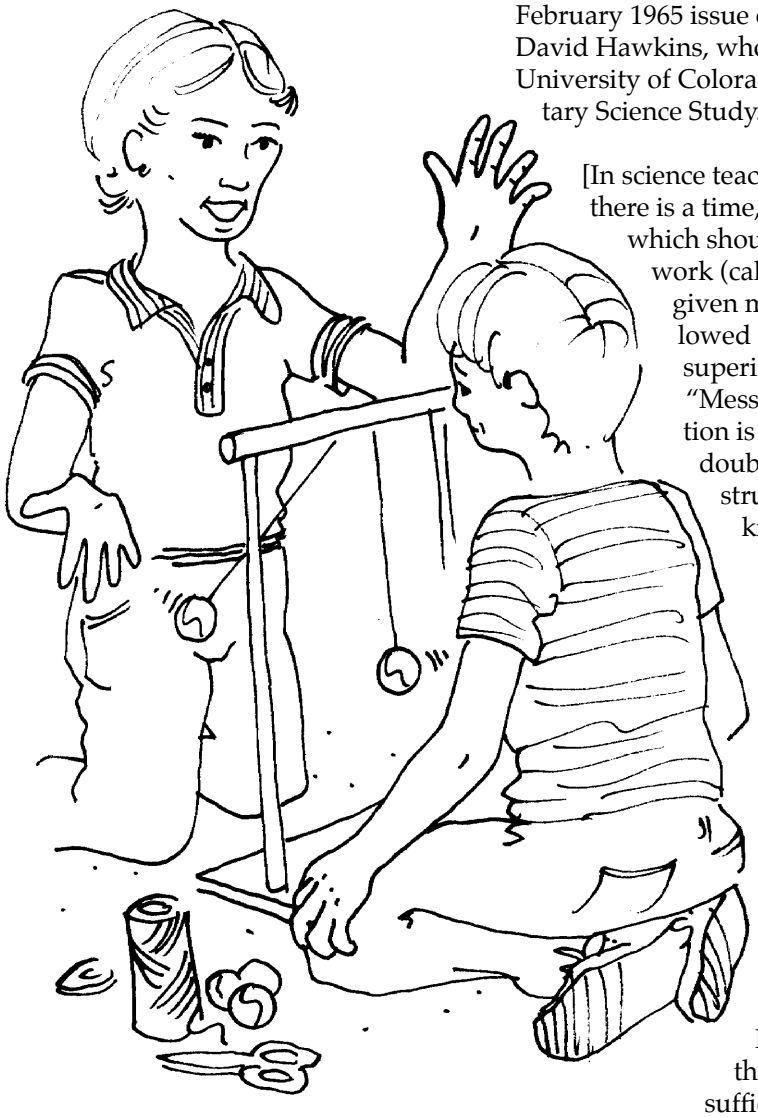
CHAPTER 1:

LEARNING ENVIRONMENT

INTRODUCTION

"Messing About"

Below is a section from John Holt's 1983 revised edition of *How Children Learn*, pp. 219-226. Mr. Holt quotes segments of an article called "Messing About in Science". The article, which appeared in the February 1965 issue of Science and Children, was written by Professor David Hawkins, who at that time was a professor of philosophy at the University of Colorado. He was formerly the director of the Elementary Science Study. Mr. Hawkins says in part:



> [In science teaching, and other aspects of elementary education] there is a time, much greater in amount than commonly allowed, which should be devoted to free and unguided exploratory work (call it play if you wish; I call it work). Children are given materials and equipment — things — and are allowed to construct, test, probe, and experiment without superimposed questions and instruction. I call this phase "Messing About." …In some jargon this kind of situation is called "unstructured," which is misleading; some doubters call it chaotic, which it need never be. "Unstructured" is misleading because there is always a kind of structure to what is presented in a class….
>
> Let me cite an example from my own recent experiences. Simple frames, each designed to support two or three weights on strings, were handed out one morning in a fifth-grade class. There is one such frame for each pair of children. In two earlier trial classes, we had introduced the same equipment with a much more "structured" beginning, demonstrating the striking phenomenon of coupled pendulums and raising questions about it before the laboratory work was allowed to begin. If there was guidance this time, however, it came from the apparatus — a pendulum is to swing!
>
> In starting this way, I for one, naively assumed that a couple of hours of "Messing About" would suffice. After two hours, instead, we allowed two more and, in the end, a stretch of several weeks. In all this time there was little or no evidence of boredom or confusion. Most of the questions we might have planned for came up unscheduled.

Mr. Holt adds: "We teachers like to think that we can transplant our own mental models into the minds of children by means of explanations. It can't be done."

Why did we permit this length of time? First, because in our previous classes we had noticed that the things went well when we veered toward "Messing About" and not as well when we held too tight a rein on what we wanted the children to do. It was clear that these children had had insufficient acquaintance with the sheer phenomenon of pendulum motion and needed to build an appreciative background, against which a more analytical sort of knowledge could take form and make sense.

Second, we allowed things to develop this way because we decided we were getting a new kind of feedback from the children and were eager to see where and by what paths their interests would evolve and carry them. We were rewarded with a higher level of involvement and a much greater diversity of experiments. Our role was only to move from spot to spot, being helpful but never consciously prompting or directing. In spite of — because of! — this lack of direction, these fifth-graders became very familiar with pendulums. They varied the conditions of motion in many ways…. There were many sorts of discoveries made, but we let them slip by without much adult resonance, beyond our spontaneous and manifest enjoyment of the phenomena. So discoveries were made, noted, lost, and made again. I think this is why the slightly pontifical phrase "discovery method" bothers me. When learning is at the most fundamental level, as it is here, with all the abstractions of Newtonian mechanics just around the corner, don't rush! When the mind is evolving the abstractions which will lead to physical comprehension, all of us must cross the line between ignorance and insight many times before we truly understand.

Holt comments: "All of us must cross the line between ignorance and insight many times before we truly understand. Not only must we cross the line many times, but in the words of the old spiritual, nobody else can cross it for us, we must cross it by ourselves. Being shoved or dragged across does no good."

This (Messing About) phase is important, above all, because it carries over into school that which is the source of most of what children have already learned, the root of their moral, intellectual, and esthetic development. If education were defined, for the moment, to include everything that children have learned since birth, everything that has come to them from living in the natural and the human world, then by any sensible measure what has come before age five or six would outweigh all the rest. When we narrow the scope of education to what goes on in schools, we throw out the method of that early and spectacular progress at our peril…. To continue the cultivation of early ways of learning, therefore; to find in school the good beginnings, the liberating involvements that will make the kindergarten seem a garden to the child and not a dry and frightened desert, this is the need that requires much emphasis on the style of work I have called "Messing About".

