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Survey of Microcomputer Access by Students with Mild Handicaps in East Central Illinois

William O. Searby
Eastern Illinois University

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Survey of Microcomputer Access by Students With

Mild Handicaps in East Central Illinois

(TITLE)

BY

William O. Searby

THESIS

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Abstract

This descriptive research was conducted to collect data concerning the accessibility of school microcomputers to students who have been labeled as having a mild (high prevalence) handicapping condition. One hundred thirty nine randomly selected school administrators in East Central Illinois were surveyed to determine the number of microcomputers in their schools and the types of programs that were offered to students with special needs. The schools were divided into seven categories depending on the type and size. Total school enrollment figures were divided by the total number of microcomputers available at the school to determine a student to microcomputer ratio at the school. As 99% of the survey respondents reported seeing students with mild handicaps using microcomputers in the schools, this ratio was considered a measure of accessibility for the purpose of comparison. The findings were that students with mild handicaps had decreased accessibility to microcomputers in their schools by an average of 8.5 students per microcomputer in the elementary and middle schools. In the high schools, however, students with mild handicaps had increased access to microcomputers by an average of 5.5 students per microcomputer. It was concluded that special education funding for classroom technology is probably concentrated at the secondary level.

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Computer use has become increasingly widespread in our society and our schools. Kominski (1988) reports that in the year 1984, 15,542,000 or 30.2 percent of children ages three to seventeen used a computer either at home or at school. In addition, 31,099,000 persons age eighteen and above report using a computer somewhere; either at home, at work, or at school. A study of teachers from ten diverse sites across the nation by Wiske, et al (1988) shows that teachers believe that computers can have a significant effect on the content, skills, scope, and sequence of the curriculum, and on the process of teaching and learning. Studies are needed to test these beliefs.

Statement of the problem

Hanley (1984) reported that no uniform conclusions can be drawn about the effectiveness of computer-assisted instruction (CAI). CAI has been shown to be very useful in certain situations and equally useless in others. Hanley suggested that research be directed more specifically at the component of individualized learning with the focus on special education. The ultimate goal would be to provide an understanding of the elements of computer-assisted instruction.

A report by Bennett (1986) noted the "dizzying" pace at which microcomputers were being used in special education. Bennett presented a framework of five areas to guide the posing of research questions. One of these five, the service delivery area of instruction, which includes those programs designed to help students develop academic, social, or functional living skills, guides the research questions regarding whether microcomputers are actually being used in special education, and the manner in which they are being used. This look at the service delivery area of instruction and its impact on the various skills of students identified as handicapped raises the question of how these computers are actually being used in special education.

Review of related literature

Computers began to emerge on the American scene soon after World War II. Early computers took up large amounts of space and had very limited capabilities. The invention of the vacuum tube and later the transistor greatly enhanced the capabilities of computers and enabled the expanded application of their unique qualities. The use of computers as an educational tool, however, was still limited by the size, cost, and availability of the systems. According to Hasselbring & Hamlett (1984), the invention of the Intel 4004 computer chip was a milestone in the production of computers because it allowed for the miniaturization of the hardware, and contributed to lower costs and easier production. This improved availability of computers, made possible by lower costs, allowed schools to begin to use the computer for the aspects of education to which it is well suited. These areas include 1) Drill and practice, or the presentation of practice problems to an individual without providing any instruction, 2) Tutorial, providing instruction, feedback, and remediation to the individual along with the appropriate practice, and 3) Simulation, whereby a scenario is created for the individual to work through (Kulik, Bangert, & Williams, 1983).

Hummel and Balcom (1984) pointed out that computer-assisted instruction was being used increasingly for more than just drill and practice. Data-based management and word processing programs were being used by learning disability resource teachers as well as regular classroom teachers. Mineo and Cavalier (1985) reported that cognitive software was being developed to help teach those who are identified as learning disabled and/or mentally retarded. The assumption was that the logic and memory of microcomputers could be used to reinforce the affected cognitive processes in these individuals.

Studies show that the attitudes of students are affected by the nature of the instruction. The first of these studies was by Jamison & Lovatt (1983). The question of the effect of CAI on the extreme end achievers was addressed. One hundred and twenty thirteen and fourteen year old males in England were classified in categories as 1) best achiever, 2) best behaved, 3) worst behaved, 4) and worst achiever. All students used CAI in math and reading. Post test scores showed that the best achievers scored significantly higher than worst achievers. The group classified as worst behaved showed a higher rate of improvement than those classified as best behaved. The conclusion was made that CAI is best suited for the extreme ends of achievers, and that this is probably due to the individualized nature of the instruction.

Another study on attitudes by Dalton (1986) compared traditional CAI to computer-assisted interactive video instruction and stand alone video instruction. One hundred thirty four junior high level shop class students were assigned to one of three groups to receive safety lesson instructions; 1) video (television alone), 2) CAI tutorial, and 3) interactive video. The lesson post-tests showed that both traditional CAI and interactive video were more effective than stand alone video. The attitudes of low level learners were negative toward the CAI but this was attributed to four years prior remedial training. These attitudes may evolve based on repeated use. The conclusion was that interactive technologies provide opportunities to improve learner attitudes toward instruction if they are properly implemented.

A study by Rieth, Bahr, Polsgrove, Okolo & Eckert (1987) looked at the effects of microcomputer use on the ecology of the secondary school resource room. Data on fifty two special education resource programs revealed that language arts, math applications, computation, and non academic activities occurred more frequently ($p<.001$) in computer use classes than in non-computer use classes. It was concluded that the mere presence of computers in the special education classroom does not drastically alter the classroom ecology. The most positive aspects of the computer use appeared to be increased active task engagement and individually focused instruction.

