

# Student-Teacher Relationships

Research suggests that students will work for teachers for no other reason than loyalty. As the professional, educators need to take advantage of that knowledge and talk to their kids. Teachers also need to watch how they talk to them. They need to be positive. Rather than saying things like “If you don’t do your homework, you will fail”, they need to say, “If you do your homework, you will be successful.”

Remember, treat your students the same way you want your own sons and daughters treated by another teacher. So talk to the kids; while you are not their friend, you can be friendly. Talk to them about sports, their social life, the dance, game, or weekend. Form a bond that suggests to the students if they stopped coming to school, someone would miss them – that you care about them.

Bottom line, teachers need to reinforce to their students that accomplishment is more dependent upon hard work and self-discipline than on innate ability. School administrators also need to be told the same thing; adoption of the latest new program will not lead to success, *work does*. In fact, the only place *success* comes before *work* is in the dictionary

Build trust with your students. Make sure they know you are there for them. Grading papers is not about taking points away from students. It should be about finding out how much they learned and helping them become more successful. Don’t get caught up in arguing about points deducted in a test. If a student deserves the points, give them.

# Success on Success

If you are really interested in your students succeeding, then you should *build success on success*. Use the first unit of the year as the unit to shape beliefs, teach students to study effectively and efficiently, as well as teach mathematics.

To *build success on success*, students must first experience success. So, over-teach the first unit, the students over-learn it, all the while teaching them what kind of learners they are, visual, auditory, kinesthetic. Discuss their concentration times, how to take notes, how to study effectively and efficiently. Provide examples of how you remembered important information, allow time at the end of the class for note reviewing, ensuring they have the information they need to successfully complete their homework or prepare for a test.

My belief is that I can successfully teach math to anyone willing to learn. If I can get the students to be successful on the first test and I can show them that success was based on what they did to prepare – not just being smart, I will be on my way to a great school year. Preparing them to learn will help them succeed and make you feel better about your students' accomplishments

If you hear yourself or others talking about “those” students, not *my* or *our* students, then chances are you are not taking ownership in their success. There is a disconnect, a disassociation that acts as a disclaimer to your part in your students' learning.

# Vocabulary & Notation

A certain amount of thoroughness, precision, and formality is required in mathematics and specifically in terms of notation and vocabulary; these are the building blocks of concepts and therefore their correct use is vital. So while initially introducing new concepts in familiar language should be encouraged, by the end of the lesson, more formal language should be used to describe the mathematics.

Mathematics notation is a system of shorthand for the language of mathematics. This notation utilizes symbols to denote quantities, relationships, and operations and has evolved over time to enable us to show the manipulation of data and ideas. Notation enables us to designate mathematical concepts and processes with precision and clarity.

According to the research, there is no more single important factor that affects student achievement than vocabulary and notation. All too often student difficulty in mathematics is a direct result of a lack of understanding of the vocabulary and notation. For example, when algebra students are asked to find the degree of a monomial,  $5x^2y^3z^4$ , many are unable to do so. To find the degree of a monomial, you merely add the exponents. The answer is 9. It is not that the mathematical concept is difficult, but rather students do not understand what the question is asking. Therefore, the precise use of vocabulary and notation is essential.

Knowing and understanding vocabulary and notation require teacher modeling; students seeing it, saying it, reading it and writing it. There is, and should be, an expectation that students can understand, read, and write mathematics. Students in elementary school should be able to read 16.023 as sixteen and twenty-three thousandths – not sixteen point zero, two three. Similarly, secondary school students should be able to read  ${}_nP_r$  as a permutation of  $n$  things being taken  $r$  at a time – not as “ $npr$ ”.

Clearly, this falls under the category of language acquisition. Students not acquiring the vocabulary and notation will have great difficulty on high stakes tests. And teachers need to remember, this is not just a problem for non-English speakers, it's a problem for all students.

# Simple Straight Forward Examples

Nothing ruins a good lesson like a bad example. Teachers must take great care in choosing examples. Teachers need to be careful and pick simple, straightforward examples that clarify what they are teaching that don't bog kids down in arithmetic.

