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ABSTRACT

The handbook describes first year results of a project involving microcomputers in the education of behaviorally disordered students. Following an overview of computer assisted instruction (CAI), the book specifies project goals and research questions. Software selection is examined in terms of instructional factors, program decisions, and motivational factors. Three pilot studies are then discussed which explore the motivational capacity of microcomputer free time as an individual classroom reinforcement activity; the studies highlighted topics of reinforcement preference, reinforcement selection, and motivation for behavior change. Additional studies include case study and traditional investigation of CAI for students with attentional difficulties, in interpersonal problem solving for adolescents in Learning Disabled/Behaviorally Disordered classrooms, in impulse control, and in fostering cooperative group skills. Appended materials include a software evaluation guide and a bibliography on microcomputers and computer technology. (CL)

COMPUTER APPLICATIONS FOR STUDENTS WITH BEHAVIOR AND LEARNING PROBLEMS

TEACHER'S MANUAL

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IOWA CITY, 1984

Project Iowa

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P R E F A C E

In April, 1983, the Iowa State Department of Public Instruction made funding available under the Project Iowa Model Practices Award Grant program for field-based projects. This manual is the result of a one year project supported by Project Iowa. This project, which has been awarded an additional year of funding, was developed at the Department of Educational Services, Child Psychiatry Service, The University of Iowa Hospitals and Clinics. Most of the activities were conducted with the children who were referred to our clinic and attended the inpatient school. Other activities were completed in public school programs that serve behaviorally disordered students. Without the support and cooperation of the instructional personnel in those programs, the successful completion of this project would have been much more difficult.

Realizing the rapid growth in availability of computers to students and teachers in special education programs, the primary purpose of the Computer-Assisted Behavior Training Project was to empirically investigate ways that microcomputers might optimally be used in the B.D. curriculum. Our emphasis during the first year of the project was to pilot test the activities developed at Child Psychiatry Service and to collect data on those activities regarding their effectiveness in helping create behavior change in students in selected public school and residential programs in the state. The primary objectives in the second year of the project will be to continue exploration of unique curricular uses of the microcomputer and to utilize the results of the previous studies in providing training for teachers on using computers effectively in their programs.

This handbook covers the results of the research activities conducted in the first year of the project and discusses implications for special educators who use computers in their classrooms with behaviorally disordered (BD) learners. It also includes pragmatic information for the teacher who wishes to use the microcomputer more effectively in the classroom.

INTRODUCTION

By now, most educators are aware that communicating with a computer is rapidly becoming a daily activity--from making transactions at an automatic bank teller to purchasing a soft drink from an automatic vending machine. For the most part, computers are being utilized in all walks of life because of the speed and accuracy with which they make decisions and carry out activities. Microchip products are also relatively inexpensive, which makes them an economically attractive tool for performing multifarious tasks, ranging from the monotonous to the technologically fascinating. Personal microcomputers have advanced in their level of sophistication and friendliness, i.e. our ease in communicating with them. The prediction has been made that by 1990 microcomputers will be as common in homes as television sets are presently.

The growth of microtechnology is perhaps no more evident than in the field of education. The number of microcomputers being used by educational personnel and students has made a quantum leap. Within the last three years school districts have realized the advantages personal computers can bring to the educational process and have made huge financial commitments toward the purchase of hardware and software. This has created a pressing need for teacher training in the educational uses of microcomputers.

Much of the same is true in special education, except that the impact of microtechnology is just being evidenced. Many special education programs now have their own computers, and most exceptional students at least have access to a computer in the school building. Unfortunately, there is an extreme shortage of courseware specifically designed with the needs of exceptional populations in mind.

Much of the initial development in the application of microcomputers to special education has been in the area of computer-managed education. Regulations of P.L. 94-142 have placed an enormous paperwork burden on teachers and administrators of special programs. Microcomputers are able to manage the filing and documentation associated with the I.E.P. process with relative simplicity and speed. This allows more time for teachers to spend in such areas as program development and improvement and may decrease some of the causes of teacher "burn-out" associated with the paperwork in special programs. Microtechnology has also opened a world of possibilities for the development of adaptive communication devices for physically handicapped learners. Robotics is another exciting area that may help provide the technology in the future to assist handicapped learners to interact with their environment.

For the mildly handicapped learner, the educational potential of computers is just now being examined. Although there is an extreme paucity of courseware designed specifically for the mildly handicapped population, teachers are learning how to evaluate existing software to determine its appropriateness for their students. Teachers are discovering that computers can provide challenges and opportunities for tapping educational abilities in learners that often remain hidden in traditional forms of instruction. At this point in time, empirical evidence needs to be gathered to determine the merits and unique uses of this potentially powerful instructional tool with mildly and severely handicapped learners.

EDUCATIONAL USES OF THE MICROCOMPUTER: AN OVERVIEW

CATEGORIES OF CAI MATERIALS

In computer-based instruction (CBI) most usage could be classified under one of two categories: computer-assisted instruction (CAI) and computer-managed instruction (CMI). Since most of this manual deals primarily with student uses of microcomputers, much of what will be described in this section is considered CAI.

Computer-Assisted Instruction

Software that falls under the heading of CAI is called courseware; courseware programs are used by students for instructional purposes and are usually part of the school curriculum. Most courseware can be classified under one or more of the following instructional designs: tutorials, simulations, and drill and practice. Computers can also be used as a writing tool to assist the student in completing written assignments (word processing), an artist's tool to design graphics, and as a computational tool in performing calculations and conducting research activities. Finally, the student can become a tutor and teach the computer to perform unlimited tricks, while in the same process learning the skills of problem solving and computer programming.

Tutorials

Courseware in tutorial form covers a wide range of instructional applications, all of which give instruction to the learner. The concepts presented in a tutorial program are usually new or unfamiliar to the learner. Courseware is available that covers nearly every topic or subject in the curriculum. In tutorials, students typically work through information that is carefully sequenced and explained. The program frequently presents the student with questions or problems concerning the subject matter to determine recall and comprehension. Depending on the student's responses, the program proceeds to new information or branches to another section of the tutorial for review or remediation.

Drill-and-Practice

Drill-and-practice programs are simply that--instructional drills that present questions or problems covering material that is familiar to the student but needs to be practiced for the student to reach mastery level. Drill-and-practice programs are only successful if proper instruction and student learning have preceded them. Many tutorial programs conclude with a drill-and-practice activity reviewing the concepts covered in the tutorial. Some programs also make use of a management system for tracking and recording student performance. This allows for teacher and student monitoring of learning rates. Some programs will automatically increase or decrease the number, speed or difficulty level of problems presented to the students depending on their performance. Other programs allow for teacher control of difficulty level or response rate. Finally, well designed drill-and-practice programs will keep a student motivated in an otherwise boring activity by making use of gaming features.

Simulations

Educational simulations are programs that present information to the learner in the context of a replicated real-life situation, event or activity. Simulations are often used with content or topics that are too difficult or expensive to do in the classroom. For example, they are frequently utilized in the history and science curriculum to simulate complex or dangerous experiments and historical events such as civil war battles or traveling in a wagon train over the Oregon Trail. In many simulations students actually "experience" learning by assuming a particular role in the situation the simulation portrays and making decisions when faced with challenges or questions. When a student reacts to such a dilemma, the program then provides consequences of either an expected or unexpected nature. Simulations may be presented in written text or graphic form, or a combination of both.

Under these three designs of instruction, computer courseware is primarily used as an instructional material to supplement the regular curriculum. The computer can also be used as a learning tool, just as a pencil or slide rule might be used by a student to write a report or perform a mathematical function. One way that a computer can be utilized as a learning tool is through word processing.