Nor does the garden in this sense end with a child's first school year, or his tenth, as though one could put away childish things. As time goes on, through a good mixture of this with other phases of work, "Messing About" evolves with the child and thus changes in quality. It becomes a way of working that is no longer childish, though it remains always childlike, the kind of self-disciplined probing and exploring that is the essence of creativity….

Math Their Way Environment

"Don't tell me the answers. Let me enjoy the wonder of wondering."

Kim Hix

A Math Their Way environment is a place where children engage in collaborative interactions with other individuals — peers and adults. The activities and experiences are socially, emotionally, physically, and developmentally appropriate for the group of children in the classroom. Emphasis is placed on the learning process rather than quick right answers. Errors are viewed as natural occurrences during any learning process. Children are free to experience, to react, to think and thus to learn, grow and change in "their way". The teacher determines the children's needs and provides appropriate classroom activities by observing them at work with the concrete manipulatives. Although the teacher is actively engaged in the classroom activities, he or she is very careful not to impose his or her answers on the child.

The goal of the Mathematics Their Way activities is to develop an understanding of and gain insight into mathematical patterns through the use of concrete materials. It is important to surround children with a variety of challenging math experiences which enable children to internalize concepts within the context of real experiences.

Setting the Tone for Questions

> ***"Teaching means creating situations where structure can be discovered."*** ***Jean Piaget***

Teachers can "create situations where structure can be discovered" by the statements they make and the questions they pose. Studies show that the average teacher allows less than three seconds for a response before he or she asks another question or tries to clarify the first question. To help remedy this situation, we as teachers can silently count to ten after asking a question before we make another verbal statement. More children participate in the discussion when the teacher allows ample lag time between questions. Allowing the lag time may not be easy at first for the teacher, but can produce excellent dividends in terms of increased participation.

Appropriate Questions

A key factor to creating a supportive, challenging environment lies in the types of questions and statements set forth by the teacher. Teachers can challenge children's thinking by utilizing divergent questioning. Divergent questions are open-ended and allow many possibilities for responses. Convergent questions, on the other hand, often have one right answer. An example of a divergent question during a graphing lesson might be: "What do you notice about our fruit graph?" From this question, the group can list various true statements about the graph (i.e., There are more oranges than bananas. There are the same amounts of grapes, oranges and bananas. More people brought apples than any other fruit, and so on…). An example of a convergent question is: "Which row has the most fruit?" This question can only have one answer.

Let the discoveries flow from the children. It's so much more exciting that way. Encourage the children to ask divergent questions of one another. Bob Baratta-Lorton addresses the importance of questions in Issue 1 of the *Mathematics . . . a Way of Thinking* Newsletters. He lists six basic questions and statements that can be used over and over:

What would happen if…?
If you can do it with ____, can you do it with ____?
How many ways can you… or Can you think of a different way?
Do you see a pattern?
Predict….
Find the one(s) that doesn't (don't) work. Find the exception.

Once you have learned how to ask relevant and appropriate and substantial questions you have learned how to learn. This is what we need to teach in our schools.

Students are too often restricted to the process of memorizing (partially and temporarily) somebody else's answer to somebody else's questions.

Neil Postman
TEACHING AS A SUBVERSIVE ACTIVITY

Kinds of Math Their Way Activities

The activities in *Mathematics Their Way* are divided into two different types:

1. Whole Class and Small Group Activities

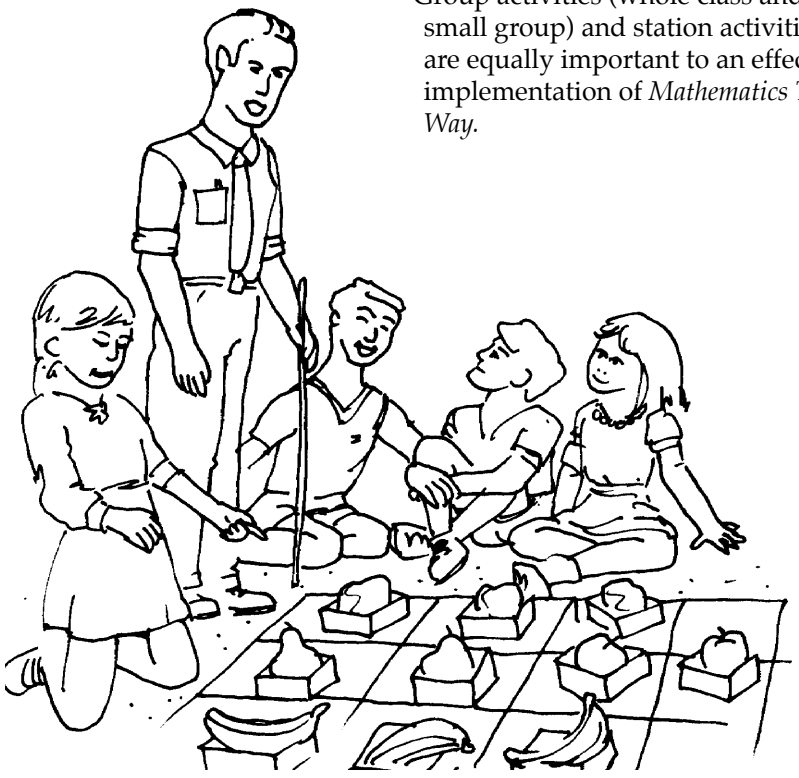
Whole class and small group activities are suggested at the beginning of each *Mathematics Their Way* chapter, as well as in this newsletter (see Newsletter Table of Contents for listings of the activities). These activities are structured to introduce and review specific mathematics concepts. Some of the whole class and small group activities can be adapted to independent activities. Once the children have been introduced to the activity, place it on a shelf in the classroom for them to freely choose (see NL p. 6.4-6.7, 10.13-10.14, 11.11-11.14, 11.17-11.18 for examples of independent activities).

2. Application and Extension Activities

Open-ended activities which enable children to apply and extend the concepts that were introduced in the whole class and small group sessions are suggested later in each *Mathematics Their Way* chapter. The children work independently at math stations. Suggested activities for math stations are listed in the Tubbing Section at the end of this newsletter.

