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ABSTRACT

As a baseline measurement of what is being learned about computers in California, a study, originally reported in "Student Achievement in California Schools: 1982-83 Annual Report," investigated the knowledge, attitudes, and experiences of a representative sample of 6th and 12th graders. The survey was developed by experts on computer technology drawn from the public school system, universities, and industry, and included questions based on objectives used with the Department of Defense Dependent Schools, attitude questions, background statements/questions to assess relevant prior knowledge of computers, and demographic questions. The sixth grade survey was given to a sample of students as part of the April 1982 administration of the California Assessment Program Survey of Basic Skills. Findings indicate that most students have had programming experience by the 12th grade and that programming experience was associated with markedly higher test scores. A large majority of students exhibit awareness of routine characteristics and uses of computers. Performance on programming objectives is low, however, and mastery of general knowledge is not much higher. Boys appear to have an advantage over girls in computer knowledge. This report includes 39 tables, 3 figures, and a 16-item reference list. (LMM)

California Assessment Program

Computer Literacy of California's Sixth and Twelfth Grade Students

Prepared Under the Direction of
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Contents

Synopsis of Findings

The study described and reported in this publication was sponsored by the California Assessment Program (CAP) of the State Department of Education, and it was conducted during the 1982-83 school year. A sample group of sixth and twelfth grade students from throughout the state was tested during the study.

The results of the study were originally published in Student Achievement in California Schools: 1982-83 Annual Report (Sacramento: California State Department of Education, 1984). They are reproduced here because of the wide interest shown in the use of computers in the classroom and the relationship between the use of computers and other educational and social experiences.

This is a report of a study on the knowledge, attitudes, and experiences of California's sixth and twelfth graders in the area of computer technology. It is intended as a baseline measurement of what is being learned about computer technology in California, not as a measure of success.

A committee of experts on computer technology was drawn from the public school system, universities, and industry. The committee designed a survey that assessed a wide variety of instructional objectives in the area of computer studies as well as attitudes towards computer technology and relevant experiences with computers.

A representative sample of twelfth graders was tested in December of 1982. Sixth grade students were tested in April of 1983.

Twelfth Grade Results

- More than half the students in the twelfth grade sample reported actually having used a programming language of some kind. Thirty-seven percent reported having used BASIC.
- Playing games--instructional games or video games--was not associated with higher test scores in computer literacy or computer science.
- A substantial majority could correctly identify simple truths and misconceptions about computers.
- More detailed knowledge of computers, as measured by test scores, was low. Knowledge of programming was very low. Sixteen percent reported having learned programming in school.
- Twelfth grade boys scored consistently higher than the girls did. The better performance of boys was associated with greater exposure to computer technology.
- There was a clear relationship between test scores and the parents' educational levels. Children of more highly educated parents consistently scored higher than children of less well-educated parents.

Sixth Grade Results

- About 68 percent of sixth graders indicated having some type of in-school computer learning experience, and 56 percent said they had used some type of computer in school.
- About 15 percent of the sixth graders reported having learned to write computer programs at school.
- A substantial majority could identify simple truths and misconceptions about computers and saw a much larger role for computers in the work place.
- Test scores summarizing detailed knowledge of computers were low, and scores representing knowledge of simple programming techniques were quite low.
- Boys scored higher than the girls did, and students with professionally employed parents scored higher than students with parents in semiskilled or unskilled occupations.

Background

The computer can be a means of educating students and an object of study in itself. Historically, in the public schools, there has been more interest in the former application than in the latter. These two applications are not mutually exclusive. Using the computer as an instructional tool invariably requires learning something about the machine and how to operate it. It is also true that the study of computers and programming can be a natural and stimulating way to learn problem-solving skills and various mathematical and scientific concepts.

There is strong evidence for the growth of a serious interest in computer studies. The California State Board of Education in 1983 made computer studies a part of its model graduation requirements, a measure which is being considered and duplicated in other states. The College Entrance Examination Board in 1982 inaugurated an advanced placement test for high school students in the area of computer science. The National Center for Educational Statistics in 1983 initiated a nationwide study of computer literacy.

The primary goal of this study was to examine the knowledge, attitudes, and experiences of California's sixth and twelfth graders in the area of computer technology. The study was designed to encompass the diverse educational objectives of many different district and school programs. The result was a baseline measurement of what California's students know about computer technology. It should not be interpreted as an evaluation of a particular course of instruction.

Educators have witnessed in recent years a lively debate about what students should learn about computers. Statements of educational objectives have been published by the Committee on Computer Education (1972); the National Council of Supervisors of Mathematics (1978); Johnson, Anderson, Hannon, and Klassen (1980); Anderson and Klassen (1980); Rogers (1982); and the Department of Defense Dependents Schools (1982). Interest has risen to the point that textbooks have begun to appear (e.g., Horn and Poirot, 1981; Miller, Chaya, and Santora, 1982; and Luerman and Peckham, 1983). Discussion of various key issues can be found in Papert (1980); Melmed (1982); and Shane (1982).

The National Assessment of Educational Progress (NAEP) included several questions on computers in its 1977-78 mathematics assessment, which have been reported by Carpenter, Corbitt, Kepner, Lindquist, and Reys (1980). They concluded that a large majority of the thirteen and seventeen year old students tested had little or no experience in actual applications of computers. For example, only 8 percent of thirteen year olds and 13 percent of seventeen year olds said they knew how to program a computer. By contrast, there was a somewhat higher level of awareness of the routine uses of computers. Understanding of more sophisticated uses of computers in complex decision making and mathematical modeling of problems was more limited.

Method

Twelfth Grade Survey

A committee of specialists in computer technology was assembled from the public school system, universities, and industry, and they designed a survey to assess a wide variety of instructional objectives in the area of computer studies, attitudes towards computer technology, and relevant experiences with computers. Cognitive test questions were written to conform to a set of objectives that was developed and used with the Department of Defense Dependents Schools (DoDDS) curriculum shown in the chart entitled "DoDDS Student Objectives."[1] Test questions were reviewed for relevance and accuracy of content, sex or ethnic bias, and typographical correctness. All cognitive test questions were multiple choice with four options.

Attitude questions were obtained from a set that had been administered by the National Assessment of Educational Progress in a 1977-78 mathematics

[1] The terms "computer literacy" and "computer science," as used in this report, should be understood in light of the described objectives. The number of questions relevant to each objective is written in parentheses after each statement. There were, in all, 430 questions, including 239 for the area of computer literacy and 191 for computer science. The Northwest Regional Educational Laboratory in Portland, Oregon, shared questions that had been written for a DoDDS evaluation and assisted in the question-writing process.

DoDDS Student Objectives

Following are the objectives used as the basis for the curriculum of the Department of Defense Dependents Schools (DoDDS). They are arranged by DoDDS objective category and subcategory numbers. The number after each item is the number of survey items devoted to that objective on the twelfth grade test.

1. Demonstrate understanding of the capabilities, applications, and implications of computer technology. (239)

   1. Interact with a computer and/or other electronic devices. (42)

      1. Demonstrate ability to operate a variety of devices which are based on electronic logic. (8)
      2. Demonstrate ability to use a computer in the interactive mode. (13)
      3. Independently select a program from the computer resource library. (9)
      4. Recognize user errors associated with computer utilization. (12)

   2. Explain the functions and uses of a computer system. (91)

      1. Use an appropriate vocabulary for communicating about computers. (25)
      2. Distinguish between interactive mode and batch mode computer processing. (9)
      3. Identify a computer system's major components, such as input, memory, processing, and output. (20)
      4. Recognize tasks for which computer utilization is appropriate. (14)
      5. Describe the major historical developments in computing. (23)

   3. Utilize systematic processes in problem solving. (58)

      1. Choose a logical sequence of steps needed to perform a task. (10)
      2. Diagram the steps in solving a problem. (7)
      3. Select the appropriate tool and procedure to solve a problem. (11)
      4. Develop systematic procedures to perform useful tasks in areas such as social studies, business, science, and mathematics. (12)
      5. Write simple programs to solve problems using a high-level language, such as PILOT, LOGO, or BASIC. (18)

   4. Appraise the impact of computer technology upon human life. (48)

      1. Identify specific uses of computers in fields, such as medicine, law enforcement, industry, business, transportation, government, banking, and space exploration. (12)
      2. Compare computer-related occupations and careers. (13)
      3. Identify social and other nontechnical factors which might restrict computer utilization. (10)
      4. Recognize the consequences of computer utilization. (11)
      5. Differentiate between responsible and irresponsible uses of computer technology. (2)

2. Demonstrate understandings of computer systems including software development, the design and operation of hardware, and the use of computer systems in solving problems. (191)

   1. Write structured and documented computer software. (95)

      1. Write well-organized BASIC programs which include the use of color, sound, and graphics statements. (41)
      2. Write programs which demonstrate advanced programming techniques used to solve problems in business, scientific, or entertainment applications. (19)
      3. Write programs in an additional high-level language such as PASCAL, COBOL, or FORTRAN. (25)
      4. Write programs in a low-level language, such as machine language or assembler. (10)

   2. Demonstrate knowledge of the design and operation of computer hardware. (57)

      1. Demonstrate unassisted operation of at least two different configurations of computers and their peripherals. (16)
      2. Use a special-purpose computer or computer-interfaced devices to monitor or control events by sensing temperature, light, sound, or other physical phenomena. (10)
      3. Describe the computer's digital electronic circuitry in terms of binary arithmetic and logical operators. (19)
      4. Perform vendor-authorized minor maintenance on the computer system. (12)

   3. Use computer systems in problem solving. (39)

      1. Use data processing utilities, including word processing and data base management, in problem solving. (12)
      2. Translate software from one language to another or to another version of the same language. (11)
      3. Analyze different solutions to the same problem. (16)

assessment. Each of the 13 attitude questions requested the student to indicate agreement (strongly disagree, disagree, undecided, agree, strongly agree) with a particular statement. The statements were:

- Computers dehumanize society by treating everyone as a number.
- The more computers are used, the less privacy a person will have.
- Computers will probably create as many jobs as they eliminate.
- Computers slow down and complicate simple business operations.
- Someday most things will be run by computers.
- A knowledge of computers will help a person get a better job.
- Computers can help make mathematics more interesting.
- Computers are suited for repetitive, monotonous tasks.
- Computers are programmed to follow precise, specific instructions.
- Computers require special languages for people to communicate with them.
- Computers have a mind of their own.
- Computers make mistakes much of the time.
- To work with a computer, a person must be a mathematician.