Word-Processing

Personal computers are probably used more for word processing than for any other purpose. Students can use word processing to complete written projects and assignments. Simply stated, word processing is similar to using a typewriter except that the words and phrases typed on the keyboard are stored in the computer's memory and can be saved on disk or cassette to be used or edited at a later time. Documents can have text added, deleted or moved by using certain commands that the word processing program understands. Print-outs, called "hardcopy", of the documents are formatted by using print commands that allow the writer to set line spacing, margins, etc., prior to printing. Printers have the capability to provide a hardcopy in a very short amount of time--some as fast as 160 characters per second.

Each word processing program has a set of commands unique to that particular program and the make of the computer for which it is designed. Typically, the more sophisticated and powerful a program is, the more functions it can perform and the more commands the writer must learn. The trend, however, is that word processing programs are becoming "friendlier" or easier to use.

Friendly, yet powerful, word processing programs are now available for uses in the classroom as a management tool for teachers and as a writing tool for students. Virtually anything that can be written by pen or pencil can be done on a word processor. Word processing is appealing to many students for a number of reasons. Editing can be done with relative ease. Students have a neatly written end-product free of smudges, eraser marks or scribbled-out words. Some word processing programs even have the capability to check the spelling and mark the words appearing to be misspelled.

Computer Programming

Computer programming requires the use of a programming language that will "tell" the computer what to do. A programming language, not unlike a foreign language, must be used to communicate with the computer. Programming languages are made up of a set of special character codes and symbols that, when put together according to special rules and typed into the computer, will make the computer perform activities. Some programs are built right into the hardware of the machine while others come in the form of software. Nearly all the computers used by educators have the language BASIC (Beginners Allpurpose Symbolic Instruction Code) built into the machine. BASIC is the most commonly used programming language. However, there are dozens of programming languages available, each designed with a specific purpose in mind.

One of the newest and most popular programming languages used in educational settings is LOGO. LOGO was developed at M.I.T. by Seymour Papert who was a student of developmental psychologist Jean Piaget. He developed LOGO to be a tool for creating an environment where the child is free to learn programming features through exploration with the "turtle graphics" language program. By using LOGO and similar programming languages, students learn by teaching the computer rather than the computer teaching the students. With such programs, students experiment and create computer products in an exciting and responsive educational environment by using the skills associated with creative problem solving, sequential planning, and logical thinking.

Problem Solving

Many of the new courseware packages require students to learn by using the steps and skills associated with problem solving. Some of these programs are designed for various curricular subjects and utilize the computer's ability to hide information until the learner has figured out the correct procedure to get that information. Students can learn how to gather information, analyze that information, determine choices for input, and receive feedback which will determine what to do next. Problem solving strategies, when incorporated into simulation courseware, can provide intriguing opportunities for adventuresome learning. Adventure games, simulations that have an adventure theme (e.g., treasure hunts, medieval quests, outer space encounter) can provide hours of problem solving practice and entertainment.

Graphics Design

One of the areas that appears to be advancing the fastest in microcomputer technology is computer graphics. Since the development of color for the microcomputer about ten years ago, the software and hardware industry has produced some very exciting graphics programs. This is evident in arcade games alone; what was once black and white ping-pong is now the colorful animated world of outer space, dragons, wizards and other fantastic creatures! There are graphic programs available which enable the designer to develop colorful computer pictures with the keyboard as well as with alternative input mechanisms such as light pens, graphics tablets, joy sticks, and a small device that's moved around a desk or table top called a "mouse." Some programs allow users to save their pictures to be incorporated into other programs and even to invent their own arcade games. Most graphics programs are very easy to use and require little computer programming expertise.

MICROCOMPUTERS FOR BEHAVIORALLY DISORDERED STUDENTS

It is not easy for special teachers to continually find unique and motivating ways to help meet the needs of special learners. With each child needing individual goals, materials, and methods of instruction, scheduling and documentation become a burden--not to mention the effort it takes to prepare and actually teach lessons. The ability to create a motivating learning environment will seriously affect the success of the total BD program.

Providing and maintaining a high level of educational stimulation also take considerable effort on the part of teachers of BD students because of the interference often caused by behaviors incompatible with learning. Although there is no simple recipe that provides the ingredients for overcoming the many and varied problems that are faced daily by teachers and BD students, it is clear that a successful management program must be built around a curriculum of well planned, educationally appropriate and motivating instructional events. Furthermore, for a program to be effective, the learner must view the educational environment as a place where it is more rewarding to learn than it is to disrupt learning. It is generally felt that the computer can assist the teacher in providing a stimulating and motivational instructional environment.

In addition to planning and carrying out activities designed to meet these motivational and instructional demands, the teacher of BD students must provide instruction relevant to each child's interpersonal problem solving ability and level of social skills. Planning individualized instruction activities with respect to each student's needs in these self-regulatory skill areas, as well as in the academic and functional skill areas, is a major part of any special program. Besides being a timesaving and economical aid to instruction and management of special programs (Bloomer, 1973; Greeno, 1978; Burns & Bozeman, 1981; Brown, 1981), computers have the potential to help deliver individualized instruction to learners (Loewen, 1981). Although there is courseware that can provide individualized instruction covering many academic skills and concepts, there are few programs adequately designed to meet learners' needs in special curricular areas (Hannaford & Taber, 1982).

Regardless of the type of courseware used (e.g., tutorial, drill, or simulation), programs designed to provide effectively for individualization will take learners through an appropriate sequence and level of skills depending on the learners' responses within the program. For example, if a student makes frequent errors on a particular problem or concept, the program will "branch" to another area in the program to cover those problems in a manner that may be more easily understood. Likewise, should the student be mastering concepts with considerable ease, the program may branch ahead to provide instruction in new concepts or problems to keep the student challenged. This "branching" method of courseware design can help assure that there is appropriate matching of instruction with the current level of student performance. Furthermore, program branching for remediation can be done in an unobtrusive manner. Even though the student is aware of his/her performance, it is not broadcast to the entire class by a teacher or another student; feedback is immediate and more exact than if he or she were working at a desk or in a small group. In other words, remediation can take place without the student first having to experience the negative feelings that often accompany failure. For many students with learning and behavior problems, whether they feel successful in the learning situation can greatly effect how they behave in class.

Some educational programs have the capacity to record student performance. This information can be stored on disk or cassette for teacher reference and student use. This allows the student or teacher the opportunity to establish goals or aims for future performance. Some programs may also offer pre- and post-assessments over concepts covered in the program, providing further documentation of student performance. Other programs have the capacity to graphically present student performance. Record-keeping courseware used on the computer provides numerous possibilities for assisting BD students in self-monitoring of their performance and behavior.

The computer offers a multi-sensory approach to learning. Sound, colorful graphics and animation can effectively be used to present and highlight important concepts and processes as well as to act as cueing devices to assist learners in focusing their attention (Alesandrini, 1981). Graphics commands can be input in various ways depending on the hardware, software, and peripherals in use. Good programs will require only a few key strokes for graphics input, while some hardware and peripherals allow the learner such input alternatives as talking to a voice input mechanism, moving a joy stick or "mouse," or simply touching a screen. Graphics tablets are now fairly inexpensive and allow the learner to input information by writing on an "electronic pad" while the screen displays the information. The output of information can also be presented in alternative ways through voice synthesis and robotic devices that can move about the floor drawing LOGO images.

These technological features provide fun and exciting alternatives for learners to interact and express themselves in the instructional process. They may be especially valuable for behavior and learning problem students who have difficulty sustaining attention or who find it particularly stressful or threatening to put pencil to paper or otherwise respond through traditional methods of instruction.

