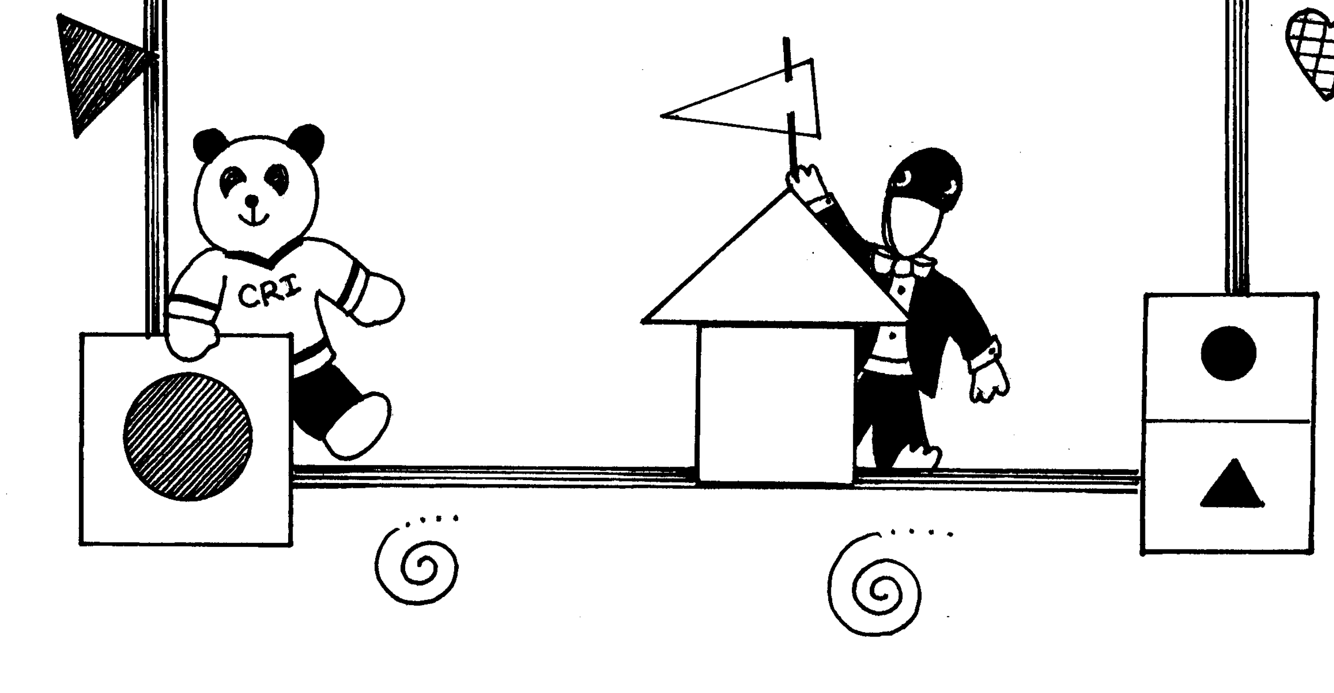
INTRODUCTION



Introduction

The Value of Teacher-Made Materials

Creating Child-Centered Materials for Math and Science, written as a companion to the *Creating Child-Centered Classrooms* series, is designed for teachers of children ages 3 to 6 years. It offers math and science activities made from commonly available materials. The activities are designed to reinforce the goals of the Step by Step program: individualizing learning experiences, encouraging children to make choices, and involving families in the education of their children.

The idea for the book came about because some of the countries implementing the Step by Step teaching methods have limited selections of educational materials to equip classrooms. Moreover, many of the school systems are unable to pay for expensive classroom materials. Finally, very few open-ended materials were available for teachers to provide "hands on" learning experiences for young children, especially in the areas of science and math.