The committee designed background statements/questions to assess relevant prior knowledge of computers and experiences with them. The statements/questions were:

- Indicate which of the following languages you have actually used to write and run computer programs. (BASIC, PASCAL, LOGO, PILOT, FORTRAN, COBOL, FORTH, ASSEMBLY LANGUAGE, Other, None)
- Indicate which of the following video games you have at home. (Atari, Odyssey, Intellivision, Colecovision, Other, None)
- Indicate which of the following types of microcomputers you have at home. (Atari 400 or 800, TRS-80, Apple, PET-Commodore, IBM, Texas Instruments, Osborne, Other, None)
- Indicate which of the following types of microcomputers you have used at school. (Atari 400 or 800, TRS-80, Apple, PET-Commodore, IBM, Texas Instruments, Osborne, Other, None)
- Approximately how many hours per week outside school do you spend in each of the following activities? (Reading for pleasure, Doing homework, Playing video games at home, Playing video games away from home, Working with a computer, Athletics, Watching television, Other hobbies

or recreation--None, Less than 1 hour, From 1 to 2 hours, From 2 to 3 hours, From 3 to 4 hours, From 4 to 5 hours, Between 5 and 10 hours, More than 10 hours)

- Indicate the types of in-school microcomputer learning experiences you have had. (Write programs, Generally learn about computers, Drill and practice, Simulations (math or science demonstrations), Tutorial, Instructional games, I have had little experience with computer.)

- Indicate where you learned about computers. (At home, At friends' homes, Special summer programs, Museum or science hall, At school during the day, At school during the evening, Computer stores or salesmen, Playing with video games, I know little about computers.)

Students were asked to report demographic information, including sex and level of parent education. The five possible categories of parent education were:

- Not a high school graduate
- High school graduate
- Some college
- Four-year college graduate
- Advanced degree

That category corresponding to the highest educational level reached by a parent was to be selected.

The test was designed in a matrix format so that each student saw only a small part of the entire pool of questions. Eighty-six unique forms of the test were created, each containing five cognitive test questions, one attitude question, and two background questions. The attitude and background questions were assigned to the 86 test forms so that each would appear approximately an equal number of times. A different set of cognitive test questions, selected to cover both computer literacy and computer science objectives, appeared on each form. These were arranged so that easier questions appeared first on the test. The test forms were spiraled for distribution so that each one would be given about the same number of times within each school.

Sixth Grade Survey

The questions selected for use with sixth grade students were a subset of those developed for twelfth graders. The selected questions were included on the CAP Survey of Basic Skills: Grade Six, which is administered annually to all public school sixth grade students in California. There are 40 different forms of the test, and each student takes just one form. In addition to the reading, written expression, and mathematics questions included on each form, there was space for one additional computer test question. This meant that 40 different computer test questions could be given to sixth grade students.

Twenty-four cognitive test questions were selected. These questions all corresponded to DoDDS objectives appropriate for elementary graders, and all related to computer literacy. The question categories are identified by a DoDDS number. (See "DoDDS Student Objectives.") The categories and number of questions were:

- Objective 1.2.1, Use an appropriate vocabulary. (4 questions)
- Objective 1.2.2, Distinguish interactive and batch processing. (3)
- Objective 1.2.3, Identify major computer system components. (4)
- Objective 1.2.4, Recognize appropriate tasks for a computer. (1)
- Objective 1.2.5, Describe major historical developments. (2)
- Objective 1.3.4, Develop procedures to perform useful tasks. (2)
- Objective 1.3.5, Write simple programs. (4)
- Objective 1.4.1, Know specific uses of computers. (2)
- Objective 1.4.2, Know computer occupations and careers. (3)

In addition to the four regular response options originally included in the questions, sixth graders were permitted an "I don't know the answer" response to each of these questions. The cognitive test questions given to sixth graders were:

- 1.2.1 What is a computer program?
- 1.2.1 What is a computer printout?
- 1.2.1 To say that a computer has 16K memory means that:
- 1.2.2 You can interrupt data processing when you use which mode?
- 1.2.2 Batch mode is often preferred over interactive because it is:
- 1.2.2 What is the main advantage of the interactive mode?
- 1.2.3 Besides input and output equipment, what must a computer have?
- 1.2.3 Which part of a computer is used to prepare permanent written reports?
- 1.2.3 Which part of a computer is used for mass storage of information?
- 1.2.3 Computers are least useful for which of the following tasks?
- 1.2.4 Computers can do which of the following tasks?
- 1.2.5 Who was the inventor of the 80-column IBM punch card?

- 1.2.5 The scientific discovery which made microcomputers possible was:
- 1.3.4 A computer would be most useful for which part of an experiment on farming?
- 1.1.4 Word processing on a computer is useful in business because it:
- 1.3.5 In the BASIC computer language, a string contained within PRINT statement is:
- 1.3.5 In what computer language is the following program written?
- 1.3.5 In what computer language is the following program written?
- 1.3.5 In BASIC programming, you type in the line you want and then ...
- 1.4.1 Which of the following fields uses computers to store large quantities of information?
- 1.4.1 A basic use of computers in libraries involves:
- 1.4.1 Computers are useful in medicine because they can:
- 1.4.2 Which of the following persons is most likely to be skilled in writing computer programs?
- 1.4.2 Translating a flow chart into a computer language is the job of a:
- 1.4.2 What is the main duty of a computer programmer?

The four background questions asked of sixth graders included: types of in-school learning experiences; presence of video games at home; types of computers used at school; and where students learned about computers. All except two of the rating scale, or attitude, questions were included in the sixth grade survey. The two excluded questions were those that assessed factual knowledge of computers: computers are programmed to follow precise instructions; and computers require special languages. This was done to maximize the number of regular cognitive test questions that could be asked.

Teachers supplied information on the sex of the student and parents' occupations. The categories of parents' occupations were:

- Professional
- Semiprofessional
- Skilled
- Unskilled

Teachers were instructed to select the category corresponding to the occupation of the principal wage earner.

Twelfth Grade Sample

Schools included in this study were sampled randomly. On the basis of California Assessment Program data collected the previous year, high schools were ranked and classified into five equal categories on the basis of number tested (a proxy for school size). Within each size category, schools were ranked and classified into five equal groups on the basis of an average index of parent education (a proxy for social class). This resulted in a five-by-five cross-classification of schools with equal numbers in each of the 25 cells. Schools were selected randomly with a probability of p = .125 from each cell.

From the original population of 784 schools, 98 were selected, which had an estimated 23,395 students. The sample did not differ significantly from the population in terms of achievement or parent education. The sample average number tested per school, N = 239, was smaller than the population average of N = 281, indicating a slight oversampling of small schools. Eighty-seven schools participated in the study, yielding a school response rate of 89 percent. Several schools declined to participate on the basis that their students were not prepared for such an assessment. Survey questionnaires were received from 17,861 students, yielding an estimated student response rate of 88 percent from participating schools.

Sixth Grade Sample

The Survey of Basic Skills: Grade Six was administered to 293,717 students between April 25 and May 13 of 1983 under standardized conditions. Test forms were assigned to students by an effectively random procedure, with approximately equal numbers of each test form given in each school. As a result, each computer test question was given to an average of 7,343 students. Rates of nonresponse ranged from 4 to 6 percent.

Analyses

Twelfth Grade Analyses

Responses to individual cognitive test questions were classified according to student objectives and aggregated on the basis of sex and parents' education. Students who did not attempt to answer any of the five cognitive questions on a given test form were excluded from the analysis. Given the matrix format of the test, each of the 430 cognitive test questions was answered by about 200 students. Percents correct for all objectives are shown in Table 1.

Plots of computer literacy (CL) and computer science (CS) composite scores for different levels of parents' education and sex are shown in figures 1 through 3. Percents of students selecting each option of the attitude questions were calculated, along with their average test scores. These scores are shown in tables 2 through 14. Each of the 13 attitude questions appeared on six different forms of the test and was responded to by approximately 1,200 students.

For each option, the percents of boys and girls and percents of students in each parent education category are reported. Analyses of the background questions, shown in tables 15 through 23, were similar. Background questions were placed on each test form in a pair, so that each one appeared on about 24 different test forms and was responded to by approximately 4,800 students.

Sixth Grade Analyses

All questions given to sixth graders were analyzed in a format similar to that already described. Total percents of students selecting each option of the questions were calculated. For each option, the percents of boys and girls and the percents of students in each parent-occupation category were reported. Percents correct for cognitive questions are shown in Table 24. Responses to attitude questions are summarized in tables 25 through 35. The analyses for the background questions are presented in tables 36 through 39.

Results

Twelfth Grade Results

Average scores for each student objective are shown in Table 1. There were several trends evident here which were confirmed in subsequent analyses. Test scores were not high for any of the objectives tested. This is not surprising given that most schools and districts were just beginning their computer studies programs. Scores were low, near the so-called "chance level" (25 percent correct) of responding, for those objectives calling for knowledge of programming, especially for those students with little actual programming experience. Students demonstrated higher mastery of objectives relevant to: the operation of electronic devices; appropriate tasks for computers; logical analyses of problems; and uses of computers in specific fields. Boys performed consistently better than girls. In one skill only, "choosing a logical sequence of steps needed to perform a task," did girls outperform boys. For most objectives, the difference in mastery was between 1 and 5 percentage points. There was a clear relationship between achievement and parents' educational levels. Children of more highly educated parents consistently scored higher than children of less well-educated parents. Differences in scores between students whose parents had advanced degrees and those whose parents had not completed high school were typically between 5 and 15 percentage points.

The overall results are displayed graphically in figures 1 through 3. Boys scored consistently higher than girls for all levels of parents' education in both computer literacy and computer science, as shown in figures 1 and 2. Higher levels of parents' education were associated with greater differences in test scores. These results may reflect a tendency for boys to take more advantage of opportunities, a tendency for parents or teachers to encourage boys more than girls, or a combination of both. Computer literacy and science test scores, broken down by parents' education, are displayed in Figure 3.

Concerns about privacy and being treated as a number are often associated with the introduction of computer technology. Student responses to questions about these issues are summarized in tables 2 and 3. Twenty-nine percent of the students were undecided with regard to the statement that "computers dehumanize society by treating everyone as a number," as shown in Table 2. There was a tendency for more students to disagree than to agree. The high average score on this item in computer literacy (CL), of 43.5 percent, correct, was obtained by those who disagreed; and the high average score on this item, of 34.0, in computer science (CS), by those who disagreed strongly. Of the 10.1 percent who strongly disagreed, more were male than female (62.3 percent versus 35.6 percent). Parents' education is associated with attitudes here. A larger proportion of students whose parents had not completed high school more strongly agreed than strongly disagreed. Responses to the statement that "the more computers are used, the less privacy a person will have," summarized in Table 3, were similar to those in Table 2. The modal response category, with 29.8 percent, was "undecided." Those who disagreed tended to score higher than those who agreed. A higher percent of boys than girls strongly disagreed (58.9 percent versus 38.4 percent).

Tables 4 through 7 address attitudes towards the effects of computers in the work place. To the statement that "computers will probably create as many jobs as they eliminate," there was a bimodal response pattern, shown in Table 4, with large percents of students both disagreeing (24.2 percent) and agreeing (34.9 percent). Overall, more students tended to agree than disagree. The highest average scores on this item were attained by the 9.6 percent who strongly agreed (CL = 57.4, CS = 36.8). There were more boys than girls in this group (56.0 percent versus 41.1 percent).