The computer will give the student its undivided attention regardless of how long it takes to respond and in spite of other distractions in the classroom. This allows the learner to work at his or her own pace free from the interruptions in instruction that are frequently caused by the teacher having to tend to the behavior of others. It is important for all teachers to limit the unwanted distractions in their instructional environment, especially when teaching students who have attentional deficits.

Frequent mistakes do not annoy or dismay the computer. This allows the student to work in a relatively non-threatening instructional environment. Furthermore, the computer can remain objective in the instructional situation, limiting its feedback to actual performance. This is especially important for the students who repeatedly demonstrate poor performance or who experience frequent failure. Students who feel good about themselves as learners are more likely to feel better about school and, as a result, cause fewer school-related behavior problems in general.

Computers offer a highly interactive learning environment. Much of traditional instruction (e.g., textbooks, workbooks, films, videotapes, lectures, etc.) is entirely passive and requires the student to be an inactive participant in the learning process. Numerous research studies of students with learning problems have concluded that these students often perform poorly in school because they are considerably less active in their approach to learning (Torgesen, 1980; 1981). With many of the traditional approaches to instruction, students are expected to cognitively ingest instructional information via "inactive" methods such as reading, viewing and/or listening. The microcomputer can actively involve the learner by requiring interaction in the form of input and giving feedback regarding that input. With microcomputers, the student learns by actually doing rather than just passively sitting and being expected to learn. It is obvious that the more instruction requires input from the learner, the more apt it is to involve him or her in the instructional process.

Many programs allow learners to control the difficulty level and sequence of instructional events. This gives students the opportunity to manage the instructional situation rather than be managed by it. There is no conclusive evidence suggesting that learning and behavior problem students do better when they control the pace of instruction (Polsgrove, 1984). However, when the student is in charge of the learning situation, it not only allows him/her to control the instructional pace, but helps minimize the chances of teacher-learner conflicts occurring over some aspect of instruction. Computer programming and some problem solving programs go one step further by having the student control the program by assuming the role of "teacher" while the computer takes on the role of "learner" and performs the tasks asked of it by the "teacher." In educational simulations, the student plays a particularly important role and, depending on his or her behavior in that role, controls the outcome of events.

Computers frequently provide immediate feedback to the student regarding his or her responses, rather than having to wait until the teacher is free to check the work. The feedback can be continuous, personal (computers can remember the student's name and use it in feedback), entirely positive, and corrective should the student make an error. In courseware simulations, feedback is in the form of consequences pertinent to the situation depicted in the simulation. Feedback is essential in successful teaching and behavior management and should do more than inform the learner of his or her status regarding school performance and appropriateness of behavior. It should also provide information as to why a specific problem or behavior is incorrect and what can be done as an alternative in similar situations.

To help motivate learners, many CAI programs make use of a game format. Some of the reasons learners find this form of instruction motivating are the same reasons they find video-arcade games fun. These games require a high rate of interaction to be successful and use action-packed graphics, animation and sound for feedback and visual appeal. In educational computer games, instructional content is usually conveyed to the learner through arcade game features and the student learns by playing. Most educational arcade-type games are in the form of drill and practice courseware. In addition to high interaction rates and the use of stimulating graphics, there are several other aspects of program design that are considered essential when choosing a drill and practice game for instruction. These include: (a) students should only be reinforced for correct work so the game is not as much fun to play when incorrect responses are made as when the responses are correct; (b) sound and animation should serve purposes other than decoration which may actually distract the student from the instruction; and (c) in programs where graphics and animation are controlled by the players, students must be able to control them with ease.

Malone (1980) investigated educational computer games to determine why students like them. He noted that students find educational games intrinsically motivating for reasons that could best be classified under three general categories: challenge, fantasy, and curiosity. He theorized that for an educational environment to be challenging the student must be provided with the opportunity to try to attain a goal. He believes that for a goal to be challenging it should be obvious, at an appropriate difficulty level, and the students should be able to tell when they are getting closer to the goal. He further asserts that the nature of the best goals are often practical or fantasy-oriented rather than goals of simply getting better at a skill.

Computer games are not considered challenging if the student is certain that he or she will either win or lose. Ways that computer games can keep the outcome uncertain and, therefore, challenging are: (a) by having a variable difficulty level that is determined automatically according to the learner's performance or chosen by the learner; (b) by providing several levels of goals so the student can still be challenged by goals at a higher level once the outcome becomes certain at an easier level; (c) by hiding information from the learner and selectively revealing it; and (d) by introducing randomness which heightens interest in many of the gambling games (Malone, 1980).

Fantasies make educational games more interesting because they evoke images of physical objects or situations. For example, fantasies as part of simulations help students portray important characters who determine the outcome of such things as Civil War battles or an excursion into the outer reaches of our solar system. Fantasies also may take the form of analogies in which a particular skill is represented by another event, object or living thing (Malone, 1980). For example, reflections made by a student-controlled spotlight directed at a tilted mirror might represent the skills and concepts necessary for understanding the formation of angles in a geometry lesson.

Educational computer games are also interesting to students because they engage their curiosity. Two ways that curiosity can be evoked within learners are by making the feedback just informative enough to stimulate more exploration and by making the computer environment appear interestingly complex with the use of sound and visual effects and alternative input and output devices (Malone, 1980).

In conclusion, fun and exciting educational experiences are few for children with learning and behavior problems. Although computers will never replace the need for human interaction in the classroom (nor should it) computer-assisted instruction can help make learning fun for students who ordinarily find most instruction unrewarding.

PROJECT IOWA GOALS

In the previous sections some of the characteristics and potentials of educational uses of computers were explained. With these unique motivational and instructional qualities in mind, we wanted to explore some new uses for the computer in special classrooms focusing on the needs of learners with behavior and/or learning problems. Our initial areas of interest included using computer activities to motivate and reinforce students, improve academic learning, practice impulse control, teach problem solving, and develop cooperative work skills. Our rationale for choosing these areas to explore was based on our own professional experience with behaviorally disordered students, other exceptional populations, regular education curriculum, and teacher needs. We felt these areas would be particularly relevant in the curriculum for behaviorally disordered students. We recognize that these areas do not exhaust curricular needs in BD settings.

The specific pilot research activities were undertaken to help determine: (a) the feasibility of such research, (b) further research questions and hypotheses, (c) appropriate research designs for implementing in future pilot centers, (d) appropriate populations for the studies, (e) software and hardware needs for the studies and (f) training needs for teachers who would be conducting these activities in their classrooms. All of the studies conducted this year involved relatively small numbers of students; therefore, it would be inaccurate to regard the results as being representative of any larger population or definitive at the end of the first project year.

The specific questions focused upon in the pilot studies were primarily comparative in nature. We attempted to contrast computer-related activities with traditional classroom activities. The research questions focused upon in year one included the following:

1. When given a choice of classroom rewards, how popular is computer free time in comparison to other typical classroom rewards and activities?

2. How effective is computer activity free time compared to other reinforcers and activities when used in a contingency program to increase positive classroom behavior and academic productivity?

3. How effective are computer-assisted training activities compared to traditional activities when used in impulse control training programs?

4. How effective are computer-assisted activities compared to traditional activities when used in problem solving programs?

5. How effective is computer-assisted instruction compared to traditional instructional activities with regard to spelling achievement among students with attentional difficulties?

6. How do student cooperative work skills on computer-assisted projects compare to cooperative work skills on other classroom projects?

SECTION 1

SOFTWARE SELECTION

Selecting software to meet the needs of behaviorally disordered students was a particularly lengthy and complicated task confounded by many factors. Software specifically designed for mildly handicapped learners is nearly nonexistent (Hofmeister, 1982), especially in the self-regulatory and affective areas of the curriculum such as impulse control and interpersonal problem solving (Polsgrove, 1984). Most software vendors do not have preview policies allowing consumers to try out software before it's purchased or satisfaction guaranteed policies to protect consumers if the software does not meet their needs. Most of the published software reviews are not conducted by special educators trained in the evaluation of courseware.