A study of preschoolers by Johnson (1985) was made to determine the abilities and play preferences of preschool children with different levels of interest and involvement with microcomputers in the nursery school class. Eleven pre-school children of middle class, cross ethnic origins and an average age of forty nine months were introduced to an Apple computer before it became an optional activity in the classroom. After observation, the children were grouped according to high, medium, and low interest. The groups did not differ significantly on measures of divergent thinking, social knowledge, and two perspective taking measures. There were significant group differences on symbolic uses task, color perspective taking task, and the picture perspective taking task. It was concluded that there are important underpinnings (certain cognitive or behavioral styles) to spontaneous microcomputer involvement by young children in the preschool. There may be a relation between high computer interest and these certain cognitive or behavioral styles.

Questions regarding cognitive styles with regard to CAI have been explored on numerous occasions. One such study by Caldwell (1974) compared CAI to programed instruction. Forty five students aged 14 to 18 were randomly assigned to two treatments, 1) programed instruction, and 2) CAI. Both of the groups made gains in reading achievement, but neither treatment was more successful than the other. Difficulty in securing the sample for this study prevented the use of control groups. The conclusion was reached that these two methods of instruction are equally effective.

The art of intellectual model building through the use of CAI and programming was introduced by Papert (1980). The idea that CAI should involve the child programming the computer, and in doing so, builds mastery over technology is the central theme of Papert's work. The procedure was to create a computer language known as LOGO. This language contains what is known as an object to think with, which is called a turtle. Upon using the turtle and the LOGO language, learners would begin to understand a process of learning by acquiring deeper insight into what was being learned. This follows "...'Piagetian learning', the natural, spontaneous, learning of people in interaction with their environment" (p.156). It was concluded that the use of LOGO promoted a cognitive style of talking about the process of thinking.

This area of metacognition, or thinking about thinking was explored by Wong & Jones (1982) who studied students who were trained to monitor their understanding of important elements to improve comprehension performance. This training consisted of reading passages and then generating questions about the content. It was called self-questioning training. The subjects were 120 students in all, half of them eighth and ninth graders labeled as learning disabled, and the other half normally achieving sixth graders. Subjects were randomly assigned to the training conditions which consisted of instructing the subjects to generate their own questions about the material which they had read. Correlations were r=.84 for prediction data, r=.91 for good questions generated, and r=.87 for comprehension data. Students from the labeled group as well as students from the non labeled group who received the training consistently predicted more important idea units than students that had not received the training. It was concluded that metacomprehension training appears necessary for enabling students with learning disabilities to ascertain their comprehension of important textual units.

Another question within the cognitive area of CAI use was studied by Kulik, Bangert, and Williams (1983). They performed a meta-analysis of the literature to determine under what conditions, for which students, and for what outcomes was CAI effective. A total of 51 studies which met specific criteria were included. It was required that the study must have been done in an actual classroom in grades 6 through 12. The study had to report measured outcomes on both CAI and control groups. Finally, the studies had to be free of methodological flaws. The major finding was in the area of final exam performance. Computer-assisted instruction raised final exam scores from the 50th to the 63rd percentile. It was also found that retention exam scores were also raised, but the effects of CAI were not clear here. Finally, it was found that CAI substantially reduced the amount of time students needed for learning. Based on this meta-analysis, it was concluded that the effects of CAI seemed especially clear in studies of disadvantaged and low aptitude students.

A study which is frequently referred to within the literature of this area of CAI is by McDermott & Watkins (1983). They explored the effectiveness of CAI in math and spelling with students labeled learning disabled at the elementary school level. The subjects were 250 students in grades one through six who had been labeled as having a learning disability. Half the students were assigned to an experimental group to receive CAI in math and spelling. The other half received conventional remedial training. A pre-test/ post-test design was used with an independent co-variance analysis on the post test scores. The findings were that no method of instruction in either area emerged to indicate greater effectiveness of CAI over regular , remedial instruction. The conclusion reached is that CAI holds no clear advantage over traditional remedial instruction for elementary level children who are learning impaired. One reason for the results of this finding compared to other results may be due to the differences found in the software which is used.

The cognitive aspect of CAI involves the software, or the program instructions that are used to tell the computer what to do. A study by Grover (1986) compared the effects of two different types of software. The first type was described as "cognitive" (designed in accordance with cognitive- developmental principles). The second type was described as "non-cognitive" (designed without cognitive developmental principles). The subjects were 134 students from 4 elementary schools. Groups were not randomly assigned, but were matched as closely as possible on prior computer experience. The experimental group contained 25 students. They were given non-cognitive software. The remainder used cognitive software. The dependent measure was the mean percentage of correct responses, with a one way analysis of variance. The findings indicated that students who used the software designed in accordance with cognitive developmental principles had higher mean percent of correct responses. It was concluded that the incorporation of cognitive development principles could be useful in future software design.

A study in Israel by Mevarech & Rech (1985) examined both cognitive and affective aspects of CAI. The subjects were 376 elementary students in third through fifth grades. Half were randomly assigned to the experimental group which used CAI for math instruction. The rest were the control group which was taught math in the traditional manner. Scores on a widely used achievement test in Israel were used as the dependent measure, along with a math self concept questionnaire, which was developed for this study, and a widely used scale which measures attitudes toward school life. Major findings show that CAI pupils in fourth grade achieved one standard deviation higher than the control group. CAI pupils also rated themselves higher on both the self concept of arithmetic achievement, and the school life scale. It was cautioned that prior, reliable achievement data was not available from the period prior to the use of CAI, so analysis was conducted on post treatment data only. The conclusion was that the use of CAI provided significant mathematics achievement gains, and leads pupils to improved perceptions of self and schooling. A similar study by Crumb & Monroe (1988) reported similar results.