Regardless of the wealth of materials available to a classroom, there is an intrinsic value for teachers to have their own collections of professional materials for teaching. Good teaching materials are essential for learning and the supply must be ample so that children can use them liberally for experimentation. Effective teacher-made materials build on the child's unique interests and developmental needs.

The materials and activities in this book provide opportunities for active learning. Many are commercially unavailable, because they are specifically designed to serve a singular purpose or to meet an individual need. Other materials or activities are well known, and have been adapted. All are simple to make from readily available, low-cost supplies. Each activity has a "home connection" that extends the learning experience to the home.

Many commercially available teaching materials fail to include the principles of diversity and inclusion. In a natural and thoroughly integrated fashion, teacher-developed materials include representation of diverse ethnic groups, ages, genders, professions, and disabilities.

The growing need for environmental protection provides one more reason to develop teacher-made materials from recycled materials. Children, families, and teachers must consciously reduce waste and the drain on the limited supply of natural resources. Children learn lessons about protecting the environment when they use recycled materials.

The materials used here are safe for children. Both teachers and parents should be concerned with safety issues as they collect materials and develop educational activities from found objects. Glass containers should be avoided in favor of plastic. Children involved in wood working activities should use real tools rather than toy or plastic tools and wear safety goggles. The best safety precaution is adult supervision. Teachers involve family members to provide help during activities that require increased supervision.

Background of the Step by Step Program

> *"If a society values obedient followers, its educational goals and methods will be quite different from those of a society which values independent and critical thinkers."*
>
> Urie Bronfenbrenner

The primary purpose of the Step by Step Program is to educate children to participate in a democratic society. Even very young children can make effective choices, understand the consequences of their actions, and respect the different styles of fellow students under the guidance of a teacher. The Step by Step Program advances child-centered teaching that respects the individual learning style and developmental stages of each child.

The fundamentals of the Step by Step Program include an emphasis on:
- Individualizing learning experiences for each child
- Assisting children to make choices through planned activities in activity centers
- Family participation

Individualizing

Each child is a unique combination of genetic heritage, personality, cultural and family background, and experience. The content of the curriculum, the teaching methods, the classroom materials, and the adult interaction with children should be responsive to these individual differences. Teachers individualize by respecting the present developmental stage of each child and the unique approach that each child brings to the learning experience by planning a range of appropriate activities to ensure each child's successful experiences.

The child-centered classroom supports individualized learning. Thoughtful teacher planning ensures that the activities are relevant to each child. Children individualize for themselves based on their interest and skills when they choose a particular activity. By planning flexible and interesting activities and by carefully observing children during the activities, the teacher can change and adapt materials and activities as needed. Most activities are conducted in small groups to maximize the opportunities for individualization.

When children learn at their own pace, the classroom becomes a dynamic and changing environment filled with materials and experiences designed to correspond to children's individual interests and developmental stages.

Making Choices

The Step by Step classroom is arranged in activity centers to encourage children to make choices based on their interests. The activity centers contain many different materials for exploration and play. They may vary from classroom to classroom, but activity centers usually include:

Mathematics/Manipulatives	Literacy
Science	Art
Sand and Water	Outdoor Activities
Dramatic Play	Blocks
	Music

The materials in activity centers stimulate and challenge children to use all their senses. Through experimentation, investigation, and discovery, children test ideas and gain information in their own individual ways. This is how children develop the habit of solving problems, thinking critically, and making choices.

Young children should not be forced to pursue an activity that is not of interest to them. Instead, the classroom is set up to provide a choice of activities and diverse materials from which children may choose.

Family Participation

Families are the primary educators of children and have the greatest influence upon them. Consequently, in the Step by Step Program, families reinforce and expand classroom learning, and the teacher builds on the interests and learning that occur at home. The reciprocity between home and school reflects a mutual respect between parents and teachers.

Step by Step is a two-generation program. It promotes family participation in many ways: family members assist in classrooms; they are actively involved in decision making through parent advisory committees; and they contribute information for the teaching team about the developmental needs and strengths of their children. Teachers and parents share the responsibility of working together to develop communication, mutual respect, and acceptance of differences.