Too many teachers think of examples as they are teaching, without much forethought, and wind up picking a variation of the concept or skill which results in confusion for the students. Before variations are discussed, it helps student understanding to first understand the big idea being discussed. Building student confidence and building *success on success* goes a long way to increasing student achievement. Introducing variations of the problems before student understanding is complete often distracts them from learning the objective of the day. Use simple straight forward examples that clarify what is being taught is referred to as "comprehensible input" in the world of teachers working with students whose second language is English.

# CONCEPT DEVELOPMENT

Remember, it's not a matter of if students are going to forget information they have learned, it's a matter of when they will forget it. Without concept development, students will not be able to reconstruct knowledge lost over time.

In mathematics classrooms that lack sufficient concept development, memorization of rules and algorithms is emphasized but little or no attempt is made to help students understand the "why" of mathematics processes. Concept development should be as important as memorizing basic facts and algorithms. Students understanding of, and comfort level with, new ideas is increased when concept development is done properly.

Sometimes students are able to "get the right answer" even though they don't necessarily understand the "why." Mathematics then becomes an arbitrary set of isolated rules which can often lead to future pitfalls. As mathematics becomes more abstract, "math anxiety" may develop if these rules and algorithms have not been developed with an understanding of why they work. Eventually, students can become frustrated and quit taking math, even though the grade they earned in their last class was average or above.

Developing concepts and linking those ideas to students prior experiences helps to explain the "why" and makes students more comfortable in their knowledge and understanding of mathematics. For example, rather than just having students "flip and multiply" when dividing fractions, the division algorithm might be developed through use of repeated subtraction. Solving equations should be connected to the "Order of Operations." Finding the sum of the interior angles of a triangle might be introduced by having students cut out angles in triangles and piece them together. The Pythagorean Theorem might be explained by using the areas of the squares formed by the sides.

Unfortunately, students all too often "tune out" teachers during concepts development. Since students value what teachers test, concept development must be tested. Students might write a brief explanation of the development of a particular concept as a part of the homework assignment, and then be asked an open-ended question on a test where they must explain the origin of a rule or algorithm.

# LINKAGE

As teachers teach mathematics, they should 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 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 should link the new material to previously learned concepts or outside experiences. By introducing concepts through the utilization of linkages, 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 not being threatened. Teachers, on the other hand, have an opportunity to *review and reinforce* previously learned topics, topics and skills 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 linkage is being used.

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

# **BALANCE**

**Balance in mathematics has been defined as:**

**Vocabulary & Notation  
Concept Development & Linkage  
Memorization of Important Facts & Procedures  
Applications  
Appropriate Use of Technology**

**Balance should be reflected in assessments and in the delivery of instruction.**

# Memorization

Memorizing can help students absorb and retain information on which understanding and critical thought are based. The more sophisticated mental operations of analysis, synthesis, and evaluation are impossible without rapid and accurate recall of bodies of specific knowledge.

"Mnemonics are based on the principle that the brain is a pattern-seeking device, always looking for associations between the information it is receiving and what is already stored. If the brain can find no link or association, it is highly unlikely that the information will be stored in long-term memory. Unfortunately, this scenario is relatively commonplace in the classroom"

The brain has trouble storing information that it cannot associate to a picture such as letters and numbers. Mnemonics create rhyming links or associations that give the brain an organizational framework on which to hook new information. In certain circumstances, teachers use mnemonics because they were taught them while they were in school. Many middle school students are introduced to the phrase- Please Excuse My Dear Aunt Sally as a way of remembering the Order of Operations. SOHCAHTOA is familiar to many trig students learning the trigonometric ratios.

Helping students remember is essential, helping them remember over time is important if we are to build credibility in the public education system. As students are first being introduced to definitions, concepts, and skills, their likeness causes them confusion. For instance, if we look at the definitions of complementary angles and supplementary angles, we see how this might occur. Complementary angles are defined as two angles whose sum is  $90^\circ$ . Supplementary angles are two angles whose sum is  $180^\circ$ . The definitions are similar and students might mix them up. A teacher might suggest the "c" in complementary might be associated with a corner because it also begins with a "c", hence  $- 90^\circ$ . Likewise, the "s" in supplementary might be associated with the "s" in a straight angle thereby associating that with  $180^\circ$ .