A plurality of 37.8 percent of students strongly disagreed with the statement that "computers slow down and complicate simple business operations," as shown in Table 5. Average scores of these students were higher than those of other groups (CL = 47.9, CS = 33.2). Relatively higher percents of students whose parents did not have a high school education tended to agree with the statement. The reverse was true for students whose parents had advanced degrees.

Seventy-nine percent of the sample either agreed (46.0 percent) or strongly agreed (33.0 percent) that "someday most things will be run by computers," as shown in Table 6. It was interesting, however, that the highest computer scores were obtained by the 3.0 percent who disagreed (CL = 57.4, CS = 37.4). A higher relative proportion of students from advanced degree families fell into this group than into any of the other groups. This may reflect sophisticated awareness that while computers may control many processes, people are the ultimate controllers of computers.

A similar overall pattern of response, shown in Table 7, was obtained for the statement "a knowledge of computers will help a person get a better job." Nearly three-fourths of those responding either agreed (46.2 percent) or strongly agreed (28.5 percent) with this statement. The highest average scores on this item went to those who strongly agreed (CL = 44.6, CS = 32.2). There were more boys than girls in this group (52.0 percent versus 47.1 percent).

Computer studies are generally thought to be related to mathematics. Two aspects of this belief are reported on in tables 8 and 9. Some 48.2 percent agreed and 23.9 percent of the sample strongly agreed that "computers can help make mathematics more interesting." Those who strongly agreed had the highest test scores on this item (CL = 51.4, CS = 30.5). Of this group, 60.9 percent were boys, compared to 35.4 percent girls. A somewhat different attitude was expressed by the statement that "to work with a computer, a person must be a mathematician." The pattern of responses here was bimodal, with 39.0 percent disagreeing and 21.9 percent agreeing. The highest average scores on this item were exhibited by the 14.3 percent who disagreed strongly (CL = 46.8, CS = 31.4). Relatively larger percents of students from lower educational backgrounds either agreed or strongly agreed. Those whose parents had advanced degrees were more likely to disagree or strongly disagree.

Tables 10, 11, and 12 summarize responses to simple statements of fact about computers. Responses here were less reflections of value judgments than assessments of knowledge of very basic facts about computers. The general pattern of response was the same for all three statements. More students tended to agree than disagree with them. The modal response category was "agree" in each case. Although smaller percentages of students agreed strongly, their scores were consistently higher than those of the other groups. The group that agreed strongly tended to include about 15 percent more boys than girls.

Responses to two possible misconceptions are summarized in tables 13 and 14: "Computers have a mind of their own" and "Computers make mistakes much of the time." Again, the task of the student was not so much to render a value judgment as to pass on the correctness of the statement. These were similar patterns of response to both statements. Larger percentages disagreed than agreed, and average test scores tended to be higher for those who disagreed. An exception to this were the high scores of the 1.8 percent of students who strongly agreed that computers make mistakes much of the time. This may be a sophisticated minority who were responding on the basis that the quality of computer output is no better than what is input. Roughly 15 percent more boys than girls strongly disagreed with these statements. Parents' education was related to the response: Relatively larger percentages of students whose parents have advanced degrees either disagreed or disagreed strongly.

The ability to write and use computer programs is an important outcome of a course on programming. Students were asked to indicate the computer languages they had used to perform these tasks. Results are summarized in Table 15. Percents in this and the following tables may not sum to 100, because students could select more than one option. BASIC, used by 37.0 percent of students (54.4 percent versus 44.2 percent), was the most frequently selected language. However, the highest average scores on this item were attained by the 3.3 percent minority who had used PASCAL (CL = 56.0, CS =40.1). Of the PASCAL users, 70.7 percent were boys, and 28.1 percent were girls. A plurality of 43.4 percent indicated that they had not used any languages, and their average scores were the lowest in this table (CL = 45.0, CS = 25.1). This group of nonusers included 53.0 percent girls and 45.3 percent boys.

Video games are considered by some to be a first introduction to computer technology. Responses are summarized in Table 16 to the question "Which of the following video games do you have at home?" The most frequently chosen

video game was Atari, 27.9 percent, followed by: Intellivision, 8.4 percent; Odyssey, 3.0 percent; and Colecovision, 2.3 percent. The scores of the Atari group (CL = 48.6, CS = 32.0) were only marginally better than those of the 53.0 percent of students who reported having no video game at home (CL = 47.5, CS = 31.5). Access to the other video games listed was associated with scores in the same range. Very few students whose parents had advanced degrees indicated having no video game at home. This was not true for students in the other parent-education groups.

Access to a microcomputer, at home or at school, ought to be positively associated with student mastery of computer technology. Schools provide a structured climate for learning, leading one to expect higher scores for students with access to a microcomputer at school. This was not necessarily the case, as shown in tables 17 and 18. The microcomputers and percents reporting access were: Texas Instruments, 14 percent; Atari, 9.9 percent; Apple, 5.2 percent; IBM, 4.0 percent; TRS-80, 3.1 percent; Commodore, 2.1 percent; and Osborne, 0.8 percent. The highest average scores on this item were associated with IBM (CL = 53.8, CS = 27.8) and Apple (CL = 53.8, CS = 31.7). This apparent advantage of IBM and Apple may be related to parents' education. Relatively high percentages of students whose parents had advanced degrees reported having access to these machines. Among the more frequently selected machines, Atari and Texas Instruments, and for the group reporting no home access, the scores for boys and girls were approximately equivalent.

Microcomputers found in the schools were: Apple, 20.0 percent; IBM, 12.6 percent; TRS-80, 10.2 percent; Texas Instruments, 7.8 percent; Atari, 7.0 percent; Commodore, 7.0 percent; and Osborne, 1.1 percent. Machines that were frequently selected in the home were not the most popular at school. One possibile explanation is that schools may base their purchasing decisions on the availability of educational software and in-service training. Price may be a more important criterion for home purchases. The highest average scores on this item were associated with the TRS-80 (CL = 51.6, CS = 34.1) and the Apple (CL = 50.5, CS = 31.6). Relatively larger percentages of boys than girls enjoyed access to a microcomputer at school. This was noticeable for the Apple and TRS-80 machines at school. Of the 42.6 percent of students who reported having no access to a microcomputer at school, more were girls (45.7 percent versus 52.8 percent).

It was reasonable to expect that the amount of time spent on activities outside school, such as working with a computer or playing with a video game, would be associated with test scores. Ideally, the amount of such activity would be observed directly by people trained for the task. This was not feasible, so students were asked to rate for themselves how many hours per week they typically spent in certain activities. The reliability and validity of such responses were limited by accuracy of memory and social desirability response biases. An indication that similar limitations may apply here was the nonresponse rate of about 15 percent, compared to less than 5 percent for the other questions. Given these points, the results can still be used to indicate general trends. Percents of students in each activity category are shown in Table 19, computer literacy scores in Table 20, and computer science scores in Table 21.

A majority of 59.2 percent of the sample reported doing no computer programming at home. This was identical to the percent reporting no microcomputer at home. Comparable percents of students reported not having a video game at home (57.2 percent). Relatively small percents of students reported programming computers at home more than two hours per week. More popular activities, involving more than ten hours per week, were television (12.3 percent), athletics (11.8 percent), and homework (10.1 percent). Increased involvement in four activities was associated with higher computer literacy scores, as shown in Table 20. These were: computer programming; doing homework; pleasure reading; and watching television. The highest average scores on this item were attained by the small group (1.9 percent) that spent more than ten hours per week programming. All four of these activities, with varying degrees of efficiency, involve the transmission of information and have potential for learning. However, the one activity that involved actually working with computers was associated with the highest test scores. Higher scores in the area of computer science were associated with only three activities. These were: computer programming; reading for pleasure; and homework. Again, the highest average scores on this item were associated with programming activities.

One measure of the effectiveness of school programs is the extent to which they are associated with higher achievement. Data summarizing students' microcomputer learning in school are displayed in Table 22. Fully 53.0 percent reported having little such experience in school, and their average scores were the lowest in the table (CL = 49.4, CS = 33.7). Percents of students indicating each type of experience were: general learning, 16.9 percent; programming, 15.6 percent; games, 12.3 percent; drill, 11.3 percent; simulations, 8.4 percent; and tutorial, 4.8 percent. The highest average scores on this item were associated with programming activities (CL = 56.9, CS = 46.8). Low average scores were associated with computer games (CL = 51.6, CS = 39.1). Boys were more likely to be involved in programming than girls (55.2 percent versus 42.2 percent), and girls were more likely to report having little experience with computers (45.6 percent versus 53.2 percent).

Learning about microcomputers in school appeared to have a powerful effect on test scores. This can be seen by comparing the scores of those who reported having programming experience with the scores of those reporting no experience. In computer literacy, there was a gain from 49.4 to 56.9, or 7 percent. The gain in computer science, from 33.7 to 46.8, or 13 percent, was about two times as large. Given that the test was not designed specifically to assess instructional outcomes in these classes, the estimated gains were conservative.

Microcomputers have so permeated our society that there are many different sources of information about them. Students' responses to where they learned, displayed in Table 23, were: at school during the day, 28.0 percent; video games, 21.2 percent; at home, 14.0 percent; at friends' homes, 9.8 percent; in computer stores, 6.4 percent; summer programs, 3.4 percent; at school in the evening, 2.4 percent; and at museums, 2.0 percent. Relatively higher scores were attained by those who reported learning in school, during the day (CL = 47.2, CS = 35.1) or during the evening (CL = 47.0, CS = 38.8). This fact reinforces the earlier findings regarding the effects of instruction. The lowest average scores were exhibited by the 44.9 percent of the sample who reported knowing little about microcomputers (CL = 38.6, CS = 27.3). This group contained more girls than boys (40.7 percent versus 57.7 percent). Although

many students reported learning from video games, their scores were, in fact, low (CL = 40.8, CS = 30.1).

Sixth Grade Results

Average scores for sixth grade students are shown in Table 24. Test scores ranged from a high of 38.6 percent correct for the vocabulary questions to lows of 19.2 percent correct for history and 22.4 percent correct for simple programming. These scores are not directly comparable to those of twelfth grade students for two reasons: the sixth graders were permitted an "I don't know the answer" option which was not available to twelfth graders; and the twelfth grade average scores represent more questions than were answered by sixth graders. With these qualifications in mind, overall twelfth grade scores were about 15 percentage points higher than were sixth grade scores.

Overall, sixth grade boys scored about 5 percent correct points higher than did the girls. Students whose parents were classified as professionals scored about 17 points higher than those whose parents were unskilled. Similar trends were obtained for the twelfth grade boys and girls and for students from different parent-educational backgrounds. It appeared, though, that the group differences in average test scores were smaller for the twelfth graders than for sixth graders.

Sixth graders' attitudes towards privacy and being treated as a number are shown in tables 25 and 26. A majority of students, 56.3 percent, either strongly disagreed or disagreed with the statement that computers treat everyone as a number. This compared to 35.9 percent of twelfth graders who gave similar ratings. Among sixth graders who strongly agreed, there was a relatively higher proportion with parents from unskilled backgrounds, indicating a possible relationship with the parents' occupations. There was a similar pattern of response for twelfth grade students in the lowest parent-educational category.

