book" cover on the front, stapling it at the two designated places. (The teacher will want to demonstrate this to the children.) The book can now be tallied on the chart and sent home.



*Activities such as counting jars of objects and estimating and graphing (pages 310 and 319) in MATHEMATICS *THEIR* WAY done independently make good Concept Level alternatives.

Step A: Making equation cards

Make addition equation cards without totals. The child puts out any desired number of objects onto each counting area.



The child then records the resulting addition combinations on a small piece of paper. Totals are not yet recorded because the focus is only on recording the process of addition.



This activity can be repeated for subtraction as well.



Step B: Recording the answers to addition and subtraction equations

This step encourages the children to solve both addition and subtraction problems within the same lesson. The child puts an addition or subtraction equation card with each counting area and builds the appropriate concrete representation of each.



Now the child puts a blank piece of paper $(2'' \times 6'')$ with each counting area and records both the problem and the answer.



When the children finish they gather up their papers and put a "tiny *equation* book" cover on the front, stapling at the two designated places. (The teacher will want to demonstrate this to the children.) This book can be tallied on a chart and then can go home.



Step C: Making up problems

The child makes up his or her own problems on the counting areas (using any of the Workjobs) recording them either on $2'' \times 6''$ pieces of newsprint or on a dittoed sheet (see page 153 of the Appendix). The child should not be required to fill every space with equations.

At this stage it seems to work best if the child uses only one counting area which is cleared at the end of each problem and revised for the next. This provides maximum freedom to create large problems.



Using the Activities to Explore Place Value, Multiplication and Division

Children who are ready to explore the numbers above ten should first be exposed to the place value counting game and the activities described on pages 276-306 in MATHEMATICS *THEIR* WAY and in issue III of the MATHEMATICS *THEIR* WAY NEWSLETTER.* These activities give children the necessary and appropriate experiences to enable them to discover and to understand the structure of our base ten number system. Once the children have had these experiences, they will benefit from using WORKJOBS II activities to build large numbers and to explore multiplication or division.

*Available at cost, from the Center for Innovation in Education, 19225 Vineyard Lane, Saratoga, CA 95070.

EXPLORING LARGE NUMBERS





"three tens and six"

"one ten and eight"



"two tens and five"



"seven tens and one"

EXPLORING MULTIPLICATION



EXPLORING DIVISION



The teacher makes a stack of cards like the ones shown above for the children to use to explore division. None should have remainders. The back of each card shows the total number of objects (the dividend) in groups of tens and ones, and has a picture of the number of counting areas to be used (the divisor).



"... twenty-two, twenty-three, twenty-four!"

"Divided by four...."





"... puts six on each one! That's twentyfour divided by four equals six."

Cleaning up.



"I'll try another."