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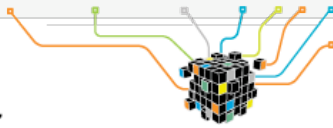
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April 1, 2008, 7:40 pm

Does Computing Add Up in the Classroom?

By STEVE LOHR

Computing is essentially math on steroids. So, at first glance, it would seem no surprise that the recent report by the National Mathematics Advisory Panel would include computer-based instruction among its recommendations to address the "mediocre level" of math achievement by American students.

But the champions of computing in the classroom have hailed the math panel report as an encouraging win for their side. It suggests, they say, that computing should be seen as a valuable tool in mainstream education, like math and science, in kindergarten through high school curriculums.

"There is a real battle going on to determine the role that computing is going to play in K-12 education," observed Robert B. Schnabel, a computer scientist at Indiana University, who is chairman of the Association for Computing Machinery's education policy committee. "Is it going to be integrated into math and science curriculums or is it going to be more like shop?"

The debate over the appropriate place of computing in grade schools and high schools echoes the debate in universities decades ago, when computers and software were initially seen as mere plumbing. And certainly not something worth of study in its own right? A department of computer science? Why not a department of slide rules?

But over time, computer science became a science of its own, and computing is regarded as a universal tool of all sciences and many social sciences, adding new powers of simulation and measurement to mathematics.

Below the university level, however, computing is far from that stature today. But the math panel report recommends well-designed computer instruction as a way to nurture greater fluency in math and understanding of math concepts, from drill and practice to programming with visual languages like LOGO, developed in the 1960s by Seymour Papert and others at M.I.T. and Bolt, Beranek and Newman, a research firm.

"With computing, it's not just words and symbols, but you build things," explained Doug Clements, a professor at the graduate school of education at the University of Buffalo, who was the principal author of the math panel's recommendations on technology. "Computing offers multiple, interconnected pathways to understanding."

But the progress is likely to be gradual. Myra Deister teaches both math and computer science at Sunny Hills High School in Fullerton, Calif. When she can, Ms. Deister says, she tries to use computing in her math classes. But math and computer science, she adds, are still viewed as separate worlds in most of the education community, and curriculums reflect the schism, with much of computer science education focused on

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All this is why I quit the AMS and joined SIAM

Those who ignore history are doomed to repeat it.
— George Santayana

— Posted by Steve Stevenson

6. April 2nd,
2008
2:57 pm

I agree very much with the posting by "mike." The US is having a difficult time being competitive on the international stage when it comes to technical fluency. In fact, for recruiting purposes,the bulk of Cornell, MIT, Stanford engineering science people of my group (www.geocities.com/engineer_brunch) are from abroad. They all have a successful time gaining interesting projects as employees in Fortune500 firms. Americans have an interesting challenge to face, no doubt.

— Posted by H Shimbo

7. April 2nd,
2008
3:29 pm

"As a High Tech Recruiter for a major Silicon Valley Corporation"... you are seeing the world from a particular point of view. I am a manager with a large tech company, as well as the parent of an elementary-school child. While I agree with most posts here that computers are a great tool for teaching all sorts of skills, including math, I believe teaching computer science is not a new 'basic' need. We need doctors, too - should every elementary child be taught anatomy? Or to use a different metaphor: nearly everyone needs to know how to drive, but not everyone needs to know how to mill a camshaft. It is important to avoid the tendency to generalize from existing local trends, such as high tech hiring. Not everyone is fated to be a technologist, and we should ensure that basic education serves all potential outcomes. Specialization comes later. It would be shortsighted to structure the elementary education of tomorrow's workforce to address our hiring needs of today.

Projecting forward, it seems that the increasing sophistication of computer-based products will reduce the need for the average person to understand principles of computer science - just as today's automobile requires less mechanical acumen on the part of the operator than earlier vehicles. (When did you last check your oil?) While we will still need computer scientists and engineers, I simply do not foresee a significantly escalating need for those people - despite today's hiring challenges. Rather, the majority of people will find themselves interacting with computer applications, and the industry has recognized that a given product will be successful if the software meets the human's need rather than requiring the human to conform to the software's limitations. In other words, the tough stuff is under the hood. When software engineers do their job well, it is simply not necessary for the end user to "understand computers".

— Posted by Ian King

8. April 2nd,
2008
4:05 pm

Ian: Beautifully said. The analogy with car manufacturing is insightful. The more complex and sophisticated a technology becomes, the less tinkering it requires on the user's part. Just because the telephone was invented, not everyone needed to be trained as a switchboard operator.

For the vast majority of users, computers remain relatively basic writing, calculating, information processing, and, increasingly, entertainment devices. In many white collar jobs, companies train their employees how to use a customized, in-house mix of computer programs and processes—thus rendering moot any advanced computer training someone might have learned in high school or college.

Computer programmers often scoff at the relative unsophistication of the way that we paeans make use of computers (point and click, basic text editing, etc.). But techies also tend to "oversell" what computers have to offer everyday users, making our lives unnecessarily complex. (Computers are overkill for many everyday tasks.)

Those who need highly specialized computer applications will undoubtedly acquire the wherewithal to seek them out or develop them themselves.

— Posted by Matt

9. April 2nd,
2008
5:31 pm

"We need doctors, too - should every elementary child be taught anatomy?"

Every middle school child learns Biology and then receives it again at least once in High School. A student can leave High School without even the slightest understand of how a computer works or how to program one.

I think several comments misunderstand the term 'computing'. 'Computing' does not refer to the practice of using a computer — which if not being done in schools already means we're in big

trouble, but instead refers to the science and math behind computers.

Math and Computer Science are deeply connected and I believe CS should be mandatory at some level in High School.

— Posted by JS

10. April 2nd, 2008 5:36 pm

I'm reading Clifford Stoll's High tech Heretic right now. I'd bet he'd have something to say about this.

I'm a mathematician who makes a living writing code. Computer Science is *not* maths. They have different goals. I use programs like Mathematica (Wolfram Research) every day, but I'd never use it to teach high school algebra, and I'd be cautious about using it to teach calculus.

Not everyone needs higher math, but everyone needs to know algebra and basic geometry without computers or calculators. They need to know when their calculator — or some bureaucrat — is giving them a nonsensical number.

In my opinion, maths education has been a mess since at least as long ago as I was in high school - the late 1950s and early 1960s. The entire *point* of maths has been lost. It is not primarily a left-brain activity. It is a way for the left brain to make sense of the patterns that the right brain already knows about.

It is more important to know the difference between fact and opinion. Computation can help. Math can help more. Actually caring about how the world really works instead of some computer simulation — that's priceless.

— Posted by George Woodrow III

11. April 2nd, 2008 6:50 pm

As a second-career Computer Science teacher in a public high school, I can tell you that a lot of water has already passed under the bridge. After graduate school, I spent time at the MIT AI lab and later at BBN ... So, I spent 20+ years in various places in the "industry."

Today, I fight on a daily basis to educate parents, Administrators, School Board members, and, ironically, other teachers who still think that Computer Science is about software applications. It's almost as bad as the industry representatives who think that Computer Science is only about programming computers, or some such thing.

Thank you for this article, by the way, which I shall forward to my Principal and several members of the hierarchy who have some influence (but not enough, sadly) in the creation and delivery of curriculum.

By way of a reality check for the majority of readers: One big reason that CS hasn't found a home in the public school classroom is due to the shipwreck called No Child Left Behind (or, No Child Left Alive), which has so badly damaged the public schools that it will require YEARS just to return to normal health. With our narrow focus on the so-called "academics" to the exclusion of anything that isn't reading 101 or arithmetic, we've eliminated the courses that engaged a generation of students.

Regards,

TomR

— Posted by Tom Reinhardt

12. April 2nd, 2008 7:56 pm

There are two distinct issues here: one is computer-assisted education, and the other is how big a place learning about computers themselves should occupy in grades K-12.

Computer-assisted education is useful, but has shown mixed results. Computers are tools, like a pencil, or a simple, hand-held calculator, but obviously are much more complex.

Education is always going to be a human activity. Everyone has fond memories of at least one teacher who influenced him or her in a positive manner. These memories are about human interactions, not about human-machine interactions.

Hence computer-assisted education is mostly going to be dependent on the humans who interact with the students, showing them what is in the computer-assisted lessons, how to navigate the software, etc. Here, better teachers make for better learning.

The quality of the educational software also has an influence on how well computer-assisted education is conducted. Better software = better lessons and learning.

Teaching computers as a subject matter is a matter for the school's curriculum. This will depend on the school, its budget, its leaders, and its orientation. Some high schools decide to focus on teaching technology and trade skills more than on general pre-college courses.

In general, computers as a subject to learn about are emphasized in the higher grades of basic education. This makes sense, because full rational thought in terms of logic and understanding does not begin

until early adolescence, as per Piaget.

Also, one needs the fundamentals of reading and math skills in order to negotiate the understanding of computers.

Some of you may object, saying that you yourself jumped into computers as a subject matter when you very young. This may be true, but you are likely to be quite bright, and also are likely to be a self-learner with a high degree of motivation. Such is not the case for most of us.

It is important for a discussion such as the one in this blog to separate these two distinct computer-related activities: computers as an educational tool, and computers as a subject matter to study.

— Posted by Rob L; N Myrtle Beach SC

13. April 2nd, 2008 8:19 pm

I'm an electronic engineer, and math is part and parcel of my career.

When long division was taught in 3rd grade I was out sick for two weeks. I *never* felt I fully understood long division until I got a chance to implement division in assembly language on an IMSAI 8080 microcomputer late in high school. The mechanical act of coding the process brought complete clarity!

My first read of this article was met with disagreement. I couldn't see how letting kids play with toys could teach them the core of mathematics. On reflection, and remembering the above, I now couldn't agree more with the ACM movement. But I would argue that teaching Word and Excel won't help in any way. Well, maybe Excel.

— Posted by Ken Schmahl

14. April 2nd, 2008 9:22 pm

Interesting article. I teach in a middle school computer lab. My focus is supposed to be on "Business Applications", yet I still find time to introduce web page creation, LOGO and Scratch to my students. I do my school's web page because the techies at the district level can't figure how to set up a server and include all the schools. My students get to use a LCMS for my class, so they have some experience of having to create and use online content.

Yet, I worry that when I retire in just a few years, there will be no one to go forward and the lab will slip into "Business Applications" only — how boring and, I think, a loss to those students.

— Posted by CarlB

15. April 3rd, 2008 2:23 am

I am from originally India, have lived in the US for the last 14 years and work in the 'hitech industry'.

I am amazed and very concerned at the frequency that I hear from seemingly college educated people who keep touting the self deprecating "Oh! I dont get math" .. "I am not a math person!"... and yet they make it sound fashionable. Something is very wrong with this culture of ignorance!

In my opinion, there is also something fundamentally wrong rooted in the observation in the article.. "the math panel report recommends well-designed computer instruction as a way to nurture greater fluency in math and understanding of math concepts, from drill and practice to programming..." Why not go back to the basics and use a "well-designed math instruction to enhance understanding math?

Injecting computers or any form of CS program with the hopes of improving our grade school students math ability has no chance of making a positive difference. We need to go back to the basic of arithmetic (not math) instruction at elementary levels; then follow up with rigorous algebra and geometry at middle and high school. Calculators should be completely disallowed until high school. Computer courses should be offered only in high school for those with an aptitude and proven abilty on algebra and math.

— Posted by S.k.S

16. April 3rd, 2008 9:52 am

Computing is not only useful in support of traditional science and mathematics (and many other areas), but also is giving us a revised perspective on our theoretical understanding in physics and other sciences. Thinking from a programming perspective as well as a purely mathematical one is extremely useful (as Minsky observed, you never understand anything until you learn it more than one way).