# Basic Facts & Procedures

Mastery of basic facts is an essential part of learning mathematics. When students encounter mathematics concepts they need instant recall of basic facts. Stopping to remember these facts interrupts the flow of thought, which negatively impacts learning. What constitutes “basic knowledge” depends upon the grade level. Basic facts in elementary school might be arithmetic facts. In middle school, they might be expanded to include the conversions between fractions, decimals, and percents, or the algorithm for adding fractions. In high school, basic facts may also include the Quadratic Formula, the Pythagorean Theorem, knowing what the graph of a 2<sup>nd</sup> degree polynomial equation looks like or algorithms for solving linear equations.

Since student deficiencies are evident at all levels, teachers should regularly revisit basic facts. Many higher-level thinking processes required for success in high school mathematics courses demand immediate recall of basic facts. The demands of teaching dense curricula and addressing student deficiencies may, at times, overwhelm the teacher. However, if carefully analyzed and incorporated into lesson plans, deficiencies can be addressed successfully.

The use of algorithms – which are systematic, step-by-step procedures used in computation or problem solving – helps to address the difficulty students often have sequencing complex mathematics problems. The National Council of Teachers of Mathematics’ (NCTM) *Curriculum and Evaluation Standards* recommends that students use algorithms to compute and solve problems. However, algorithms should not stand alone and usually need to be preceded by concept development.

By developing an understanding of a concept, students will be better able to understand the objective involved. They will then be more willing and able to identify patterns that lead to the shortcuts we call rules, algorithms, formulas, theorems, or conjectures. These shortcuts were developed in many instances because someone recognized a pattern that would give them the desired result without having to do as much work. Teachers should stress to students that the shortcuts, by themselves, often do not make sense. It is vital that students understand the concepts and how and why the shortcuts work. With this knowledge, students are better able to make sense of mathematics and are more likely to use suitable strategies and algorithms.

# Reading

Reading math text is different from reading a novel. Students and their parents might not realize that, so classroom teachers have to teach students to read mathematics.

When assigning reading in mathematics, teachers should explicitly introduce new vocabulary and notation before assigning the reading. Teachers should preview the reading and connect the reading to previous knowledge. After the students have read the assignment, teachers should check for student understanding of the reading and correct their understanding – just as they do with homework problems.

Students should have a paper and pencil to assist them in their reading of math content. Students reading mathematics don't read by chapter, by section, by page, by paragraph or sentence, they typically read phrase by phrase – every word counts. Students should copy important information, definitions, formulas, examples, and draw pictures to help them comprehend what they are reading.

As students read an assignment, their eyes will dart back and forth from their reading, to diagrams, to examples, and back to their reading. They will generally re-read a phrase a number of times before they feel comfortable enough to continue reading.

Students who have experienced success in mathematics don't like or feel comfortable reading their math text. They want it explained to them. Students who have not experienced success in math see reading a math text as futile, a waste of their time, and intimidating. Teachers need to teach students how to successfully read their math text. If the math teachers don't, who will?

Teachers cannot increase student achievement in mathematics if the students cannot read mathematics – if they cannot translate English to math and math to English. All of today's high stakes tests are made up of word problems – students have to know how to read mathematics.

# Writing

Writing helps students clarify and solidify what they have learned and helps them respond to what they have read. Teacher expectancies supported by research, vocabulary, reading and writing are seen as important expectancies because of their connection to language acquisition. Educational researchers have identified vocabulary as the single most important factor that leads to comprehension – student understanding.

Classroom teachers should incorporate a number of writing tasks into their daily instruction. Students might be asked to explain a concept, write a word problem, illustrate a concept, give examples or make lists, describe or define, reflect, justify a solution, write a summary, predict what might occur, and compare or contrast what they are learning. The simple fact is that if our students are not required to write, if they are not given feedback on their writing in the content areas, then our students will not perform well on NAEP – considered to be the nation's report card.

