


place. That same diligence may be a part of learning to ride a dirt bike, ski, use a skateboard, as the student matures.

It is appalling to think about how difficult it is to learn to walk. Children fall down again and again, legs quivering, bumps from coffee tables and bruises from abrupt loss of balance, not withstanding. How does a newborn get from that helpless state to a point of successfully walking and talking inside 18 months -- without a manual, lesson plans, formal training, grades for effort.

	<ul style="list-style-type: none"><li>• Charlotte Scott, a deaf mathematics professor, was the Chief Examiner in mathematics for the U.S. College Board.</li><li>• Lev Potryagin, who was blind from adolescence, eventually became vice president of the International Mathematics Union.</li><li>• Stephen Hawking, confined to a wheelchair since 20 years of age, is a professor of mathematics at Cambridge University in England, and has given us some of the most powerful looks at the meaning of the universe through his study of physics.</li><li>• Edison, who holds more patents than any single individual in the U.S., was removed from school, for his teacher believed him too retarded to learn.</li></ul>
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**Remember -- if you wish to teach students instead of subjects,**

- When a student says "NO" find out why.
- When a student says "I CAN'T", believe him or her and back up to the place where success can occur.
- When a student expresses discouragement, go beyond encouraging and listen to the student's true message.
- If a skill eludes a student, try the following:
- Link math instruction to the student's current conceptual understanding.
- Give students problems that pertain to their own lives.
- Teach word problems as games and have students develop their own rather than solving preset ones.
- Concentrate on the success and what is going well.
- Allow students to find personal methods for solving math problems and then get them to teach it to others.
- Encourage students to use manipulatives, calculators, computer games to enhance depth and rate of learning.
- Find ways to generalize math operations to current, every day use of the skills.
- How about drill? Rote memorization can help, but drill can kill -- kill interest in math and in its place create boredom, carelessness, or worse, -- rebellion

**Adapting for Auditory Learners**



- ❖ Be certain to explain the directions orally before having student begin to work

- ❖ Provide a verbal summary of each step.
- ❖ During an activity, use key words to focus students' attention to tasks, for example, "Now watch."
- ❖ Allow students to discuss the work as it progresses; to ask peers questions, to share insights, to provide help to one another verbally. [Sometimes you can tell who these students are by watching who "buzzes" as soon as instructions are given -- since these students often turn to others to get a repetition of directions or to say out loud - self talk - what the instructions seem to be].
- ❖ Let students tape record lectures or make a video, when there is a lot of board work, so they can review it and listen as often as needed.
- ❖ Purchase tapes that explain math and let students check them out.

### Adapting for Visual Learners



- ❖ Use concrete manipulatives or demonstrations and modeling to show students what they need to do.
- ❖ Have students practice what they observed.
- ❖ Use mental pictures to punctuate verbal instructions.
- ❖ Consider using nonverbal signs to pace of the lesson or as an aide to transitions in the lesson.
- ❖ When possible, make picture cue cards or overheads showing the sequence of tasks. Use pictures and graphs to explain processes.

### Adapting for Kinesthetic Learners



- ❖ Expect students to gain insight from using manipulatives.
- ❖ Discuss (two-way talk) what the student is finding and extend learning by modeling some of the outcomes when a student is stumped.
- ❖ Pair the student with others who learn through touch and let them work in cooperative groupings, sharing insights.
- ❖ Use a number of different mediums for learning - rods, blocks, puzzles, glitter, food, so the student generalizes the concepts rather than identifying learning with one setting. ( From Mercer and Mercer, 1988)

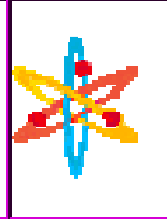
**IV. Believe that all can learn math**, and that we can develop strategies to help students succeed. But also, remember that math does not come from a book, that it is not always sequential, that we cannot force learning and love of a subject. We love to do things that we find challenging, that we may be able to get good at doing and that feel hopeful for us. We do not love to fail and we do not love to feel threatened. Sometimes it helps to recall what math is really about, so once more, we define math as being able to:

form and remember associations	understand basic relationships
make simple generalizations	see and use patterns

*If we teach our children merely to compute while we teach our computers to think ever more intelligently, who is*

## Empowering the Student - Collaborative Classrooms - Loving to Learn

To involve students  
To emphasize to students their responsibility for learning.  
To reinforce learning by active participation.  
To encourage students to learn from each other.  
To open up a questioning attitude  
To develop learning skills for lifelong learning



In collaborative classrooms, students are initiators and active participators. Students set goals and plan learning tasks; during learning, they work together to accomplish tasks and monitor their progress; and after learning, they assess their performance and plan for future learning. As mediator, the teacher helps students fulfill their new roles.

Students prepare for learning in many ways. Especially important is goal setting, a critical process that helps guide many other before-, during-, and after-learning activities. Although teachers still set goals for students, they often provide students with choices. When students collaborate, they should talk about their goals to clarify and solve the problems actively. As students become actively involved they can design learning tasks and self monitor time on task and progress in learning and constructing personal learning. While teachers plan general learning tasks, students assume responsibility for planning their own learning activities. Ideally, these plans come from goals students set for themselves. Thoughtful planning by the teacher ensures that students can work together to attain their own goals and capitalize on their own abilities, knowledge, and strategies within the parameters set by the teacher.



