Sources of Knowledge

**Physical Knowledge:**
Knowledge that has its source mainly in physical objects

**Logico-Mathematical Knowledge:**
Knowledge that has its source in the knower's head. It is the making of all kinds of relationships.

**Conventional Knowledge:**
Sets of rules, symbols, and facts agreed upon by society and gained through interactions with people.

Constructive Error

The teacher's response to an error depends on the source of knowledge involved in the error.

**Physical Knowledge:**
If the error can be corrected by the child through his/her own observations and actions, the teacher encourages the child to test the idea.

**Logico-Mathematical Knowledge:**
If the error depends on the child's deductive reasoning, the teacher explores and accepts the child's ideas and finds ways to inspire further thinking.

**Conventional Knowledge:**
The teacher provides the correction in a manner that does not feel punitive to the child. Positivity and kindness!
# Types of Knowledge Activities

What concepts, activities, opportunities, etc. do young children construct in each of the Sources of Knowledge Categories? List them in the boxes below.

<table>
<thead>
<tr>
<th>Sources of Knowledge</th>
<th>Concepts, activities, opportunities, etc.:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Knowledge</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Logico-Mathematical Knowledge</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Conventional Knowledge</strong></td>
<td></td>
</tr>
</tbody>
</table>
Constructing Physical Knowledge

Children construct physical knowledge by acting on objects, observing the effect of their actions, and reasoning about why these effects occur. In physical knowledge experiences children make and test their predictions about how physical objects act and react.

Sometimes children’s actions on an object is primary and the observation is secondary (e.g., activities involving pushing, pulling, rolling, dropping objects). At other times, the child’s observation is primary and the action is secondary (e.g., mixing paints or baking a cake).

Children who actively explore objects and observe reactions construct different understanding than do children who merely sit and swatch while others do the experimenting. For example, a young child who is told by an adult that blue and yellow make green does not know this fact in the same way as a child who has personally mixed these two colors over and over with the same results. Children need numerous opportunities to explore a variety of objects, as well as the freedom to choose what to do with those objects. Such opportunities play a vital role in a child’s construction of logico-mathematical knowledge too.

Rich physical knowledge learning experiences should allow children to:

- experiment and explore the physical properties of objects
- act directly on objects
- vary their actions and observe immediate results
- make theories about why things happen as the do and retest their theories

Physical knowledge activities should allow children opportunities to:

- Purposefully inspect objects to gather information (using sight, touch, taste, sound, smell; experimenting with balance scales; examining properties of solids/liquids; look at objects or organisms under a magnifying glass, microscope, binoculars; observe animals; and more).
- Produce and observe movements (redirecting the flow of water by building dams; toss a paper airplane; play Frisbee; roll balls or marbles or cars down a ramp).
- Compare reactions of different objects to the same actions (rolling various objects down an incline; experiment with objects that respond differently to a magnet; strike various objects with a drumstick or mallet to observe the various sounds; blow across various bottles with or without water, to notice the different sounds; move objects by blowing them with a straw; stack blocks of different sizes or shapes).
- Compare reactions of the same object to different actions (bounce, roll, hit, or throw a ball; blow a cotton ball across a table with or without a straw).
Teacher’s Role in Helping Children Construct Knowledge

1. Preparation

2. Supporting or extending children’s ideas

3. Encouraging peer interactions

4. What else?
Logico-Mathematical Knowledge

To promote logico-mathematical knowledge, activities should:

- correspond to the child’s natural way of thinking
- create a “need to know”
- promote the making of relationships
- reduce adult authority
- allow the child to be mentally and physically active
- involve exchanges and justification of points of view
- be select by children

A developmentally appropriate constructivist program requires a rich environment that promotes mathematical thinking by encouraging children to:

- form all kinds of relationships between items (classifying, comparing, contrasting, ordering) in contexts that are personally meaningful
- begin to develop a sense of number, time, and space
- relate new understanding to knowledge they have already constructed
- exchange points of view
- think in their own ways (rather than recite the “right” answer)

Games are a good way to support children as they develop logico-mathematical knowledge because they:

- promote problem solving
- develop critical-reasoning skills
- promote active construction of a number system
- allow immediate feedback from peers rather than adults
- promote autonomy and sociomoral development
- encourage intrinsic motivation
- assess the process rather than the product
- replace skill/drill/practice worksheets
- they are fun—and fun is meaningful to children

What other ways do you encourage children to think mathematically?
Teaching Strategies to Encourage Children’s Construction of Math Concepts

1. Store and label materials in a way that encourages children to compare attributes, sets, number, etc.

2. Provide ample materials for counting, sorting matching comparing, ordering, patterning, and seriating:

3. Provide opportunities and materials for children to organize data a time and to record or graph their comparison of materials.

4. Encourage and allow children to share the responsibility of distributing things. Have children problem solve procedures for distributing things.
5. As children solve problems, listen for their references to attributes, similarities, differences, and number. Ask questions, comment, and introduce mathematical vocabulary to extend their thinking. For example, ask:

6. Support children as they collect things by providing time to collect and record and discuss collections with them.

7. Extend children’s attempts to talk and write about numbers.

8. Allow their errors to become creative opportunities to refocus, incorporate mistakes into the activity, rearrange elements, and generate alternative ideas.

9. Because young children interpret time in terms of observable phenomena, encourage them to make observations, and ask questions to build their understanding of time. For example:

10. Make sure that children have access to literature that contains math concepts.
Mathematical Terms and Concepts

Rote Counting:

Tagging:

Synchronic Counting:

One-to-One Correspondence:

One-to-One Tagging:

Magnitude:

Cardinality:

Conservation:

Hierarchical Inclusion:

Subitizing: