Double ten-frame

Description and Instructional Intent

There are several purposes for the double ten-frame activity. One is to promote the use of thinking strategies: the +1 thinking strategy, the compensation thinking strategy, and the filling-up-the-tens thinking strategy. Another is to promote the development of number facts to 20 (not through memorization but) through number relationships. Therefore, it is essential that the chips in the two frames show up as distinct quantities. That is the reason for using chips of one color in one frame and chips of another color in the other frame. Doing so also facilitates communication by making it possible to ask about how many there are of each color. E.g. how many red apples? How many yellow apples? And we can ask about the total. How many apples?

A carefully selected **sequence of tasks** can promote the use of thinking strategies. For example, if we start with 6 (as 3,3) and 4 (as 2,2) as task 1, we can pose 6 (as 3,3) and 5 (as 3,2) as task 2. From one perspective we have just posed 6 + 4 followed by 6 + 5. However, because we are posing the tasks using the chips on the double-ten frame it is very likely that at least some children will notice that we have added one more chip so the total has to be one more than it was before. This is the beginning of using the +1 thinking strategy. Our ultimate goal is that children will eventually use it spontaneously when solving addition tasks posed in purely symbolic. For example, if we pose 6 + 7 in purely symbolic form and the child does not know that sum, but does know 6 + 6, he might think, "Since 6 + 6 is 12, 6 + 7 has to be 13 (one more than 12)." Our intention is to initiate this type of reasoning through using visual materials—the chips and the double ten-frame.

Likewise, we can pose tasks one after the other that can promote the use of the compensation thinking strategy. For example, if we pose 6 (as 3,3) and 5 (as 3,2) as task 1 and next pose 7 (as 4,3) and 4 (as 2,2) as task 2, both of these problems have the same sum, namely 11. The child might think, one chip was taken away from the 5 and one was added to the 6. (Other children think of one chip being moved from the 5 over to the 6, making it 7 and 4.) This is the reasoning involved in the compensation thinking strategy. Again, the chips help children begin to reason this way. It also helps students if we emphasize this reasoning and possibly use symbolic notation, such as writing the number sentences one below the other

6 + 5 = 11
7 + 4 = 11

pointing to them as we talk about how the numbers changed. (However, it is really productive to use the double ten frame many times initially without using any notating. You can decide when it seems appropriate to start notating. See the note to the teacher at the end of this section.)

The filling-up-the-tens thinking strategy is a bit different. Children use it when they take part of one quantity and put it with the other quantity to get 10. For example, if we show 7 in the first frame and 4 in the second frame and a child says, "I moved three chips from the four over to the 7 to fill up the frame and make 10—so I have 10 and then one more. It's 11." That child used the filling-up-the-tens strategy. In my experience it is useful for the teacher to actually move the chips the child referred to so that others can visualize how the ten was "filled up." This is the strategy where it is also useful (actually, very important) to use the inverted v notation and write

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7 + 4 = 11
  / \
 3   1
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10 + 1 = 11

Using this type of notation demonstrates to students how this type of reasoning might be recorded and gradually leads students to be able to reason in purely symbolic situations. (See note for the

teacher below.) The challenge for the teacher is to come up with these sequences of ten frame tasks. If you try to create a few of them, it will start making sense and you will find it gets easier to make them up.

Once the children start to give thinking strategy type solutions it is easier and easier to eliminate the unproductive counting solutions. Actually, in some cases, we simply have to interrupt the children and tell them that they are using a counting solution and that's not what we are trying to do now. (At the same time, we have to be sensitive to the fact that some children have no way except to count right now. And we have to let them do that else they can't participate at all. We can call on them when we pose simpler tasks, like 5,0, 5,0.)

Note for the teacher

Beginning to use notation and gradually increasing the sophistication of the notation is an integral part of the Structuring Numbers (Arithmetic Rack) Instructional Sequence. For this reason, you may choose to do little if any notating with the double-tens frame instructional activity, especially in first grade. In fact, using notation prematurely is counterproductive. In the patterning and partitioning instructional sequence the focus is on visual patterns and number relationships and not on symbolic notation.

Caveat

There is considerable overlap between the learning opportunities provided by the double ten-frame and activities in the Structuring Numbers instructional sequence that use the arithmetic rack. You may decide to omit the double ten-frame completely or use it only sparingly until after working with the Structuring Numbers sequence.