The N-percent Solution


The following is quoted from "The Two Percent Solution" an editorial in the March 1984 issue of The Computing Teacher.

I am frequently asked how much money schools should be spending for instructional use of computers. My answer is that it depends upon the goals set by the school or district.

But that answer is less than satisfying to administrators in a school district who are just beginning to make a serious commitment to the instructional use of computers. Administrators need help in determining the level of expenses and nature of the commitment that may be necessary over the long run.

With these people I discuss "The Two Percent Solution." The idea is simple enough. Let's see what could happen if a school district budgeted two percent of its total funds, year after year, for instructional computing.

The closing paragraph of this editorial states:

Two percent is a good initial goal. It is enough money to establish a solid program of instructional use of computers. However, two percent will probably prove quite inadequate over the long run. Perhaps a few years from now I will be writing an editorial on the five-percent solution. That is closer to the level of funding that will be necessary if we want to provide one microcomputer per two students, a good goal to aim at in the next decade.

Almost a decade has passed since that editorial was written. The computer world has changed immensely. The number of computers in schools has grown rapidly, but the ratio is still considerably less than one computer per 10 students. The amount of compute power that a dollar will purchase has gone up by far more than a factor of 10. The quality and quantity of educational software has steadily increased. And, of course, we now have hypermedia that greatly increases the need for more computer power and more equipment.

I think it is time to reanalyze the recommendations in "The Two-Percent Solution." Should the recommended percentage now be much larger, such as the five-percent mentioned in the closing paragraph of the March 1984 editorial? Or has the rapid gain in price-to-performance ratio of microcomputers made it possible for schools to achieve their instructional computing goals with less funds?

There are lots of ways to approach these questions. The approach used here is to estimate the dollars per year needed in each of four major categories, convert each dollar figure to a percentage, based on an estimated average school budget per student per year, and then tabulate the results.
One of the key ideas that is emerging is that students and teachers need both the convenience of easily portable computing facilities and the greater power and versatility of non portable facilities. It seems evident that students need both portables and docking stations—systems that connect to portables and that can tie together and provide easy access to a full range of the multimedia facilities appropriate for use in education.

Category 1: Teachers. This category includes hardware, software, teacher training, curriculum development resources, and other direct support of teachers in their professional work at school and at home.

Category 2: Students. This category includes hardware, software, and courseware that students carry around to use at school, home, and wherever else suits their convenience.

Category 3: Classroom. This category includes the hardware, software, and courseware in a classroom for use by teachers and students (for example, docking stations providing access to multimedia facilities).

Category 4: Other (Infrastructure and Miscellaneous). This category includes networking, computerized libraries, maintenance and support personnel, technology coordinators at the school and district level, contingency funds, and miscellaneous.

Here are my thoughts as to where schools should be headed in each of these categories.

1. Teachers. Every teacher should have a powerful, easily portable computer. Many teachers need a docking station at home; all teachers need ready access to a docking station at school, for example in their office area. There is a tremendous need for on-going inservice for teachers. I would allocate between $1,000 and $1,500 per teacher per year.

2. Student. Every student should have a reasonably powerful, easily portable computer for use both in school and outside of school. I would allocate between $250 and $400 per student per year.

3. Classroom. Every classroom needs a powerful multimedia teacher presentation station. Most classrooms also need a reasonable number of multimedia docking stations for students. I would allocate between $4,000 and $6,000 per classroom per year.

4. Other (Infrastructure and Miscellaneous). The computer facilities in a school and school district need to be networked to each other and to the world. Students and teachers need routine access to local and worldwide computerized databases and libraries. There are many special needs students in schools who need far more resources than are allocated above. Including contingency and miscellaneous, I would allocate between $100 and $200 per student per year, and between $500 and $1,000 per teacher per year.

What do all of these allocations add up to? Suppose that a school system has one teacher per 25 students, 30 students per class, and a budget of $5,400 per student per year (the latter figure being the current national average for K-12 education). Then the totals are:

<table>
<thead>
<tr>
<th>Category</th>
<th>Lower % of</th>
<th>Upper % of</th>
<th>Lower $ per</th>
<th>Upper $ per</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers</td>
<td>4.00%</td>
<td>6.00%</td>
<td>$1,200</td>
<td>$1,800</td>
</tr>
<tr>
<td>Students</td>
<td>0.83%</td>
<td>1.33%</td>
<td>$75</td>
<td>$120</td>
</tr>
<tr>
<td>Classroom</td>
<td>13.33%</td>
<td>20.00%</td>
<td>$12,000</td>
<td>$18,000</td>
</tr>
<tr>
<td>Other</td>
<td>0.38%</td>
<td>0.63%</td>
<td>$1,620</td>
<td>$2,700</td>
</tr>
</tbody>
</table>

Total: $27,570 per year.
Most people laugh when they see these figures. "You are joking, right?"

One response is to suggest a look at business and industry. In "knowledge industry" types of businesses, what is the annual expenditure per worker for the types of support listed above? Of course, the answer varies a great deal. However, if we think of both students and teachers as "workers," than the recommendations I have made are small relative to the support that workers receive in many businesses.

When was the last time you visited the office of an executive secretary or administrative assistant in a high tech company? Do you think that $1,000 per year would pay for the equipment that this person is using? Arguments such as these tend to be convincing to people who are familiar with business and industry.

The next question is often, "Okay, I believe you. But where could the money come from?" The answer to that has three parts. First, reallocation of current funds can make a significant dent in the resources problem. For example, all schools have staff development, curriculum development, and library funds that might be reallocated. Second, good arguments can be made that school budgets will need to increase. Third, there will need to be a major change in the nature of school staffing. Businesses have made massive cuts to middle management and to support staff. Right now, in a typical school system, only about 40 to 45 percent of the budget is used for salaries and benefits of teachers. In addition, few schools make adequate use of a differentiated staffing structure that includes a number of instructional assistants.

The above type of analysis leads me to believe that a 10% to a 20% "solution" should be the goal in the next decade.

**Retrospective Comment 8/28/08**

Changes in networking and easily portable storage devices have decreased the importance of docking stations. Improvements in portable computers have increased the number of people who are satisfied to just have a laptop, and do not feel the need to have both a laptop and a desktop computer.

During the past 16 years, the costs of many of the items discussed in this editorial have decreased while their capabilities have substantially increased. Moreover, the average amount of public school funding per student has increased. Taking all of these things into consideration, a school can now take the approach of providing every student with a laptop for quite a bit less than 10% of the budget. This “experiment” is being tried out at quite a few schools throughout the country.
Higher education has achieved similar results, but through a different approach. Nowadays, a typical student owns a computer. The college or university provides wireless connectivity. Some of the software a student needs is purchased by the student, and some if provided by the college or university. The college or university provides quite a bit of technical support. Even with students buying their own computers, a typical college or university is probably spending more than 5% of its total budget for ICT.