Sixth graders' concerns about privacy are reflected in Table 26. More sixth graders either disagreed or strongly disagreed, 34.6 percent, that computers lessen privacy than either agreed or strongly agreed. This compared to a figure of 30.8 percent for twelfth graders. Relatively larger percentages of students from unskilled backgrounds strongly agreed, and larger percentages from professional backgrounds strongly disagreed with the statement.

Tables 27 through 30 address sixth graders' feelings about computers in the work place. Twenty-two percent either disagreed or strongly disagreed that computers would create as many jobs as they eliminate, compared to 35.5 percent who agreed or strongly agreed. Some 46.7 percent either disagreed or strongly disagreed that computers slow down and complicate things. A majority of students saw a larger role for computers in the future. Sixty-six percent either agreed or strongly agreed that someday most things would be run by computer, compared to 11.0 percent who either disagreed or strongly disagreed. Students from professional backgrounds were more likely to indicate agreement, and those from unskilled backgrounds were more likely to indicate disagreement. Some 66.4 percent either agreed or strongly agreed that knowledge of computers will help people to get better jobs, compared to 11.4 percent who disagreed or strongly disagreed. Students from professional backgrounds were relatively more likely to agree strongly. Response patterns of sixth graders on these

questions were generally the same as those of twelfth graders. Higher proportions of twelfth graders saw a larger role for computers in the future and believed that knowledge of computers will help them get a better job.

Sixth graders tended to believe that computers can help make mathematics more interesting (Table 31). Some 71.3 percent of sixth graders either strongly agreed or agreed with the statement, compared to 72.1 percent of twelfth graders. Of the 24.5 percent of sixth graders who strongly agreed, 60.3 percent were boys, compared to 38.7 percent girls. Although a majority of sixth graders felt that computers help to make mathematics more interesting, they did not overwhelmingly believe one had to be a mathematician to work with a computer (Table 32). The response pattern to this question was bimodal, with 22.3 percent agreeing and 35.0 percent disagreeing. Relatively larger percentages of sixth graders from professional backgrounds and relatively smaller percentages from unskilled backgrounds tended to disagree with the statement. Twelfth grade students exhibited a similar bimodal response pattern, which was similarly related to parents' education.

Sixth grade students were generally able to recognize simple truths and misconceptions about computers, as shown in tables 33 through 35. A majority (53.9 percent) either agreed or strongly agreed that computers are suited for doing repetitive tasks. By contrast, 38.7 percent either disagreed or strongly disagreed that computers have a mind of their own. A possibly complicating factor is the recent publicity of artificial intelligence research. Artificial intelligence is the field of computer science that endeavors to create computers that can simulate human intelligence. A sophisticated student might infer that in some sense, computers can have minds of their own. Finally, 46.3 percent either disagreed or strongly disagreed that computers make mistakes much of the time. The response pattern of twelfth graders was the same but indicated a more informed awareness of these truths and misconceptions.

Video games were more popular among sixth graders (Table 36) than among twelfth graders. Only 34.7 percent of sixth graders reported not having a video game at home, compared to 53.0 percent of twelfth graders. This may reflect a tendency of older students to spend more time away from home. Of the sixth graders without home video games, 37.7 percent were boys, compared to 61.5 percent girls. Atari, with a 44.3 percent share of the sample, was the most popular video game among sixth graders. Twelfth grade results showed almost equal proportions of boys and girls without the devices but did show Atari as the most frequently selected one.

A substantial fraction of sixth graders, 31.9 percent, indicated that they had no in-school computer learning experience (Table 37). Of these students, a majority were girls, 54.5 percent, compared to 44.9 percent boys. Relatively higher percentages of students from unskilled backgrounds reported having no computer learning experiences in school. Types of in-school learning and the percents of students for each were: computer games, 33.1 percent; drill and practice, 21.8 percent; mathematics or science demonstrations, 17.9 percent; programming, 14.7 percent; and general information, 14.7 percent. Percentages may not sum to 100, because multiple responses were possible. Of the students who wrote programs, a majority were boys, 54.9 percent, compared to 44.3 percent girls. A larger proportion of twelfth graders, 53.0 percent, indicated having no computer learning experience in school. By contrast, a smaller proportion of twelfth graders reported using computer games in school.

Less than half of the sixth grade sample, 43.7 percent, reported not having a microcomputer at school (Table 38). Of this group, a majority, 52.0 percent, were girls, compared to 47.4 percent boys. Similar estimates were obtained for twelfth grade students. The most frequently indicated school microcomputer was the Apple, with 20.5 percent, followed by Atari, with 9.4 percent, and Commodore, with 8.9 percent.

Sixth graders reported learning about computers most frequently by playing video games, 42.4 percent, as shown in Table 39. Other frequently selected learning situations were: at school during the day, 27.3 percent; and at home, 22.6 percent. By comparison, fewer twelfth graders reported learning at home, 14.0 percent, or by playing video games, 21.2 percent. The large proportion of sixth graders who selected video games as a response may reflect a lack of clear understanding of the differences between video games and computers. This fuzziness of definition is increased, no doubt, by the use of many computers to play games and by simple computing capabilities of some devices marketed as video games.

Discussion

Affective goals are as much a part of the educational process as are cognitive goals. In addition to technical knowledge and skills, students should develop a positive regard for the beneficial capabilities of computers. Ideally, the more one knows about computer technology, the more evident these attitudes should be. Related to this is the ability to recognize popular myths about computers and their implied value judgments. Concerns about privacy and being treated as a number, although valid when understood in the context of the actual capabilities and limits of technology, can be exaggerated in isolation from such knowledge. Twelfth grade students who exhibited higher test scores tended to reject these concerns. There was a similar tendency to reject other, more naive, myths about computers; e.g., that they have minds of their own or make mistakes much of the time.

At the same time, there was an awareness of basic facts about computers by a substantial majority of twelfth graders. This general pattern of response supports the conjecture that a majority of twelfth graders have, at least, an accurate awareness of the general characteristics of computers. Responses to the background questions suggest that this awareness does not extend to widespread familiarity with machines or working knowledge of them for at least half the sample.

Sixth graders were less likely to believe that computers threaten privacy or treat people like numbers than twelfth graders. This is evidence that sixth graders are less likely to believe naive myths about computers. Other evidence that sixth graders tend to have a realistic awareness of the capabilities and limits of computers was the relatively large percentages who were able to recognize simple truths and misconceptions. Even with this relatively high level of awareness, it still was true that almost a third of the sixth graders either

agreed or strongly agreed that a person must be a mathematician to work with a computer. This mistaken belief, which is also held by many adults, is evidence that students need more educating about the basic concepts and uses of computer technology.

Perhaps the primary finding of the analysis of twelfth grade test scores was the generally low overall level of mastery, especially in the area of computer science. Results for the background questions provide some explanation. Roughly half the sample had never used a programming language or had access to a microcomputer at home or at school. Access to a video game was not associated with higher test scores. To learn computer programming, one must actually write programs and run them. School is a good place to learn programming. The BASIC programming language is more widely disseminated with microcomputers than any other; over one-third of the sample reported having used BASIC. However, FORTRAN, COBOL, and PASCAL were each used by 3 to 4 percent of the sample, and they were associated with higher test scores than BASIC. This may be a reflection of the sophistication of the languages. It is thought to be more difficult to learn FORTRAN or COBOL, and having learned these languages, one may know more about computer technology. Availability of software is one reason for the popularity of BASIC in the schools. The choice of programming language in schools needs further debate.

Overall, sixth grade scores were about 15 percent correct points lower than twelfth grade scores. This difference should be interpreted cautiously, since the twelfth grade scores are based on more test questions. Furthermore, the sixth grade students had the "I do not know the answer" option available, and the twelfth graders did not. The presence of this option may have decreased the likelihood of guessing by sixth graders, compared to what it would have been otherwise.

Both sixth grade and twelfth grade boys had generally higher scores than girls did. The reason for this difference appeared to be that boys had more experience with computers and programming than girls did. This was true at school and, to a lesser extent, at home. Sex equity has been an issue in public education, and it is likely that related concerns will carry over into the area of computer studies. If students with a background in computer technology benefit professionally from their experience, there needs to be an assurance that specific subgroups of the population are not being discouraged from acquiring that experience. This study does not explain why girls appear to have less experience in computer studies than boys, but it indicates that there is a difference.

It is unfortunate that social class historically has been correlated with achievement of all kinds. This relationship is clearly demonstrated in the area of computer studies, although the reasons for the relationship are not so clear. The difference in computer literacy scores between the highest and lowest parent education groups was about three times as large as the difference between boys and girls. It was about one and a half times as large for computer science scores. There was no trend for students from lower educational backgrounds to be less involved in learning about computers in school. They were less likely to learn about them at home or from friends. No students from the lowest parent-education category reported learning about computers in museums. Opportunities for learning extend beyond the school into the community and the

family. It would be desirable to assure equity of learning opportunities for students from all social classes, although this is no less difficult than important.

Conclusions

The NAEP 1977-78 mathematics assessment concluded that a large majority of students had no experience programming a computer. The more optimistic conclusion of the current study is that a majority of students have had programming experience by the twelfth grade. Programming experience--particularly in school, but at home as well--was associated with markedly higher test scores. This reflects substantial progress in implementing computer studies programs. A large majority of students exhibit awareness of routine characteristics and uses of computers. Performance on programming objectives is low, however, and mastery of general knowledge is not much higher. Boys appear to have an advantage over girls, which is probably the result of greater access to computers and experience with them, both at home and in school.

Students were aware that computer skills could lead to better jobs. Even students who had programming experience or who reported participation in a computer class at school did not display a level of knowledge that would be adequate for the practical needs of business. The issue--whether public schools should provide training sufficient for entry level jobs--is one that needs to be faced squarely. A positive answer would require the spending of large amounts of money on equipment, software, and teacher training. If the commitment is made to computer studies, the problem of equity of access, especially for girls, should be addressed. Efforts should be made to see that students from lower social classes benefit from such access as much as students from higher social classes.

