Whose Computer is it, Anyway?: Schools Embrace Computers Without Knowing Why

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There are now approximately 325,000 microcomputers in schools in the U.S. with most school districts scrambling to purchase more. The intensity of this interest in school computers is undoubtedly attributable to parental concerns about future job prospects for their children, despite growing evidence that the high tech society has a greater need for low paid, semi-skilled factory labor than for high paid systems analysts. Exploiting these concerns, computer hardware and software makers have tended to reinforce commonly held, but little substantiated, beliefs about children and computers. For example, Commodore computers are for the child who wants to "learn" as well as "play games", with the implication that if you don't buy one for your children they won't be able to go to college.

Despite the questionable assumptions being made about why computers should be in schools there may well be considerable benefits to having them there. Computers can in principle be used to make educational resources more widely available (e.g., through network access to data bases and library resources), to facilitate more active student involvement in and control of learning (e.g., through the use of computer tools such as text editors and programming languages), and to partially address the needs of students who are victims of educational neglect.

Unfortunately, the progressive potential of the computer is all too often unrealized. Intentionally or unintentionally, computer use is more apt to reinforce existing patterns than to change them. In many ways the introduction of computers appears to be increasing rather than reducing inequalities in education.

These inequalities were not caused by computers, but they may well be reproduced and even accentuated by their use. We examine here three areas in which these problems arise: hardware, software, and classroom use. We present more examples on the third area because it is more apt to be overlooked in discussions of equity in computer use, and because the process by which inequalities are produced is more subtle.

Inequalities of Access

"There is a persistent and substantial inequality in the access to new technologies among both schools and school children." In simple terms, the poorer a school is, the less likely that the school is to have any of this new technology." So said Tarr-Whelan, the President of the National Education Association, before the House Subcommittee on Science, Research and Technology this spring [1]. One measure of inequality is the student to computer ratios among categories of schools. Not surprisingly, urban schools

with a high proportion of poverty-level families have more students per computer than either suburban or rural schools. The graph below (adapted from [2]) shows the results of a nationwide survey of school districts by Market Data Retrieval during the 1983-84 school year. It is clear that as the percentage of children from poverty level families goes up, so does the number of students who must compete for access to a computer.

One of the bills on computer education now before Congress -- the Computer Education Assistance Act introduced by Senator Frank Lautenberg -- reserves 50% of the Federal funds for hardware purchases by poverty area school districts. But even if that bill should become law, which seems unlikely, it will only alleviate inequality at one level of the education system, and there are other ways in which computers aggravate existing inequalities rather than reduce them.

Inequalities of Software Usage

Even if urban schools should catch up in the number of computers owned and access to some kind of computer becomes equalized from school to school, there may still be substantial educational inequality. The number of computers in a school is a poor indicator of the quality of educational experiences that students get when they sit down at the terminal. Here, too, inequalities are already apparent:

> While middle class students, especially those who are in advanced programs (e.g., Gifted and Talented Education) receive instruction which encourages learner initiative (programming and problem solving), low income and ethnic minority students receive instruction which maintains the control of learning within the program (computer aided drill and practice).[3]

For example, Rand Corporation conducted an intensive study of 40 elementary and 20 secondary teachers in California who were nominated as exemplary computer users in mathematics and science instruction. [4] Four types of computer use appeared: orchestration-- with the widest variety of uses directly linked to the regular curriculum; enrichment--which familiarized students with computers as a separate subject; adjunct instruction--that selectively augmented math and science lessons; and drill and practice in basic skills. On the question of equity, the researchers conclude:

> Both percent minority and ability level were associated with variation in instruction. Specifically, classrooms with students above average in ability and low in numbers of minorities tended to be found with teachers characterized as "orchestrating"... [Whereas] the five classrooms with a high percentage of minority students low in ability employed computers to deliver drill and practice (p. 62).

No one claims that computers have created this disparity in educational experiences, but they certainly appear to reinforce it them.

Some studies have found greater access to and use of computers by boys than by girls, especially at the high school level and during electives and after-school periods.

> Boys outnumber girls 2 to 1 in high school programming courses and 3 to 1 in attendance at computer camps. They have less access to computers at home and are less likely to participate in free time (out of class) computer

use at school. [5]

But here, the type of computer software and computer use makes a difference. Studies of computers used for writing by upper elementary school children have not found girls to be at a disadvantage. In our own study of computers with writing by upper elementary school children have not found girls to be at a disadvantage. In our own study of computers with writing software in two urban sixth grade classrooms, we found that girls were as likely to be star computer users as boys. And while some boys in each class were prolific writers on the computer, the girls overall did more computer writing than the boys. Moreover, when students were ranked by amount of computer writing done, and relative ranks were compared across time, girls in both classrooms tended to move up in rank over time while boys tended to move down.