The selection of software used in the pilot studies was based on an intensive perusal of software catalogs and published reviews of programs. Other professionals involved in the evaluation of courseware were also consulted for their opinions concerning appropriate and well designed courseware. Some courseware was selected after being previewed on loan, but most selections were based on information provided through the published materials. One of the greatest difficulties in selecting software was trying to find programs designed to assist special learners in the acquisition of affective and self-regulatory skills. It quickly became apparent that such software did not exist. Therefore, many of our choices for software in those areas were based on what we felt might best supplement traditional instruction of those skills, even though the software may have been designed for other purposes. We were also limited considerably in our choice of software for activities that were conducted in public school programs because of copywrite laws that prohibited us from copying and distributing the software we selected for pilot testing.

The effectiveness of computer-assisted instruction largely depends on the quality of the software used by the student, assuming hardware needs are adequately met. Therefore, the results of any comparative research conducted between CAI and traditional methods are influenced to a degree by the software variables. The same, of course, can be said of the variables that affect the worth of a particular traditional method of instruction. In other words, comparisons between student responses to, for example, MECC Lemonade Stand (CAI) and math word problems from a worksheet (traditional instruction) do not necessarily reflect the total comparative worth of all CAI or, for that matter, all the worksheets used in instruction.

There are many factors that affect the quality of courseware. Good courseware primarily makes use of strategies uniquely possible via CAI and takes advantage of the computer's visual and interactive capabilities (Alesandrini, 1981). Many of the early CAI programs did not take advantage of the ability to interact with the learner and primarily relied on verbal information to deliver instruction. This resulted in little more than "page-turner" programs of textual information that was often boring for the learner and hardly different from traditional text books. When evaluating software there are many elements that must be considered. The elements that affect the evaluation of courseware might be best described under the following three areas: instructional factors, program decision, and motivational factors.

Instructional Factors

The instructional factors that can affect the quality of courseware include the elements of instruction that help make the program educationally sound. The following instructional considerations must be kept in mind when evaluating courseware:

* The topic chosen for instruction should be particularly suited for computer-assisted instruction. Some topics and concepts might be made clearer to the student if presented through traditional instructional methods. There is little merit in teaching something via CAI that can be done more effectively or efficiently in another way.

* The program must be at an appropriate grade, ability, and interest level for the intended learners.

* The reading level must remain consistent throughout the program.

* The goals of the program should be made clear to the student, and the teacher should be able to establish higher goals and objectives for the learner once he or she has mastered the present level.

* The content of the program must relate to the needs of the learner and the goals of the total program and curriculum. There is no need, except for reinforcement purposes, to place a student on some entertaining program if the content is not relevant to the learner's educational or behavioral needs.

* The content should be accurate with regard to the skills being taught, have an appropriate focus for the population it is intended and be compatible with other materials covering the same content.

* The program should take into account the prerequisite skills necessary to use the program. For example, many programs require typing skills or expect the learner to know how to start up and operate a computer.

Program Design Factors

Program design factors cover the aspects of the program that affect the presentation and display of information. This includes the mechanics and flow of the program when it is run, the documentation (written materials) that accompany the program, the type of input required of the learner, and the quality of feedback in response to that input. The following are some of the program design aspects that must be considered when evaluating courseware:

* The instructional design format (e.g., drill and practice, tutorial, simulation) should be suited to the instructional content and the expected outcome of the instruction. Some information might best be delivered through one approach while other concepts might be easier understood by the learner when presented under a different design format. For example, the presentation of topics that involve problem solving processes are particularly suited to simulations, whereas basic arithmetic skills are more suited to tutorials and drill and practice.

* Most students should be able to complete a program in an appropriate amount of time. It should take students no longer to meet their objectives with a CAI program than it does through a traditional approach to instruction. If it does, it is not an efficient use of valuable instructional time.

* The program should start-up automatically and not require the user to input "booting" commands to get the program to run.

* The content should be presented as verbally concise as possible, free of irrelevant details.

* The program should be free of any errors in spelling or grammar as well as programming "bugs" that interrupt the flow of the program.

* The program should make use of graphics and animation whenever possible to illustrate critical concepts and processes as well as to cue students' attention to important information.

* If the primary vehicle for delivering information is text, its layout should be centered on the screen with lines of print spaced apart for visual appeal and ease of reading.

* Learners should be able to control the pace of the program. In some programs information automatically "scrolls" off the top of the monitor screen after a certain amount of time. Since everyone learns at a different pace, programs should advance to a new "page" only when determined by the learner.

* The program should provide clear directions for proceeding and a "help" function available when the user gets confused as to what to do next.

* The program should provide prompts and hints only when they are necessary to help foster independent learning.

* The program should provide a "menu" clearly labeling the sections of the program. Similar to a table of contents, this "menu" should give the student the option of selecting any starting point in the program to avoid having to repeat part of the lesson to get to a new section. Furthermore, this "menu" should be easily accessible throughout the program.

* The program should provide information on how to exit the lesson at any time without erasing completed work from the disk or cassette.

* Students should be able to input information with ease. Questions should require single, relevant keystrokes such as "Y" for "yes" and "N" for "no" whenever possible. The program should also make use of intelligent "answer judging" routines so responses that require words or phrases won't be judged incorrect if there are minor spelling errors. Some programs provide the option of using alternative input devices such as joy sticks and touch tablets.

* The program should operate smoothly without teacher supervision.

* If the program makes use of sound, the user should be given the option to turn it off at any time to avoid disturbing others in the classroom.

* The program should be accompanied by complete written documentation covering such areas as program goals, rationale for development, instructional range, directions for operating the program, etc.

Feedback

The type of feedback used in CAI lessons is a controversial issue among designers of instructional software (Hofmeister, 1984) and, because of this, will be treated as a separate section under the factors of program design.

The computer is often heralded for its ability to provide learners with immediate feedback concerning their performance but, ironically, very little research has been conducted in an effort to demonstrate the efficacy of immediate feedback with special learners (Hofmeister, 1984). Nevertheless, the following features should be considered when evaluating software for its quality of feedback:

* Feedback should provide the learner with corrective information regarding the accuracy of the response. Corrective information might include hints on how the student might find the correct answer should a similar problem be given.

* Feedback should be encouraging and reinforcing in nature. Encouraging feedback can take the form of words or phrases directed at the student such as "Keep up the good work, Sally!" or in the form of animation and sound effects. Programs that utilize animation and sound effects for feedback must be chosen carefully since they can become annoying and tedious after a few runs.

* Feedback for incorrect responses should never be accompanied by sound, graphics or humorous phrases since some students may find them more interesting than the feedback given for correct responses. No annoying buzzes should be given for incorrect responses since other students in the classroon will soon recognize when one makes a mistake in the lesson.

Motivational Factors

The motivational aspects of CAI were discussed in a previous section of this manual. However, the following points must be considered when evaluating a program for its motivational characteristics:

* Color, animation and graphics displays should only be used to attract the learner's attention during the opening display, to highlight important points, to illustrate concepts and processes to make them clear, and to provide reward for accurate and complete work. They should never be used for decoration or in other ways that might distract the learner from the subject content. Sound should be used in the same way.

* The program should involve the learner through frequent interaction. The more interaction required by the program, the more it is likely to keep the learner's attention. Nothing is more boring to students than programs that only require a press of the space bar to go on to new information.

* The program should occasionally address the learner by his or her name to help personalize the lesson.

