How to Use a MathRack

The following instructions on the use of the MathRack 20™ have been compiled by Angela G. Andrews. Angela is an expert on using MathRacks and can be contacted at auntymath@comcast.net for information on MathRack™ workshops.

MathRack 20

The MathRack 20 is a manipulative similar to an abacus but without place value columns. It is a powerful manipulative that can help children:

- Learn to see numbers as quantities that can be divided into various groups.
- Have the opportunity to break numbers into groups as a means of problem solving.
- Move from the act of counting numbers to the process of grouping numbers and organizing them in efficient ways. For example; if asked to solve the problem 8+3, by thinking 8+3 is the same as 8+2, which is 10+1, which is 11, instead of counting 3 from 8.
- Begin to see numbers as quantities rather than digits.
- Develop efficient thinking strategies that will give them flexibility, accuracy and automaticity.
- A MathRack 20™ is composed of 2 rods with ten beads on each rod. Each rod is composed of 5 red beads and 5 white beads. (The five structure offers visual support because the "anchor number" five can often be visualized as a whole and a child can soon quickly see that 7 is just 2 more than 5.)

The starting position for any work with the MathRack 20TM is with all of the beads to the child's right. The child works by pushing the beads to the left and reading the beads left to right. If this procedure is not followed, it is not as easy to visualize the "anchor number" 5.

Getting Started With The MathRack 20™
Privileging 5 and 10

Cover up the lower row of beads and work only with the top row. After establishing that there are 5 red beads and 5 white beads, say, "We're going to play a game with this MathRack™. I am going to show you some of the beads rather quickly and you have to tell me how many you see."
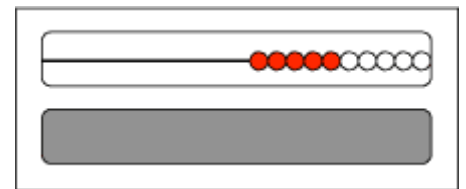
Push over 2 beads. "How many?" Push over 6 beads. "How many?" Push over 9 beads. "How many?" Listen for explanations that include subitizing (instant recognition of amount) and privileging (using a known amount to think about another amount).

One Push

The "one push" rule discourages counting from 1 and encourages subitizing five (instant recognition of amount without counting) and "privileging" the anchor number 5 and 10 (internalizing that 7 is 5 and 2 more and 9 is 1 away from 10). Teacher directs the children to show a specific number of beads on the MathRack™ in just one push. For instance, for 7, the child would have to push over 5 reds and 2 whites in one push, either on the top or bottom row.

Non-Counting Strategies for Addition
Level 1 Work

Teacher tells the children that they will see some beads quickly and they are to figure out how many beads there are altogether. When they see them they are to think about it, then quietly share their thinking with a learning partner, and then raise their hand when partners are ready to share with the class.
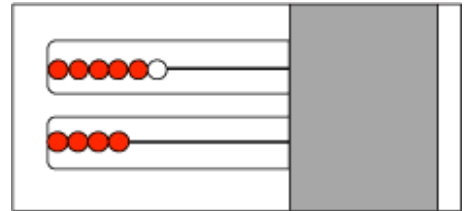
Teacher prepares MathRack 20™ and shows beads briefly to class then recovers in order to prevent counting strategies. "What did you see?" Responses might include:

- I saw 10 because I saw 5 reds and 1 white on the top, that was 6 so then I counted the 4 on the bottom. 7,8,9,10
- I saw 10. I saw 5 reds on the top and 4 on the bottom. I just moved the white down to the bottom in my mind to make 5 there, cause I know 5 and 5 make 10 so it's ten.
- I saw 4 and 4 was 8, then 9, 10, so it's 10 If it was 5 and 5 and 1 more it would be 11 but there was 1 missing on the bottom, so it's 10. Etc.

Level 2 Work

Once children have had experience with the previous types of posed problems, teacher will pose the following problem types, using only 1 row:

By now the children should know that the beads on the right are "out of play" and don't need to be covered. However they are very helpful thinking aids.

"How many do you see?"

Children should be able to answer 8 rather easily by now.

Say "I want you to do this one in your heads without me pushing over any beads on the second row. I want you to figure out what 8 beads and 4 more beads would add to. Think about it, then tell your partner and when you both agree, raise your hand to share your thinking with the class."

Typical answers might include:
- It would be 12 because only 2 more would make ten and then 2 more would make 12.
- I started at 8 and counted on 4 more and got to 12.

Level 3 Work

Once children can solve problems with only the first addend showing on the MathRack™, the teacher might bring the MathRack™ forward but keep it covered while posing problems such as: "What if there were 7 beads on the top row and 6 on the bottom row. How many would that be all together?"

Typical answers might include:

Well, that would be 5 reds and 2 whites on the top and 5 reds and 1 white on the bottom so it would be 10 reds and 3 whites or 13
Well, you would need 3 more on the top to make 10, so if you took 3 away from the 6, that would leave 3, so it's 13
7 and 7 are 14, so it would be 1 less. 13.
5 and 5 are 10, so its 11,12,13.
I thought 5 and 5 are 10, and 2 and 1 are 3, so it's 13.

Teacher should model, or have children model their strategies on the board. Remember, when working with the MathRack 20™ and addition, the sequence is

1. Show both rows.
2. Show one row and let students visualize the second row.
3. Show no rows and let them visualize both rows. This should evolve over a period of weeks.