In studies relating to the cognitive area of CAI in general, some researchers have focused on the efficacy of exposure to CAI in its many forms (Christensen & Cosden, 1986, Gilman & Brantley, 1988, Roninson-Staveley & Cooper, 1990). They concluded that generally, computer use improves the quality of work completed. They also recognized that there are many variables to be considered. Also, in the area of special education, it was believed that a failure to provide computer literacy skills could seriously retard those students' ability to adapt in a computerized society (Christensen & Cosden, 1986).

A study comparing computer aided instruction to workbook instruction by Harper and Ewing (1986) found that for eight of nine subjects, the microcomputer was the most effective treatment in terms of productivity. The subjects were nine special education students classified as high incidence, learning disabled. The single subject design used year end test results on the Comprehensive Test of Basic Skills and an informal reading assessment to determine the grade level placement. Baseline data was collected on paper and pencil activities. The second phase alternated students between microcomputer and workbook instruction for a period of four weeks. The third phase was followup in which only the most effective treatment was implemented for one week. Interobserver reliability between observers of the productivity performance (attention to task behavior) ranged between 90 and 100 percent with a mean of 98 for the microcomputer instruction. The range was 77 to 100 percent, with a mean of 95 for the workbook instruction.

Goldman (1988) compared the results of a randomly selected group of twenty two second grader's performance in a basal reader with an equivalent group which used computers. The results indicated that the use of computers increased reading performance more than the basal readers. The study was pre-test, post-test design. Three instruments were used for measurement They were the Gates-McGinite Reading Test, the H.B.J. Reading Program, and selections from Hartley Courseware.

A study of the effects of new computer technology on children's word recognition automaticity by Greene (1988) found that the method of instruction did not affect the level of performance. Sixteen third and fourth grade students of mixed socio-economic backgrounds and identified as moderately delayed readers were the subjects. They were randomly assigned to two groups of equal size. Instruction and practice was provided in a computer lab equipped with Apple II computers. Each group received repeated reading instruction and context free instruction on two different word sets. The groups alternated through each instructional condition twice. Inter-rater reliability for the dependent variable (the number of words pronounced correctly) was 98.5% for both types of instruction. In addition to studies, there are numerous opinions contained in the literature concerning computer use.

According to some of the researchers, the studies pertaining to the cognitive area of CAI use do not show conclusively that CAI is of major benefit. Other research indicates an opposing view that CAI is beneficial in metacognition. While the precise variables involved are not clearly defined and isolated, the general consensus of the research is that CAI is of worthwhile use in the area of cognition.

The design of microcomputer software is another area of concern found in the literature. Vargas (1986) pointed out that CAI can be effective only if the programs adopt those features shown to be necessary for learning. He summarizes the features as 1) a high rate of relevant overt responding, 2) appropriate stimulus control, 3) immediate feedback, and 4) successive approximation (gradually withdrawing cues).

A recent study by Litchfield, Driscoll, & Dewpsey (1990) examined the effects of sequence presentation and difficulty level to concept learning in computer based instruction. Fifty five undergraduate college students enrolled in biology for non majors served as the sample. They were randomly assigned to four treatment groups. 1) adaptive- the sequence is based upon previous performance, 2) inclusive- the sequence is presented in a linear, non-adaptive fashion, 3) formulae- the sequence is based on a rational set generator by Tennyson, and 4) subject matter expert- five experts determine the difficulty of the sequence. It was found that on the retention test, there were no significant differences between all four groups on sequence difficulty or interaction. Time on task showed significant difference between adaptive and inclusive groups. The adaptive group answered 35% fewer examples. This indicates that they required less assistance from the computer presentations than the other groups. The conclusion was that this study provided evidence that supports the efficacy of adaptive instruction in computer-based learning situations.

A study by Lee (1987) surveyed teachers of students with learning disabilities about computer courseware design. Four steps were used: (1) a questionnaire was designed which met two criteria, A) the items on the questionnaire were congruent with accepted learning theory, and B) CAI proponents agreed that the item was of optimal benefit to CAI instruction; (2) twenty learning disability teachers were asked to rank the sixteen items; (3) The same teachers then used a Likert scale to rate one piece of courseware with the sixteen items, and (4) Forty different learning disability teachers rated one piece of courseware. The findings were that the importance of the components of the courseware was independent from usage. Three distinct conclusions were reached. The first conclusion was that courseware manufacturers do not use empirically derived guidelines for production. Second, learning disability teachers want well developed tutorials and not just drill and practice materials. The third conclusion, surprisingly, was that teachers did not feel that there was a need for computers to be any more than a visual medium of instruction. These findings are the result of teacher opinions. The teachers clearly want highly developed instructional materials for CAI use, but do not feel comfortable with using the expanded capabilities of the computers.

The effects of the computer enhanced classroom on the achievement of remedial high school math students was studied by Lang, Branch & Thigpen (1987). Pre-test and post-test scores from the Comprehensive Test of Basic Skills were compared among 4,293 remedial students who had participated in the Governor's Remediation Initiative Program. This program was only described as a computer enhanced classroom. The findings showed that all comparisons of California Test of Basic Skills math scores showed significant gains. No significance level was reported. The conclusion was that the computer-based instruction used in this project was effective and superior to traditional classroom instruction. Some question remains, however, about the soundness of the methodology and thoroughness of this research.