* Drill and practice programs should make use of gaming features whenever possible. This includes the elements that make the drill challenging for the learner. Some drill and practice programs can provide a fantasy format and hide information to keep the learner curious enough to pursue the goal.

* Simulations should involve the learner by providing a role to play in the program.

* The program should always allow for learner control of the events that take place within the program. This will give the learner control of the instructional situation and allow him or her to work at a self-controlled pace.

* Feedback should always be positive. If incorrect responses are made, feedback should encourage the learner to try again. The program should also give the learner several chances to get the problem correct if an error is made.

Although this list of factors for courseware evaluation cannot be considered complete, it does stress some of the more important aspects to be considered in the selection of educational software. Generally speaking, the program should function properly, be instructionally sound, and differ from traditional forms of instruction in its presentation of information. Probably the best way to evaluate courseware is to have it pilot tested with the students for whom its use is intended. There are also numerous published software reviews and evaluation forms to assist in the evaluation process. Some of these are included in the appendix of this manual.

SECTION 2

THE COMPUTER AS A REINFORCER IN THE CLASSROOM

RATIONALE FOR THE STUDIES

Many special education teachers are familiar with or have used some form of reinforcement procedure in their classrooms to increase appropriate behavior. For teachers of students with learning and behavior problems, a system of reinforcement is often the backbone of their behavior management program. Reinforcement procedures have demonstrated their effectiveness with both individual students (Walker & Buckley, 1968; Brinbauer, Wolf, Kidder, & Tague, 1964; O'Leary & Becker, 1967; and Ayllon & Azrin, 1968) and groups of students with behavior problems (Packard, 1970; Sulzbacher & Houser, 1968; Bushell, Wrobel, & Michaelis, 1968).

Different types of reinforcers are used in classrooms as well as different methods of delivering reinforcement. There are social rewards such as verbal praise, hugs, pats on the back, etc.; nonsocial rewards that include edibles (e.g., food, candy, gum, pop), tangibles (e.g., stickers, toys, trinkets); and activity rewards (e.g., free time with others, games, movies, record player). In most classrooms that have reinforcement systems, reinforcers are presented either immediately or in a delayed manner via tokens. Token contingency programs might use points, play money, chips or stars as tokens that can be collected and traded for a back-up reward. In nontoken programs there is usually a direct relationship between the reward and the behavior earning the reward. The desired behavior and reward for performing that behavior are often on a one-to-one contingency (e.g., "Finish your math and you may play a game.") but can also be established in the form of a certain ratio of behaviors to reward (e.g., "For every five problems you do correctly, you may have one minute of free time.").

Many teachers provide a variety of rewards and reinforcers in their classroom contingency programs. From a "menu" of reinforcers, students can select a reward determined by their preference and behavioral or academic performance. This is done to help keep motivation high once a student no longer finds a particular reinforcer motivating.

One of the potential uses of the microcomputer in classrooms for students with behavior and learning problems is as a free time activity in a reinforcement program. Much of the rationale for using computer-assisted instruction is based on the computer's ability to create a highly motivating learning environment. There is also a wide variety of software available in the form of arcade games, programming languages, and graphics programs that are highly appealing to young people. For this reason, free time on a microcomputer may have considerable potential as an activity-type reinforcer to help increase positive classroom behavior.

In three separate but related studies, the motivational or rewarding potential of microcomputer free time as an individual classroom reinforcement activity was investigated. In the first of the three pilot studies, students were asked via a questionnaire to indicate their reinforcement preferences. Reinforcement choices included computer free time activities, edible rewards, and other activity-type rewards. This was followed by a study designed to determine what students would actually select when given a choice of those rewards. The third study was designed to compare students' on-task behavior under three reinforcement conditions: a) no reward for task productiveness, b) computer free time activity as a reward, and c) tangible or other free time activity rewards.

REINFORCEMENT PREFERENCE STUDY

Subjects

The participants in this phase of the study included 36 adolescents (16 males) who were inpatients in Child Psychiatry at The University of Iowa Hospitals and Clinics. These adolescents had a mean age of 14.1 (range =12.2 to 16.3 years).

Procedure

Shortly after entering the inpatient unit the subjects were asked to complete a Reinforcement Preference Questionnaire. (A copy is included following this section.) This questionnaire contained four questions dealing with the individual's previous exposure to computers, as well as 27 forced-choice questions of which he/she would like to earn after working hard in school. Three broad categories of reinforcers were included: a) free time on the computer; b) free time in general; or c) food. The 27 questions were broken down into three groups of 9 each comparing a and b, a and c, and b and c. For the current investigation attention was directed at the number of times the adolescents chose computer time versus the other two categories of reinforcers.

Results

The first analyses compared the frequencies with which computer time was chosen as compared to both the free time and the food choices. Computer time was chosen, on the average, 5.5 times out of the 9 questions contrasting it with food. This figure is significantly more frequent than the expected chance rate of 4.5, X^2 (1) = 16.9, $p < .01$. The participants chose computer time, on the average, 5.2 times out of the 9 questions contrasting it with free time. This is significantly more frequent than expected by chance, X^2 (1) = 7.0, $p < .05$. Thus, in both forced-choice comparisons the students indicated a preference for earning computer time as compared to free time or food.

The next series of analyses compared sex differences in the choices made by the inpatient adolescents. There was a significant age difference between the boys (M = 13.7) and girls (M = 14.6), t (34) = 2.6, $p < .05$. Thus, in the ensuing analyses, age was covaried out.

There was no significant difference between the boys and girls in the likelihood of choosing computer time as opposed to food, F (1, 33) = 1.6, p = .21. Boys (M = 7.2) were significantly more likely than girls (M = 3.6) to choose computer time when contrasted with free time, F (1,33) = 16.0, p < .001. The final analysis compared whether previous exposure to computers affected the reinforcement choices made. All 35 participants (data were missing for one person) indicated that their schools had computers, and 34 indicated some previous experience with computers. Ten had a computer at home and 13 had one in their classroom. No significant difference was found between those who had a computer in the home (M = 6.3) and those who did not (M = 5.1) in terms of the likelihood of choosing computer time as opposed to food, t (33) = 1.1, p = .27. Similarly, there was no significant difference between the two groups (means = 5.6 and 5.2, respectively) in terms of the likelihood of choosing computer time over free time, t (33) = .42, p = .68. Further, there were no significant differences between those students who had a computer in the classroom (M = 5.3) and those who did not (M = 5.5) in terms of choosing computer time over either food, t (33) = .24, p = .81, or free time (means = 5.0 and 5.5, respectively), t (33) = .46, p = .65.

Taken together, these results suggest that an individual's previous exposure and experience with computers did not seem to effect whether he/she would choose computer time over either free time or food.

Discussion

The results of these investigations suggest that, when asked in a forced-choice format, inpatient adolescents are significantly more likely to indicate a preference for free computer time compared to either free time on other activities or food. Further, this preference does not seem to be affected by the individual's previous exposure to computers. However, there was some evidence that boys and girls may differ in their preference for computer time, especially when contrasted with free time.

The forced-choice questionnaire employed in this study was comparable to those frequently employed to identify potential reinforcers for students in the classroom. As such, the results of the present investigation indicate that, consistent with the widely held belief, (adolescent) students would value time on a computer as a potent reinforcer. However, the results of this study are based upon choices indicated in hypothetical situations. A more meaningful investigation would be to analyze the participants' choices when given a chance to actually earn a reinforcer. This was the goal of the next study.

REINFORCEMENT SELECTION STUDY

Subjects

Fourteen (9 males) inpatient pre-teen and adolescent students served as the participants in this study. The subjects had a mean age of 12-8, with a range of 10-8 to 15-6.