Hanlon has long recommended that tests, quizzes, notes, and homework assignments include writing. In mathematics, which is considered a language by many, vocabulary and notation are seldom tested at the upper grades despite what the research suggests.

As part of the homework, teachers might ask students to write a procedure or explain a concept. During note taking, if something appears out of the ordinary – a trick, students should be given time to write an explanation of what occurred so when they study their notes later, the problem makes sense.

Teachers might ask their students to use concept cards. On one side of the card the students write the basic concept or procedure, on the other side the students explain how they might address a variation in the concept or procedure. By asking students to write about what they understood about a lesson or what caused them difficulty or confusion, teachers would gain insight into how they might address their own instruction to increase student achievement.

# Problem Solving

Mathematics is more than just memorizing rules and procedures, it is a discipline. Students must be taught and encouraged to think, to imagine, and to be creative in their approaches to solving problems. The National Council of Teachers of Mathematics materials state, “problem solving is not a mystery.” It is also not limited to solving traditional story problems or word problems. It is a way of thinking that can be learned. Teachers need to encourage their students to approach learning/problem-solving activities with an open mind and to realize that this kind of thinking takes time and effort to achieve. Students’ answers, whether correct or not, should be viewed as opportunities to explore thinking strategies. Open-ended questions that evoke thoughtful responses and require more than one word answers should be presented. Students should also be encouraged to utilize a variety of problem-solving methods. This process requires that teachers provide students with sufficient thought time. While problem solving is difficult to teach, and requires commitment and patience on the part of both teacher and learner, it is an essential experience.

Requiring teachers to have a balance in their delivery of instruction and assessment should come under the heading of *teacher expectancies*. In math, we’d also expect all teachers to employ recognized problem solving/learning strategies, such as:

- Go back to the definition
- Look for a pattern
- Make a table or list
- Draw a picture
- Guess and check
- Examine a simpler case
- Examine a related problem
- Identify a sub-goal
- Write an equation
- Work backward

# NOTE TAKING

When asked, memory researchers reported the number one “memory aide” which they themselves use is “write it down.” Teachers should require students to take notes in all mathematics classes. Notebooks keep students engaged in learning, help them complete their daily homework assignments, enhance their study, and act as a foundation from which to prepare for tests. Also, since students are not allowed to keep their textbooks, the student notebook is usually the only mechanism available for review in later years.

Note taking is a process used by students to record important information that they are trying to understand and need to remember. Because of the importance of a student notebook, teachers need to be prescriptive in how notes are taken and accommodating in their instruction. Notes should usually include a title, the date they were taken, objectives, definitions, identifications, pattern or concept development that leads to some conjecture, a formalized rule or algorithm, and an number of example problems used in guided practice. Teachers should also encourage students to write an explanation of what led to the procedure being used to manipulate or solve problems. Explanations are especially important when a problem-solving method might be construed as a “trick” and whose rationale would not be immediately obvious to the student when reviewed at some future date.

Finally, while note taking is a student responsibility, teachers need to hold students accountable for taking notes. This need not be complicated or time consuming, but it must be done frequently and consistently to further encourage students to take notes.

# ORAL RECITATION

Oral recitation, is the practice of having the entire class recite important facts, identifications, definitions, and procedures within the instruction and later when they need to be revisited. Concept development generally precedes oral recitation. Whole class recitation (repetition) of this information should be repeated a number of times, however the total time involved should not exceed two and one-half minutes. By having the students first read the information off the board with the teacher, students learn how to read information correctly and how to say it. Oral recitation is a language acquisition strategy that helps all students learn – not just English language learners.

Oral recitation is just one method of helping students memorize information. Adults often use it when trying to remember a license plate number or grocery list. This practice anchors information in the brain and helps students absorb and retain information upon which understanding and critical thought is based. The more sophisticated mental operations of analysis, synthesis, and evaluation are impossible without rapid and accurate recall of bodies of specific information.

The process also keeps students engaged in learning, helps them verbalize their knowledge, and suggests that if the information being presented is important enough for the entire class to recite, it is worth remembering.