Computing is becoming more than a useful support system for managing information in many, many fields - it's becoming it's own approach to them. Stephen Wolfram's New Kind of Science should be integrated into the curriculum of any high school seeking to promote critical thought.

— Posted by Alex O'Neal

17. April 3rd, 2008

Studying computing isn't studying math. Computing has far more in common with logic than math. From the basic of logic gates to

10:14 am   designing relational databases, computational skills aren't needed - but clear, linear thinking is.

— Posted by AlibiFarmer

18. April 3rd, 2008 11:05 am

"Computers are generalized information machines (see Alan Turing, et al.), useful for teaching almost any subject at any level. The failure to fully understand this must be part of the reason computers are so poorly utilized in schools".

No argument with the first part of the statement but I do not think that is why they are poorly utilized in schools. Remember when we say schools we mean all schools not just your well off middle class schools. Think NYC, Newark, or rural school in Kentucky. The reason why computers are not utilized properly would be things like:

1. Technology purchases are a low priority compared to keeping a building in good repair.

2. Money is finite. Computers vs. increased security personnel, and technology. Where do you think the priority lies.

3. Where are the people who are going to teach using technology, computers, programming etc. When a Computer Science graduate makes a choice he/she can choose to start at 35K in a school or 50k in an industry job. Not a hard choice also when you think of the long term advancement opportunties.

4. Can computers be used to replace teachers for teaching basic skills? I wish I knew the answer to this one but right now my feeling is no. I teach in a relatively affluent community where the vast majority of my students have home access to computers but their basic skills (ability to read, write, and compute) is very low. From what I see most young people do not see computers as tools for learning but rather a tool for staying socially connected. If we could find a way to leverage this connection to increase their ability to learn we'd have something.

— Posted by Paul

19. April 3rd, 2008 11:14 am

Take a walk through your neighborhood school. What you will see are classrooms with computers, some with 5 or so, some with one on each desk. most are not being used. They sit idle most of the time. If a teacher is lucky he or she can have a program that actually works with the curriculum, most do not. Computers make a great supplement to education. Only now are teachers graduating with the skill set to use them. These teachers who grew up using them are able to use computers to enhance the curriculum. Computers should be an tool of the teacher much like chalk and textbooks.
The use of computers should not be noticed, they should be regarded as a part of the total educational experience.

— Posted by Scott

20. April 3rd, 2008 11:27 am

Computers in grade schools are a huge waste of tax dollars. Studies show the Fin's have the best educated kids without the use of computers in the classroom. Not only that, but from my experience the kids are always at the same level or further ahead than the teachers in their computing abilities. Schools should stick to the basics and let families and kids decide what else is needed. Our society's blind acceptance that anyone can be anything they want, and computers are the answer to educations problems is the biggest problem. Modern parents push they're kids into certain fields instead of letting kids pursue they're real talents where they can really excel doing something they enjoy while making even better contributions to society and the economy.

— Posted by Roger Miller

21. April 3rd, 2008 5:52 pm

I think S.k.S. has the right idea when it comes to comes to the idea promoting math literacy. There's a pervasive culture of ignorance that strongly inhibit many schoolchildren's desire to learn math, science, or for that matter - much about any subject material. Invariably, students are going to be attracted to different things, primarily hobbies focused on the practical.

Do I think Computer Science instruction would have a positive influence improving performance in math and sciences? Probably, because it may reach out to students who may be thrilled with the power that comes with programming and developing computing systems. However, it's not going to take to everyone - just like so many science and math majors belittle Liberal Arts studies that many highly intelligent college students are passionate about.

The point is, for math scores to improve, a culture must understand its importance and learn to care about it. Whether the motivation is financial, or intellectual, aesthetic or social - people need to stop thinking "Who cares?" when it comes to math and science before things will improve. It's hypocritical to denegrate these skills, and

then become enraged why students and teachers don't perform well.

I work directly with many high school and college students who are definitely not "math/science types," but for one reason or another must learn. Once the desire is there, the rest simply falls in place.

— Posted by Jeff

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