Procedure

The data for this study were collected over the course of 35 inpatient school days. At the end of each class day, the tokens earned by all of the students were put in a raffle box and a winner was randomly chosen. Thus, the winning token was more likely to be selected from one of the students who had earned the most tokens during that particular day. The winner was allowed to choose from one of five different reinforcers: a can of pop or 20 minutes on one of the activities of computer time, stereo time (Walkman), free time, or typewriter time. All of the participants in this study had the chance to sample the reinforcers at least once prior to the beginning of the study.

Results

Computer time was chosen 24 of the 35 days, pop 8 times, and the Walkman 3 times. The computer time was thus chosen significantly more often than the chance rate of 7, X^2 (1) = 51.6, $p < .001$. All 14 participants won the drawing at least once, and all but one chose the computer time at least once. For 11 of the 14 participants the computer time was their first choice, and several individuals continued to choose computer time even by the third or fourth choice.

Discussion

Consistent with the results of the Reinforcement Preference Study, this study suggests that when given an actual choice inpatient adolescents are significantly more likely to choose computer time over other reinforcers commonly employed in the classroom, including pop and use of a Walkman. Unfortunately, due to the limited number of days on which this study was run, and the fact that only one student won on any given day, it is impossible to know whether novelty effects may have played a role in the selection of computer time. Although a few students did continue to choose computer time even by their third or fourth choice, most participants had the opportunity to make only one, or at most, two choices during the course of the study. It would be interesting to know if this preference for choosing computer time would continue over long periods of time and repeated exposure to the computer. Along these lines, it is relevant to note that in the Reinforcement Preference Study, previous exposure to and experience with computers did not significantly effect the likelihood of indicating a preference for this reinforcer. Future studies can ascertain whether this verbal preference translates into actual choices over repeated exposure to the reinforcers.

MOTIVATION FOR BEHAVIOR CHANGE STUDY

Subjects

The subjects for the present study consisted of 5 boys who were inpatients on the Child Psychiatry unit. All of the boys had a diagnosis of Attention Deficit Disorder and four of them also had a diagnosis of Conduct Disorder. The boys ranged in age from 8 to 13 (M = 11.0, SD = 2.) and an IQ from 76 to 113 (M = 91.2, SD = 14.1).

Procedure

A multielement baseline design (Ulman & Sulzar-Azaroff, 1977) was employed, in which three types of reinforcements were presented in a modified latin square design. The three reinforcement conditions included:

1. No reward for performance.

2. Computer time. The boys could earn up to 20 minutes on the computer depending upon their productivity. They could select any available software, which included arcade games, educational programs or games, graphics programs, and programming software.

3. Stickers or free time. The younger boys could earn 'Scratch and Sniff' stickers while the older boys could earn free time in a gym with foosball, air hockey, pool, and basketball.

The experimental task involved working on math computation problems provided at the boys' instructional level. Each boy participated in the study either 12 or 15 days. On each day the boys were given math problems and asked to complete as many as possible during the 15 minute independent work period. Observations of the boys' on-task behaviors were collected, along with the number of problems completed. The Teacher Aide was trained in a simple time-sampling observation procedure, adapted from the Classroom Behavior Record (Nichols, Fitzgerald, & Robinson, 1979). (A copy of this observation form is included in this section.) The experimental days were divided into blocks of three, consisting of one of each of the reinforcement conditions, with the order of presentation varied. At the beginning of each block of three days the difficulty of the problems was slightly increased, although the difficulty level remained constant during all three reinforcement conditions during that block of days. At the beginning of each independent work period, the boys were told what the reinforcement was and the level of productivity needed to earn the reinforcements.

Results

The dependent variables for this study consisted of the average on-task behavior rates for the three reinforcement conditions, as well as the average number of items completed for the three conditions. The average on-task behavior rate for the No Reward, Computer, and Stickers/Gym Time conditions were .63, .88, and .55, respectively. A one way analysis of variance with repeated measures did not find these differences to reach significance, $F\ (2,3) = 2.5$, $p = .23$. However, given the small nature of the sample size, correlated t-tests were also computed comparing each pair of reinforcement conditions. There was a trend for the Computer condition to result in significantly greater on-task behavior rates than either the No Reward condition, $t\ (4) = 2.5$, $p = .07$, or the Sticker/Gym Time condition, $t\ (4) = 2.3$, $p = .08$. The No Reward and Sticker/Gym Time conditions did not differ significantly, $t\ (4) = .77$, $p = .49$.

Similar results were obtained when the productivity data were analyzed. The means for the three conditions were 95, 130, and 77, respectively. An analysis of variance did not reveal a significant main effect, $F\ (2,3) = 2.7$, $p = .21$. Correlated t-tests revealed a trend for the Computer condition to lead to greater productivity than the Sticker/Gym Time condition, $t\ (4) = 2.5$, $p = .07$. There was no significant difference between the Computer and No Reward conditions, $t\ (4) = 2.0$, $p = .11$, or between the No Reward and Sticker/Gym Time conditions, $t\ (4) = .89$, $p = .42$.

Discussion

The results of this study must be considered tentative at best, given the small sample size employed. However, they do suggest that offering computer time as a reinforcement can serve as a powerful inducement to increase both time spent on-task and math productivity among a sample of combined Attention Deficit Disorder and Conduct Disorder boys. Further, the incentive of computer time had a normalizing effect on the boys' behavior, bringing their on-task ratio up to a respectable 88%. In contrast, the No Reward and Sticker/Gym Time conditions resulted in on-task behavior rates of 63% and 55%, respectively, levels traditionally associated with boys identified as having attentional problems. Although these differences did not reach statistical significance, any teacher can readily recognize the educational significance of students on-task 88% compared to 63% of the time. Further support for this argument is seen in the fact that on 12 of the 23 days observed under the Computer condition, the boys were on-task 90% of the time or better, and their on-task behavior rate never dropped below 77% of the time. In contrast, for the other two conditions the boys' performance was noticeably more inconsistent, with on-task behavior rates ranging from 0% to 97%. For example, the No Reward condition had three 0% on-task days, whereas the Sticker/Gym Time condition had 7 such days. Given the nature of these boys' problems, not only would these days translate into no math getting completed, but the boys would probably be disrupting the performance of other students by being off-task so much.

Along these lines, it is important to note that the increased on-task behavior rate noted for the Computer condition translated into increased productivity. One of the major differences noted between behavioral and pharmacological interventions with hyperactive children is that, although both may improve on-task behavior, the former is more likely to have this improvement translate into actual increased productivity (Pelham & Murphy, 1983). The results of the present study indicate that the chance to earn free time on a computer can serve as a powerful incentive among these children in achieving this end.

SUMMARY AND IMPLICATIONS

The present investigations were designed to determine the degree to which learning and behavior problem students indicate a preference for and actually select computer free time activities in contrast to other reinforcers traditionally used in special classrooms. Further, computer free time activities were contrasted with traditional classroom rewards with respect to their efficacy in a classroom contingency program. The results suggest that students with learning and behavior problems were more likely to favor and select individual free time activities on a computer over other typical classroom rewards. Also, they were more likely to increase positive task-related behavior when working toward computer free time activities rather than for no rewards or other typical rewards in an individually delivered nontoken contingency program. These findings are encouraging to teachers who have difficulties finding motivating reinforcers for use in their classroom management programs. Although the sample size of five was small, the results of the final study are also encouraging because the subjects were all boys with attention difficulties and/or aggressive conduct disorders. This population of learners is typically the most difficult to motivate in an educational setting and are commonly placed in programs for behaviorally disordered students.

Reactions to Software

The fact that there was a large selection of software available during the computer free time activities may have had some effect on the selections made by the students, although in the reinforcement selection study students were offered a "Walkman-type" personal stereo player with approximately twenty-four different popular tapes. The free time activities used in the motivation for behavior change study also included a number of popular activities from which to choose, including foosball, air hockey, pool, and basketball.