# Questioning Strategies

Who's doing the talking in the classroom? For students to learn the language of mathematics they have to read it, write it and speak it. How questions are asked in a math classroom can either promote or hinder dialogue.

Questions can take different forms. Using one form of questioning, directed, a teacher might ask a student for an answer to a particular question and receive a one or two word response. "What's the answer to number 8?" Another form of questioning, regurgitation, students might be asked for formula, procedure or list. A third type of question might be referred to as cueing. In that situation, a teacher asks a question, after the student responds, the teacher repeats the student response, then asks for more information by asking questions like "why?" or "because...". And finally, there are conceptual questions, questions that have students explaining or linking a concept, comparing and contrasting. Questions that elicit more than a one word answer or list, but causes students to communicate their thoughts and understandings of a particular topic.

All of these types of questions should be incorporated into daily lessons. To keep students engaged, teachers need to ask all four kinds of questions. Importantly, teachers need to allow students time to think of an answer before they just give it. Teachers clearly need to understand the value of "wait time" when asking students to engage in discussions.

To help teachers determine the types of questions they asking of their students, administrators observing a lesson might list these four categories and determine the number and types of questions teachers are asking of their students. Knowing the emphasis of their questioning might help teachers get student more engaged in their learning.

# Practice; Guided & Group

Before students are sent home with homework (independent practice), guided practice should be extended to ensure that students are proceeding correctly. Several exercises, similar to the homework assignment, are provided for students to work on in class. Teachers should monitor students carefully, looking for points where they become stuck or confused. If many students stumble on or fail to grasp a given idea or step in an algorithm, the teacher should immediately address the problem on a class-wide basis. If only a few students experience difficulty, these problems can be handled on an individual basis. In either case, a review of the guided practice exercise is recommended before students leave class to begin independent practice.

Having students talk to each other about the problems provide students an opportunity to use the language, that communication has the benefit of having students reflecting on their own knowledge

It must be noted that guided practice should not be “starting homework.” Students frequently dawdle during or entirely misuse class time allocated to practice if the time is for “homework”. Homework, for the most part, is to be done outside class time; guided practice is done in class with immediate feedback. As an incentive, teachers may add an assessment component to guided practice—essentially a participation grade.

When someone takes up a new sport, they do not expect to be proficient immediately. One expects to practice a new activity to get better at it; long, hard extensive practice is almost always necessary to become proficient. Learning mathematics skills can be equated to learning physical skills. Practice, with frequent reinforcement and evaluation, is essential in order to master abstract concepts. In order to avoid short-changing their students, teachers need to provide practice – both guided and independent.

As part of developing mathematics concepts, teachers need to give students opportunities to practice new skills with immediate feedback. Initially teachers should include several examples as part of the explanation while giving notes.

Guided and independent practice may be more than paper-and-pencil work. It may include labs, projects, and the use of technology.

# HOMework

Student achievement rises significantly when teachers regularly assign and students consistently complete homework. The extra study that homework provides helps students at all levels of ability. Homework boosts achievement because the total time spent studying influences how much is learned. While time is not the only ingredient for learning, without it achievement is diminished. Homework also gives students experience in following directions, making judgements and comparisons, raising additional questions for study, and developing responsibility and self-discipline.

To make the most of what students learn from homework, teachers need to give the same care in preparing homework assignments as they give to classroom instruction. Homework is most useful when teachers carefully prepare the assignment, thoroughly explain it, and give timely comments and criticism when the work is completed. Also student are more willing to do homework when they believe it is part of instruction, when it is evaluated, and when it counts as part of their grade.

In many math classes, homework is used as practice. Initially, that practice should be “guided” practice to ensure that students are proceeding correctly. When students begin their homework assignment in class, teachers need to monitor their understanding. To accomplish this, teachers should require students to do several problems and check them before they are left to do the remainder of the assignment independently.

Homework should include what teachers say they value. Besides assigning a problem set for homework, teachers should also require students to copy definitions, algorithms, and write brief explanations to explain the day’s work.