A study of the effects of CAI on math facts automaticity was done by Hasselbring, et. al (1988). The subjects were 160 students with either mild handicaps or no handicaps, ages seven to fourteen. Students with handicaps were assigned to either a computer or a control condition. Students without handicaps were assigned to the control condition only. The computer group received ten minutes daily computer instruction (drill and practice) using "Fast Facts" software. Post data were taken after forty nine days. The experimental group was found to have increased the number of facts recalled by 45 (from 29), a 73% increase. The control group with handicaps showed no gain. The control group without handicaps showed increase of only 8 additional facts. Maintenance data taken on the experimental group four months after the post test showed the average number of fluent facts dropped by only 4 facts. Hasselbring (1988) concluded that the combination of recall training plus drill is a powerful tool to develop automaticity in learners with handicaps. Also, with sufficient training, students who are learning handicapped should be able to develop automaticity with basic math facts at a level equal to peers who do not have learning handicaps.

Several studies were located in the literature regarding the effects of CAI upon different aspects of reading. Harper & Ewing (1986) compared microcomputer versus workbook instruction. In this study of reading comprehension using a commercially available tutorial program, it was found that among nine students in a junior high special education resource program, the microcomputer was most effective for eight of them. Pre and post-test mean scores showed a 12 point difference in favor of the CAI. The ninth subject reported a fear of the microcomputer. In light of these findings, it was concluded that CAI was more effective than workbook instruction in this small sample, single subject design.

Nelson (1972) conducted an evaluation of computer-assisted vocabulary instruction with children who were mentally retarded. The subjects of the study were twelve students labeled educable mentally retarded, and twelve students labeled normal, with an average mental age of approximately the first grade level. Teletypewriter terminals were used in the treatment. Scores on post tests showed no significant differences between learning of children labeled EMR and children labeled normal of comparable mental age. There was a significant negative correlation ($r = -.869$) between mental age and errors on the post test in the experimental group. It was concluded that the vocabulary presentation was productive in teaching students who are mentally retarded.

A study of a small sample of students in a special education project which involved learning LOGO turtle graphics, was done by Turkel & Podell (1984). It was found that students were generally focused and on task. It was concluded that computer-assisted learning appears to have potential as a valid means of motivating active problem solving in special education students.

In the area of reading, a study by Fletcher & Suppes (1972) examined the aspects of reading instruction that would lend themselves to computer-assisted instruction. It was found that the number of items presented in vocabulary is about twice what is presented in basal readers. It was concluded that great amounts of material can be covered using short daily sessions of CAI.

Another study in the area of reading by Baumgart & Walleghem (1987) focused on the teaching of sight words. Computer-assisted and teacher taught methods were compared. The subjects were three adults with moderate mental retardation. The first achieved no difference between the treatments, the second achieved 100% on CAI and 86% on teacher taught, the third did not ever reach mastery with CAI alone. It was concluded that microcomputers coupled with peripherals can enhance instruction of persons with moderate handicaps.

What is the current status of CAI use in special education? A longitudinal descriptive research survey was done by Russell (1987). The problem addressed is that there was no body of knowledge about non-drill uses of microcomputers. This two year national survey included an assessment of why and how special education departments are or are not using learner centered software, and identification of a sampling of promising practices. It was found that word processing was used by 27% of the sample, which made it the most popular. 15% reported using problem solving software, 12% used LOGO, and 9% made use of other applications such as database. It was concluded that teachers need a demonstration that the use of learner centered software has broader effects. This means not just self image and motivation, but also thinking and learning.

In support of the conclusions of the Russell study, four study analyses were reviewed. Kulick, Kulick, & Bangert-Downs (1985) showed only one study was available which was done with a microcomputer, concluding that more up to date research is needed. Cosden, Gerber, Semmel, Semmel, & Goldman (1987) found that of the instructional software available in their study, few programs were used by more than 10 students, and that most programs were categorized as math drill and practice. Niemic & Walberg (1987) found that CAI appears to be effective based on their review. They conclude CAI is about as effective as tutoring or adaptive education.

What are the future directions? According to Hofmeister (1984), the children in school now are the first generation of the information age. He suggested that our knowledge base is expanding rapidly, and that the textbook is no longer the best source for future use. To be prepared to direct the course of the future, we should build or information management skills. He said that tutorial CAI holds considerable promise for two reasons.

Most students in special education are served in the mainstream where the teacher/ pupil ratio is higher, and secondly, little software is developed specifically for the learning disabled, which is the largest population of special education pupils.

Hofmeister (1983) also points out that the students presently in school are the first generation of the information age. The computer is the major tool of the information age because of its capability to store, locate, and retrieve large amounts of information in very short periods of time. By studying the computer carefully, we can get glimpses of the nature of the coming information age, and its potential impacts. The uncertainties caused by the coming information age create many challenges for educators with regard to computers.

Special education applications of microcomputers, according to Hofmeister (1983), lie primarily in the area of computer-assisted instruction. This is because the computer's use as a personal assistive device is limited to approximately 7% of the school age population whose handicapping conditions include visual impairment, deafness, crippling conditions, and multiple handicaps. The remaining 93% is made up of individuals identified as learning disabled, mentally retarded, and emotionally disturbed. The needs of this majority is of primary concern.

