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ABSTRACT

This report presents findings from a national survey on the extent of microcomputer use in elementary and secondary schools. The survey results indicate that: (1) in half of the schools with microcomputers, only one or two are regular users; (2) many teachers have become more than mere computer users and spend much time on programing; (3) in schools with microcomputers, one student in every seven uses the computer in an average week; (4) secondary schools are more likely to have microcomputers, and to have more of these, than elementary schools; (5) secondary school students have more access time to computers than elementary school students; (6) computer access time for students increases as schools get more microcomputers; (7) more computer time is used for programing than for drills and remedial activities; and (8) in elementary schools, drill and practice programs using computers function to increase students' understanding of the computer more than to teach subject matter and basic skills. (Author/MJL)

School Uses of Microcomputers

Reports from a National Survey
Issue No. 2, June 1983

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Center for Social Organization of Schools The Johns Hopkins University

Note for Readers New to this Series

This is the second interim report from the National Survey of School Uses of Microcomputers. The results presented are based on data from 1,082 microcomputer-using schools, representing 68% of a nationally representative sample of public and non-public elementary and secondary schools that obtained one or more microcomputers for use by teachers or students prior to January, 1983.

The first issue in this series, published in April, presented basic data on the number and uses of microcomputers in elementary and secondary schools (as reported by the primary computer-using teacher in each responding school), and on apparent changes in their use over time.

Focus of this Issue: How Much are Micros Actually Used

The fact that microcomputers are present in a majority of U.S. schools does not necessarily mean that most students are getting exposure to them nor that they are being intensively used. A handful of microcomputers available to student bodies of many hundreds or even thousands means either that students must get very little time to experience microcomputers or that only a few students may get sufficient time for the experience to be more than merely exposure to a new cultural object.

This issue looks at the numbers of students and teachers using microcomputers in elementary and secondary schools, the number of hours per week that microcomputers are in use, and the amount of time that each student-user has with the machine, both in general and for specific learning activities.

How Many Computer-Using Teachers?

To understand patterns of student use, it is important to first look at how many teachers do different things with microcomputers.

In About Half of the Schools with Micros, Only One or Two Teachers, at Most, are Regular Users. In a few schools, primarily elementary schools, NO teachers regularly use the school-owned microcomputer with their students. Most often, though, one or two teachers are involved in its use. For example, in exactly one-half of all secondary schools with a microcomputer, one or two teachers regularly use a microcomputer with their students. "Regular Users" are teachers who either use packaged programs such as those for math or language drills or who teach computer programming to students.

The other side of the coin is that in about half of the micro-owning schools, more than two teachers are regular users of the equipment. Where more than a few teachers are involved, it is most often by using packaged "learning games" or "drill-and-practice" programs. Rarely do more than one or two teachers teach programming to students, and this is true both for elementary and secondary schools. (See Figure 1.) The emphasis on using "drill" and "game" programs in

schools with many computer-using teachers is somewhat deceiving, though, as will be apparent when we examine the findings on student use.

