Hanlonmath Newsletter

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A newsletter for math teachers and administrators
who work with struggling students

Common Sense Strategies that Work!

The Many Benefits of Linking Concepts & Skills

As math is being taught, our most effective teachers remain cognizant of the fact that the concepts and skills they teach will be used later as building blocks to introduce more abstract concepts. Middle-school teachers use concepts, skills, formulas and algorithms taught in elementary school, and high-school teachers continue to build on student knowledge gained in middle school. This process is referred to as "linkage" (connections), the introduction of new material through the use of skills and concepts that have previously been taught.

Therefore, as lessons are presented, teachers link the new material to previously learned concepts, skills, or outside experiences. By introducing concepts by linking, teachers enable students to place new ideas into a context of past learning. Students are introduced to new or more abstract concepts using familiar language, thereby making them more comfortable in their knowledge, understanding and application of mathematics. Teachers also have an opportunity to review and reinforce previously learned topics they often identify as deficiencies and reasons why they are not successful teaching their assigned curriculum. Teachers can then compare and contrast that information, and students see the idea used in a different context. Research suggests all the aforementioned leads to increased student achievement. Simply put, students are then more likely to understand and therefore absorb new material when these linkages are being used.

The importance of linking concepts and skills to previously learned math and outside experiences cannot be overstated. Many of our best students probably don't realize the equation of a circle, the distance formula, Pythagorean Theorem, and trig identity $\cos^2 x + \sin^2 x = 1$ are all the same formula, just written differently because they are being used in different contexts. By not introducing these concepts through linkages, teachers lose valuable instructional time because new concepts are taught as brand new

and isolated topics and students don't see or understand the beauty behind mathematics.

Rather than just having students "flip & multiply" when dividing fractions, the division algorithm might be developed through repeated subtraction – just as was done in fourth grade with division of whole numbers. Solving equations should be linked to the Order of Operations. The standard multiplication algorithm that is taught in fourth grade is the same algorithm that is used in algebra to multiply polynomials. Invariably, student memory, over time, will diminish. It is my belief that is not a question of **"if"** students will forget information; it's a matter of **"when"** they will forget it. An understanding of where theorems, formulas and algorithms (short cuts) originated will enable students to reconstruct concepts and solve problems over time.

Where possible, linkages should also be made to student experiences in "real life." as well as between concepts within the course. Buying candy at a store can be linked to such mathematical concepts as ratios, proportions, slopes, ordered pairs, graphing, and functions. Students quickly see that if one candy bar costs fifty cents, then two will cost a dollar. The link is readily translated to the math they learn in the classroom. As a proportion, 1 candy bar is to $.50 **as** 2 candy bars is to $1.00; or written as ordered pairs, (1, .50), (2, 1.00). Linking ideas makes math more relevant and it is very important for students trying to learn the language or students coming from poverty – by reviewing and reinforcing previously learned concepts and skills in a non-threatening manner.

The idea of slope is used quite often in our lives. However outside of school it goes by different names. People involved in home construction might talk about the *pitch* of a roof. If you were riding in your car, you might have seen a sign on the road indicating a *grade* of 6% up or down a hill or reading a graph and identifying a *trend* line - all of those cases refer to what we call *slope* in mathematics.

Kids use slope on a regular basis without realizing it. Let's look at an example, a student buys a cold drink for $0.50, if two cold drinks were purchased, the student would have to pay $1.00.

Now if I asked the student, how much more was charged for each additional cold drink, hopefully the student would answer $0.50. So the difference in cost from one cold drink to adding another is $0.50. The cost would *change* by $0.50 for each additional cold drink. The *change* in price for each

additional cold drink is $0.50. Another way to say that is the *rate of change* is $.50. In math, we call the rate of change—slope.

In math, the rate of change is called the slope and is often described by the ratio $\frac{rise}{run}$.

I could describe that same situation mathematically by using ordered pairs: (1, $0.50), (2, $1.00), (3, $1.50), and so on. The first element in the ordered pair represents the number of cold drinks, the second number represents the cost of those drinks. Easy enough, don't you think?

Let me leave you with three points. 1. Making linkages to prior learning and experiences matter when trying to increase student comfort, understanding and achievement, 2. Making these linkages allows us to review and reinforce concepts and skills and address student deficiencies 3. Making these linkages is not something else or new to do, we have advocated making these linkages/connections for a very long time.

Bill Hanlon, former Director of the Southern Nevada Regional Professional Development Program, is a noted speaker, an author, educator, consultant and coach for schools, and is a national presenter for organizations such as AASA, ASCD, ALAS, NMSA, NASSP, NSBA, and NCTM.

He was the coordinator of Clark County School District's Math/Science Institute and was also responsible for K-12 math audits. He served as vice president of the Nevada State Board of Education, Regional Director of the National Association of State Boards of Education (NASBE) and as a member of the National Council for Accreditation of Teacher Education (NCATE) States Partnership Board. He also hosted a television series, "Algebra, *you can do it!"* on PBS Las Vegas.