Tables and Figures

TABLE 1

Percent Correct Scores for Twelfth Grade Students, by Objective and Subgroup, April 1983

Objectives	Percent correct scores							
				By parents' educational level				
	Total	Boys	Girls	Not high school	High school	Some college	Four years college	Advanced degree
1. Computer literacy	46.0	47.7	44.3	41.3	43.6	45.5	49.3	49.5
1. Computer Interactions	50.3	51.3	49.3	47.3	48.3	50.0	53.0	52.5
1. Operations	67.9	69.7	66.0	63.7	68.9	67.1	72.4	67.9
2. Interactive mode	49.0	48.8	48.8	41.9	44.8	50.8	50.5	53.7
3. Program selection	48.9	49.4	48.5	50.7	43.7	49.1	50.9	51.4
4. User errors	40.7	43.4	38.5	37.5	40.7	39.6	44.6	41.3
2. Functions and uses	41.5	44.2	38.9	35.7	38.9	40.5	45.4	46.8
1. Vocabulary	38.5	40.6	36.6	32.2	35.5	37.0	42.6	44.0
2. Interactive vs batch	25.9	27.1	24.8	24.1	25.9	23.0	31.1	27.2
3. System components	44.2	47.4	40.9	36.4	40.6	44.3	47.9	49.6
4. Appropriate tasks	69.8	71.7	67.8	62.7	63.6	71.0	73.7	77.4
5. History	30.7	34.0	27.3	25.4	29.4	29.3	33.5	35.8
3. Problem solving	44.2	45.3	43.2	40.0	43.2	43.6	46.8	46.3
1. Logical steps	63.1	63.1	63.2	60.7	60.4	65.1	62.9	64.2
2. Diagrams	49.5	49.7	49.1	41.7	50.3	46.6	55.4	50.6
3. Tools and procedures	43.3	44.3	42.1	36.1	42.4	40.7	45.9	49.3
4. Useful tasks	50.4	51.7	49.3	48.1	49.4	49.9	54.0	51.1
5. Simple programs	28.3	30.0	26.6	26.5	27.4	27.7	30.6	28.6
4. Impact on life	52.9	54.8	51.2	48.6	49.4	53.5	56.0	56.1
1. Specific uses	58.3	62.6	54.2	56.3	53.6	58.1	62.9	61.3
2. Occupations	49.3	49.7	48.9	44.3	46.3	50.3	51.1	54.2
3. Restrictions	52.4	53.8	51.6	47.9	50.8	51.7	55.4	55.3
4. Consequences	53.2	54.2	52.1	48.2	48.6	55.1	57.5	55.5
5. Responsible use	43.8	44.8	42.8	35.0	44.1	46.1	40.6	45.0
2. Computer science	29.2	30.7	27.8	27.1	27.4	29.2	30.1	31.9
1. Software	26.1	27.1	25.2	24.7	24.9	25.8	26.3	29.1
1. BASIC programming	28.7	30.1	27.7	25.0	26.0	29.1	29.4	33.5
2. Advanced techniques	30.7	31.2	30.2	28.2	29.9	30.6	31.5	32.7
3. PASCAL, COBOL and FORTRAN	20.0	20.8	19.4	20.8	19.5	20.5	19.5	20.5
4. Machine language	21.7	23.1	19.9	26.7	24.0	17.0	20.1	25.1
2. Hardware	34.8	36.7	32.9	31.6	32.5	35.5	35.6	37.1
1. Configurations	37.4	39.7	35.3	33.9	33.4	38.5	35.8	43.6
2. Interface devices	50.2	51.0	49.5	45.1	46.8	49.3	56.4	53.7
3. Circuitry	21.7	23.8	19.5	19.8	21.9	22.2	21.1	22.2
4. Maintenance	39.0	40.8	37.3	35.2	38.1	40.4	39.9	38.7
3. Problem solving	28.6	30.3	26.9	26.5	25.9	28.0	31.4	31.2
1. System utilities	33.7	36.1	31.5	32.0	30.5	33.7	38.0	34.6
2. Software translation	18.3	20.4	16.5	15.3	16.4	17.7	20.2	21.5
3. Analysis	31.6	33.1	30.4	29.8	29.0	31.1	33.3	35.0

TABLE 2

Computers Treat Everyone as a Number

Response	Total percent	Test scores		Twelfth graders' subgroup percents						
						By parents' educational level				
		Literacy	Science	Boys	Girls	Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	10.1	42.4	34.0	62.3	35.6	8.2	12.3	30.8	22.6	23.3
Disagree	25.8	43.5	32.5	51.5	47.7	8.9	17.0	29.7	20.2	22.6
Undecided	29.0	38.5	28.3	44.4	54.0	10.1	24.2	27.6	22.3	13.7
Agree	22.4	41.6	28.1	49.2	49.5	12.4	24.5	26.3	19.2	16.1
Strongly agree	7.3	38.3	27.9	60.0	39.1	15.2	16.2	24.8	14.3	24.8

TABLE 3

The More Computers Are Used, the Less Privacy There Is

Response	Total percent	Test scores		Twelfth graders' subgroup percents						
						By parents' educational level				
		Literacy	Science	Boys	Girls	Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	8.4	42.1	35.8	61.5	32.8	8.2	16.4	25.4	24.6	18.9
Disagree	27.1	43.2	30.6	42.4	56.1	14.5	16.3	25.5	21.7	20.4
Undecided	29.8	38.3	26.8	44.2	52.8	11.1	24.1	27.6	20.4	14.8
Agree	23.1	40.0	30.3	46.1	51.5	12.3	23.4	25.5	21.6	16.5
Strongly agree	7.7	43.0	29.7	58.9	38.4	11.6	18.8	25.0	17.9	20.5

TABLE 4

Computers Create as Many Jobs as They Eliminate

Response	Total percent	Test scores: Literacy	Test scores: Science	Twelfth graders' subgroup percents: Boys	Girls	By parents' educational level: Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	8.8	54.7	35.6	69.0	28.7	17.1	20.9	31.8	16.3	12.4
Disagree	24.2	53.8	33.7	51.1	47.5	8.5	20.1	29.1	20.3	20.6
Undecided	18.9	52.2	34.3	48.6	49.6	14.1	19.9	26.8	20.7	16.3
Agree	34.9	56.5	33.0	48.0	49.9	9.2	22.9	28.4	20.2	18.4
Strongly agree	9.6	57.4	36.8	56.0	41.1	9.2	26.2	28.4	18.4	16.3

TABLE 5

Computers Complicate Simple Business Operations

Response	Total percent	Test scores: Literacy	Test scores: Science	Twelfth graders' subgroup percents: Boys	Girls	By parents' educational level: Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	37.8	47.9	33.2	58.9	39.6	10.1	15.1	30.1	20.6	21.5
Disagree	34.9	48.1	29.7	43.7	55.1	10.3	20.9	31.2	19.1	16.5
Undecided	13.0	44.3	23.1	37.2	61.7	12.2	24.5	35.1	10.6	17.0
Agree	6.4	37.6	29.2	40.2	59.8	13.0	34.7	21.7	17.4	10.9
Strongly agree	2.3	32.6	13.2	54.6	39.4	24.2	15.2	21.2	24.2	12.1

TABLE 6

Someday Most Things Will Be Run by Computers

Response	Total percent	Test scores: Literacy	Test scores: Science	Twelfth graders' subgroup percents: Boys	Girls	By parents' educational level: Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	4.2	50.0	30.3	59.0	39.3	9.8	23.0	16.4	24.6	23.0
Disagree	3.0	57.4	37.4	51.2	46.5	11.6	16.3	14.0	27.9	30.2
Undecided	10.0	45.6	27.8	50.7	48.6	13.9	25.7	30.6	13.9	15.3
Agree	46.0	52.1	30.7	48.4	49.8	8.9	21.7	28.2	19.5	20.1
Strongly agree	33.0	52.9	33.6	51.5	46.9	8.8	20.6	29.8	20.0	19.5

TABLE 7

Knowledge of Computers Helps to Get a Better Job

Response	Total percent	Test scores: Literacy	Test scores: Science	Twelfth graders' subgroup percents: Boys	Girls	By parents' educational level: Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	3.4	42.0	29.9	59.2	38.8	16.3	28.6	16.3	16.3	18.4
Disagree	5.4	34.8	29.2	41.6	57.1	6.5	20.8	26.2	18.2	28.6
Undecided	13.1	41.4	26.7	40.4	58.0	11.2	25.5	30.3	17.6	13.8
Agree	46.2	43.2	28.8	50.9	48.5	10.4	23.0	28.0	20.0	17.5
Strongly agree	28.5	44.6	32.2	52.0	47.1	11.7	22.2	26.8	19.5	17.3

TABLE 8

Computers Make Mathematics More Interesting

Response	Total percent	Test scores		Twelfth graders' subgroup percents						
						By parents' educational level				
		Literacy	Science	Boys	Girls	Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	4.3	40.0	26.8	51.6	46.9	10.9	9.4	32.8	21.9	21.9
Disagree	4.4	40.7	29.1	43.1	53.9	18.5	24.6	15.4	16.9	23.1
Undecided	15.9	41.5	25.9	45.5	52.8	12.3	26.0	23.8	16.6	20.9
Agree	48.2	44.9	27.0	43.6	54.3	12.8	21.1	25.9	21.4	17.4
Strongly agree	23.9	51.4	30.5	60.9	35.4	13.0	19.8	28.1	19.8	18.7

TABLE 9

To Work with a Computer, a Person Must Be a Mathematician

Response	Total percent	Test scores		Twelfth graders' subgroup percents						
						By parents' educational level				
		Literacy	Science	Boys	Girls	Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	14.3	46.8	31.4	53.2	45.1	6.4	19.1	27.8	26.0	20.8
Disagree	39.0	44.1	29.6	51.3	47.3	9.9	21.1	25.7	20.0	21.9
Undecided	11.6	38.3	22.8	44.7	51.8	12.8	31.2	27.0	13.5	14.2
Agree	21.9	42.1	25.8	48.1	49.3	14.7	22.6	30.5	16.2	15.4
Strongly agree	9.1	37.8	30.4	48.7	48.7	21.6	25.2	28.8	9.9	11.7

TABLE 10

Computers Are Suited for Repetitive, Monotonous Tasks

Response	Total percent	Test scores: Literacy	Test scores: Science	Twelfth graders' subgroup percents: Boys	Girls	By parents' educational level: Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	6.8	53.8	29.1	49.0	45.5	12.2	14.3	20.4	23.5	25.5
Disagree	10.1	49.3	31.0	41.5	55.8	12.2	15.7	28.6	21.8	18.4
Undecided	21.3	48.7	29.8	44.2	53.9	12.0	26.6	27.9	17.2	13.3
Agree	37.3	53.0	34.6	45.6	52.4	9.8	21.1	25.9	22.4	18.5
Strongly agree	17.5	55.8	41.4	62.5	36.4	10.3	16.2	29.6	18.6	23.3

TABLE 11

Computers Are Programmed to Follow Instructions

Response	Total percent	Test scores: Literacy	Test scores: Science	Twelfth graders' subgroup percents: Boys	Girls	By parents' educational level: Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	4.0	38.7	38.0	36.0	62.0	14.0	26.0	28.0	22.0	8.0
Disagree	2.6	30.2	23.4	53.1	43.8	15.6	31.3	12.5	15.6	18.8
Undecided	9.7	40.7	24.6	44.3	53.3	10.7	28.7	26.3	13.9	19.7
Agree	40.7	40.1	30.0	40.9	57.0	11.4	19.7	28.3	23.0	16.1
Strongly agree	37.2	45.4	35.4	56.0	42.5	9.0	16.3	26.0	25.5	22.5