Figure 1: How Many Teachers Per School Use Micros

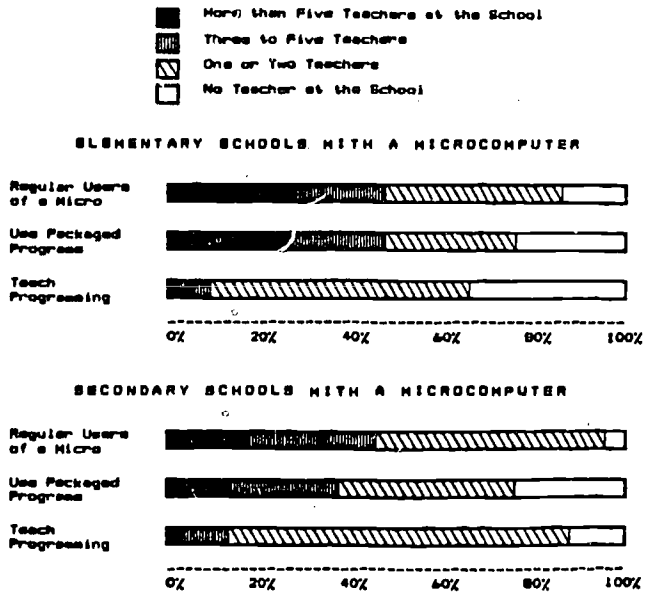
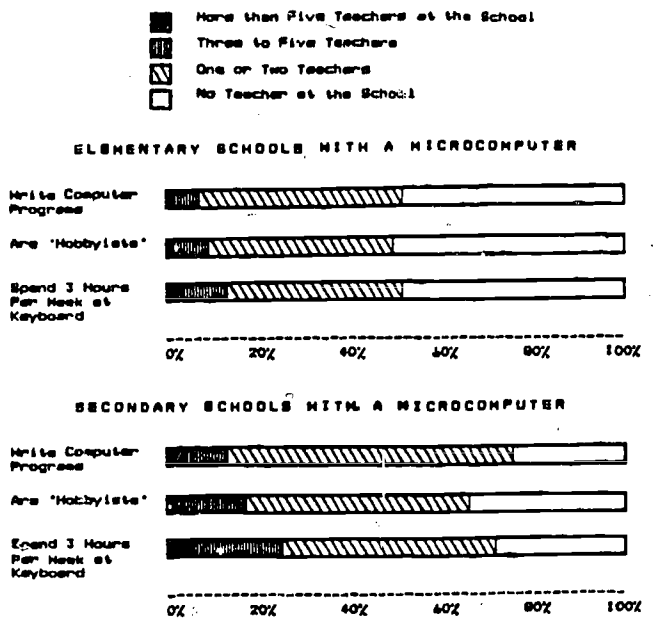


Figure 2: How Many Teachers Are "Computerists"



Many Teachers Have Become "Computerists" Rather Than Merely "Computer-Users." In about half of the elementary schools and 70% of the secondary schools, at least one teacher spends time writing or designing computer programs for use with students; at least one is thought to be "a computer hobbyist"; and at least one is reported to "spend three or more hours per week working at a microcomputer keyboard." (See Figure 2.) There are seldom more than two of these "computerists" in any one school, but a majority of computer-owning schools has at least one teacher whose use goes beyond packaged programs or instruction in computer programming.

Descriptive Statistics on Student Use of Micros

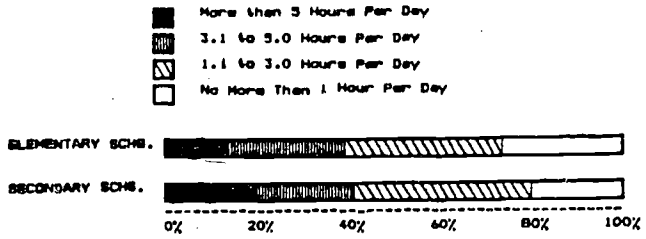
How Many Students Use Micros in an Average Week? Respondents to the survey reported student use for each of up to five computer-using teachers. Based on these answers and imputing additional use to other teacher-users, we estimate that about 70 students use microcomputers in the typical micro-owning school during any given week (62 in elementary schools and 77 in secondary schools). This represents about one student in every seven in those schools with a microcomputer (16% of the students in micro-owning elementary schools; 13% of the students in micro-owning secondary schools).

Elementary schools are more likely than secondary schools to have obtained a microcomputer but not yet begun to use it with students; but they are also more likely to give a substantial fraction of their students some exposure to the microcomputer. In about a third of the micro-owning elementary schools, more than 40% of the student body has some contact with a micro; this is true for only one out of every eight secondary schools with microcomputers.

Schools Vary A Great Deal in How Much Their Micros Are in Use. On the average, microcomputers are used by students for about two to three hours per day. (The typical elementary school micro is used 11 hours per week; the typical secondary school micro is used 13 hours per week.) However, quite a few schools

make relatively little use of their microcomputers. About one-quarter of the elementary schools and one-fifth of the secondary schools use their equipment no more than an hour per day. At the same time, there are many reports of machines being in constant use. About one-fifth of secondary schools with micros and one of every seven elementary schools with micros indicate that their micros get more than five hours of use per day each. (See Figure 3.)