Scheduling Math Their Way Activities

Both types of activities are conducted interchangeably in the classroom throughout the school year. Some teachers alternate days with group activities and math stations. Other teachers schedule a time in the daily schedule for both group and station activities. Group activities (whole class and small group) and station activities are equally important to an effective implementation of *Mathematics Their Way.*



Whole Class / Small Group Lessons

RATIONALE

The purpose of a group lesson is to focus on specific math concepts. A lesson usually includes several related activities. The pace of a lesson is meant to be fast. The size of a group varies from small group to the whole class — depending on the nature of the activities and the lesson's objectives.

Group lessons are not always preplanned. During the math stations, the teacher may observe several children who are ready for a new concept to be modeled, or perhaps a child asks the teacher a question which leads to a small group lesson. Both of these situations provide an opportunity for the teacher to model the concept immediately. Impromptu group lessons, when teachers model mathematical concepts in the context of the station activities, provide students an excellent opportunity for meaningful learning experiences.

Whole group activities can be scheduled throughout the school day — e.g., during the daily calendar activities or before the children begin their work at the math stations. Whole group activities — such as counting activities, clapping a pattern, searching for numbers and making predictions on the number line — can also occur spontaneously. Take advantage of the few minutes before the children go to lunch, or while waiting for a specialist to arrive for music, art, or gym, or while waiting to depart on the school bus at the end of the day.

WHEN YOU PLAN A GROUP SESSION:

Focus on the needs of the children who will participate in the group. Group lessons should be developed from classroom observations, assessments, questions and comments from the children, rather than arbitrary math goals set for each grade by the school district.

Limit the goal of the lesson to one objective (i.e., a junk box sorting lesson, a pattern language lesson or the introduction of a new manipulative material). Plan several related activities using the same basic concepts. Observe the students' interaction and response during the lesson. Vary your approach accordingly. The children are the catalyst for how the lesson progresses.

A teacher may schedule a whole class or group lesson to:

❑ ***Introduce and model manipulative materials***
Children should be familiar with the manipulative materials before the materials are placed at the math stations. A teacher can model in group lessons how to use and care for the material.

❑ ***Introduce and model independent activities***
Independent activities are activities the class can work at individually or in small groups without the teacher being present. These activities need to be modeled several times before they are placed on a shelf in the classroom for the children to freely choose.

❑ ***Introduce new math concepts***
Group lessons allow the teacher to introduce new concepts before they are the main focus of the math stations. For example, a first grade teacher may begin introducing number operations at the concept level in group lessons while the focus at the math stations is pattern.

❑ ***Review math concepts***
The decision to review is based on the teacher's classroom observations and/or assessments (informal or formal). For example, at the beginning of the school year (after assessing the class), a second grade teacher may plan a group lesson focusing on a review of number operations. Only the children who need the review are chosen to participate in the group lesson.

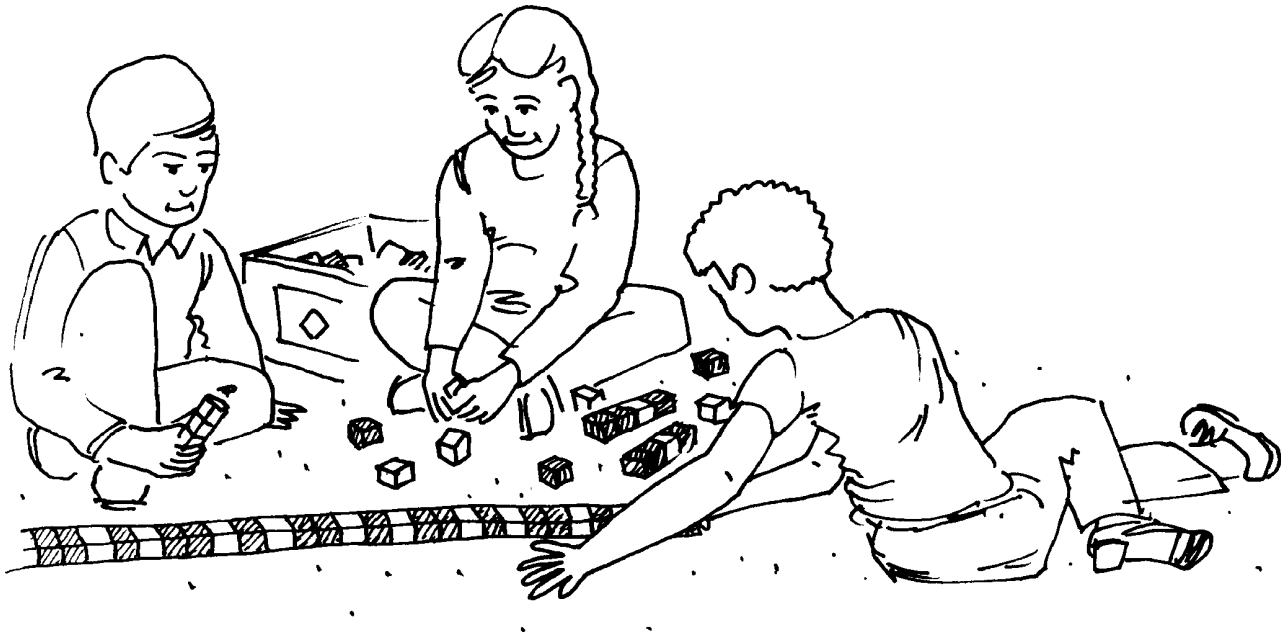
Special education teachers, tutors, or parent volunteers who work with children outside of the mainstreamed classroom for remediation can plan group lessons from Mathematics Their Way that are related to the children's experiences in the classroom.

TUBBING STATIONS

RATIONALE

The open-ended activities which enable children to apply and extend mathematical concepts are set up as math stations. An organizational system called "tubbing" is used by many Math Their Way teachers to organize the materials needed at each math station. The choice of activities at the stations is based on one general concept or mathematical idea at a time — such as, pattern, number operations or place value. No one activity is more important than any other. A child can freely explore concepts using all the activities a few times or a few activities many times. There needs to be enough materials for at least four children to work at each station. The individual children move freely from station to station exploring and experiencing the activities. The focus of the stations changes throughout the school year.

The beauty of the tubbed stations is that the class does not have to be ability-grouped. Children of various ability levels work side-by-side — sometimes together and sometimes independent of one another. The children work at a station as long as they remain interested. They are free to change activities when they wish, rather than wait for the teacher to rotate their group. Rotating children between groups creates both a time pressure to "finish at the same time" and a notion that it's important for every child to do every activity.