TABLE 12

Computers Require Special Languages

Response	Total percent	Test scores: Literacy	Test scores: Science	Twelfth graders' subgroup percents: Boys	Girls	By parents' educational level: Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	7.2	39.2	24.2	59.3	40.7	15.4	22.0	19.8	21.9	18.7
Disagree	13.8	40.4	25.4	53.1	45.7	10.9	26.9	35.4	15.4	11.4
Undecided	18.1	39.9	24.0	43.2	53.7	10.9	22.3	27.1	19.7	19.2
Agree	37.5	41.9	28.4	46.9	52.3	11.3	21.9	24.4	19.3	20.4
Strongly agree	19.0	43.3	33.4	56.4	41.9	12.0	17.8	23.2	23.7	21.2

TABLE 13

Computers Have a Mind of Their Own

Response	Total percent	Test scores: Literacy	Test scores: Science	Twelfth graders' subgroup percents: Boys	Girls	By parents' educational level: Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	31.5	60.7	31.5	62.3	35.7	9.7	17.9	23.4	23.4	22.9
Disagree	31.4	53.1	28.3	47.5	50.3	8.7	21.0	28.8	19.5	19.8
Undecided	14.3	46.8	22.8	32.4	64.8	12.6	23.6	28.6	14.3	17.6
Agree	14.0	47.6	24.1	45.5	50.6	15.2	30.9	24.1	16.9	11.2
Strongly agree	5.3	41.5	27.2	52.9	45.6	23.5	22.1	25.0	8.8	16.2

TABLE 14

Computers Make Mistakes Much of the Time

Response	Total percent	Test scores		Twelfth graders' subgroup percents						
						By parents' educational level				
		Literacy	Science	Boys	Girls	Not high school	High school	Some college	Four years college	Advanced degree
Strongly disagree	22.2	56.8	34.4	61.9	35.6	9.4	22.3	21.2	16.9	28.4
Disagree	40.3	48.4	28.6	50.5	48.3	9.9	19.4	27.9	19.2	22.0
Undecided	20.5	43.4	24.2	43.2	54.9	12.5	24.9	30.0	14.8	16.0
Agree	11.4	43.2	25.2	44.4	53.5	12.5	22.9	29.2	13.9	16.7
Strongly agree	1.8	50.0	39.6	54.6	40.9	4.6	40.9	31.8	9.1	9.1

TABLE 15

Programming Languages Used

Response	Total percent	Test scores		Twelfth graders' subgroup percents						
						By parents' educational level				
		Literacy	Science	Boys	Girls	Not high school	High school	Some college	Four years college	Advanced degree
BASIC	37.0	49.7	30.9	54.4	44.2	11.3	19.6	27.0	20.5	20.8
PASCAL	3.3	56.0	40.1	70.7	28.1	7.9	15.9	30.5	17.7	26.2
LOGO	3.4	47.1	27.1	55.8	40.7	9.3	16.3	31.4	18.6	20.4
PILOT	2.2	42.4	32.0	75.2	22.0	13.8	18.4	33.0	11.9	20.2
FORTRAN	4.2	52.6	34.5	59.1	36.1	6.3	18.8	25.0	24.5	24.0
COBOL	4.4	51.1	35.1	58.3	38.5	6.9	21.6	28.4	19.3	21.6
FORTH	1.0	45.2	38.1	79.2	16.7	8.3	12.5	39.6	20.8	16.7
ASSEMBLY	4.7	48.9	32.3	62.9	34.6	15.6	19.4	25.7	19.0	16.9
Other	4.5	49.7	36.8	59.5	39.2	11.9	16.3	30.0	17.2	23.4
None	43.4	45.0	25.1	45.3	53.0	10.3	21.5	27.3	21.0	18.3

TABLE 16

Types of Video Games Used at Home

Response	Total percent	Test scores		Twelfth graders' subgroup percents						
						By parents' educational level				
		Literacy	Science	Boys	Girls	Not high school	High school	Some college	Four years college	Advanced degree
Atari	27.9	48.6	32.0	52.3	45.8	9.7	21.1	30.4	18.9	18.2
Odyssey	3.0	50.0	32.5	59.0	38.2	6.9	17.4	33.3	18.8	20.4
Intellivision	8.4	47.9	28.4	58.7	40.3	7.1	19.1	30.7	20.9	19.1
Colecovision	2.3	44.6	29.4	67.6	28.7	12.0	19.4	31.5	15.7	17.6
Other	8.2	50.8	34.5	58.3	40.2	8.2	20.5	27.1	16.1	25.8
None	53.0	47.5	31.5	49.9	51.8	13.0	20.2	26.9	19.1	1.6

TABLE 17

Types of Microcomputers Used at Home

Response	Total percent	Test scores		Twelfth graders' subgroup percents						
						By parents' educational level				
		Literacy	Science	Boys	Girls	Not high school	High school	Some college	Four years college	Advanced degree
Atari	9.9	49.9	29.9	48.9	48.3	8.6	21.9	30.2	19.7	17.8
TRS-80	3.1	51.9	29.9	65.0	30.9	11.3	12.4	33.0	18.6	23.7
Apple	5.2	53.8	31.7	61.4	34.4	6.8	11.7	30.1	19.6	27.6
PET-Commodore	2.1	47.7	31.0	71.2	25.8	9.1	10.6	25.8	22.7	28.8
IBM	4.0	54.5	27.8	56.8	40.0	8.8	16.0	23.2	17.6	28.8
Texas Instruments	14.0	48.4	31.7	48.1	49.7	10.8	19.2	27.5	18.7	21.7
Osborne	0.8	48.4	23.8	72.0	20.0	16.0	12.0	20.0	20.0	12.0
Other	6.0	51.8	31.5	52.4	43.9	9.5	13.2	27.5	20.1	25.9
None	59.2	50.3	29.8	49.2	49.7	12.0	21.8	28.6	18.6	17.8

TABLE 18

Types of Microcomputers Used at School

Response	Total percent	Test scores: Literacy	Test scores: Science	Twelfth graders' subgroup percents: Boys	Girls	By parents' educational level: Not high school	High school	Some college	Four years college	Advanced degree
Atari	7.0	42.0	24.7	59.5	37.0	12.7	23.1	27.5	19.2	15.4
TRS-80	10.2	51.6	34.1	64.9	33.1	7.1	22.8	27.7	21.3	19.8
Apple	20.2	50.5	31.6	56.3	41.7	10.1	19.7	26.5	21.0	21.2
PET-Commodore	7.0	49.6	32.9	63.5	33.3	10.5	21.9	28.6	17.4	19.1
IBM	12.6	42.9	26.2	20.8	57.1	15.1	24.5	25.9	19.7	12.4
Texas Instruments	7.8	47.1	26.2	53.4	43.6	10.0	20.5	27.1	20.5	18.8
Osborne	1.1	45.5	31.8	70.0	23.8	10.0	20.0	27.5	17.5	22.5
Other	11.0	49.8	32.1	55.2	42.8	10.3	18.4	29.0	19.6	21.1
None	42.6	43.9	26.2	45.7	52.8	10.8	21.3	25.8	21.4	18.9

TABLE 19

Percents of Students Engaging in Selected Activities, by Hours per Week

Activity	Twelfth graders' hours per week outside of school: None	Less than 1	1-2	2-3	3-4	4-5	5-10	More than 10
Reading	15.4	20.4	19.7	8.9	6.3	5.4	4.8	3.6
Homework	6.9	12.0	18.1	10.6	8.0	8.8	12.9	10.1
Video games at home	57.2	12.7	5.4	2.5	1.6	0.8	0.9	0.7
Video games away	45.5	22.2	7.4	3.1	2.0	0.9	0.8	0.7
Computer	59.2	9.2	4.0	2.1	1.6	1.6	1.6	1.9
Athletics	15.9	11.0	13.3	10.7	7.4	6.6	8.4	11.8
Television	6.7	9.5	12.5	11.9	9.6	10.7	13.0	12.3
Other	6.7	5.4	10.0	10.8	9.6	9.9	12.4	21.0

TABLE 20

Computer Literacy Achievement Scores, by Hours Spent in Selected Activities

Activity	Twelfth graders' hours per week outside of school							
	None	Less than 1	1-2	2-3	3-4	4-5	5-10	More than 10
Reading	41.7	46.8	48.7	49.1	49.1	49.0	51.0	47.7
Homework	38.6	45.0	45.3	44.6	47.6	47.0	52.1	51.9
Video games at home	47.2	46.4	47.8	43.3	49.0	59.2	49.1	45.4
Video games away	46.6	48.2	46.0	47.4	44.1	48.8	37.4	47.2
Computer	45.4	49.6	55.7	54.8	55.4	49.5	51.8	55.4
Athletics	44.1	47.8	46.7	46.8	43.8	49.1	48.3	48.9
Television	42.2	46.5	46.5	44.2	47.5	47.3	49.5	47.7
Other	40.1	49.2	44.4	48.2	47.3	47.7	48.3	47.7

TABLE 21

Computer Science Achievement Scores, by Hours Spent in Selected Activities

Activity	Twelfth graders' hours per week outside of school							
	None	Less than 1	1-2	2-3	3-4	4-5	5-10	More than 10
Reading	29.9	28.9	31.2	32.2	33.8	35.3	35.7	34.6
Homework	28.3	30.3	28.8	30.7	31.0	32.6	34.8	32.8
Video games at home	31.1	32.0	34.2	31.2	34.3	29.9	27.6	21.7
Video games away	31.1	31.4	33.9	33.2	33.2	27.1	26.4	30.4
Computer	29.3	33.0	39.5	39.3	34.1	40.3	41.9	46.2
Athletics	31.2	32.4	29.6	32.0	28.5	33.3	31.8	30.4
Television	32.2	33.9	28.9	29.5	30.1	31.4	31.6	32.4
Other	28.2	33.2	30.7	30.1	31.1	28.8	34.5	31.6

TABLE 22

Microcomputer Learning Experiences in School

Response	Total percent	Test scores: Literacy	Test scores: Science	Twelfth graders' subgroup percents: Boys	Girls	By parents' educational level: Not high school	High school	Some college	Four years college	Advanced degree
Program	15.6	56.9	46.8	55.2	42.2	9.3	19.8	24.0	21.7	19.8
General	16.9	56.8	44.7	48.5	48.9	10.1	20.6	27.0	18.7	21.2
Drill	11.3	53.5	42.5	49.8	48.9	10.9	18.3	24.4	21.9	21.5
Simulations	8.4	56.2	42.8	51.5	45.9	12.6	18.6	29.0	18.2	19.9
Tutorial	4.8	55.0	47.1	52.6	45.9	9.8	21.1	25.6	20.3	21.1
Games	12.3	51.6	39.1	54.1	44.1	10.4	19.8	31.7	19.2	17.5
Little experience	53.0	49.4	33.7	45.6	53.2	9.5	21.2	28.1	21.4	18.6