Figure 3: How Much Use During the School Day

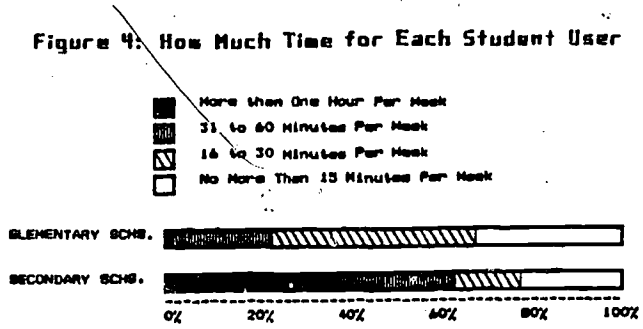


In Elementary School, A Student Who Uses a Micro Gets Less Than 30 Minutes of Use During a Week. Even if a school uses its microcomputers all day long and limits access to perhaps 60 students (two classes) per week, if a school has only one or two of them, it would be difficult for students to receive a major exposure. Because (1) most elementary schools with micros do have only one or two micros, (2) many schools try to give access to as many students as possible, and (3) they typically use their equipment during only one-half of the school day, each student user is not likely to get much time at the computer.

Figure 4 shows that a third of the elementary school users during a given week actually use a micro for 15 minutes or less during that week--or, equivalently, three minutes per day each day for a week. (The survey did not inquire whether the same students use the microcomputer each week, or whether different students get the 15 minutes of exposure during different weeks.)

Of the remaining students who get more than 15 minutes, most get only

Figure 4: How Much Time for Each Student User



an additional ten or fifteen minutes per week. Only one student user in 50, at the elementary school level, gets more than one hour of time on a microcomputer during a given week--that is, about 15 minutes per day, each day for a full week.

Secondary School Users: A Majority Get More Than 45 Minutes Per Week. Secondary schools typically have

Reader's Note

Estimates of how many students use microcomputers and how much time they use them do not include use of the equipment to play games unrelated to classroom work, unless that play is under the direction of a teacher.

The reader should be aware of the distinction between our use of the word "typical," as in "typical school," and the word "average." "Typical" is used to denote the median case--the school at the midpoint of the distribution of values from "lowest" to "highest" on the matter in question, such as "access time per student user." It is used to draw attention to the center of the distribution. Where "mean" or "average" is used, we are focusing on the total distribution. The mean is very much affected by schools with extreme questionnaire responses and in most cases, the median gives a better overall picture of micro-owning schools.

more microcomputers. (See Issue No. 1 of This Newsletter.) Consequently, even though secondary schools usually give only a few more students access to micros during a week, and typically use their equipment for only 2 more hours per week, the students who use microcomputers have an opportunity to use them for longer stretches of time.

As Figure 4 shows, nearly four out of every ten secondary school microcomputer users have access for more than one hour during the week that they are a "user." About the same proportion of users, though, have 30 minutes or less time during the week. But on the average, secondary students who use a microcomputer have about twice as much access time during an average week as their elementary school counterparts.

Effect of Having More Micros on How They are Used

Schools with more microcomputer resources can do two things with their relative surplus: (1) extend access to more students or (2) give each student-user a more intensive computer experience. Elementary and secondary schools display striking counter-tendencies regarding these alternatives.

As Elementary Schools Get More Micros, They Give Access to More Students. Elementary schools with more micros do not give students any more minutes per week at the computer keyboard--they just extend the opportunity to a larger number of students. (The correlation coefficient between number of micros and percent of students who use micros is about +.3; the correlation between number of micros and "minutes per user" is +.04.)

As Secondary Schools Get More Micros, They Give Longer Access to the Same Number of Students. At the secondary school level, the corresponding relationships are exactly reversed. There is a positive correlation of +.3 between the number of micros a school has and the number of minutes per student user, and hardly any correlation at all between the number of micros and the percent of students who are micro-users. That is, secondary schools with five or more micros have only a few more student users than those with one or two; the students merely get an opportunity to use them for more minutes during the week. Because the average use at the secondary school level is only 45 minutes per user per week, such

Table 1: Teacher-Directed Computer Activities: Reported Incidence: Number of Students Involved

(NOTE: Data often were not reported for EACH computer-using teacher at the school, so the numbers in this table are apt to be somewhat reduced from what really prevails.)