TEACHER'S ROLE

> ***As teachers, our own attitude toward learning determines the conditions we create for learning in the classroom...***
> ***Sprinthall***

The teacher's role during math stations is that of a facilitator, active participant and observer. By actively engaging in the activities at the stations, the teacher can sense when there's a need to challenge the children or if there's confusion. He or she has a better sense of when to adapt materials to better fit the interests of the group. Children imitate adult behavior. If the teacher displays genuine respect and interest in the stations, then the children will probably show the same interest and respect. But, if the teacher exhibits little interest in the stations, then the children may also become disinterested.

RECORD KEEPING

The observation sheets provided in the Mathematics Their Way Blacklines were developed to assist teachers in keeping anecdotal records of the behavior and learning that occurs at the stations. Anecdotal notes, coupled with the individual student assessments, are especially helpful when it's report card or parent conference time.

Observe and record:

Individual and class behavior.

Who works well with others; who constantly needs teacher intervention in order to get along with other children; who works best alone; who needs help finding something to do; who gets involved independently, works with confidence and generates many ideas to explore.

Watch for children with short attention spans. They're going to need lots of encouragement and appreciation to stay motivated. Look for the leaders and for those who appear to be good peer tutors. Note the children's perceptual development and motor coordination.

How the class interacts with the manipulative materials.

What are the children doing during free exploration? (e.g., Are they sorting, patterning, building, etc?) What are the favorite materials? ...the least favorite? Is it time to vary the manipulatives by adding something new to the stations or combining two types of manipulatives? Perhaps it's time to place new materials at a station.

TUBBING STATION MANAGEMENT

The tubbing station system enables children to take more responsibility for their learning. They can deliver the tubs to the designated areas, work freely at the stations, and clean up at the end of the session with little or no direction from the teacher. Teachers often worry about the chaos, or that the children will flit from place to place and not settle down to a station long enough to work seriously. Be assured, most children (even five year olds) can make decisions and be responsible for their actions when the learning environment allows such behavior.

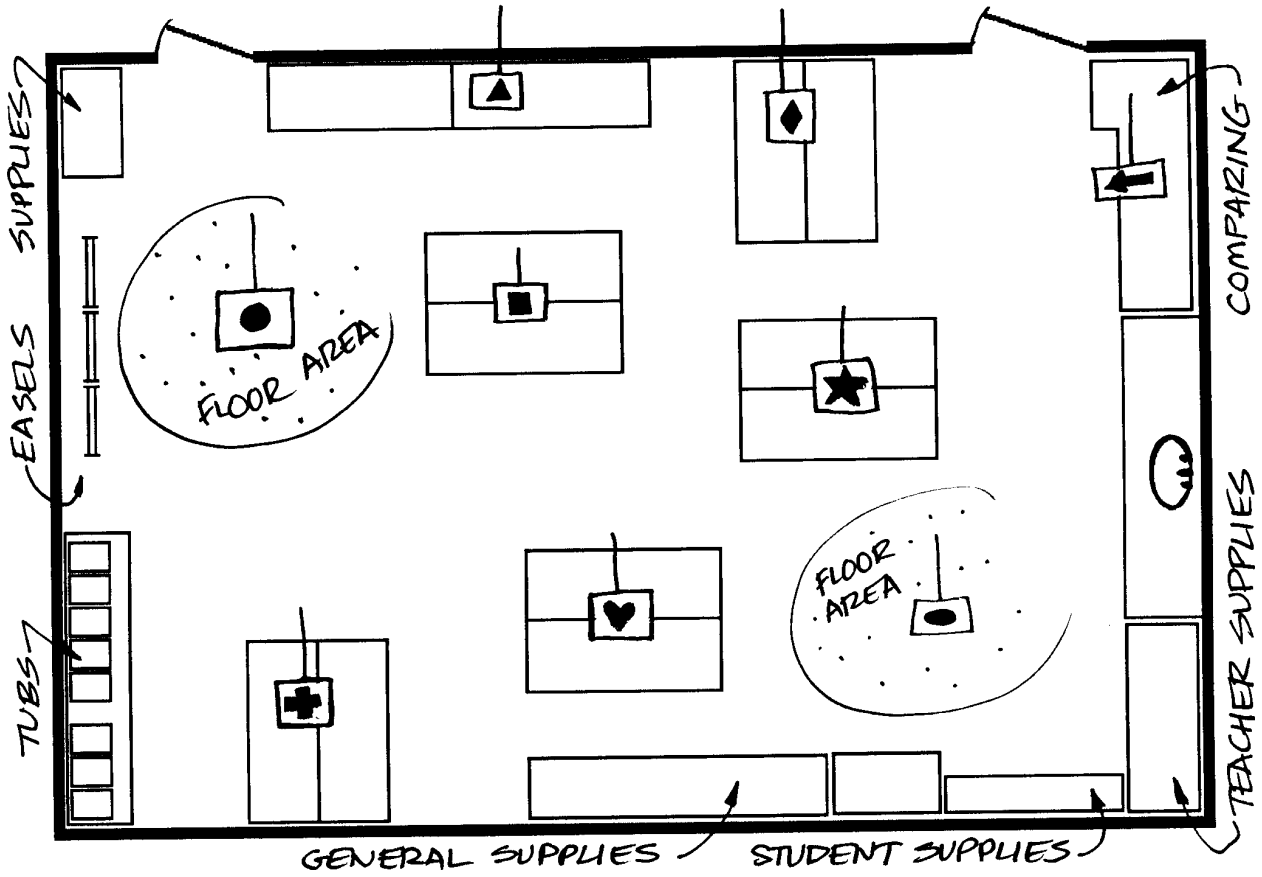
Inevitably, some children may not be able to handle the freedom of choice. They may need some guidance in learning to make choices and to work in harmony with their classmates.