# REVIEWS

Reviews help students remember, what students remember in school is often equated with learning. As we teach, we not only expect students to remember what we have just presented, there also is an expectation students will remember what was taught earlier in the year and information that was presented years earlier by other teachers. Unfortunately, over time, memories tend to dissipate. Because of high stakes testing, educators can not afford to allow students to forget.

To address memory, classroom teachers should schedule two review periods almost every day. The first review should be scheduled near the beginning of the class. That review should cover recently taught material, such as going over homework assignments and may be used as an introduction to the lesson. This review helps place material into short-term memory.

A second review should be scheduled toward the end of the period, after the close of the day's lesson. This review should address long-term knowledge. That might include: basic skills, important formulas, facts, procedures, definitions, strategies, and deficiencies. This review is designed to place into long-term memory those items that all students should know at the completion of the school year. These reviews are important because they require students to revisit information that will reinforce their memory.

The second review period also allows teachers an opportunity to better prepare their students for high stakes tests such as the HSPE, ACT and SAT by addressing the knowledge and skills needed for success on those tests. That time can be used to reinforce memory as well as address known student deficiencies. The material being reviewed should be based upon student performance and may not be part of this year's curriculum.

While there is more to learning than just memorization, memorization is an important component of learning. Knowing "how" we remember is important if we are going to help students. Teachers should teach their students to review using different strategies such as mnemonics, linking, developing relationships, learning in context, and utilizing audio and visual cues.

# Memory Aids

"Mnemonics are based on the principle that the brain is a pattern-seeking device, always looking for associations between the information it is receiving and what is already stored. If the brain can find no link or association, it is highly unlikely that the information will be stored in long-term memory. Unfortunately, this scenario is relatively commonplace in the classroom"

The brain has trouble storing information that it cannot associate to a picture such as letters and numbers. Mnemonics create rhyming links or associations that give the brain an organizational framework on which to hook new information. In certain circumstances, teachers use mnemonics because they were taught them while they were in school. Many middle school students are introduced to the phrase- Please Excuse My Dear Aunt Sally as a way of remembering the Order of Operations. SOHCAHTOA is familiar to many trig students learning the trigonometric ratios.

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# TESTING

Teachers should prepare students to succeed. In preparing students for tests, teachers should provide tips on how to study. For instance, students sometimes confuse the definitions of complementary and supplementary angles. Teachers might suggest the “c” in complementary comes before the “s” in supplementary as  $90^\circ$  comes before  $180^\circ$ . Teachers should also take the time to help students differentiate between problems that look alike. For example, while students might learn several different methods of factoring, they may not be able to determine an appropriate method of factoring when a mixture of problems is presented. Students have to be taught how to recognize differences and when to apply the appropriate method.

Teacher-made tests should reflect what is taught and valued in mathematics education. For example, while many teachers say mathematics is a language, this may not be reflected on their tests. If we value students’ ability to verbalize their knowledge, then definitions, identifications, and procedures should be part of tests. In addition, manipulation of data, open-ended questions, problem solving and appropriate use of technology should be included on tests. Also, to encourage students to review and reinforce previously learned material, teachers should make their tests cumulative.

Tests are formalized vehicles to not only evaluate student learning, but should also act as an assessment tool. As such, tests provide students a blueprint to increase their knowledge. Teachers should use test information, particularly questions answered incorrectly, as one way of increasing student performance. Addressing these deficiencies can increase student achievement. The language used on teacher made test questions should reflect the language used on more formal standardized tests.

# TIME ON TASK

State and local school districts usually determine the classroom time available to teachers and students. However, regardless of the quantity of time allocated to classroom instruction, it is the classroom teacher and school administrator who determine the effectiveness of the time allotted.

According to a survey conducted by the American Association of School Administrators, teachers identify student discipline as the single greatest factor that decreases time on task in the classroom. Generally, teachers with well-managed classrooms, have fewer disciplinary problems. These classrooms typically have teachers who have established rules and procedures are in the classroom when the students arrive, and begin class promptly. They reduce the “wear and tear” on themselves and students by establishing procedures for make-up work, they arrange their room to accommodate their teaching philosophy and style, and they develop routines that increase overall efficiency. The benefits of establishing these classroom procedures and routines become apparent as the total time on task approaches the allocated time.

