Bite-Sized Success Works

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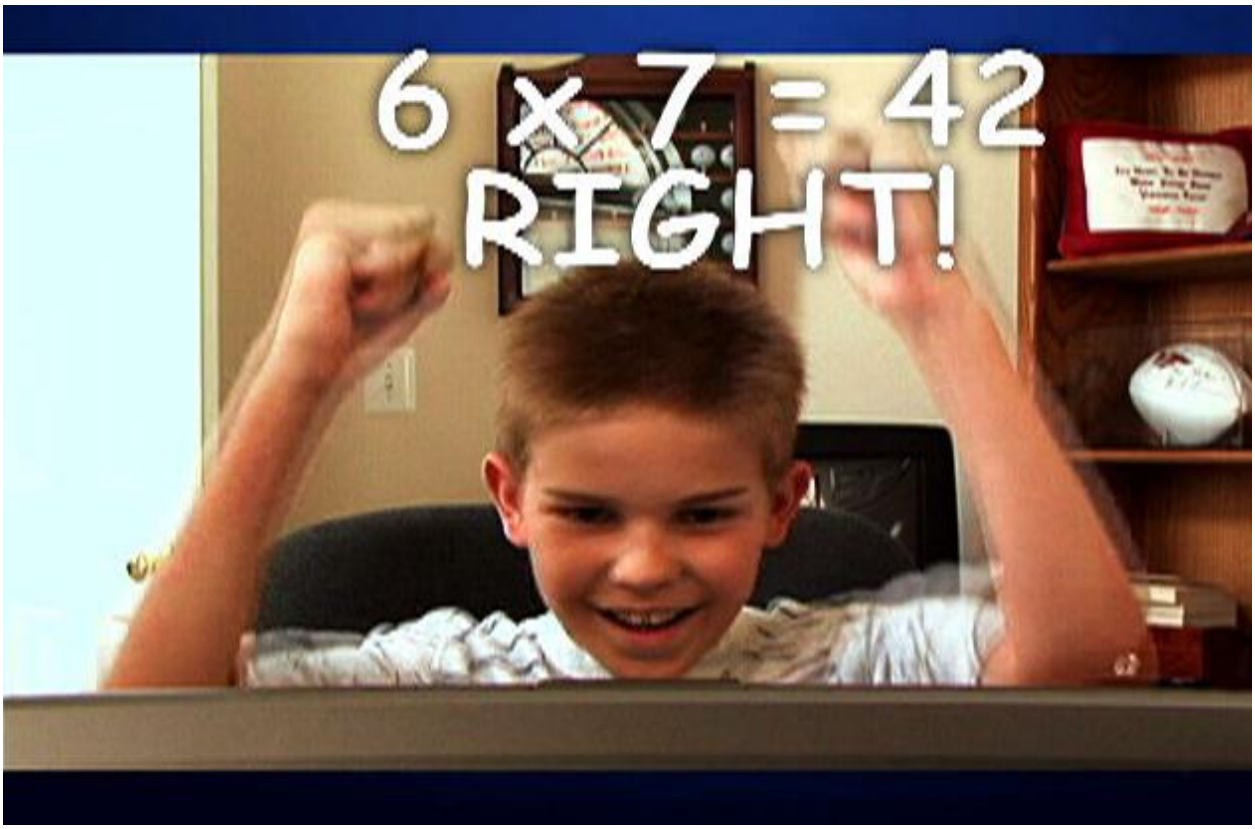

The kids were popping in and out of our booth all day long. At the Christian Homeschool Association of Pennsylvania (CHAP) convention in Harrisburg, we were showing a game-like program to build basic math skills. We had it running on two laptop computers. While their parents shopped for other learning materials, a lot of kids were roaming the show and had discovered our booth to be a fun place to hang out. That was fine with us. We love having youngsters demonstrate our system.

One particular group of four or five children would re-appear every couple of hours or so. Some were siblings and they all knew one another. They were good at taking turns on the computers, and a feature of the software allowed them to pick up play from where they had stopped on the previous visit. A couple of kids had already made visible progress.

On one return visit the group was accompanied by Angie, a newcomer around 11 years old. Angie was a little bashful. As the group piled into the booth and found seats, she hung back and lingered several steps outside. I invited her in and a couple of the others encouraged her as well, but she held her ground out in the aisle, shyly shaking her head.

The kids at the computers were clearly having fun. The ones watching couldn't help kibitzing and shouting out answers when they knew them. I could see Angie watching all this from outside. After a few minutes, we invited her in again. This time her curiosity got the better of her and she ventured in.

One of the kids gave Angie his seat. I set the computer at an intermediate level of addition and got her started. I immediately saw why Angie had hesitated. She was lost with sums as basic as "5 + 4." We tried again at an easier level. She still struggled. I was momentarily astounded. I could not recall running into a child her age being so far behind in math. In her other schoolwork Angie must have been working around the fourth- or fifth- grade level. How much must she hate math if she still couldn't do basic addition?

Meanwhile, the last thing I wanted was for Angie's initial fears to be confirmed. Not in our booth! So, still all smiles and encouragement, I changed the game scoring format and set it at the very easiest level, the "plus ones." Then I walked away. What happened next was not only a delight but also showed me something about the importance of success. Within a few minutes Angie had successfully solved all 10 of the "plus one" problems. Moreover, she had become familiar enough with the program that she could do the problems in less than three seconds each. The software had recognized this achievement and complimented her on it. Now she was working on the "plus twos."

Angie was beaming. Her progress slowed a bit at the higher level, but it was still progress, and Angie was eating it up. This was no longer the shy little girl lingering fearfully outside. Angie's friends had also seen the spark and were happy to let her keep her seat. After a while, her mom arrived to see what was going on. Angie was still on the "twos," but a little further along and still having fun.

Angie and her mom conferred, and when her mom pulled out her checkbook to purchase the software, Angie rushed to give her a big hug around the waist.

It was a moving moment for me. As far as I could tell, this was as much math success as Angie had ever had. I explained to her mom that the trick

had been to present the addition table in small chunks, starting with the easiest and letting the difficulty increase at Angie's own pace. I showed her how the program would manage the process automatically. Based on what we'd already seen and with Mom's encouragement, there was no reason to think that Angie's achievement wouldn't continue as long as she stuck with it. Subtraction, multiplication, and division would all work the same way.

That evening my wife and I reflected on the differences between Angie's math experiences and those of her friends and the extent to which those differences had influenced achievement and attitudes.

You simply can't overstate the contribution of success toward learning. They say we learn from our mistakes. We learn a whole lot more from our successes. Success is fun, it feels good, and students develop a taste for it. It keeps them coming back. Students with enough success in their backgrounds will have built the attitude and confidence they need to undertake new things.

On the other hand, lack of success creates situations such as Angie's. The learner is held back by memories of frustration and failure. In a perfect world, each student's success would be the overriding goal. Teachers could design lessons tailored to individual needs, just the right size and just difficult enough to promote each student's successful performance.

Teachers reading this are laughing because they know in the real world this is not humanly possible. With technology, though, some possibilities are available, especially with math.

Several things set math apart from other subjects. Its problems have definite answers, and answers are readily confirmed. Under these conditions, a person's skill at math becomes obvious relatively quickly. Moreover, when people learn a new math concept, they know that they know it. That confidence reduces doubt about the chances for success in other areas.

Confidence pays off even more as existing skills contribute to new ones. More than any other subject, math skills and concepts tend to be hierarchical and to build on one another. So as a student succeeds, he or she can reasonably expect to succeed at the next level as well.

There's more. Because math success is more pronounced than in most other subjects, people tend to either like it a lot or not at all. Our booth could have offered a spelling game or one involving geography or history, but it's hard to imagine any of those having the same attraction as our math

game or the intimidating effect we saw with Angie. Unfortunately, math's polarized popularity skews toward the negative. If you say you're no good at math, you'll have no trouble finding lots of kindred spirits

However, for that relative handful of people who feel successful at math there are special rewards. There is evidence that math skill flows to other areas. Although it makes no statement about success or self-confidence, a study conducted at UC Irvine by Distinguished Professor of Education Greg Duncan, shows early math skill to be the strongest predictor of subsequent scholastic success.

Duncan's finding coupled with what we saw with Angie suggests some new, and potentially powerful, teaching opportunities. Suppose we could have given Angie the exuberance of those simple "plus one" and "plus two" successes when she was 6 years old? How might that have given her educational career more of a jump start? Not only would she have avoided the math shyness that held her back, she would likely have done better in her other studies, as well.

Simple addition is the first tough math hurdle that students encounter. Then come subtraction, multiplication, and division. Success with these basic skills can have a huge effect on how the student is going to feel about math. Historically, however, too few students have experienced such success. Unable to provide the individualization needed for widespread success, teachers have had to resort to methods less effective and largely unappealing to students. As a result many first, second, and third graders end up with negative feelings about math.

The technology needed to change this—that is, to ensure success by presenting math in small, achievable steps—has been around for years. That same technology can also track the individual efforts within an entire class of students, a difficult task for a teacher working alone. What's been missing is our awareness of how much adding these features would improve math performance, much less performance in other subjects.