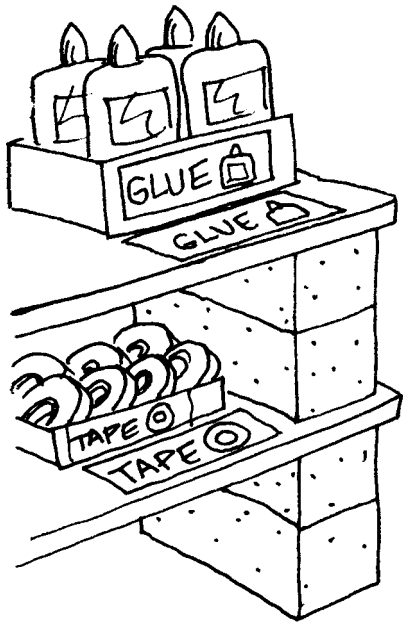
Behavior issues (see MTW, pp. 14-15) should be dealt with immediately and consistently. Begin by reviewing the ground rules privately with the child. Be sure the child understands the consequences for inappropriate behavior. Focus on the child's behavior during this talk, rather than what he or she is learning in mathematics. Any attempt to deal with both academic and social growth at the same time may only sidetrack the efforts to change the inappropriate behavior.

It's very important to be 100% consistent with the ground rules and the consequences for inappropriate behavior. Calmly move the child to a chair apart from the group the moment he or she exhibits inappropriate behavior. Give no warnings. Warnings quickly turn into games. The child needs to learn quickly that there are immediate consequences for inappropriate behavior.

Approach the child after he or she has been separated from the group for about three to five minutes, and unaccusingly, ask whether he or she is ready to go back to work — rephrasing whatever the infraction was as the desired positive action. (i.e., Carol, are you ready to go back to where you were working and respect John's work?)

CLASSROOM ORGANIZATION





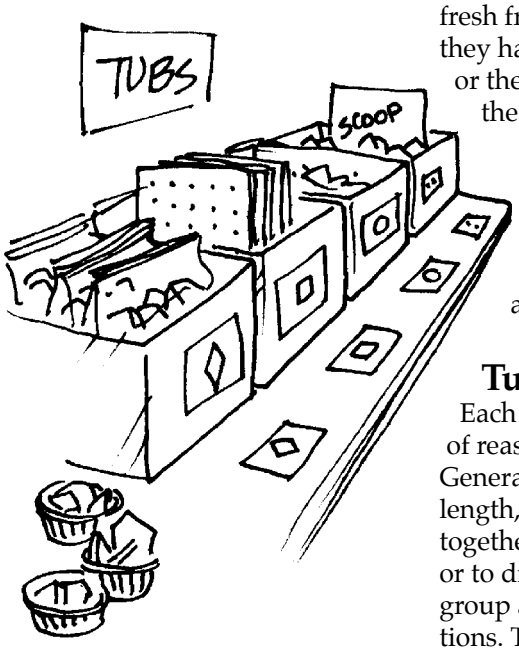
Make a floor plan of your classroom. Plan for nine or ten work areas (at the tables and on the floor). Arrange the room. Label each station area with a symbol. The station labels can be displayed at the stations by either hanging the station labels above the station area or taping them onto the appropriate tables and floor spaces.

A permanent station could be set up for the comparing and measurement activities. Necessary materials can be added gradually to the area throughout the year to provide the children opportunities to freely explore comparing and measurement concepts. (see Chapter 7, Measurement).

Designate shelf areas to store:

- teacher supplies
- classroom supplies (e.g., tape, markers, pencils, crayons...)
- general supplies (math materials for tubbing stations)
- tubs with station materials

Label the shelves where the supplies are to be stored (see MTW, p. 4). This way the children can easily return the materials when they are finished using them. (See NL Blacklines #50-52)



Preparing the Tubs

Get ten medium-sized cardboard boxes (about 12" by 18", cut 6" high) from the grocery store. (Some teachers use flats that are used to pick fresh fruit — like strawberries or blueberries. The flats are nice because they have a handle and they stack well.) Do not cover either the boxes or the flats. Leave them natural so the children will be able to read the original box labels. The boxes hold up for years.

Cover the shorter ends of the box or tray with a piece of manila tagboard. Put a smaller version of the hanging station symbols in the center of each piece of tagboard. This way, no matter how the box is placed in the storage area, the label is always visible.

Tubbing Schedule

Each teacher's schedule for tubbing stations will vary for a variety of reasons — such as, the time of year and the age of the children. Generally, the sessions are approximately 45 minutes to one hour in length, and are conducted at least three times a week. The class gathers together for the first part of the session to review ground rules, and/or to discuss a new station. Sometimes the teacher will include a quick group activity. The tubs are then delivered to their appropriate stations. The children are dismissed from the group area to begin working at the station of their choice. It's helpful if the teacher gives the children a ten minute warning before it's time to clean up the stations. This enables the children time to complete the activity on which they are presently working. Allow enough time at the end of the station time for the children to clean up and put the stations away.

INTRODUCTION TO THE TUBS

Free Exploration

Familiarize the class with the tubbing station routine.

If this is the class's first experience working at stations, begin by placing familiar activities in the stations (e.g., clay; paper, crayons, and pencils; Legos; puzzles; wooden colored cubes...) Choose activities that are open-ended and manipulative, but not necessarily math related. The emphasis at this time is to acquaint the children with the tubbing routine and establish the basic tubbing ground rules (see MTW, p. 5).

The two basic ground rules are:

1. You and only you have the right to mess up and/or put away what you created with the manipulatives at a station.
2. Materials for learning are never to be thrown.

Review the free exploration activities.

Begin each school year with a free exploration period at the stations. This is a time for the class to freely explore, without specific directions, the manipulative materials which will be used in mathematics throughout the year.

Review Chapter One in Mathematics Their Way (pp. 6-17) and the Free Exploration Station Sheets (NL, pp. 1.19-1.20). The tubbing sheets suggest activities to begin with at the free exploration stage of the stations. The activities are listed on the tubbing sheets in the order they would be introduced to the class.

Introduce the free exploration activities in group sessions.

Introduce the math manipulatives that are going to be experienced at the station to the class in a group session (one material per session). The materials should be modeled and experienced either in whole class or small group sessions several times before they are placed in the stations. Some items (e.g., geoboards and junk boxes) may need to be experienced many times before they are placed in the tubs. If you don't have all the materials suggested, then adapt the activities to the materials you do have available.

Place the activities in the stations.

Place the free exploration activities (one or two at a time) in the tubs until all the stations have an activity. Gradually, the original activities in the tubs will be replaced by the math manipulatives to be free explored.

Vary the free exploration stations.

The class's free exploration experiences can be extended and expanded upon by periodically varying the free exploration station activities. Change the manipulatives in some of the stations, combine several types of manipulatives in one tub, or possibly change the location of the activities from a floor activity to a table activity, and vice versa. Select the activities appropriate for your class's needs. A blank tubbing sheet is provided as a blackline to help you plan and organize the stations to meet your needs (see NL Blackline #1).

