

“5+1”
**Turning Struggling Students
of Math into
Successful Students**

**A GUIDE
FOR
PRINCIPALS
AND
TEACHERS**

Not only is what students are being taught important but, how they are taught and tested on those concepts and skills is just as important. This book addresses very effective teaching strategies for learning mathematics. The author’s knowledge of mathematics combined with his knowledge and insight of working with students of poverty results in recommendations that result in increased student achievement.

BILL HANLON

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Bill Hanlon, Director of the Southern Nevada Regional Professional Development Program, has been an educator for over thirty-five years. His educational experiences include teaching at the junior high, senior high, and college levels. He was the coordinator of Clark County School District's Math/Science Institute and was 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. Bill was also a member of Nevada's standards writing team in mathematics, and served on the Learning First Alliance Review Team of the NCTM's standards. He hosted a television series, "*Algebra, you can do it!*" and taught mathematics at the University of Nevada, Las Vegas, to prospective K-12 classroom teachers.

Bill's knowledge of mathematics combined with his knowledge and insight of working with students living in poverty brings uniqueness to his style of professional development. Based on the foundation that students should feel comfortable in their knowledge, understanding, and application of mathematics, Bill provides professional development for teachers that will assist them in helping all students succeed in math.

Bill has published three books, *Math, your students can do it!*, *Algebra, you can do it!* and *Accelerating Mathematics Achievement*. He has presented at numerous local and national conferences including the Standards & Assessment, National Council of Teachers' of Mathematics, National Association Secondary School Principals, National Association of School Boards as well as providing services to local school districts.

To learn more about professional development opportunities, visit or call www.hanlonmath.com, 1.800.218.5482 or email at bill@hanlonmath.com.

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Preface

Kids only get one chance at receiving a good education, we owe it to them to make sure we are doing everything possible to ensure they receive it. The content teachers teach clearly impacts student achievement, but as importantly, so does how that content is taught. We clearly know *what works is work*, but working smart will increase the success rate of our students. We need to keep in mind, the only time *success* comes before *work* is in the dictionary – there are no silver bullets.

Math is more than just a body of knowledge; it is a way of thinking that affects the way we live. Students can't be critical thinkers, problem solvers, if they do not have a body of knowledge to draw from. Too many of today's math students are not mastering or connecting concepts and skills they are being taught. Students should be taught how math is linked; how the Pythagorean Theorem, distance formula, equation of a circle, or the trig identity, $\cos^2x + \sin^2x = 1$ are all the same formula – just written differently because they are being used in different contexts.

By introducing concepts & skills in familiar language by linking those concepts and skills to previously learned math and outside experiences, we have the opportunity to make students more comfortable in their knowledge, understanding and application of mathematics. To create interest and enthusiasm in mathematics, students should know the math they are learning is used outside the classroom. Besides finding the vertex, focus and directrix of a parabola, students should realize that paraboloids are used in making headlights, flashlights, satellite dishes and amphitheatres. That changing the tire size (circumference) of a car also changes the speedometer and odometer reading. Yes, we use the math we learn in the classroom everyday.

A basic axiom of math; *the more math you know, the easier math is*. All too often, students who face the most difficulty in math are the ones who don't realize there might be a better way to compute, solve or graph an equation than the method they are employing. The secret to success in math is having that body of knowledge that is committed to memory, then making decisions based upon the problem presented. As an example, if I asked students who typically experience difficulty in math to compute $4 \times 13 \times 25$, many of them would take out a pencil and paper and begin multiplying 13×4 , then multiply that result by 25. That takes time. Students who were taught math correctly would have examined the problem for a few seconds and realized that they could use the associative and commutative properties, in their head, and multiplied 4×25 , mentally, then multiplied that by 13 getting a result mentally of 1300 in seconds.

For instance, if I was asked to add fractions, the first thing I would do is find a common denominator. I typically use one of four methods to find a common denominator. If the denominators were relatively prime, I would probably multiply them. If the numbers were familiar to me and a little larger, I might write multiples to find the common

denominator. A third method, I very rarely use, is to find the least common multiple by writing the denominators as a product of primes using a factor tree. And a fourth method I would use if the numbers were larger and I didn't know the multiples mentally would be the reducing method. The point I want to make is I can make the computation easier by choosing the most appropriate method of finding a denominator based upon the denominators presented in the problem. Students who experience difficulty, who struggle, would probably know only one method – multiplying the denominators.

Good students know that math can be made very easy by having a body of information that allows them to make decisions/choices that makes their work easier. Students solving systems of equations know they have choices; graphing, substitution, linear combination or by matrices. Successful students look at those problems, then make a decision based on the coefficients. The same decision-making process occurs all throughout mathematics. Students can solve quadratic equations using the Zero Product Property, Completing the Square or the Quadratic Formula. Again, the most successful students use the easiest method based upon taking a few seconds to examine the coefficients.