TABLE 23

Where Student Learned About Computers

Response	Total percent	Test scores: Literacy	Test scores: Science	Twelfth graders' subgroup percents: Boys	Girls	By parents' educational level: Not high school	High school	Some college	Four years college	Advanced degree
Home	14.0	46.1	33.6	57.4	40.4	4.0	14.2	24.7	26.4	28.7
Friends	9.8	45.0	33.0	64.4	33.8	5.7	18.9	23.8	23.1	27.1
Summer programs	3.4	45.6	36.4	49.0	51.0	9.2	25.5	23.5	13.3	24.5
Museums	2.0	44.9	35.8	56.9	37.9	0.0	13.8	32.8	22.4	27.6
School (day)	28.0	47.2	35.1	48.1	50.0	12.0	23.2	27.2	16.7	19.0
School (evening)	2.4	47.0	38.8	62.3	36.2	8.7	24.6	23.2	20.3	18.8
Stores	6.4	47.5	31.3	67.2	32.8	8.7	15.9	27.9	21.3	23.5
Video games	21.2	40.8	30.1	56.9	40.8	11.7	23.8	27.7	16.0	19.0
Know little	44.9	38.6	27.3	40.7	57.7	10.4	22.5	27.2	19.0	19.3

TABLE 24

Percent Correct Scores on Cognitive Questions for Sixth Grade Students, by Objective and Subgroup, April 1983

Objective	Percent correct scores						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Overall	28.0	30.1	27.6	38.0	32.3	25.5	20.9
1.2.1 Vocabulary	38.6	42.6	34.4	54.7	46.1	36.4	26.1
1.2.2 Interactive and batch	9.2	10.3	8.0	9.8	9.5	9.2	8.8
1.2.3 Components	31.6	35.3	29.2	39.9	35.5	31.1	24.9
1.2.4 Tasks	42.6	43.9	41.3	60.9	51.5	24.8	27.4
1.2.5 History	18.6	22.1	14.9	25.7	20.5	17.8	14.2
1.3.4 Systematic procedures	35.1	35.22	34.9	45.8	38.6	34.5	27.8
1.3.5 Programs	21.9	24.0	19.9	31.8	25.3	20.0	16.9
1.4.1 Specific uses	36.9	38.1	45.8	49.8	43.3	35.4	27.1
1.4.2 Careers	23.7	25.2	25.6	31.5	27.6	22.4	18.2

TABLE 25

Computers Treat Everyone as a Number

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Strongly disagree	7.0	62.8	35.8	18.9	17.1	33.9	22.1
Disagree	49.3	49.9	48.9	15.9	18.7	38.0	20.1
Undecided	19.3	49.9	48.9	15.9	18.7	38.0	20.1
Agree	28.0	52.2	47.4	14.7	18.2	38.7	21.1
Strongly agree	7.8	64.1	35.1	15.7	12.7	35.3	26.9

TABLE 26

The More Computers Are Used, the Less Privacy There Is

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Strongly disagree	10.2	64.1	35.4	18.4	18.1	36.8	20.1
Disagree	24.4	53.6	56.7	17.4	23.5	34.5	17.5
Undecided	27.6	42.8	56.7	17.1	17.5	37.0	20.4
Agree	23.8	52.2	47.1	13.5	17.6	38.5	23.3
Strongly agree	8.5	59.7	39.7	9.0	13.8	39.2	28.6

TABLE 27

Computers Create as Many Jobs as They Eliminate

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Strongly disagree	6.3	30.2	39.4	16.8	14.6	41.3	19.4
Disagree	15.7	55.6	44.0	18.5	17.9	36.9	19.9
Undecided	27.1	43.0	56.2	15.5	18.9	37.6	19.5
Agree	35.8	49.3	49.9	17.1	18.2	38.9	19.1
Strongly agree	9.7	65.1	34.4	12.9	18.1	38.9	21.6

TABLE 28

Computers Slow Down and Complicate Things

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Strongly disagree	17.5	61.8	37.1	22.8	22.0	33.3	15.4
Disagree	29.2	47.6	52.4	20.5	20.8	35.2	16.3
Undecided	23.4	39.2	60.1	13.4	17.3	37.2	23.5
Agree	18.2	48.7	50.7	8.0	15.9	39.9	26.2
Strongly agree	6.2	58.4	40.9	9.0	12.3	40.5	29.3

TABLE 29

Someday Most Things Will Be Run by Computers

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Strongly disagree	3.8	57.5	40.4	9.5	13.3	41.1	26.7
Disagree	7.2	50.0	49.4	12.9	17.9	36.9	25.8
Undecided	18.8	60.7	58.3	13.6	18.2	39.3	20.5
Agree	46.2	47.8	51.5	17.3	17.3	37.7	18.7
Strongly agree	19.8	64.6	34.8	17.5	20.2	35.6	19.8

TABLE 30

A Knowledge of Computers Will Help to Get a Better Job

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Strongly disagree	2.8	58.1	41.4	10.5	11.4	39.5	31.4
Disagree	8.6	42.8	56.1	13.5	18.3	38.7	21.9
Undecided	17.7	41.4	58.1	13.3	18.8	38.3	21.4
Agree	46.4	47.7	51.4	16.1	18.6	38.5	19.2
Strongly agree	20.0	62.6	36.6	46.9	20.0	36.1	18.7

TABLE 31

Computers Can Help Make Mathematics More Interesting

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Strongly disagree	2.7	62.4	36.1	11.9	15.8	32.7	26.7
Disagree	5.6	50.8	48.4	13.7	17.5	38.9	21.6
Undecided	15.6	41.3	58.1	14.6	18.3	40.1	20.1
Agree	46.8	46.9	52.5	45.6	49.8	37.1	20.3
Strongly agree	24.5	60.3	38.7	18.1	19.8	37.9	17.9

TABLE 32

To Work with a Computer, a Person Must Be a Mathematician

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Strongly disagree	12.2	53.9	45.3	20.3	21.3	36.6	16.3
Disagree	35.0	48.0	50.7	19.5	19.8	36.7	17.3
Undecided	16.5	45.3	53.9	13.8	16.8	39.1	21.0
Agree	22.3	51.7	47.4	11.3	16.9	38.4	25.2
Strongly agree	9.3	56.5	43.0	9.9	11.8	40.1	29.0

TABLE 33

Computers Are Suited for Doing Repetitive Tasks

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Strongly disagree	3.8	59.6	39.4	14.6	15.3	38.7	23.3
Disagree	8.7	49.1	50.0	13.3	14.5	39.8	23.3
Undecided	28.1	42.1	57.0	14.8	18.9	38.1	20.1
Agree	41.2	50.7	48.3	16.4	18.1	37.9	20.3
Strongly agree	12.7	59.4	39.6	14.9	18.1	38.3	21.1

TABLE 34

Computers Have a Mind of Their Own

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Strongly disagree	13.1	60.4	38.8	22.7	21.2	36.1	14.3
Disagree	25.6	51.6	47.4	17.9	21.9	36.4	16.9
Undecided	20.1	42.9	56.1	14.0	20.8	36.1	20.8
Agree	28.0	46.2	53.3	12.4	17.0	38.6	24.4
Strongly agree	8.5	59.6	39.9	7.8	15.4	36.7	30.1

TABLE 35

Computers Make Mistakes Most of the Time

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Strongly disagree	12.2	63.7	35.9	20.9	22.4	34.0	14.6
Disagree	34.1	51.6	47.4	19.0	19.9	36.8	17.1
Undecided	25.3	40.2	59.0	14.4	19.5	36.3	21.8
Agree	19.1	49.2	49.9	9.0	16.4	39.0	26.8
Strongly agree	4.7	64.0	39.0	7.8	12.7	40.2	31.2

TABLE 36

Types of Video Games at Home

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Atari	44.3	54.6	44.6	16.7	21.9	38.2	16.2
Odyssey	3.1	61.2	38.3	22.5	18.1	37.4	15.9
Intellivision	7.6	59.1	40.4	19.3	20.4	37.1	17.3
Colecovision	5.8	65.3	34.2	15.7	20.4	31.9	22.0
Other	9.4	59.2	40.1	27.0	19.9	33.3	14.2
None	34.7	37.7	61.5	13.2	14.8	35.5	26.9

TABLE 37

Types of In-School Computer Learning Experiences

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Write programs	14.7	54.9	44.3	26.6	22.5	31.3	12.9
General information	14.7	52.0	47.3	25.7	23.5	30.8	14.7
Drill and practice	21.8	49.3	49.6	20.9	18.7	33.5	20.6
Math or science demonstrations	17.9	53.0	46.3	15.8	17.8	34.9	22.5
Computer games	33.1	51.9	47.1	19.6	21.4	35.5	17.2
No experience	31.9	44.9	54.5	28.1	31.8	33.5	32.5

TABLE 38

Types of Computers Used at School

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
Atari 400 or 800	9.4	57.6	41.8	15.7	18.7	37.1	19.4
TRS-80	6.5	55.8	42.3	21.0	21.0	34.0	19.3
Apple	20.5	55.7	43.9	22.3	19.2	35.1	16.7
PET-Commodore	8.9	53.8	45.4	23.6	21.8	31.7	15.5
IBM	2.6	58.1	40.8	13.1	13.1	40.8	13.0
Texas Instruments	5.7	51.7	47.2	15.1	19.3	38.0	20.8
Osborne	0.4	67.9	28.6	10.7	17.9	28.6	39.3
Other	6.2	55.0	44.2	15.8	20.1	36.8	18.2
None	43.7	47.4	52.0	12.9	46.5	40.0	22.8

TABLE 39

Indicate Where You Have Learned About Computers

Response	Sixth graders' subgroup percents						
				By parents' occupational level			
	Total	Boys	Girls	Profes-sional	Semi-profes-sional	Skilled	Un-skilled
At home	22.6	56.9	42.4	25.0	22.5	33.8	11.9
Special seminars	3.5	60.2	39.0	34.9	20.1	27.7	12.1
Museum or hall of science	3.7	59.9	40.1	28.3	22.2	30.8	12.2
At school (day)	27.3	48.2	50.9	21.2	20.9	32.7	17.2
At school (evening)	2.7	61.3	37.2	21.1	14.6	32.7	25.1
Computer stores	9.6	51.2	48.0	22.4	22.3	33.7	13.8
Playing with video games	42.4	45.7	39.0	15.1	20.2	37.4	20.1
I know nothing about computers	17.0	38.8	60.6	9.7	14.0	38.7	29.3