What is the next step after free exploration?

After the children have experienced the free exploration stage to its fullest, begin to shift the focus of the tubbing activities to a specific mathematical concept. The sequence of the general concepts explored at the tubbed stations varies according to the grade level and experience of the children. Most teachers move into the pattern stations after the free exploration period. Gradually, introduce the new tubbing activities for the new concept. Pace your schedule to meet your class's needs.

Station sheets, with suggested initial activities, are provided for free exploration, pattern, number, and place value. Remember, they are meant to be a starting point. Adapt the activities to meet your class's needs and the manipulative materials you have available.

FREE EXPLORATION EXPERIENCES

Children experience the manipulatives in a multitude of ways during the free exploration period. Some children experience every manipulative several times. Other children have definite favorites and can spend days (perhaps weeks) with the same manipulative.

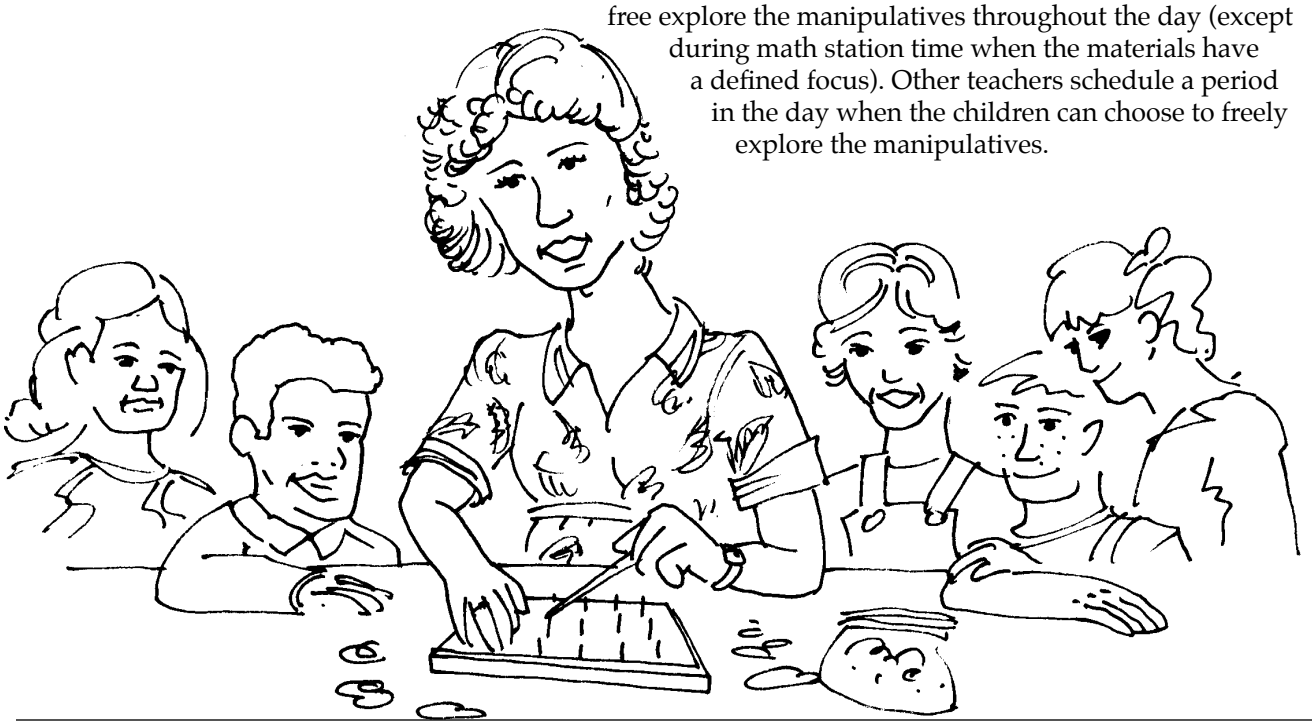
The children begin by building things that are familiar to them — such as making their names with tiles or building a tower with the cubes. They might see how long a Unifix cube train they can make. They construct elaborate buildings with pattern blocks and geoboards and even play store with the materials in the junk boxes. Some children's initial work may appear to the adult eye as chaotic and unorganized. Be assured that the work does gradually change as time goes by.

While the children are free exploring the math manipulatives during the scheduled station time, the teacher schedules whole class and group lessons another time in the day to introduce and review concepts. Some of the concepts might be rote counting in different sequences, rhythmic clapping patterns, or people sorting.

The concepts experienced in the group lessons begin to transfer into some of the children's exploration at the station activities. A Unifix train might have a color pattern, a pattern block flower might be formed in a surrounding pattern, or the children might be sorting the junk by physical attributes. It is when the class's forms of free exploration begin to change and become more focused that the teacher knows the children are ready for the introduction of specific math concepts at the stations.

Provide Children a Time to Free Explore all Year

Children need to have opportunities to continue to free explore the materials on their own throughout the school year. Some teachers structure their classroom environment so the children can choose to free explore the manipulatives throughout the day (except during math station time when the materials have a defined focus). Other teachers schedule a period in the day when the children can choose to freely explore the manipulatives.



REPRODUCING AND RECORDING DESIGNS AT THE TUBBING STATIONS

Copying a design is a more complex task than we adults may initially realize. In order to transfer the design correctly, the child must be able to handle a whole series of perceptually-based decisions and comparisons. Children who have difficulty often do not have the skill to verbalize positions and relationships of the materials.

Below is a lesson sequence introducing reproducing and recording designs with geobaords. Use the same process with the other manipulatives — e.g., Unifix cubes, pattern blocks, tiles, wooden cubes. (see MTW, p. 12-13)

There are three stages. Children need to be developmentally ready for each step. Do not move to a higher level until the children can work with ease at the earlier level(s).

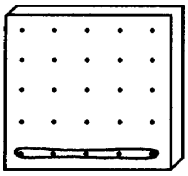
Sample Strategy Lesson

Level 1a: Verbalizing the position of the rows.

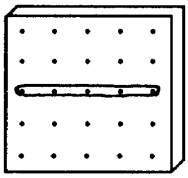
Materials:
1 geoboard per child
1 geoband per child

Model Lesson:
Put a geoband around one of the rows of nails on the geoboard. Ask the children what row it is. If they have no words to describe it, verbalize the alternative possibilities for them. Continue to work with the children until they can comfortably and consistently verbalize the position of the row on their own. The teacher's role is not to impose one way of verbalizing, but to model several alternative ways.