	ELEMENTARY SCH. W/MICRO		SECONDARY SCH. W/MICRO	
	Percent Reporting This Micro Activity	Where Used, Median No. of Students Involved	Percent Reporting This Micro Activity	Where Used, Median No. of Students Involved
Do Drills, Remedial Work, Unspecified Math, Language	54%	40	43%	40
Write Programs, Computer Literacy, etc.	43%	32	81%	42
Play "Learning Games," Recreational Games, etc.	46%	30	22%	20
Applications: Word Proc., Lab Tool, Data Proc., other use for Business classes, etc.	---	--	12%	20

additional use does not usually reflect a great deal of time, but could perhaps be the difference between requiring one week to complete an assignment instead of two weeks.

Time Spent Doing Different Things on Micros

Programming Users Get More Time Per User Than Drill Users. In elementary schools with microcomputers, teachers report using the equipment for drills and remedial activity somewhat more frequently and with slightly more students than they report using micros to teach students to write computer programs or to "play learning games." (See Table 1.) However, the average student who uses the micro for drill-and-practice at this level gets only two-thirds as much time at the computer as his fellow student who is using the micro to learn to write programs. (See Table 2, panel A, column 1.)

All in all, few students at the elementary level spend a substantial amount of time at a microcomputer during a given week, regardless of how they are using the machine. Only four percent of elementary students given programming experience during the week spend an hour at the computer, while less than one percent of students asked to do drill-and-practice spend this much time. (See Table 2, panel A, column 3.)

At the secondary school level, both the total time spent doing different things and the difference in "time-per-student" between drill-and-practice and programming uses are much more substantial. The typical programming student gets nearly an hour per week to use the school's microcomputers, while the secondary student getting skills practice gets only 17 minutes use per week--a difference of more than three to one. (See Table 2, panel B, column 1.) This "time-per-user" difference is above-and-beyond the fact that nearly twice as many secondary schools report use for programming as report use for drill-and-practice. (Table 1, column 3.)

Table 2: Time-Per-User for Different Activities

ELEMENTARY SCHOOL MICRO-USERS DURING AN AVERAGE WEEK

Activity	Median No. of Minutes of Use Per Week	Percent of Users with Use of... 1-15 Min./Week	More than 1 Hour
Write Programs, Computer Literacy, etc.	19 min.	49%	4%
Do Drills, Remedial Work, Unspecified Math, Language	13 min.	60%	0.5%
Play "Learning Games," Recreational Games, etc	12 min.	73%	0.5%

SECONDARY SCHOOL MICRO-USERS DURING AN AVERAGE WEEK

Activity	Median No. of Minutes of Use Per Week	Percent of Users with Use of... 1-15 Min./Week	More than 1 Hour
Write Programs, Computer Literacy, etc.	55 min.	18%	44%
Do Drills, Remedial Work, Unspecified Math, Language	17 min.	48%	9%
Play "Learning Games," Recreational Games, etc.	11 min.	56%	9%
Applications: Word Proc., Lab Tool, Data Proc., other use for Business classes, etc.	30 min.	28%	31%

Besides students using micros for instruction in computer programming, another group of secondary school micro-users gets a reasonable amount of time to use the equipment. Although relatively rare, students who use school micros for editing and writing ("word processing"), or as part of a science or electronics laboratory, or in their business curriculum, tend to get large chunks of time to use the computer equipment. Typically, they get 30 minutes a week, which is half of what a programming student gets, but twice as much as what is given to students using the equipment for drill-and-practice. A third of the students using the microcomputer for what might be called advanced non-programming applications get more than an hour of time per week, which is a far higher proportion of student users than any group except secondary school programming students.

A SNAPSHOT OF MICROCOMPUTER USE IN AMERICAN SCHOOLS

A survey as complex as this inevitably produces numbers that "don't add up." There are internal inconsistencies in the questionnaires, "missing data" from some schools, and incompletely reported information. The tables presented in these reports are selected after examining the data for potential sources of bias; thus they present results that are not overly affected by these problems. In order to draw together the various loose strands to produce a reasonably consistent global summary of how much microcomputers are being used in schools, we must make a number of "rounding adjustments" and "imputations." The statistics that follow, then, may best be regarded as rough but quite reasonable estimates of the amount of use of microcomputers in schools.