The software selected for use in these studies was chosen primarily for its motivational value. Many students taking part in the studies, as well as other inpatient students on individual contingency plans, selected arcade-type games to play in their free time period. Such games are highly interactive and provide a strong dose of challenge, curiosity and fantasy in a graphically-animated format. These programs have little, if any, educational value but have been rated very high in arcade game software reviews. All of the games offered to the students have several levels of difficulty so even inexperienced players could enjoy them. Most game software required the use of a joystick for player control. The arcade-type games that were most often chosen by the students include:

Choplifter, Broderbund Software
Crisis Mountain, Synergistic Software
Sneakers, Sirius Software
Miner 2049er, Micro Lab

Programs that had nearly as much appeal to the students were adventure and mystery simulations. In these programs players determine what happens to them by making choices in certain adventurous dilemmas. In the mystery program players search for clues that will enable them to solve a crime. High interest/low vocabulary text, combined with graphics and student controlled animation, help make these programs motivating. These programs have considerably more educational value since the players must read, gather information, and make decisions based on that information. The three programs that were most often selected by the students were produced by Scholastic Publications as part of Microzine, a monthly educational "magazine" disk. Each edition contains several programs dealing with such areas as computer literacy, programming, and various educational topics all presented in entertaining formats. The adventure programs were included in the first two editions of Microzine. They have special appeal because of the many different possible endings which maintain their appeal over several sessions. Each mystery can be solved in two or three twenty minute sessions. These programs and the editions of Microzine in which they were published are:

The Haunted House, I-1, Scholastic, Inc.
Northwoods Adventure, I-2, Scholastic, Inc.
Mystery at Pinecrest Manor, I-3, Scholastic, Inc.

Other software that provided a high level of enjoyment for students in the inpatient classroom were graphics programs and programming languages. The Koala Pad, a graphics tablet manufactured by Koala Technology, Inc., accompanied by the Micro-Illustrater graphics software, was a very popular choice for free time activities. This equipment and software allow the student to draw colorful pictures and, abstract designs and with considerable ease, store them on a disk. Students can select colors, brush strokes, drawing mode, etc. from a graphically depicted menu by touching the tablet with their stylus or finger and pressing one of the two buttons on the tablet. With a single stroke and a press of the button, students can draw circles, frames, boxes, lines, points or disks and other interesting shapes in twelve different colors. The program also allows the student to magnify the drawing to show detail close up. There are several other programs that can use the Koala Pad as an input device, including a math program and a music program.

Delta Drawing (Spinnaker Software) and Poster (Microzine, Scholastic, Inc.) are two simple yet powerful and motivating programs that allow the student to program animated drawings. They both use a fairly simple command code and provide immediate graphic feedback. Both programs are loosely based on the LOGO programming language but are much simpler for the student to learn. Delta Drawing, for instance, uses single keystrokes to move the graphic "Delta" around the screen (e.g. "D" for drawing a line, "R" and "L" for right and left turns). Both programs provide endless possibilities for exploring different programming procedures while giving students the option of saving their drawings on disk.

Most students consistently chose arcade games, graphics, and programming for software for their free time activities. However, one particular instructional program that was popular with students and often chosen for free time activity was Rocky's Boots (The Learning Company). Although other computer-assisted instructional programs were available and periodically were selected for use during free time, Rocky's Boots was the educational program of choice for several students over several sessions. Rocky's Boots might best be described as an "electronic erector set" for the computer. In this program students learn the logic and principles behind the construction of electronic circuitry. They then apply what they have learned by building simple or elaborate machines by moving and attaching machine parts with the keyboard or joy stick. The program is very cleverly designed in its presentation of information, ease of control, and layout of events. Furthermore, when students select a motivating educational program such as Rocky's Boots for free time, they are simultaneously participating in instructional activities and being rewarded for appropriate school behavior.

Lower functioning or younger students often selected Facemaker (Spinnaker Software), Gertrude's Secrets (The Learning Co.) and programs using the Sesame Street Muppets, e.g., Mix and Match, Ernie's Quiz, Spotlight, and Instant Zoo (The Children's Television Workshop), in addition to the arcade games for computer activities. Facemaker allows young learners to make and animate colorful cartoon-type faces by selecting different facial features and programming the faces to move (e.g., "W" = wink, "S" = smile, "E" = ears wiggle). Gertrude's Secrets is a CAI program designed to teach children the skills of classification via an imaginative game format. Flags, a "Hangman"-type word game that provides feedback and reinforcement for correct letters rather than wrong letters, is one of the programs often chosen from Mix and Match.

Implications

Teachers experienced in planning reinforcement programs for their students will have no difficulty designing one with computer free time as a reward activity. As a reinforcer, free time is a more mature choice for students to make when compared to edibles or tangibles. However, even younger students in the inpatient classrooms sought computer free time as a reward. Computer free time might fit into a teacher's "menu" of reinforcers along with other activity types of rewards commonly used in the classroom.

Computer free time can be used in a contingency program for small groups of students as well as for individual students. One misconception concerning computer-assisted educational activities is that they are primarily intended for individual instructional use and enjoyment rather than for pairs or small groups of students. Many programs are most fun when students work together to solve computer generated problems or create computer-assisted products.

Computer free time can be presented via token systems or through nontoken reinforcement programs. Computer activities can be used as back-up rewards for established levels in token programs or used as the stipulated reward in a nontoken contingency agreement. In the inpatient classroom, computer free time used as a back-up or immediate reward was shown to be effective in increasing such behaviors as homework productivity, school attendance, and task completion.

Other classroom computer activities that can be instituted to increase motivation are contests to get the best score on educational or arcade games or for the best computer graphics design related to a particular curricular topic. Teachers may also wish to schedule blocks of time before or after school so students can sign up to work on computer related activities. Organized computer activities scheduled before school may help increase attendance for those students who might otherwise be late or reluctant to attend class. It was generally felt that twenty minutes was an adequate amount of time for students to use the computer in strictly a reward sense within the school day. Less than twelve or fifteen minutes was considered too little time, but more than thirty minutes was extravagant. These time recommendations could be extended outside of the school day.

Teachers consistently try to provide a motivating educational environment for their learners. For students with a history of learning and behavior problems, providing the motivation necessary for them to become involved in the learning process is a major task. One way for teachers to increase motivation in their students is to institute a system of reinforcement designed to help increase desirable classroom behavior. The present studies suggest that computer free time activity used as a reinforcer is popular with students who have learning and behavior problems. It is also effective with those students in helping increase appropriate school-related behaviors and academic productivity.

Continued research is needed to further identify the motivational and rewarding aspects of educational microcomputer activities with learning and behavior problem students. Increasingly, software that is both educational and motivating must be identified and evaluated for its potential to help increase academic, task and social behavior in students who have specific types of learning and behavior difficulties. Finally, educators must apply what they learn from well designed software to their own instruction to make it more interactive, challenging and fun for their students. The more students find instruction intrinsically motivating, the less likely they will rely upon an externally controlled reinforcement system for motivation.

REINFORCEMENT PREFERENCE QUESTIONNAIRE

Name: ______________________ Age: ____________ Date: 42 ____________

Circle "yes" or "no" to the following questions:

1. Do you have a computer at home? yes no
2. Do you have a computer at school? yes no
3. Do you have a computer in your classroom? yes no
4. Have you ever played computer (video) games? yes no

Suppose you have worked hard in school and think you have done a good job on your work. Which one of the two things below would you like? Choose one from each pair that you would like best. Mark an "x" in the blank. Mark only one "x" for each pair.

