

# Hands Off the Textbook: Hands On the Manipulatives

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Manipulatives are very important in Division II, but for some reason, they often magically disappear around the time students move from Division I to Division II. Teaching math with manipulatives in Division II is an exciting teaching opportunity. Though manipulatives may be time-consuming to prepare, the students are more attentive, eager to learn and achieve mastery of math concepts more quickly than when the traditional lecture/textbook approach is used. Manipulatives make math exciting and give the students opportunities to learn through discovery.

## Materials

Materials come in many varieties. You may use ready-made base-10 blocks. These are durable and well proportioned. Making base-10 materials is also possible. Even when ready-made materials are used, it is often helpful to make materials with the students. The process of making materials enhances the learning process. Beansticks are popular and fun to make. They are the most durable of the student-made materials. You may also wish to use popsicle sticks and elastics, beads on pipe cleaners or beans in medicine cups. Other materials that might come in handy are plastic muffin trays; dice made from wooden cubes; "place mats" marked "ones," "tens" and "hundreds"; "place mats" marked work area and storage area; and blackboard models of the base-10 materials you are using.

## Rules and Routines

It is important to establish routines when working with manipulatives because students often get excited

and noisy. Have them use the same routine in preparing and cleaning up materials. Individual sets of base-10 materials make this process easier. When introducing a new manipulative, give the students an opportunity to explore for a few minutes. They will be better able to concentrate on the task if their natural desire to explore has been satisfied. Have students define a work area and a storage area to help them organize their materials.

## Place Value

Have students make a large pile of "ones." Thirty-four should do. Walk around and question them about what they are making by asking them questions. Are you sure that's 34? Can you prove to me that your pile has 34? After a few similar activities, ask them if they could think of a way to organize their units to help them prove that they have the correct number of units. Students will quickly begin to group their units. Discuss the advantages of one type of grouping over another. They will discover that counting by "tens" is easiest.

At this point, students are ready to make base-10 materials. After they've been given the instructions, students should be able to work on their own. Walk around the classroom and ask questions. How many "tens" do you have? How much does that make all together? How many is this number? (Separate some "tens" and "ones.")

After the materials are prepared, the students will enjoy a game of "Race to 100." Students play the game in pairs. Between them, they have one die, 40 "ones" and 22 "tens." They take turns rolling the die and collecting the number of units indicated on the face of the die. When a student has enough

“ones” to make 10, he or she must trade them in for a 10-stick. If a student neglects to trade, the other student may take 1 unit from his or her partner. The first student to reach 100 is the winner. For a more challenging game, have the students race backward from 100. Once the students have grasped the concept of “ones” and “tens,” they are ready to do a similar activity with “hundreds.”

## Operations

The concepts of addition, subtraction and some parts of multiplication will be taught using a very similar method. Most of the concepts will be taught using the base-10 materials and the place mats. Other games and activities should accompany these teaching methods so that the concepts are reinforced.

Addition problems that do not require regrouping should be demonstrated first. Most students in Division II have the ability to do this operation, but many do not understand the actual concept behind it. The following activities will help your students gain an understanding of activities that they used to do by rote.

Have students place a number such as 23 on their “ones,” “tens” and “hundreds” place mat. Place the 2 10-sticks in the “tens” area and the 3 ones in the “ones” area. Then have the students place another number, such as 36, on their place mat and follow the same procedure. To determine the answer to  $23 + 36$  students need only count the number of “ones” and “tens” on their place mat. As the students work, the teacher records what is happening on the blackboard. Later, students can record the numbers for themselves.

Another activity that students enjoy involves using teacher-made cards of different colors. Decide what color will represent “ones,” “tens,” “hundreds” and so on. For example, pink might represent “ones”; green might represent “tens”; and blue might represent “hundreds.” Number cards of each color from 1 to 9. Keeping colors separate, shuffle each pile, and place it at the top of the appropriate section on the place mat. Have the students flip one card in each pile and then make the number indicated on the cards with base-10 materials. One student may write the numbers as the other student makes it. Students then flip another card in each pile and make that number. The student then adds the two numbers together.

## Subtraction

Teaching subtraction is similar to teaching addition. Once the students need to regroup numbers they will see how important it is for them to begin by counting the “ones” first. They will realize that when there are not enough units to subtract they have to trade 1 10-stick in for 10 “ones.” Using the term “trade” instead of “borrow” is preferable because students understand the notion of trading a dollar for 10 dimes. Trading means that when you give something you get something of equal value in return. Borrowing implies that it must be returned, and this does not happen in subtraction.

## Multiplication

Multiplication may also be taught with the place mats. An alternative method is to use plastic muffin trays or something else that keeps units separate. Students begin by putting equal numbers of units in each cup. Then, they count the total number of units. This activity helps students understand the concept of “repeated addition” and reinforces basic mathematic facts.

For the multiplication algorithm, students place 14 units in each of 3 muffin cups. Ask students how they should begin. They will know that  $4 \times 3 = 12$ , and will therefore know how many “ones” there are. Students then exchange 10 “ones” for 1 10-stick and place it NEXT TO their muffin tray. Next, they multiply the 10-sticks,  $1 \times 3$ , and ADD the extra 10-stick. Again, the teacher records the students’ work. This process works for any number no matter how large.

## Division

The technique for division is very similar to the technique used for multiplication. Students make a number on their work area. Then they divide or “deal” these into the number of muffin cups that will be used. Begin with a number such as 55. Tell the students that they are to divide it by 4, and that they should begin with 10-sticks. Students will put 1 10-stick in each of 4 muffin cups. They will have 1 10-stick left over. Ask students what they should do with this 10-stick. They know that they should trade it in for 10 “ones.” Then they can add this to the 5 “ones,” and divide them among the 4 muffin cups.

Have students turn their notebooks sideways when working on division problems. The lines will help keep the problem lined up. Once students begin

working with double and triple digit divisors, have them write the rounded off number in brackets underneath the actual divisor.

## Conclusion

There are many other mathematical concepts that can be taught using manipulatives. For instance, decimals could be taught using the same activities

and concepts. Students who have worked with manipulatives in learning place value and operations will have no trouble learning decimals.

Be brave and experiment. Students enjoy all hands-on activities. You will be surprised how successful you feel when students are smiling and happy during math class. Look at your students, and you will know that it is time for hands off the textbooks, hands on the manipulatives.

National Council of Teachers of Mathematics



## Proclamation

*Whereas*, mathematical literacy is essential for citizens to function effectively in society; and,

*Whereas*, mathematics is used every day—both in the home and in the workplace; and,

*Whereas*, the language and processes of mathematics are basic to all other disciplines; and,

*Whereas*, our expanding technologically based society demands increased awareness and competence in mathematics; and,

*Whereas*, school curricula in mathematics provide the foundation for meeting the above needs;

*Now, therefore*, I, Shirley M. Frye, President of the National Council of Teachers of Mathematics, do hereby proclaim the month of April 1990 as

## Mathematics Education Month

To be observed in schools and communities in recognizing the increased importance of mathematics in our lives.

*In witness thereof*, I have hereunto set my hand and caused the corporate seal of the National Council of Teachers of Mathematics to be affixed on this 1st day of September 1989.



*Shirley M. Frye*

President