A survey of 208 schools in Southern California by Cosden, Gerber, Goldman, Semmel, & Semmel (1986) reported that approximately 65% of the schools surveyed indicated that students with mild handicaps had access to microcomputer instruction. The schools were stratified on the basis of attendance, and fell into one of four categories, 1) schools in which students with learning handicaps were reported to use microcomputers in a mainstream setting, 2) schools in which students with learning handicaps were reported to use microcomputers in their resource program in addition to possible use in the mainstream, 3) schools in which students with learning handicaps did not have access to microcomputer instruction, and 4) schools in which the respondents were unable to specify whether or not microcomputers were used by their students who had learning handicaps. Forty six percent of the schools surveyed in which students with handicaps use computers in the regular classrooms fell into category one where students with handicaps were reported to use computers in mainstream settings. Nineteen percent fell into category two, where students with handicaps were reported to use computers in resource programs. Twenty five percent fell into category three, where students with handicaps did not have access to computers, and ten percent fell into the fourth category in which respondents to the survey were not able to specify whether students in their school who were identified a handicapped had access to microcomputer use. Further study is needed to assess the effects of the commitment of the schools to microcomputer instruction on students with and without handicaps.

Statement of Hypothesis

While studies have shown that the number of computers in use in the schools is ever increasing (Bennett, 1986, Hanley, 1984, Kominski, 1988), the question of student access to these computers remains. This is particularly true with populations of students who have mild handicaps. To what extent do students who are labeled mildly handicapped (LD, BD, EMH) have access to microcomputer use in school resource, mainstream, and self contained settings as compared to students who are not labeled as handicapped? Hopefully, students labeled as mildly handicapped, regardless of setting (resource, mainstream, or self-contained), will have the same opportunities for microcomputer access as their non-handicapped peers. The basis of the comparison was the reported use of microcomputers by students labeled mildly handicapped by school administrators, and the ratio of total number of microcomputers in the school to total attendance at the school. This descriptive data concerning microcomputer use in the schools tested the null hypothesis that there was no difference in the microcomputer access ratio by students labeled mildly handicapped as compared to microcomputer access by students without mild handicaps. Four separate research questions were asked: 1. Does the presence of a special education resource program in a school have an impact on the availability and access to the microcomputers in the school? 2. Does the presence of a self-contained special education program in a school have an impact on the availability and access to the microcomputers in the school? 3. Does the presence of both a resource and a self-contained special education program in a school have an impact on the availability and access to the microcomputers as compared to schools that have only one of these programs? 4. Does the presence of both a resource and a self-contained special education program in a school have an impact on microcomputer availability and access as compared to schools which do not have either of these programs?

Method

The sample consisted of 139 schools selected from a total of 361 schools in 107 districts located in a fourteen county area of East Central Illinois. The districts are located in the counties of Champaign, Ford, Vermillion, Edgar, Douglas, Coles, Moultrie, Piatt, Macon, DeWitt, McClean, Livingston, Kankakee, and Iroquois. The entire area can be described as agricultural and mostly rural as there are no large cities (with a population greater than 250,000) in the area described. The sample was drawn from a compiled list of public schools and public school districts known as CIC'C School Directory, which was available at the public library. Enrollment and grade level information was also provided. A stratified random sampling technique was used to obtain a representative sample for the survey. Schools were stratified in size by describing schools with attendance over 400 students as "large", and schools with less than 400 students in attendance as "small." In addition, schools were stratified by type and placed into the following seven categories: 1) Small elementary schools, 2) Large elementary schools, 3) Large middle or junior high schools, 4) Small middle or junior high schools, 5) Large high schools, 6) Small high schools, and 7) All K-12 schools. For the purpose of this study, the terms junior high schools and middle schools are used synonymously and interchangeably. Thirty percent of the elementary schools, fifty percent of the junior high and high schools, and 100 percent of the K-12 schools were randomly selected for the sample (n=139). These schools were surveyed to obtain the particular information necessary for this study. The surveys were addressed to administrators and were mailed during the two week period immediately preceding the start of school in the fall of 1990. Return envelopes were provided for ease of response. A few representative non-respondents were contacted, and the results were compared to the remainder of the sample. No sample bias was detected. Figures which represent the response rate are found in table 1.

Insert Table 1 here

Instrument

The survey instrument (Appendix A) collected information regarding the presence of a resource and/or a self-contained program which serves students with mild handicaps at the school. The survey also requested the number of students served in such programs, and the total number of microcomputers available for use in the school. In addition, the survey gathered information about the microcomputer location (lab, in room, moveable, etc.), as well as the identification of a microcomputer expert or coordinator (Cosden, et al., 1986). This information was then combined with published data concerning enrollment and analyzed to determine a ratio of student enrollment to the number of microcomputers available for use at the school.

Design

Descriptive comparisons of computer availability to school attendance and number of students served in resource programs, mainstream settings, and self-contained programs were made. The descriptive data was graphically represented. The dependent variable was the microcomputer accessibility to students with mild handicaps as measured by the enrollment/microcomputer ratio in schools that house such programs compared to the ratio in schools which do not house such programs. This ratio was determined by dividing the total enrollment figure for the school by the total number of microcomputers which are available for student use. The independent variables are: 1) The presence of a resource program at the school which serves students with mild handicaps, 2) The presence of a self-contained program at the school which serves students with mild handicaps, 3) The presence of both a resource and self-contained program at the school which serves students with mild handicaps, and 4) The absence of both a resource and self-contained program at the school.

Procedures

The surveys were mailed to the administrator of each school in the sample (n=139). The survey was accompanied by a cover letter which explained the purpose of the survey, and offered the administrator a summary of the findings. A stamped, self addressed envelope was included to help encourage prompt response.

Findings

Information concerning the locations of the microcomputers was collected. As seen in table 2, a higher percentage of middle and high schools reported having microcomputer labs. An average of 39% of the schools in the sample reported having microcomputers located in resource rooms. This demographic information gives some insight into the findings regarding accessibility to these microcomputers.