**Students** are likely to engage in self-regulated tasks with more purpose and interest than in traditional classrooms. Students learn to take responsibility for monitoring, adjusting, self-questioning, and questioning each other. Such self-regulating activities are critical for students to learn today, and they are much better learned within a group that shares responsibility for learning.

- . **Monitoring** is checking one's progress toward goals.
- . **Adjusting** refers to changes students make, based on monitoring, to reach their goals.
- . **Self questioning** moves from "what grade" to what do I know, what do I need to do next to learn more?
- . **Questioning and collaborating with others** steps toward life long learning. "Who can I help, who can support my learning and understanding."

Self-assessment is intimately related to ongoing monitoring of one's progress toward achievement of learning goals. In a collaborative classroom, assessment means more than just assigning a grade. It means evaluating whether one has learned what one intended to learn, the effectiveness of learning strategies, the quality of products and decisions about which products reflect one's best work, the usefulness of the materials used in a task, and whether future learning is needed and how that learning might be realized.

Collaborative classrooms are natural places in which to learn self-assessment. And because decisions about materials and group performance are shared, students feel more free to express doubts, feelings of success, remaining questions, and uncertainties than when they are evaluated only by a teacher. Furthermore, the sense of cooperation (as opposed to competition) that is fostered in collaborative work makes assessment less threatening than in a more traditional assessment situation. Ideally, students learn to evaluate their own learning from their experiences with group evaluation. Adapted from the writing of M.B. Tinzmann, B.F. Jones, T.F. Fennimore, J. Bakker, C. Fine, and J. Pierce NCREL, Oak Brook, 1990 - *What is the collaborative classroom?*

***The transfer from teacher directed learning to student as successful, life long learner*** requires taking time to get to know the student, discuss what the student knows and believes the next step might be. It means trusting the student to care.



### Conferencing with the Student

- 1) Begin the conference by establishing rapport and giving the student time to talk about math and attitudes or feelings about personal level of competence. In that period of time it is inappropriate to correct shared feelings -- [think of it like telling a person he or she is wrong about a choice of a favorite color or food].
- 2) Give the student a forum for sharing current successes - "strut their stuff" time.
- 3) Ask the student to provide the next challenge - and if the student is uncertain about the next step, offer a problem that dovetails with the current success and a challenging new skill.
- 4) Allow the student to attempt to solve the new challenge, using personal skills, and make note of the strategies used and the "talking" or verbalization of the issues involved in solving the challenge.
- 5) Jointly make a goal that moves the student into the new challenge, and offer guidance on strategies to be employed in learning the new skills.
- 6) Jointly develop an assessment plan.
- 7) As possible, allow students to work together in pairs to conference and build new goals, and eventually, provide a weekly time for these strategy sessions to take place. Once a week, briefly review student progress [can be done in about 60 seconds while students are setting goals or working independently.]

<b>Skills that <b>students</b> believe contribute to math success:</b>	
Focus	Find ways to visualize the problem being posed
Attention to detail	A sense of adventure - ability to create, try, risk
Interest in working backward and forward - from possible answers to question, from math problem to correct answer.	Number sense - notion of how many are there, what makes sense as an answer, what fractions are about, that tables and number lines are assists, not the enemy
Memory for a few moments, or a tool / pattern to compensate	Care enough to check the answer

**Student keys to success -----**

1. Work extra hard to "visualize" math problems. Maybe even draw yourself a picture to help understand the problem.
2. Take extra time to look at any visual information that may be provided (picture, chart, graph, etc.).
3. Read the problem out loud and listen very carefully. This allows you to use your auditory skills (which may be a strength).
4. Ask to see an example.
5. Ask for or try to think of a real-life situation that would involve this type of problem.
6. Do math problems on graph paper to keep the numbers in line.
7. Ask for uncluttered worksheets so that you are not overwhelmed by too much visual information.  
Spend extra time memorizing math facts. Use rhythm or music to help memorize.

From: Strategies for students with math difficulties: <http://www.ldinfo.com/dyscalculia.htm#top>

#### Student Self Check

Step for success	Time spent _____ min./problem	Successful	
		Yes	No
I			
Visualized the problem			
Read available charts, graphs, pictures			
Said problems out loud - a partner really helps			
Came up with a real life example			
Used colored graph paper			
Wrote problems neatly and used enough paper to keep the questions and answers organized			

#### Books with excellent ideas:

Kenschaft, P. C. (1997). *Math Power: How to help your child love math, even if you don't*. Reading, MA: Addison-Wesley.

Mercer, C. D. and Mercer, A. R. (1998). *Teaching students with Learning Problems* (5th ed.). Upper Saddle River, NJ: Merrill.

#### A little Math Fun

1. Pick a number from 2 to 9. It can be 2 or it can be 9, or any number in between.
2. Take that number that you've chosen, and multiply it by 9.
3. That should give you a two digit number. Take those two digits and add them together.
4. Take the resulting number and subtract 5 from it.
5. Take that number and correspond it to the alphabet, numbering the letters. A =1, B=2, C=3, D=4 and so on.
6. Take your letter, and think of a country that begins with that letter.
7. Take the last letter in the name of that country, and think of an animal.
8. Now, take the last letter in the name of that animal, and think of a color.
9. Scroll down to find the solution -- at the bottom of this page.

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There are no ORANGE KANGAROOS in DENMARK



Remember, according to the National Math Council, math success occurs when youngsters can: