Teaching Mathematics to Non-sequential Learners

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In our case files, we have dozens of children who show superior grasp of mathematical relations, but inferior abilities in mathematical computation. These children consistently see themselves as poor in mathematics and most hate math. This situation is terribly unfortunate, since their visual-spatial abilities and talent in mathematical analysis would indicate that they are "born mathematicians."

Visual-spatial abilities are the domain of the right hemisphere; sequential abilities are the in the domain of the left hemisphere. The test performance patterns demonstrated by this group of children seem to indicate unusual strengths in the right-hemispheric tasks, and less facility with left-hemispheric tasks. In order to teach them, it is necessary to access their right hemispheres. This can be done through humor, use of meaningful material, discovery learning, whole/part learning, rhythm, music, high levels of challenge, emotion, interest, hands-on experiences, fantasy, and visual presentations.

Sequentially-impaired children cannot learn through rote memorization, particularly series of numbers, such as math facts. Since the right hemisphere cannot process series of nonmeaningful symbols, it appears that these spatially-oriented children must picture things in their minds before they can reproduce them For example, in taking timed tests, they first have to see the numbers before they can do the computation. This material apparently gets transmitted to the left hemisphere so that the child can respond. This takes twice as long for them as it does for children who do not have impaired sequential functioning; therefore, such tests appear cruelly unfair to them.

I have found that disabled learners can learn their multiplication facts in two weeks if they are taught within the context of the entire number system. I have them complete a blank multiplication chart as fast as they can, finding as many shortcuts as possible. That may take some assistance, but it enables them to see the whole picture first, before we break it down into parts. I ask them to look for shortcuts to enhance their ability to see patterns. After it is completed, we look mournfully at the table and bemoan the fact that there are over one hundred multiplication facts to memorize. Then I ask how we cut down the number of items to learn.

First, we eliminate the rows of zeros, since anything times 0 equals 0. Then we eliminate the rows of 1s, since anything times 1 equals itself. Then, we do the tens and the child happily announces that these are easy, since you just put a zero after the multiplier. By this time, the student usually notices that there are three rows of zeros, ones, and tens, and that one half of the chart is a mirror image of the other half. When we fold it on the diagonal, that becomes even clearer. I ask how this happens and the child discovers the commutative principle: that a x b = b x a. This certainly cuts down on the task of memorization considerably! If one knows 4 x 6 = 24, one also knows that 6 x 4 = 24.

At this point, I ask if the child knows his 2s and most children have no difficulty counting by twos. We try counting by twos, then multiplying by two. We do the same with the 5s. If the student has trouble remembering a multiplication fact in the fives table, I have him count by fives on his fingers until he reaches the right multiple. Then I teach the child to count by 3s. This usually takes ten minutes. I may go back and test on multiples of 0, 1, 2, 3, 5, and 10 before going on.

Next, I teach one of several shortcuts for multiplying 9s. The easiest one I know is to subtract one from the number of nines being multiplied, then find a number which, when added to the first number, results in the sum of nine. For example, in 8 x 9, the following process would occur: subtract 1 from 8, leaving 7. What plus 7 equals 9? (2). The answer is 72, since 7 is one less than 8, and 7 plus 2 add up to 9.

We have now reduced 121 facts to 10: 4 x 4, 4 x 6, 4 x 7, 4 x 8, 6 x 6, 6 x 7, 6 x 8, 7 x 7, 7 x 8, and 8 x 8. I try to teach them all of the doubles at one time, from 2 x 2 to 9 x 9. Doubles seem to be easier than some of the others. There is a natural rhythm to the doubles. Since rhythm stimulates the right hemisphere, rhythmic patterns should be emphasized. Sixes can be taught as doubles of threes and 7 x 8 = 56 can be remembered as 5 6 7 8 (56 = 7 x 8). Also, you can drive a 4 x 4 when you are 16. These tricks reduce the number of difficult math facts to only a few – usually six or less. I ask the child to make up a real problem for each of these math facts, using real or fantasy situations. I also ask the student to draw a picture for each problem. We do one problem a night for six nights. These methods bring the facts to life, enabling the student to visualize them and create meaningful associations for them.

If mathematical calculations continue to pose a major block for the child, manipulatives, fingers and calculators should be encouraged. The child should also be informed that mathematics is more than calculation. A child who cannot learn his multiplication may be brilliant at geometry, which is non-sequential. Algebra and chemistry are highly sequential but geometry and physics are spatial. Children with right-hemispheric strengths should be introduced to geometric and scientific principles at the same time that they are struggling with calculation so that they do not come to see themselves as mathematically incapable. In a world of calculators and computers, the computational wizard is all-but-obsolete.

Division is usually quite difficult for these children, since it is usually in a step-by-step fashion, and these students are lost after the second step. They are not step-by-step learners. They would learn much more rapidly if they were simply given a divisor, a dividend and a quotient, and asked to figure out their own method of arriving at the quotient. *Don't ask them to show their steps.* Just give them another problem with the solution already worked out and see if their system works. Gradually increase the difficulty of the problems to test their system. This way of teaching is a lot like the methods used in video games. Even in adult life, these individuals will do beautifully if they know the goal of an activity, and are allowed the freedom to find their own methods of getting there.

For many non-sequential learners, reading can best be taught by means of sight words, configuration, context clues, and other methods that do not involve phonics. Spelling can be taught by having the children look at the words, then visualize them before writing them. Words that follow specific rules will be easier for them to learn than exceptions to the rules, which must be memorized. Timed tests should be avoided, since learning and response time are likely to be slowed down through the circuitous mental process of one hemisphere accessing the other. *Timed activities should only be used if children are competing with themselves rather than others.* Written assignments may need to be modified, since writing is a highly sequential activity. It is recommended that these children be taught to type on a computer keyboard as early as possible and have access to word processing equipment. Note-taking may be so laborious that they give up in despair. In such cases, the students should be allowed to bring tape recorders to class. The importance of adaptive educational methods cannot be overemphasized. With this type of assistance, non-sequential learners can blossom and become highly successful.

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