Insert Table 2 Here

The data was examined for each of the seven categories of schools. Comparisons were made between the schools. The first comparison was between schools which did contain a resource program serving students with mild handicaps and schools in the same category which did not. The basis of the comparison is the microcomputer/enrollment ratio in each of these schools. The comparison in the elementary and middle schools shows decreased accessibility to microcomputers by an average of 8.1 students per microcomputer, while the high schools show increased accessibility by an average of 7 students per computer.

Insert Table 3 Here

These results are graphically depicted in figure 1.

Insert Figure 1 Here

Missing series b bars in the small middle school and K-12 categories indicates that 100% of the sample in these groups reported the presence of a resource program in the school. These results indicate that the presence of a resource program in the school does impact microcomputer access as posed in research question number 1. This finding also rejects the null hypothesis that there will be no difference in microcomputer access in this comparison.

The same comparison was made with schools that have a self-contained program serving students with mild handicaps to schools that did not.

Insert Table 4 Here

The same pattern of accessibility appeared. The elementary and middle schools showed decreased access by an average of 8.7 students per microcomputer, while the high schools showed an increase in access by an average of 4.4 students per microcomputer. The differences are more pronounced with the self-contained comparison than with the resource comparison. Based on this finding, the presence of a self-contained program in the school does impact the microcomputer access negatively in the elementary schools, and positively in the high schools. This finding also rejects the null hypothesis that there will be no difference in microcomputer access in this comparison. These results are depicted graphically in figure 2.

Insert Figure 2 Here

The third comparison was made between schools which contained both resource and self-contained programs and schools of the same type that contained only one of these programs.

Insert Table 5 Here

Once again, the elementary and middle schools showed decreased access to the microcomputers where both programs existed, compared to schools where only one program existed. The average number of student difference is 8.2. The high schools (including K-12 schools) again showed an increase of microcomputer availability in the schools which contained both programs simultaneously as compared to schools which contained only one of the programs. The average number difference is 5.2 students. Based on this finding, research question 3 is also shown to be true in that the presence of both types of special education programs in the school has an impact on microcomputer access as compared to schools that have only one of the special education programs. The null hypothesis that there will be no difference in microcomputer access is rejected here also. These figures are shown graphically in figure 3.

Insert Figure 3 Here

The last major comparison was made between schools in each category that had neither a resource or self-contained program and schools which had both programs.

Insert Table 6 Here

The results trend is the same as the other comparisons. The elementary and middle schools reported microcomputer access to be inversely proportionate to the presence of programs serving students with mild handicaps in the school. The high schools reported that the microcomputer access was proportionate to the presence of resource and/or self-contained programs. This finding positively supports research question 4, that the presence of both special education programs in a school will impact upon microcomputer access as compared to schools which do not have either of the special education programs. These results are depicted graphically in figure 4.

Insert Figure 4 Here

Discussion

A similar study in Southern California (Cosden, et al., 1986) revealed that only about half of the schools surveyed reported use of microcomputers by students who were categorized as "Learning Handicapped." In the survey conducted for this research, only one of ninety seven respondents, or roughly 1% of the school administrators reported no use of microcomputers by students with mild handicaps. This fact supports the reported (Bennett, 1986) fast pace of the introduction of microcomputer technology into the special education field. This reported use of microcomputers by students with mild handicaps from 99% of the respondents also supports the validity of the accessibility comparisons used in this study.

Elementary school children who have mild handicaps and are served in a resource program do not have the same accessibility to microcomputer use as their peers who do not have mild handicaps. This finding for research question 1 rejects the null hypothesis that microcomputer access for students with mild handicaps will be equal to microcomputer access for their peers who do not have handicaps. High school students with mild handicaps being served in resource programs had greater access to school microcomputers than their peers who had no handicaps. This finding also rejects the null hypothesis that there will be no difference in accessibility to microcomputers between the specified groups. Causal factors such as budget restraints, teacher or administrative styles, microcomputer curriculum development or availability, or district policies regarding microcomputer use in the elementary schools is not addressed. Further study would be necessary to isolate the specific factors involved.

This study also indicated that high school students with mild handicaps who are served in a self-contained program have increased accessibility to microcomputer use compared to their peers who do not have handicaps. This also rejects the null hypothesis of equality of access. Similarly, elementary school students with mild handicaps who are served in a self-contained program have decreased access to microcomputers. These findings for research question 2 also reject the null hypothesis. Once again the specific causal factors are not addressed, and further study would be necessary to isolate them.

Similar findings for research questions 3 and 4 reject the null hypothesis. The presence of both resource and self-contained programs had an impact on the access to the microcomputers. This was true when the presence of either of the programs was compared to the presence of neither of the programs in the school.

The study found that microcomputer instruction is being made more accessible to students at a time after which most of the basic skills are to have been learned. Microcomputers are being made less accessible to students with mild handicaps in the elementary schools, where the teaching of basic skills occurs. This raises a question as to whether the microcomputer is being put to best use within the special education field. The literature indicates that as an educational tool, the computer is well suited to drill and practice activities, motivation for basic skill concepts, problem solving training, and metacognitive processing techniques. The results of this study indicated that access to microcomputers by students with learning handicaps may not be occurring at a time when it's use may be optimal for the highest student achievement.

The results of this study showed that microcomputer access by students with mild handicaps is decreased in lower school grades, and increased in high school grades. Suggested further research in this area would focus on the factors involved in the creation of this scenario. Are special education dollars for technology funnelled to the high school level? Are elementary age students with mild handicaps viewed as being incapable of receiving benefit from CAI? Is CAI software inadequate for the young learner?