The Role of the Step by Step Teacher

In child-centered classrooms, the role of the teacher shifts from imparting information to facilitating learning. The teacher guides, stimulates, shares responsibility for learning with the children, and creates a safe environment for them. She is still the adult in charge, but the emphasis is on the self-directed role of the child's learning.

The teacher facilitates learning in the following ways:

- The teacher provides a wide variety of experiences and materials to give children ample opportunity to interact with their environment. Children learn best by doing. They need to figure out how things work through trial and error. Multiple active experiences reinforce a learning concept. Children learn patterns by tapping a musical beat—tum, tum ta, tum, tum ta on a drum; by weaving alternating colors in cloth; by stringing beads in blue, yellow, blue, yellow, blue patterns.

- The teacher observes carefully how children interact with materials. This observation will give the teacher clues to activities that build on specific interests (such as trucks or animals), special needs (a child with limited vision may need to reinforce learning through tactile experience), or learning style (a very active child may be calmed by water play). Alternatively, the teacher should observe which activity centers or activities children ignore, and explore why they ignore them.

- The teacher must understand typical child growth and development in order to provide a realistic array of learning materials and activities for each child at his particular level of development.

- The teacher asks open-ended questions to help children explore and extend learning. Open-ended questions allow for more than one right answer. They also provide insight into the child's thinking process. The questioning process improves both the child's reasoning skills and language usage. In classrooms where teachers ask questions, children, too, will ask questions. The development of the thinking process has greater implications for learning than memorizing factual information.

- The teacher gives children time to reflect on their activities in order to fully understand a concept. She allows time for children to answer questions and express their ideas independently.

- The teacher discusses both accurate and inaccurate conclusions with children. Children often benefit more from discussing an idea that proves to be incorrect than from discussing one that proves to be correct.

- Like the child, the teacher actively takes risks. She is receptive to new materials and the use of familiar materials in new ways. Some activities will be more successful than others. Not every child will enjoy or participate in every activity. The teacher with initiative will substitute materials when necessary and extend the activity when it is successful. She will change an activity to encourage children to try new things.

- The teacher acknowledges that she does not know the answer, rather than give inaccurate information. By saying, "I don't know," the teacher creates an environment where she and the children are active participants in search for answers. It also shows children the value of using resources. Children learn that adults are learners too.

- The teacher interacts and plays with the children. She joins them in their sense of wonder and takes an active interest in their endeavors.

- Equally important is that the teacher knows when to withdraw and allow the children to direct their own learning.

The Teachers' Collections of Materials

Just as doctors carry their own stethoscopes with them, so teachers' collections become their personal, unique teaching tools. For children, collections are useful to either introduce or reinforce a concept being taught. They help children expand and organize experiences related to the concept. As collections grow they afford children variety, and new activities often grow out of them. Collections are often conceived as teachers see that something has captured children's interest or conversely when they are searching for a way to encourage an interest in an activity center that a child has avoided. They are also useful when teachers recognize that children need review and extension of a particular concept.

The following vignette shows how one teacher's insight formed the beginning of a collection.

> *The children were dealing with the concept of large and small in class. At home, as she folded the wash, the teacher came across a man's undershirt and minutes later a baby's small undershirt, and the idea for a collection was born. To the shirts she added a tiny pencil and a very large one, a doll's shoe and a large old sneaker, a small comb and a big one, a small coffee spoon and a large wooden cook's spoon, a small key to a child's lock and a big key to an old door.*

She placed the collection in the dramatic play area where alert children soon discovered it. As they exclaimed over it and began to use it, she encouraged discussion related to the size and use of each item. Later she brought a pencil and comb that were bigger than the original large ones, and dealt with relational concepts as a child exclaimed, "Now the large comb is the small comb!"