When teachers begin class immediately, students view them as better prepared, more organized and systematic in instruction, and better able to explain the material. Students also see these teachers as better classroom managers, friendlier, less punitive, more consistent and predictable, and as one who values student learning.

Routines like beginning class immediately, reviewing recently taught material, orally reciting new material, having students take notes, and ending the class by reviewing important definitions, formulas, algorithms, and the daily objective keep students engaged and on task. Quality time on task is not a “silver bullet” that can cure all the problems facing education. However, it can play an important role in increasing student achievement.

# Technology

“The thoughtful and creative use of technology can greatly improve both the quality of the curriculum and the quality of children’s learning. Integrating calculators and computers into school mathematics programs is critical in meeting the goals of a redefined curriculum.” (National Council of Teachers of Mathematics. *Curriculum and Evaluation Standards*. Reston, Virginia: National Council of Teachers of Mathematics, Inc., 1989.)

However, the NCTM also says, “Calculators do not replace the need to learn basic facts, to compute mentally, or to do reasonable paper-and-pencil computation.” Therefore, appropriate use of technology is dependent upon the age of a student and his/her ability to demonstrate knowledge of basic facts. It is further dependent on the objective of the activity. If the goal is skill attainment, then calculator use is not appropriate. If the goal is exploration or verification, then calculator use may be appropriate.

Modern technology can free students from tedious computations and allow them to concentrate on problem solving and other important mathematics content. Students should be using calculators to strengthen and extend understanding of concepts, explore mathematical functions, investigate problem-solving activities, employ real world applications, and verify results. (In Algebra I and above, the use of graphing calculators is imperative.) *However, it is essential that all teachers maintain a balance between paper-and-pencil computation/drill and the use of technology to enhance problem solving and conceptual learning.* This requires teachers to make a conscious decision as to the appropriateness of calculator use during each and every lesson. Calculators should not be allowed as a substitute for thinking. To increase the likelihood that calculators will be used appropriately, teachers may need additional training. Total dependence on technology is inappropriate, but when combined with an understanding of the underlying concepts and proficiency with basic skills, it becomes an invaluable tool.

# Improving Students' Grades

Grades low, too many F's?

*Have a positive attitude – build success on success.  
Treat students the same way you want your own children treated.*

## TRY THESE STRATEGIES:

- State the day's objective, teach it, and then tell them what you taught them when you close the lesson – closure.
- Develop concepts. Teach the big ideas.
- Link concepts to previously learned material and/or real-world experiences.
- Use simple, straightforward examples that clarify what is being taught.
- Use numbers in examples that allow students to focus on the concept and don't bog students down in arithmetic.
- Incorporate guided and group practice to monitor student learning before assigning homework.
- Use practice tests to prepare students for unit tests. In first year algebra, use multiple test versions.
- Tell students how you remembered (learned) important information.
- Use choral recitation to imbed information in short-term memory.
- Require students to take notes and keep notebooks.
- Use the second review period to reinforce long-term knowledge and address student deficiencies.
- Change instructional practices based upon student performance.

**BAM**

# Professional Development through Sharing

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.

The *Backward Assessment Model (BAM)* changes the way professional development is delivered. Rather than having an expert tell teachers what needs to be done, the assessment model uses the expertise of the staff at the school. Educational research clearly indicates that professional development should primarily be on-site, regularly scheduled and on-going, in the discipline teachers teach, in content and pedagogy, and provided by the people that know best – classroom teachers. The assessment model places the professional development emphasis on academic standards and best practices.

The *Backward Assessment Model* is a communication model. One of its best attributes is that it provides teachers an opportunity to share their knowledge, skills, experiences, and resources with each other. Experienced teachers know where students traditionally experience difficulty. They can communicate knowledge, model successful strategies, and share accommodations that help students succeed. *BAM* also provides all teachers, experienced and new, opportunities to reexamine and reflect upon their own practices.

There are two basic premises of *BAM*. The first is that testing drives instruction, and the second is that teachers do make a difference, but teachers working together make a greater difference.