Is the skill of keyboarding considered a roadblock to CAI use in the elementary schools? Further research is needed to ascertain the answers to these questions. Speculation as to the cause of the current state of microcomputer access by students with mild handicaps would be that the dollars available for technology in special education programs has been apportioned to the secondary level, and has not yet been made available to the elementary programs.

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	Population-	Sample-	Returned-	%Sample-	%Pop.
Sm Elem	178	53	38	72%	21%
Lg Elem	56	17	13	76%	23%
Lg JrH	25	12	9	75%	36%
Sm JrH	20	10	6	60%	30%
Lg HS	27	14	12	86%	44%
Sm HS	44	22	12	55%	27%
K-12	11	11	7	64%	64%
Total	361	139	97	***	***
Average	52	20	14	70%	35%

Table 1

	Lab	Classroom	Resource Room	Moveable	Other
Sm Elem	38%	76%	41%	57%	5%
Lg Elem	31%	85%	38%	38%	15%
Lg JrH	100%	44%	22%	56%	0%
Sm JrH	67%	17%	50%	17%	17%
Lg HS	100%	83%	33%	50%	17%
Sm HS	92%	58%	33%	17%	17%
K-12	86%	86%	57%	43%	0%

(Percent of sample respondents)

Table 2

Resource	Ratio With	n	%	Ratio W/O	n	%	Diff.
Sm Elem	23.2	34	89	16.5	4	11	6.7
Lg Elem	29.2	12	92	16.0	1	8	13.2
Lg JrH	24.9	7	78	20.5	2	22	4.4
Sm JrH	24.5	6	100		0	0	
Lg HS	14.0	11	92	24.0	1	8	-10.0
Sm HS	10.0	9	75	14.0	3	25	-4.0
K-12	20.0	7	100		0	0	

Table 3

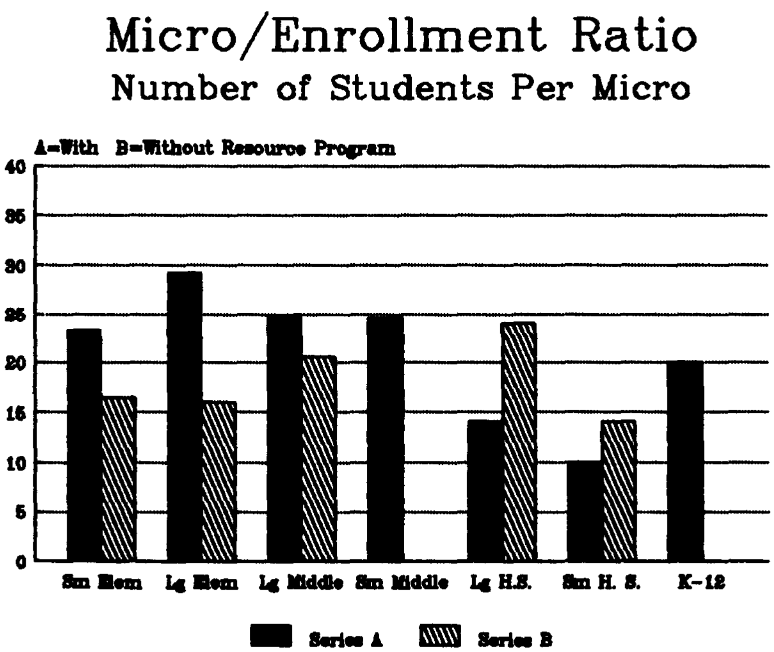

Figure 1

Self-Cont.	Ratio With	n	%	Ratio W/O	n	%	Diff.
Sm Elem	25.2	21	54	18.8	17	46	6.4
Lg Elem	29.6	8	62	25.8	5	38	3.8
Lg JrH	31.4	5	56	22.0	4	44	9.4
Sm JrH	29.5	4	67	14.5	2	33	15.0
Lg HS	14.8	6	50	15.0	6	50	-0.2
Sm HS	9.3	4	33	11.9	8	67	-2.6
K-12	17.8	4	57	28.3	3	43	-10.5

Table 4

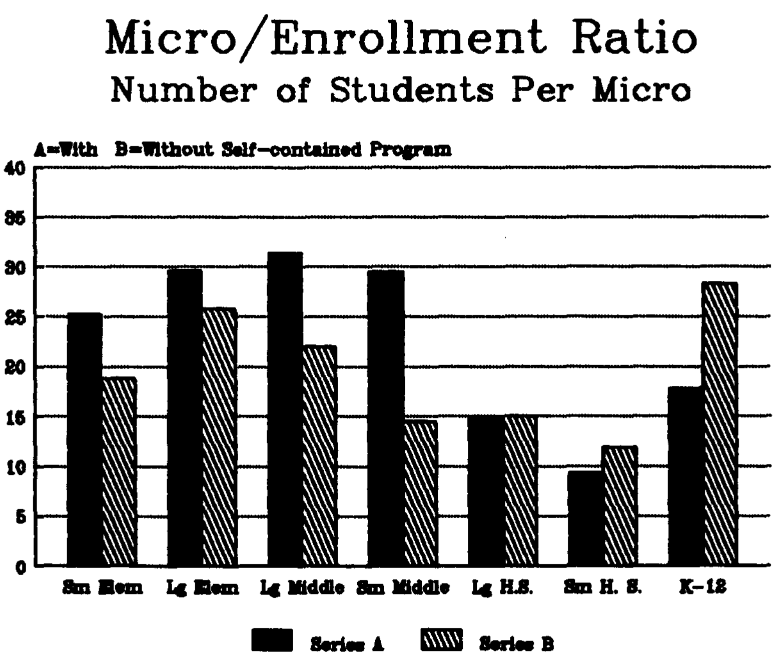

Figure 2

Both/One	Ratio Both	n	%	Ratio One	n	%	Diff.
Sm Elem	27.2	17	45	18.7	19	50	8.5
Lg Elem	31.6	13	54	24.2	6	46	7.4
Lg JrH	25.4	5	56	23.5	7	22	1.9
Sm JrH	29.5	4	67	14.5	2	33	15.0
Lg HS	13.0	5	42	16.3	7	58	-3.3
Sm HS	8.3	3	25	10.0	7	58	-1.7
K-12	17.8	4	57	28.3	3	43	-10.5