The fact that computers seem to reinforce, rather than change existing patterns still holds. Pre-computer stereotypes of male mathematicians vs. female writers are apt to continue with computer use. None of these patterns (orchestration for the rich/drill for the poor; greater access for boys; stereotypical use, etc.) are necessary in any absolute sense. They occur because present social and political relationships take precedence over issues of fairness or general educational value. The patterns of inequity persist unless they are deliberately and systematically countered.

Inequalities Within a Classroom

We know from studies of student-teacher interaction that students within any single classroom receive differential treatment from the teacher. Considered positively, this differential treatment is called "individual instruction." Considered negatively, it is a source of discrimination and self-fulfilling prophecies. Computers are very different from teachers in one way, and like them in another. The difference -- often mentioned by advocates of computer instruction for minority children -- is that computers don't see the color of a child's skin or hear his non-standard speech. Teachers form expectations on the basis of unconscious reactions to cues such as these; computers do not. That is an important difference.

But the similarity is that a computer, like a teacher, is a scarce resource, and in the allocation of this resource within a single classroom, the gap between the haves and the have-nots can be widened. In our observations of two urban sixth grade classrooms, each with a computer used for writing, we have seen teachers integrate the computer very differently into their writing programs. These observations have led us to raise some general questions about the relationship between computer use within a classroom and students' access to computer time and expertise.

If the computer is used in the final stage of writing to produce a neat, typewritten copy (rather than as a text- editing tool), the speed with which a student writes a first, hand-written draft often determines his or her number in line to enter text on the computer. Students who start out writing better and quicker often are rewarded by a prompt turn, which allows for a prompt (and probably more meaningful) connection between what they wrote on paper and what they entered into the computer.

If access to the computer is strictly controlled by the teacher (so that students have scheduled times or have to have their writing checked and OK'ed by the teacher before writing on the computer), then absenteeism is likely to influence how much time a

student has on the computer. Students who are absent often (for whatever reason) are more likely to miss their turn or be denied their turn while making up other assignments. This is often the case with students who are pulled out of the classroom for special tutoring (such as students with diagnosed learning disabilities or Title I status). Thus students who have the most to gain from time on the computer are often kept off because of institutionalized absenteeism (known as "pull-out" programs). Alternatively, some teachers have found that by making use of innovative approaches such as peer tutoring students do not necessarily fall behind just because they miss a lesson.

Another kind of access to the computer comes through students' knowledge of text-editing commands used for inserting, deleting, and rearranging text. Different teachers have different strategies for teaching their students text-editing skills. If a teacher becomes fully versed in the commands, group and individualized instruction is possible, so that the entire class can be given basic information, and advanced instruction can be provided to those students who seem "ready" for it. If a teacher does not become proficient with the commands, access to necessary skills becomes more problematic.

As an example, one of the teachers in our study did not fully master the text-editing commands. Instead, she selected one student -- a boy who seemed interested in and facile with the computer -- to become the classroom "expert." She had another teacher (who was herself an expert) give this student individual instruction, and then directed the other students to see him with questions about computer commands. By the end of the school year, only this student had fully mastered the basic text-editing commands and understood the mode orientation of the text editor. Two other students knew a few commands; both of them were close friends of the student-expert.

In this classroom, voluntary grouping at the computer was allowed when students had free time. As a rule, groupings at the computer divided along sex lines (as did grouping in the lunchroom and on the playground). Not surprisingly, the student-expert's knowledge of text-editing commands diffused narrowly in this classroom, and did not cross sex lines. Not a single girl in the class knew how to move the cursor up and down the screen or to insert or delete text.

Thus, how information about the computer is made available to students (via wall charts, formal instruction by the teacher, or informal teaching by a student expert) and how information is passed from student to student (through voluntary grouping or assigned pair work) limits or enlarges students' command over the technology.

Conclusion

Many children are effectively denied access to new educational technologies because they live in the wrong school district. Others are able to use computers, but only in the most limited ways. Our classroom study suggests that in addition to these inequalities in educational access the same computer with the same software may be used very differently by different teachers, even in the same school and with the same student population. For this reason, if we are concerned with questions of equity in computer distribution and use, we must have ways to evaluate the actual occasions of use in real classroom settings. Before asking what impact a computer with a particular kind of software will have on student learning, and hence whether it is a good thing or not, we must ask what impact the classroom (and in particular, the teacher) will have on the way the computer is used, how students get a turn, and how computer related

information is made available to students. It is these classroom-specific factors overlaid on system-wide factors such as computer and software availability that ultimately determine a student's access (or lack of access) to computer-related learning opportunities.

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