Too many of our students simply don't experience success in mathematics, they struggle in math almost every year and can't wait until they don't have to take another math class. They don't see how the math they learn today is connected to the math they learned last year or how it will be connected to the math that will be taught next year. They believe the math taught in the classrooms today has no connection to how they live life. The recommendations in this book directly address the needs of struggling students in math, students who have not experienced success in math, students earning grades of D and F, and those that see little connection to life outside of school. This book will answer the fundamental question that should be asked of all teachers and administrators: What are *you* doing to help my child learn math?

There are no shortcuts to increasing student achievement. The underlying belief is ***what works is work***. Increasing student achievement does not just happen. Classroom teachers and administrators must work to achieve their goals. That work should be reflected in the teacher's disposition, content knowledge, preparation, instructional and assessment practices, and how well they work with their students. If instruction is to improve, supervisors must give specific feedback to classroom teachers. The goal of the recommendations embodied in the "5+1" is to make students more comfortable in their knowledge, understanding and application of math by helping them organize their learning so preparation/instruction, student notes, homework assignments, test preparation and assessments are all connected and focused on student expectations so they can study more effectively and efficiently.

Increase student performance by implementing these highly effective and common sense instructional and assessment strategies today.

Chapter 1

Preparation Matters

If you want to improve instruction, you must improve teacher preparation and planning. Teachers should know what they expect their students to know, recognize and be able to do based on the common core standards, state standards, school district curriculum documents, high stakes tests and mathematical content before instruction begins. They should also know how they are going to monitor their students' learning during a unit and how they will assess it after the completion of the unit so student grades not only reflect their knowledge, but are both fair and portable.

To accomplish that, preparation and planning are keys to the success of teachers and their students. Teachers should be expected to construct a specification sheet, assessment blueprint, and practice test before instruction begins to ensure they are focused on helping students succeed. Creating a practice test before instruction begins requires the teacher to prepare the unit, timeframes to teach the unit, identify areas where students traditionally experience difficulty and identify resources and strategies to overcome those obstacles.

We have all heard expressions describing the importance of preparation like, *Today's Preparation Determines Tomorrow's Achievements*. To paraphrase the former Dallas Cowboy coach Tom Landry on preparation: The only thing more important than the willingness to succeed and win is the willingness to *prepare* to succeed and win.

Construction of a practice test for a unit that contains items from the common core standards, state standards, school district curriculum, the math content in the unit, CRTs, NAEP, graduation tests, and college entrance exams such as the ACT and SAT suggest the teacher is prepared and will be better able to prepare their students for any test they must face.

Not only should teachers be well prepared, administrators must re-examine how they supervise and evaluate instruction. As I said in the preface, I believe if a school administrator is observing classroom instruction and can't follow the day's lesson, then they should be questioning why the 13, 15, or 17 year old student sitting beside them in that classroom should be understanding the lesson since it is their very first time the concept or skill is being presented to them. I am not suggesting that principals should be able to teach the lesson or even know if something is being taught incorrectly, what I am suggesting is that school administrators should be able to follow the lesson and it should make sense to them. If they can not follow the lesson, then some questions need to be asked of the teacher during the post observation conference about what they can do to more fully and appropriately develop the concepts or skills so students are more comfortable in their knowledge and understanding resulting in increased student achievement. That means better preparation and planning.

One very effective way to improve student performance is to close out a unit by taking a couple of class periods to review what the students have learned by grouping key concepts in ways that makes it easier for students to remember – usually that means that the teacher compares and contrasts what was learned so the kids see the big idea in a simpler context.

Many students find success in learning topics on a daily basis, then perform poorly on a unit test. The reason, they don't see or understand how problems are similar and different. In first year algebra for instance, students are typically taught five methods of factoring. As each is introduced, they get it. But when the test is administered, the results don't reflect their knowledge. The reason, while they students knew that $x^2 + 7x + 12$ and $6x^2 + 7x + 2$ were both trinomials – they looked the same, they didn't realize the method of factoring would be different, determined by the leading coefficient.

Another concern is an accepted fact by math teachers, that is, math is a language. Students must be taught vocabulary so they understand the questions being asked of them. They must also realize the same question can be asked in different ways.

The simple fact is proper preparation by the teachers prevents poor performance by their students. As professionals, teachers need to realize where students might encounter difficulties and address those before they experience them.

Backward Assessment Model Professional Development & Planning Through Sharing

Let's first look at a structure that will support teacher preparation and planning, ongoing professional development and changes in instructional practices that will result in increased student achievement.

Educational research strongly suggests that professional interaction—at times informal and unstructured—is often far more influential than formally organized professional development, and is more likely to result in changed behavior on the part of the educator.

The *Backward Assessment Model (BAM)* changes the way professional development is delivered. Rather than having an outside expert tell teachers what needs to be done, the assessment model uses the expertise of the school's staff. Research suggests professional development should primarily be on-site, on-going, and regularly scheduled. Professional development should be provided by the people who know best, classroom teachers as active participants, and should focus on the discipline teachers teach, in both content and pedagogy. The *BAM* places the professional development emphasis on *academic standards, assessment, and best practices*.

***BAM* is a communication model.** Its strongest attribute is that it provides teachers an opportunity to share their **knowledge, understanding, skills, experiences, resources, and instructional strategies** with each other. Experienced teachers generally know where students traditionally experience difficulty and communicate this to less