Just as children develop individual interests, teachers become interested in useful collections for meeting children's needs. A bridge picture collection showing many types of bridges grew in a effort to encourage a child whose bridge building had become stagnated. The teacher mounted pictures of very different bridges at the eye level in the block corner in hopes that it would stimulate change. When parents saw the collection they sent post cards of bridges from towns and cities where they vacationed. The older children enjoyed finding the cities and countries on the globe.

Collections of pictures provide unlimited opportunities for learning. One teacher's collection of pictures of emotions integrated issues of diversity and provided opportunities to talk about feelings that are common to all people. A "sleep" collection gave children a way to discuss pleasant evening rituals practiced by families as well as night fears that most children have. A "What's Happening Here?" collection was a springboard for language development, imagination, and story telling.

Teachers adapt collections to the themes in the classroom, concepts that require reinforcement, and interests of the children. Collections of pair cards—children match two identical pictures mounted on cards—provide opportunities for children to expand vocabulary, recognize similarities and differences, and learn new information. Some suggestions for pair cards are as follows:

- Baby Pair Cards are useful to stimulate discussion if there is a new baby in the family. Sibling rivalry sometimes occurs as the younger child gets more attention.
- Doctor or Dentist Pair Cards provide familiarity about a visit to the doctor or dentist. If pictures are not available, perhaps a parent who draws well can develop a series for the classroom.
- Pet Pair Cards involve children who like animals.
- Transportation Pair Cards help develop an interest in transportation: cars, trains, planes, boats, carts, spacecraft, and ships pictures.
- Food Pair Cards develop knowledge of vegetables, fruits, dairy products, and so forth.
- To introduce the idea of making sets of pair cards at home, use pictures of well-known sites in the country, city, or town.

Sources for Teacher-Made Materials

A wide variety of recycled or commonly found materials are available for teachers to use in developing sound educational activities for the classroom. Every teacher should keep a "wish list" of materials she wants to collect for particular activities and elicit the help of the children and families to collect these. The wish list can be posted on the family bulletin board or sent home by flyer or newsletter. The sources include:

- the natural environment—rocks, seeds, leaves, nuts, bark, sticks
- materials from home—containers of varying sizes, jars, plastic soda bottles, cans, food coloring, wood and metal scraps, toilet paper rolls, newspapers, Styrofoam trays, cardboard cartons, bottle caps, nails, screws, fabric, food boxes, packing materials, magazines, calendars, broken small appliances
- equipment from shops and businesses—pieces of carpet, insulated wire, wood scraps, sawdust, used computer paper, discarded small appliances

The materials should be organized, labeled, and stored so that they are readily accessible to teachers.

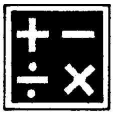
How to Use *Creating Child-Centered Materials for Math and Science*

Each illustrated activity begins with a purpose that explains the educational concept for the activity and then follows with a list of materials and directions, a description of how to use the activity, a home connection that gives tips for involving family members in either the preparation or use of the activity, and extensions that suggest ways to adapt and vary the activity.

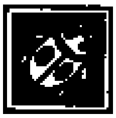
Accompanying the activity are illustrated symbols that indicate at a glance the intended age and the activity center that the activity is best suited for.

All activities in the book are designed for children between three and six years. These symbols indicate specific ages that the activity is appropriate for:

These symbols designate which activity center each activity is designed for:



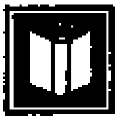
Mathematics/ Manipulatives



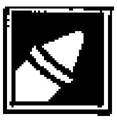
Science

Sand and Water

Dramatic Play



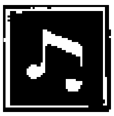
Literacy



Art

Outdoor Activities

Blocks



Music

The matrix that follows shows at a glance the activity centers for each of the activities.

The matrix identifies one or more activity centers for each activity. Yet an activity can have more comprehensive application in the areas of social and emotional development, art, language arts, science, mathematics, physical development, and social studies.