So how can we introduce these features to early math instruction? At present, experts in elementary math focus on goals dealing with students' conceptual development, problem-solving skills, and deeper understanding. These are worthwhile enough objectives, but success at them is hard to define and measure. Attaining these objectives doesn't readily contribute to the "know that you know" factor. And they don't lend themselves to the bite-sized success moments that were delighting Angie.

Experts have mixed feelings about basic computation. The timed drills and worksheets historically used to teach computation have earned the name “drill and kill,” because the learning process involved is tainted by the stigma that accompanies rote memorization. On the other hand, it is generally agreed that students need to learn the basic tables if they’re going to achieve larger conceptual goals. Desired proficiency is discussed using terms like “fluency” and “automaticity,” but most teachers are satisfied if students can simply compute well enough to do their homework, even if they need calculators to do so.

As we saw with Angie, though, basic computation provides a powerful means of generating success. Deeper conceptualization notwithstanding, it may be that a large dose of early success goes even further to produce successful math students. We saw how just a little success produced a complete turn-around in Angie’s attitude toward math. There was no reason to think that new attitude couldn’t endure as long as she stayed with it and remained encouraged.

Once we found the right starting point, my role in Angie’s experience was largely over. Everything after that she did on her own. Had she been in school, she could have easily continued working on these skills at home. This is more important than might be apparent. The old “drill and kill” activities take valuable class time. That’s a big incentive for teachers to drop them as soon as possible. Although it usually happens before a class has gained full fluency, students are still happy to put these drills behind them. Technology can change this dynamic, as well. By allowing students to work without supervision and at their own pace, time and schedule restrictions on ultimate success go away. Instead of feeling relieved when it’s over, students can give themselves congratulatory pats on the back.

In the case of basic computation, the whole process can happen as an adjunct to other math studies. What’s more, the software needed to produce the success we’re after exists, and it’s not expensive. Schools have several programs and systems to choose from, and they range in price from free to only a few dollars per student.

To provide all the benefits we saw happen with Angie, software needs to offer these features.

1. Since success is our main objective, we must start with a clear, concise, and measurable definition of success. Percentage of correct answers and number of problems completed within a time limit, for example, can provide just such a metric. The software Angie was

using defined success in terms of correct answers produced within three seconds. Measures at that level of detail are available only with computers.

2. Success often depends on the scope of the task. Software focusing on success must be able to present tasks in small-enough batches that students do not feel overwhelmed. Angie was never faced with more than 10 problems in a session, all drawn from a small set of ten. Since they were individually timed she had no incentive to rush and could deal with them one by one. She felt little or none of the pressure normally associated with timed drills.
3. Feedback is critical to success. Definitions and measures don't count until the learner sees how they apply to his or her efforts. A serious advantage of using a computer is that the learner gets feedback immediately for each problem. It's also necessary for that feedback to reflect overall skill improvement. Angie not only received positive feedback with each problem. She also got reports of her overall skill improvement from one session to the next.
4. Success milestones allow students to set intermediate goals for their efforts. For these to occur, software must be able to track and record student activity over a span of time. Milestones are also part of being able to subdivide the work into achievable segments. In our booth Angie had achieved the "plus one" milestone and was working toward the "plus twos."
5. Software can offer encouragement when it might be needed and should minimize discouraging feedback. Messages reminding students of their progress in situations where they're moving more slowly can be helpful. Errors should be all but ignored. When Angie made a mistake, she was merely asked to try again. Three tries resulted in the answer being revealed.
6. Extra practice helps a student who is struggling with a problem. The software should be able to identify this situation and provide practice as needed. If Angie needed to be shown the answer after three tries, there was a 50 percent chance the problem would be repeated immediately.
7. Documentation is also critical to success. Although working alone, the student should not be working in a vacuum. As much as Angie was enjoying her new success at math, sooner or later she was going to want her efforts acknowledged and validated by her teacher (in this

case, her own mother). Other students need validation, too. The software should provide good documentation in the form of reports, performance certificates, and progress graphs that teachers can request to show their interest and remain apprised of their students' achievements.

Given these technological tools students can enjoy a historically unparalleled degree of math success. It can begin almost from the start of their elementary school experience. The activities involved proceed simultaneously with and separately from other studies better suited to the classroom venue. Teachers may or may not look for ways to draw these external activities into their regular curriculum. In any case, the computation skills involved are developed sooner and stronger than ever before, well ahead of the later conceptual topics they support.

When it comes to any math skill, it's safe to say that if the student can't do it, we haven't taught it. Only through success do students gain concrete, measurable evidence of their abilities. The confidence engendered by "knowing that they know" is invaluable. It falls to teachers to apply new, widespread early computation skills to other math studies; but even if they do nothing, we can expect a jump in math performance and overall scholastic performance as well.

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