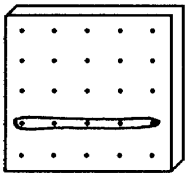
The teacher asks, "What row is this?" (Typical acceptable responses are indicated in the illustration.)



"The bottom."
"The last one."
"Row five."



"The middle row."
"The third one."
"One, two, three down."

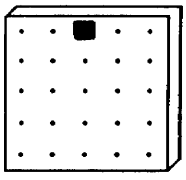


"Fourth row."
"Second from the bottom."

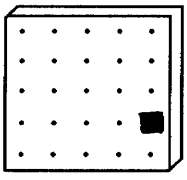
Level 1b: Verbalizing the position of the nails.

Materials:
1 geoboard per child
1 Unifix cube per child

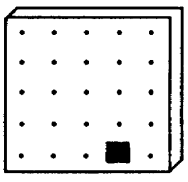
Model lesson:
Put a Unifix cube on a nail and ask the children to describe the position by row and nail. Model ways to describe the position if the children do not spontaneously verbalize on their own. Let the children work in partners — following the above sequence.



"Row one, middle nail."
"Top row, nail 3."



"Fourth row, last one."
"Second row up, end nail."



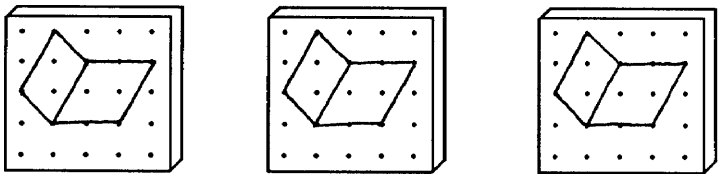
"Row 5, fourth one in."
"Last row, 4th nail."

Level 2: Reproducing a pattern with concrete materials. (Geoboard→Geoboard)

The children should be very comfortable transferring patterns from one geoboard to another before they attempt to copy a pattern onto paper. They should work in pairs.

Materials:
1 geoboard per child
1-3 geobands per child

Model Lesson:
Make a simple design with one to three geobands. Ask the group to copy the design onto their geoboards. Working in partners, the children repeat the activity on their own. One child assumes the role of "teacher" and creates a design; the partner copies the design. The partners take turns switching roles.



Level 3: Copying a pattern onto a geoboard paper. (Geoboard→Geoboard Paper)

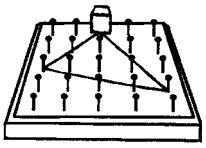
When you feel the children are ready, have them try copying a design onto a geoboard paper. The focus at this level is on copying, not teaching language. It is assumed the child has confidently accomplished the earlier language-related levels. If a child does not verbalize spontaneously, he or she may need to go back to levels 1, 2, or 3.

The teacher (T) models with a geoboard, while the children (C) record on geoboard papers.

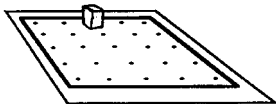
Materials:
1 geoboard paper per child
(MTW blackline #17)
1 Unifix cube per child
1 pencil or crayon per child

Teacher makes a shape on the geoboard with geobands and then places a Unifix cube over the top of one corner of the shape.

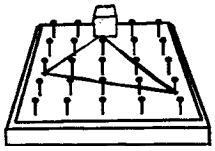
(T): "Place your Unifix cube over this dot on your paper."



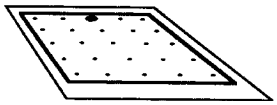
(C): Place a Unifix cube over the dot on their geoboard papers.



(T): "Take your crayon and color a dot on your geoboard dot paper where you put your cube."

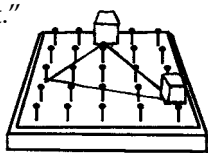


(C): Record on their geoboard papers.

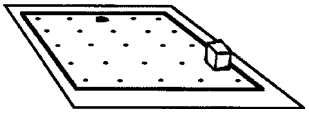


Teacher places another Unifix cube over a second nail and points.

(T): "Place a Unifix cube over this dot on your paper."
"Color that dot."

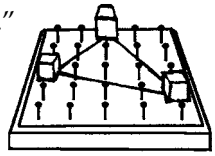


(C): "Second row up, last nail."
"Next to the bottom row, at the end."
"Fourth row, nail five."
Record on their geoboard papers.

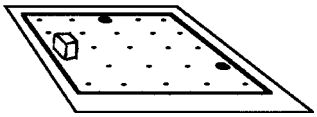


Teacher places a third Unifix cube over another nail and points.

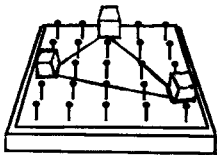
(T): "Place a Unifix cube over this dot on your paper."
"Color that dot."



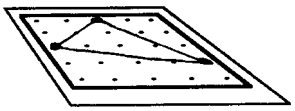
(C): "Third row, first nail."
"Middle row, nail one."
Record on their geoboard papers.



(T): "Connect the three dots to make your figure look like the shape on my board."



(C): Connect the dots on their geoboard papers.



REMEMBER:

- ❏ Group activities — where mathematical concepts are introduced and reviewed — and station activities — where children apply and extend mathematical concepts — are equally important to an effective implementation of. Both types of activities are conducted interchangeably in the classroom throughout the school year.

- ❏ The tubbing station system is meant to be used only for open-ended activities.

- ❏ Prepare eight to ten station choices with sufficient amounts of manipulative materials for at least four children at each station.

- ❏ Allow the class an adequate amount of time to "free explore" all manipulative materials before the materials are used in a directed activity. The amount of time will depend on the group's developmental age and previous experience with manipulatives.

- ❏ Review the ground rules with the class frequently (MTW, p. 5). Some materials need to be modeled many times before they are placed in the stations. (e.g., geoboards, junk boxes…)

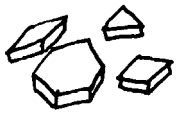
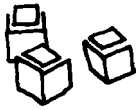
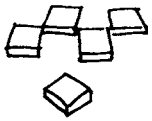
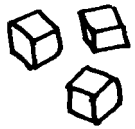
- ❏ Vary the stations to keep them stimulating and interesting by periodically moving some of the table activities to the floor and vice versa or try combining materials (e.g., geoboards with pattern blocks).

- ❏ Challenge the children with open-ended questions (see NL, p. 1.4).