Although the activities in the book have been used by classroom teachers, it is always prudent for teachers to practice a new activity before trying it with the children. As teachers become more experienced using child-centered methods, they will grow increasingly more comfortable creating classroom materials suited to the needs of the individuals and the group. These materials are not intended to be patterns for children to copy. Instead, they should stimulate the imagination and creativity of the children who use them.

The activities in this book were developed by teachers and used effectively in classrooms throughout the world. They are intended to be a beginning point. Be creative and build a collection of materials and activities that are right for the children you teach and share them with other teachers.

Matrix

	art	blocks	dramatic play	literacy	math/ manipulatives	music	outdoor activities	sand & water	science	page number
Population Pockets					X					16
Bottle Caps to Date					X					18
Number Puzzles					X					20
Same and Different Quantities					X					22
Number Lotto					X					24
Number Book				X	X					26
Butterfly Counter					X					28
Geoboard					X					30
Shape and Number Envelopes					X					32
Shape Pair Cards					X					34
Color Dominoes					X					36
Shape and Dot Dominoes					X					38
Wooden Dominoes					X					40
The Fishing Pond			X		X				X	42
Classification by Attribute Cards					X					44
Piaget's Pennies					X					46
Geometric Puzzle	X				X					50
Fruit Graph				X	X					52
Survey Graph				X	X					54
Beginners' Tangrams					X					56
Intermediate Tangrams					X					62
Advanced Tangrams					X					66
Sewing Cards and Dressing Boards	X		X		X					70
Magnets: Yes or No					X				X	74

	art	blocks	dramatic play	literacy	math/ manipulatives	music	outdoor activities	sand & water	science	page number
Exploring Magnets					X				X	76
Sink/Float								X	X	78
Measuring Liquids					X			X	X	80
Soluble Substances								X	X	82
Experiment with Sponges					X			X	X	84
Exploring with Different Size and Shape Magnets					X				X	86
Water Drop Slide									X	88
Creating Variations of Colors	X								X	90
Fizz Surprise								X	X	92
Marble Shoot									X	94
Soap Suds								X	X	96
Bubble Blowing	X						X	X	X	100
Making and Using Sieves								X	X	102
Walnut Shell Boats								X	X	104
Ordination								X	X	106
Oil and Water								X	X	108
A Visit to the Post Office		X	X							112
Tin-Can Telephones			X	X						114
Binoculars			X				X		X	116
Shadow Play			X				X		X	118
Megaphones			X				X			120
The Money Box			X		X					122
Touch and Tell Mystery Box				X	X				X	126
Color Flip Book				X	X					128
Lotto Boards				X	X					130
Puppets	X		X	X						132

	art	blocks	dramatic play	literacy	math/ manipulatives	music	outdoor activities	sand & water	science	page number
The Important Box				X						134
A Book About Me				X						136
The Big Catch				X	X					140
Letter Cards				X						142
Seed Collage	X				X					146
Printmaking	X				X				X	148
Finger Painting	X								X	150
Patterns	X				X				X	152
See-Through Strips	X								X	154
Rubbings	X								X	156
Wax Resist	X								X	158
Box Weaving	X				X					160
Food Carton Mobiles	X				X				X	162
Making an Art Easel	X									164
Pressed Leaf Book				X			X		X	166
Outside Water Painting							X	X	X	170
Gardeners							X		X	172
Young Scientists				X			X		X	176
Adopt a Tree							X		X	178
Rivers and Bridges		X	X							182
The Hoist		X	X							184
Traffic Signs		X	X	X						186
Parking Garage		X	X							188
Discovering Equivalence		X								190
Inclined Planes		X			X		X		X	192
Sound Cans					X	X				196
Maracas	X					X				198
Kazoo	X					X				200
Wooden Harps						X			X	202
Box Banjo						X			X	204