I: Micro-Owning Elementary Schools

The typical microcomputer-owning elementary school has two microcomputers, each used for about 11 hours per week, or a total of 22 hours of use per week by students under the direction of a teacher or other staff member. About 62 students (in the student body of 400) share these 22 hours of use, which is equivalent to about 20 minutes per user per week.

If computer time at this "typical" school were divided among activities according to the average or mean use of student instructional time (as we estimate it from reported and imputed use in elementary schools), we would find the following distribution of uses: Approximately 40% of all instructional time on the microcomputer is spent by having students use computer programs for practicing math and language facts, spelling drills, and various other memorization tasks. Approximately one-third of the instructional time on the microcomputer is spent having students copy, write, and test computer programs. Students spend most of the rest of the time (about 20% in all) playing games under the direction or approval of the teacher. Many of these are "learning" games, presumably designed to be "drill-and-practice" assignments presented in a more entertaining, and presumably more motivating, guise.

II: Micro-Owning Secondary Schools

The typical microcomputer-owning secondary school has approximately five microcomputers, each in use for 13 hours per week, or a total of 65 hours of use. About 80 students (in a student body of 700) use the equipment in an aver-

age week--a little more than 45 minutes per user. Programming and computer literacy activities occupy fully two-thirds of the instructional time on computers in secondary schools. "Drill-and-practice" activities take up another 18% and the remainder is split among "learning games," various advanced applications such as word processing, science lab work, and business courses, and other activities.

III: Distribution of Computer Learning Time

Because secondary schools are more likely to have microcomputers and because they have more of them, the overall picture of how schools use microcomputers is affected strongly by their use in secondary schools, primarily high schools. (In a later report, we will distinguish use in high schools from use in middle and junior highs.) In fact, about three-fourths of all student time on microcomputers in pre-college educational institutions occurs in secondary schools--only one-fourth is in elementary schools. (See Table 3.) The dominance of programming in secondary school applications of microcomputers means that overall, combining elementary and secondary schools, a majority of student time on microcomputers involves programming activities.

Table 3: Distribution of Time on Micros in Schools

(Raw data was supplemented with rough estimates for students of computer-using teachers whose data was not reported in the survey questionnaires.)

Expressed as Percent of All Student Instructional Use (Pre-College)

	Elementary	Secondary	Total
Write Programs, Computer Literacy	9%	48%	57%
Do Drills, Remedial Work, Unspecified Math, Language	10%	13%	23%
Play "Learning Games," Recreational Games	6%	4%	10%
Applications: Word Proc., Lab Tool, Data Proc., other use for Business classes, etc.	--	4%	5%
Other Uses	--	4%	5%
Subtotal for Educ'l Level	26%	74%	100%

Finally, although most drill-and-practice programs that are published by commercial organizations involve math and language subjects initially presented to students in the elementary school curriculum, there are actually more hours devoted to drill-and-practice activities in the secondary schools than in the elementary schools. This is due both to the greater number of micros in secondary schools and to the more extensive access to micros given to each secondary school user.

A Question: In Elementary Schools, Are Drill-and-Practice Programs Really Used for Drill--or is this "Computer Literacy" in Disguise? Given the rather limited exposure of elementary school students to drill-and-practice on

the computer (typically no more than 15 minutes per week), and given that having more computers usually translates at this level into more students gaining access rather than more access time per user, perhaps microcomputers in elementary schools are playing a different role than that usually ascribed to them, even by the teachers involved. (See Issue No. 1 for data on the frequency of different "Regular" uses of micros as seen by the primary computer-using teacher.)

The data shown in the figures and tables in this issue are consistent with the hypothesis that microcomputers in elementary schools do not function as major ingredients in the teaching of principles and techniques of verbal and mathematical operations, as do other media such as books, chalkboards, and worksheets. Most students do not get a sufficient amount of time for any appreciable skill building to take place, even if the computer programs were up to the task--which is itself another issue. Instead, the effect of using "drill-and-practice" programs may be to acquaint students with a bit of the nature and capacity of computational equipment in the context of showing them how computers can be useful in practicing skills. Thus, the primary consequence of this drill-and-practice experience may be an increased understanding of computers themselves rather than subject-matter learning.

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