- ❏ Model new ideas while working alongside the children at the station. You may also choose to verbalize your thinking while working with the materials. New concepts can be developed through the context of meaningful teacher-student interactions at the stations.

- ❏ Provide the children with many opportunities to reproduce designs with concrete materials before they begin to record their designs on paper. (see NL, pp. 1.15-1.17; MTW, pp. 12-13)

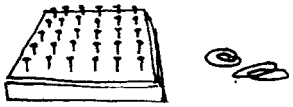
Free Exploration Stations

	PATTERN BLOCKS	UNIFIX CUBES	MIRRORS	TILES	PLAIN WOODEN CUBES
Page #'s	MTW, p. 363	MTW, p. 365	MTW, p. 10	MTW, p. 4, 360	MTW, pp. 12, 365
Activity Description	**Materials needed:** • pattern blocks (750 pieces)  *Procedure:* The children free explore pattern blocks. *Extension - Reproducing Designs:* The children work in pairs. One child builds a design with pattern blocks and the second child copies it using other pattern blocks. (see MTW, p. 13)	**Materials needed:** • 500-1000 Unifix cubes  *Procedure:* The children free explore Unifix cubes. *Extension - Reproducing Designs:* The children work in pairs. One child builds a design with Unifix cubes and the second child copies it using other Unifix cubes. (see MTW, p. 12)	**Materials needed:** • 6 single mirrors • 6 hinged mirrors • magazines and books with colorful pictures to look at with mirrors  *Procedure:* The children explore mirrors using book and magazine pictures, or other items in the classroom environment. *Extension:* Add different materials to explore: • 3" to 5" tagboard numerals (NL, Blackline #5-7) and letters (capital and lower case) • 2 - 3 bowls of pattern blocks	**Materials needed:** • 500 - 600 ceramic tiles (Tiles are all one color.)  *Procedure:* The children free explore the tiles. *Extension - Reproducing Designs:* The children work in pairs. One child builds a design with tiles and the second child copies it using other tiles.	**Materials needed:** • 500 plain wooden cubes (Use colored cubes for a substitute)  *Procedure:* The children free explore wooden cubes. *Extension - Reproducing Designs:* The children work in pairs. One child builds a design with wooden cubes and the second child copies it using other wooden cubes. (See MTW, p. 12)

* Recording materials are placed in the tubbing stations only after the children have had sufficient time to work at the concrete (concept) level with the manipulatives. Depending on the class's experience and the material in the tubbing station, the time allowed may span from several weeks to several months. Recording should be introduced as an optional activity.

	PATTERN BLOCKS	UNIFIX CUBES	MIRRORS	TILES	PLAIN WOODEN CUBES
***Recording Description**	**Additional materials needed:**	**Additional materials needed:**	**Additional materials needed:** • blank paper and markers *Recording:* The children draw a picture of the designs they see in the mirrors onto blank paper.	**Additional materials needed:** • 1" squares of paper to match the color of tiles being used (or just plain white squares) • glue sticks or paste • 6" x 9" black construction paper *Recording:* The children glue paper squares in the arrangements of the tiles onto a piece of paper. *Extension:* The children trace the design onto white recording paper with a tile template. (See MTW, p. 364). Be sure children know how to trace with templates before they actually record a tile design.	**Additional materials needed:**

Free Exploration Stations

	TOOTHPICKS	GEOBOARDS	JUNK BOXES	PATTERN BLOCK TEMPLATES	PATTERN BLOCKS SHAPES
Page #'s	MTW, p. 77	MTW, pp. 17, 361	MTW, p. 362	MTW, pp. 17, 364	MTW, pp. 17, 387
Activity Description	**Materials needed:** • plain flat toothpicks  *Procedure:* The children free explore toothpicks by making designs, etc. *Extension - Reproducing Designs:* The children work in pairs. One child builds a design with toothpicks and the second child copies it using other toothpicks.	**Materials needed:** • 6-8 geoboards • 2-3 containers with geobands  *Procedure:* The children free explore the geoboards, creating designs of their own choosing. *Extension - Reproducing Designs:* The children work in pairs. One child builds a design with geoboard and the second child copies it using another geoboard. (see NL, pp. 1.15 -1.16; MTW, p. 13)	**Materials needed:** • 4-6 junk boxes  *Note:* Change the junk boxes in the tub from time to time. *Procedure:* The children free explore the junk. *Extension - Reproducing Designs:* The children work in pairs. One child builds a design with junk and the second child copies it using the same type of junk.	**Materials needed:** • pattern block templates made from margarine lids • pencils and crayons • 6" x 9" newsprint *Objective:* To give the children experience tracing with templates on paper. *Procedure:* Children need to experience making designs on paper before they can record an actual design made of pattern blocks. The children make designs tracing pattern block templates on newsprint.	**Materials needed:** • pattern block shapes (MTW Blackline #2-6) • paste or glue sticks • wet rags for clean up • 6" x 9" black construction paper To give the children experience pasting pattern block shapes onto paper. *Procedure:* Children need to experience making designs on paper before they can record an actual design made of pattern blocks. The children make designs by pasting pattern block shapes onto black construction paper.
***Recording Description**	**Additional materials needed:** • work space (4" by 4" black construction paper) • 6" x 9" black construction paper • white glue in a small container • wet rags (for cleaning up sticky fingers) *Recording:* The children build a design on a workspace. Next they copy their designs by dipping each end of the toothpick into the white glue and placing it on a sheet of black construction paper.	**Additional materials needed:** • crayons • Blackline #17 stored in a large zippered plastic bag *Recording:* The children record the designs they make on the geoboard onto geoboard paper. (see NL, pp. 1.16-1.17 for procedure)	**Additional materials needed:**	**Additional materials needed:** • 6 margarine tubs with a few pattern blocks in each one • work space (4" by 4" black construction paper) • 6" x 9" newsprint *Recording:* The children build pattern block designs on the work spaces. Then they record the designs by tracing them onto pieces of newsprint with pattern block templates.	**Additional materials needed:** • 6 margarine tubs with a few pattern blocks in each one • work space (4" by 4" black construction paper) • 6" x 9" black construction paper *Recording:* The children make pattern block designs on work spaces. Then they copy the designs by pasting paper pattern block shapes onto black construction paper.

***** Recording materials are placed in the tubbing stations only after the children have had sufficient time to work at the concrete (concept) level with the manipulatives. Depending on the class's experience and the material in the tubbing station, the time allowed may span from several weeks to several months. Recording should be introduced as an optional activity.