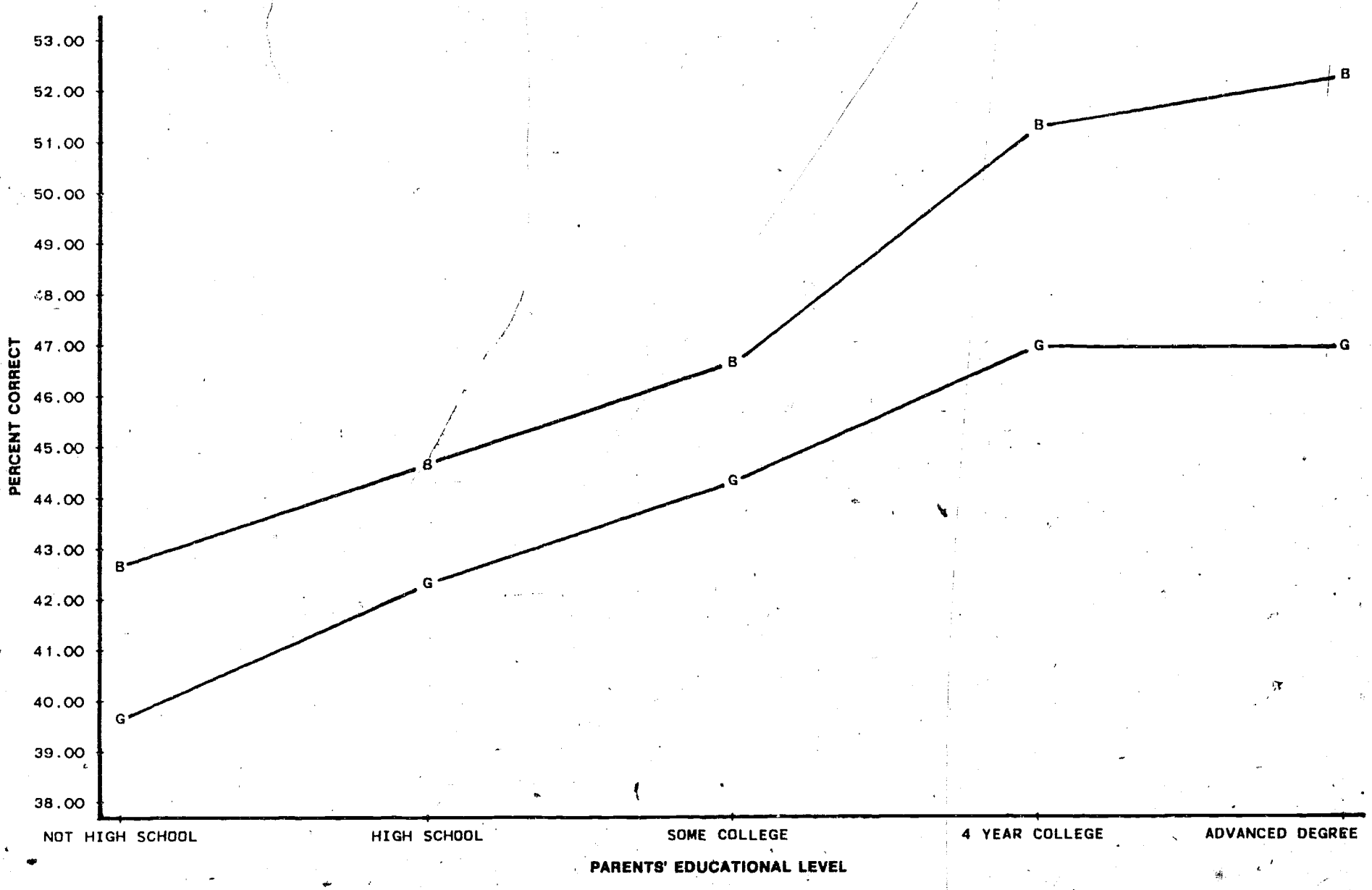

Fig. 1. Percent correct scores in the area of computer literacy for twelfth grade boys and girls, by parents' educational level

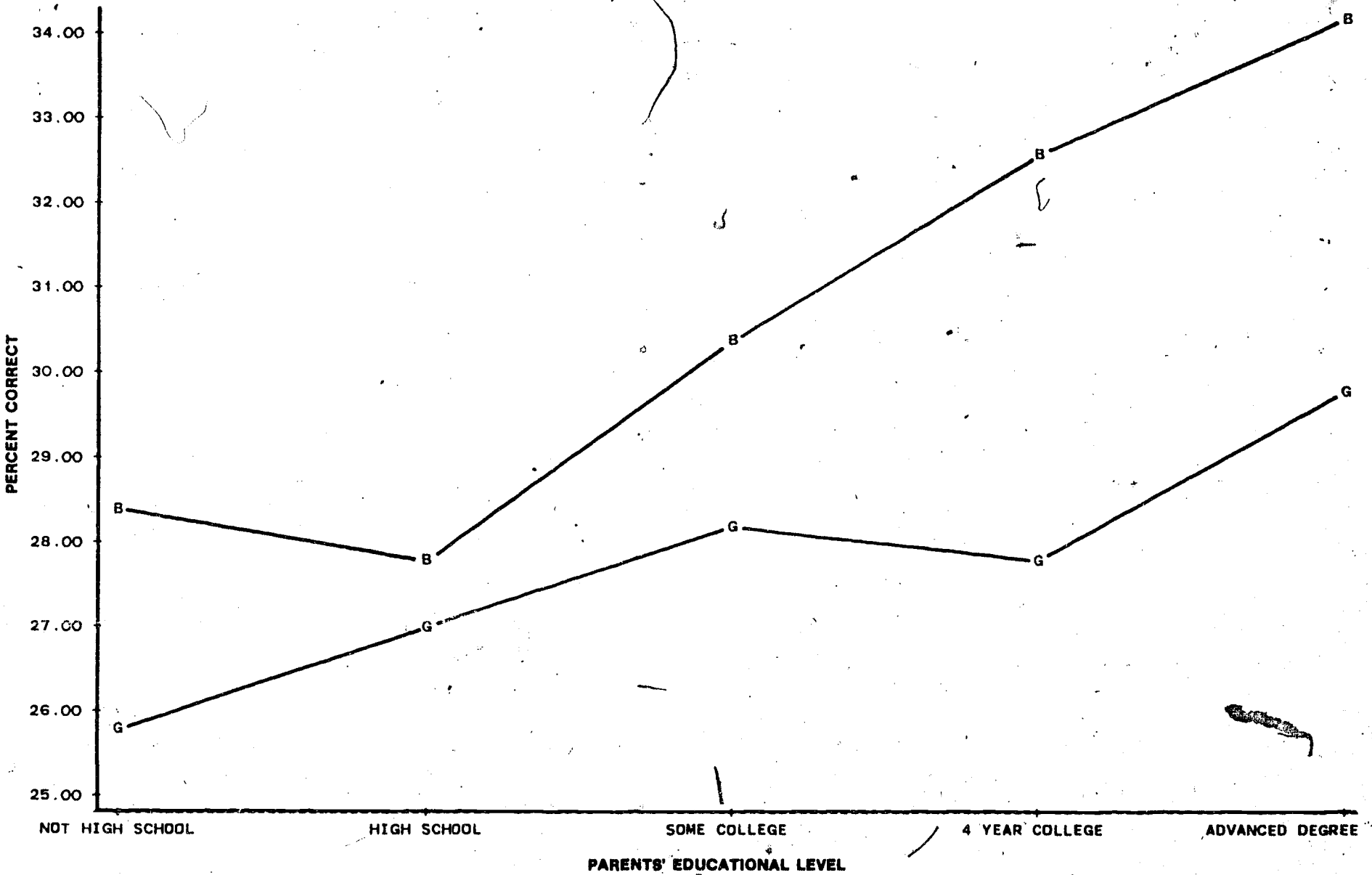

Fig. 2. Percent correct scores in the area of computer science for twelfth grade boys and girls, by parents' educational level

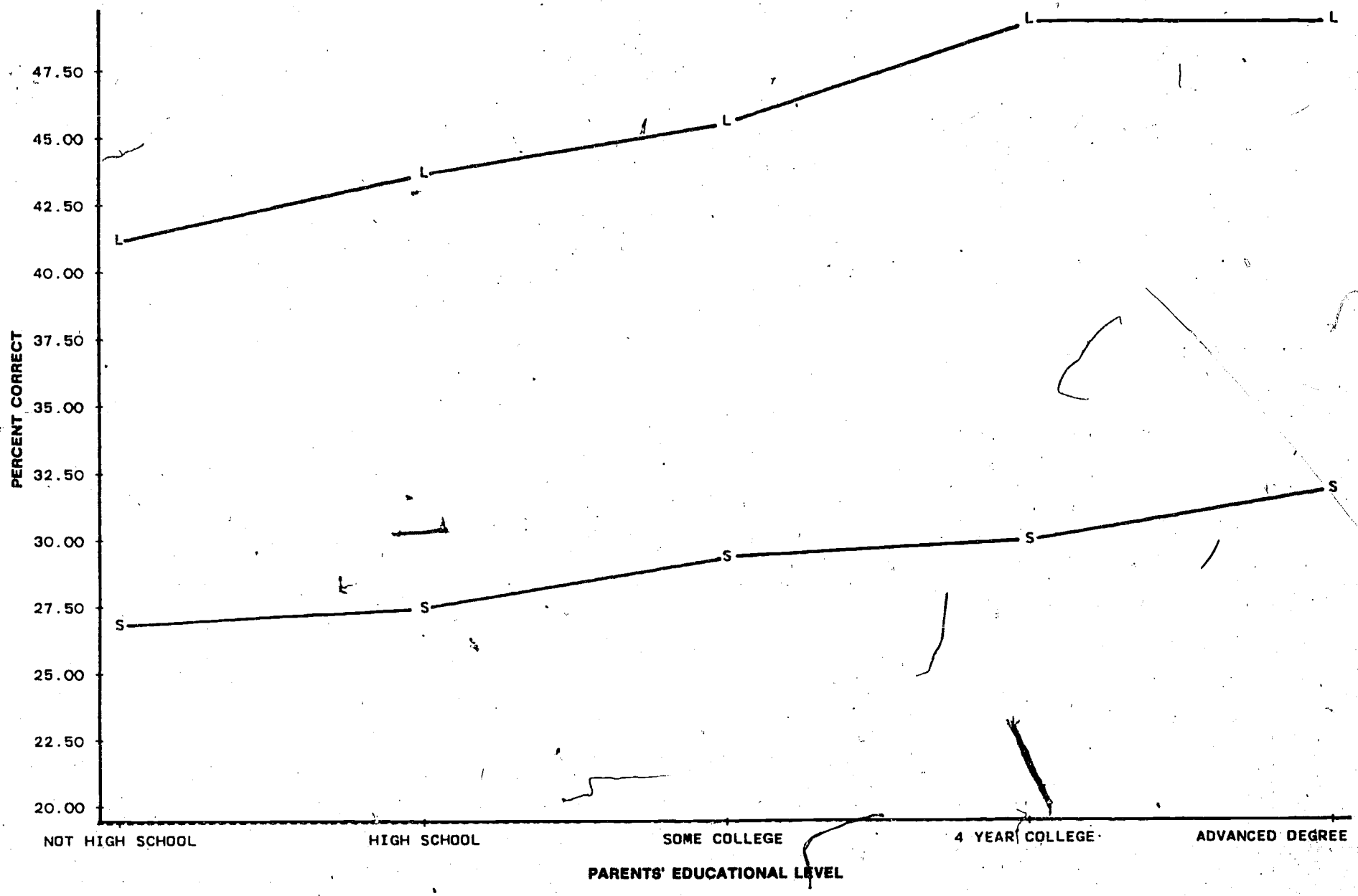

Fig. 3. Twelfth grade percent correct scores for the general areas of computer literacy and computer science, by parents' educational level

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