Table 5

Micro/Enrollment Ratio

Number of Students Per Micro

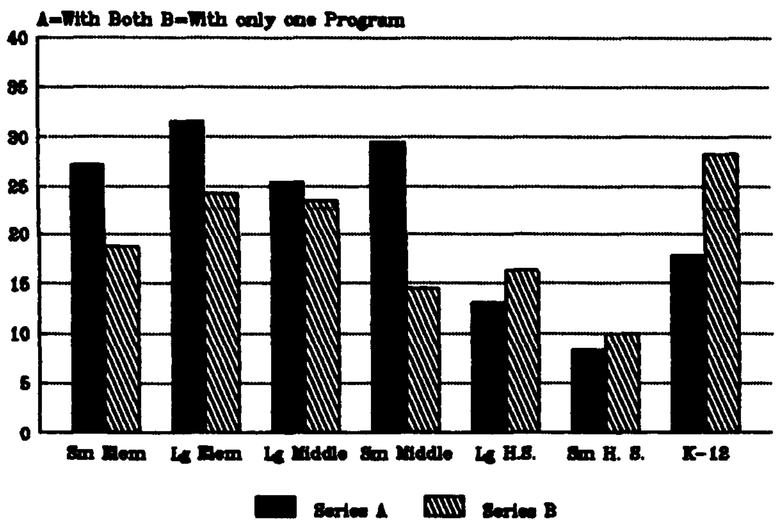

Figure 3

Both/None	Ratio Both	n	%	Ratio None	n	%	Diff.
Sm Elem	27.2	17	45	18.0	2	5	9.2
Lg Elem	0	0		0	0		
Lg JrH	25.4	5	56	20.5	2	24.9	
Sm JrH		0	0		0	0	
Lg HS		0	0		0	0	
Sm HS	13.0	5	42	15.0	2	17	-2.0
K-12		0	0		0	0	

Table 6

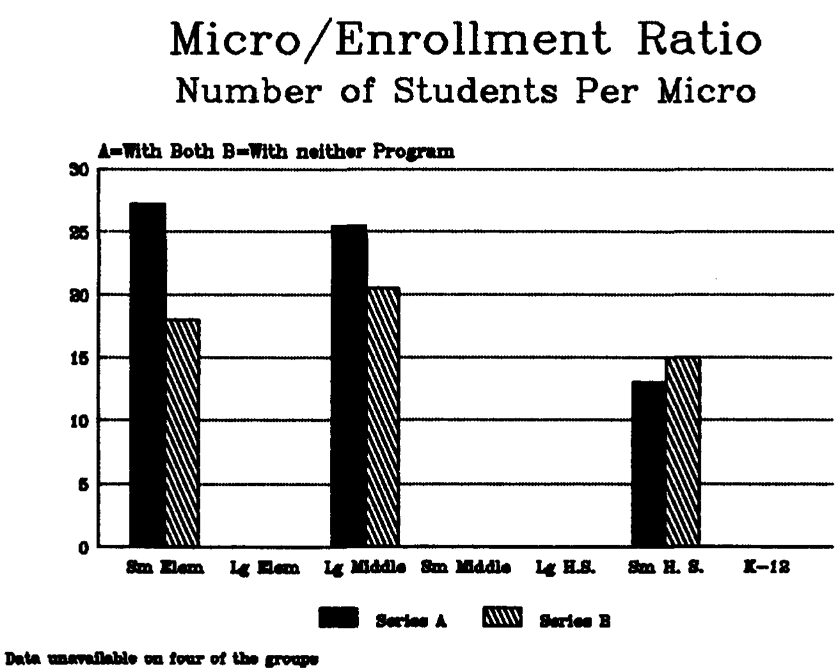

Figure 4

MICROCOMPUTER ACCESS SURVEY

Code-

1. How many microcomputers do you have in your school which are available to students?

   None_____ (Proceed to question 2)
   #_____ Where are the computers located?
   Computer lab ______
   Classroom .. ______
   Resource room______
   Moveable ... ______
   Other ...... ______

2. Do you have a resource program for students with high incidence handicapping conditions (learning disability, educable mentally handicapped, or social/emotional disorder)?

   No ____ (proceed to question 3)
   Yes____ How many students does it serve?________.

3. Do you have a self contained class for students with high incidence handicapping conditions(LD,BD,EMH)?

   No _____ (Proceed to question 4)
   Yes_____ How many students does it serve?_________

4. To your knowledge, have you seen or heard of students with high incidence handicapping conditions (LD,BD,EMH) using computers in your school?

   No _____ (Proceed to question 5)
   Yes_____ .... In self contained room?_____
   In a lab as regular instruction?_____
   In a resource room?_____
   In mainstream?_____
   Other?_____

5. Is there a person or a group at your school who is identified as the microcomputer expert or coordinator?

   No _____ Yes_____ Name?_________________________.

6. That is the end of the questions. Thank you for your help. I am grateful for your cooperation and look forward to receiving your response.

Appendix A