1. _____ A can of pop ER
   _____ Free time on a typewriter FT

2. _____ Play a video game CT
   _____ A can of pop ER

3. _____ A free time activity FT
   _____ Play video games CT

4. _____ A package of gum ER
   _____ Free time on a typewriter FT

5. _____ Listen to a tape on a stereo FT
   _____ Play a video game CT

6. _____ A candy bar ER
   _____ A free time activity FT

7. _____ Free time on a typewriter FT
   _____ Time on a computer CT

8. _____ A can of pop ER
   _____ Listen to a tape on a stereo FT

9. _____ Play video games CT
   _____ A candy bar ER

10.	____	A package of gum	ER
	____	Play with a computer	CT
11.	____	Free time at the typewriter	FT
	____	A candy bar	ER
12.	____	A package of gum	ER
	____	A free time activity	FT
13.	____	Listen to a tape on a stereo	FT
	____	Time on a computer	CT
14.	____	Free time at the typewriter	FT
	____	Play video games	CT
15.	____	Play with a computer	CT
	____	A free time activity	FT
16.	____	A candy bar	ER
	____	Time on a computer	CT
17.	____	Play video games	CT
	____	A package of gum	ER
18.	____	A can of pop	ER
	____	Play with a computer	CT
19.	____	A can of pop	ER
	____	Time on a computer	CT
20.	____	Listen to tapes on a stereo	FT
	____	A package of gum	ER
21.	____	A free time activity	FT
	____	A can of pop	ER
22.	____	Free time on a typewriter	FT
	____	Play with a computer	CT

23.	_____	A candy bar	ER
	_____	Listen to tapes on a stereo	FT
24.	_____	Time on a computer	CT
	_____	A free time activity	FT
25.	_____	Play with a computer	CT
	_____	A candy bar	ER
26.	_____	A package of gum	ER
	_____	Time on a computer	CT
27.	_____	Listen to tapes on a stereo	FT
	_____	Play with a computer	CT

Date: ____________________ Time In: __________ Time Out: __________

CODE: + = ON TASK P = PASSIVE OFF TASK M = MOTOR OFF TASK

N = NOISE OFF TASK T = TEACHER DEMAND I = INSTRUCTION

R = REMOVE A = ABSENT H = HEAD DOWN

Comments:

SECTION 3

COMPUTER-ASSISTED INSTRUCTION FOR STUDENTS WITH ATTENTIONAL DIFFICULTIES

COMPUTER-ASSISTED INSTRUCTION FOR ATTENTION DEFICIT STUDENTS

Rationale

Although schools and teachers are excited about the entry of computers into classrooms, as well as the availability of software for differentiating instruction, the efficacy of computer-assisted instruction (CAI) has not yet been demonstrated. In point of fact, there have been few controlled studies comparing learning done by computer with traditional learning methods (Stowitschek, 1984). In a review of published research papers, Polsgrove (1984) reports that computer-assisted CAI programs may be more effective with low ability students and with primary and elementary students, although even these conclusions must be considered tentative (Polsgrove, 1984).

As Polsgrove notes, the reported studies have generally lacked sufficient controls to adequately support their findings. Some of the major problems have included: a) not equalizing the material or amount of practice time under each of the treatment conditions; b) comparing results on groups of children that are quite different in ability; or c) reporting short-term, novelty effects rather than measuring learning over a longer period of time. It appears that special educators are now becoming more interested in documenting learning rates under varying instructional programs, and in using that information to provide a better match between the learner and the methods and materials selected for instruction (Stowitscheki, 1984).

Conceptually, one of two positions could be taken: 1) CAI will improve the learning of children with attentional difficulties; or 2) that the novelty and gadgetry of computers may further impede the learning of these children. In support of the first of these positions, computer-assisted instruction appears to offer important benefits for these children. Although previously labeled "hyperactive," it is generally felt that the critical educational handicap of these children is their attentional difficulty. This is apparent in their problems in focusing or sustaining sufficient attention to learning tasks to make systematic progress (Brown and Wynne, 1984). CAI courseware materials may be useful in meeting these special learning needs. The computer can attractively present information and help the student focus attention on the critical elements of a lesson through graphics, color, and/or animation. The computer is very patient and will not respond until the student makes an active response; thus, it assists in sustaining attention. For older students who have experienced years of frustration and boredom in laborious review of unmastered material, the computer may offer a study method which is viewed as more mature and acceptable. As the attention deficit student becomes more totally involved in CAI activities, self-talk has been observed as the student guides his/her responses. By virtue of the student making his/her own self-corrections, the need for negative feedback from teachers is decreased. This draws less peer attention to the student for academic difficulties.

Conversely, the second position would hold that CAI is inappropriate for attention deficit children in that it requires them to work at self-paced material independently. Further, the animation and gadgetry may distract them from the task at hand. Some software adds computer sounds for correct and incorrect responses; these can be distracting. Random responding can be encouraged by software that provides the child the correct answer or hint after a given number of errors are made; therefore real learning may not take place. A question raised with most forms of CAI is whether the task of typing is too frustrating, time-consuming, or distracting to the child without typing skills to make the keyboard a useful format for entering answers into the computer.

The present study was designed to assess the impact of CAI instruction relative to more traditional methods on the spelling performance of children with attentional problems. Care was taken to control the study factors so that all students would essentially serve as their own controls by participating in learning under both conditions. The study was designed to compare mastery of spelling words on weekly CAI and traditional paper-and-pencil drills over a five-week period of time.

Subjects

The procedures were first of all piloted with inpatient students at Child Psychiatry Service who met the established criteria for having an attentional disorder, and who needed to improve in spelling achievement. After the procedures were fully developed, two public school elementary teachers of behaviorally disordered students agreed to carry out the full study with their students.

Students with attentional difficulties were identified for this study by having their classroom teachers complete the Conners Behavior Rating Scale. The rating scales were scored on the Inattention/Overactivity Scale on the Iowa Conners Teacher's Rating Scale Revised (Loney & Milich, 1982). (A copy of this rating scale is attached to this section.) Items which loaded on this inattention factor included:

1. Fidgeting.

2. Hums and makes other odd noises.

3. Excitable, impulsive.

4. Inattentive, easily distracted.

5. Fails to finish things he starts.

Each item ranges from a score of "0" (not at all) to "3" (very much). Each child needed to have an average score on the five items of 1.5 or greater to reach criterion.

Ten students were included in the study, although one failed to reach criterion for an attention deficit. The remaining nine students had a mean age of 10.2, a mean grade of 4.2, and a mean rating scale score of 2.0 per item.

Procedure

The study design included a spelling pre-test on day one, structured study of unknown words in both CAI and TI (traditional instruction) drill formats on days two through four, and a spelling post-test on day five. This particular sequence is typically used in Iowa schools following popular spelling curriculum materials (Loomer, 1978). The following sequence was carried out identically for five weeks.

1. Day One:

The teacher administered 25 or more spelling words to each student so that a pool of 15 words was identified that were incorrectly spelled. From the 15 incorrectly spelled words, the teacher sorted the words into 3 lists: 5 for study on CAI drill; 5 for study on TI paper-and-pencil drills; and 5 for use as control words with no study provided. The teacher formed equivalent word lists for each of the three experimental conditions, according to the number of letters in each word. The child was not told which words would be studied in which way, or given information as to the purpose of the study.

The teacher entered each child's computer drill words into the Spelling Machine program by using the "Edit Sentences" option. Each child's list was identified by his/her own password. The teacher entered a simple sentence for each word to allow contextual practice.

The teacher prepared three days of practice sheets per child for the TI drills. This structured drill sheet was based on the recommended test-study-test method advocated by such materials as those used in the Cedar Rapids School District (Middleton). A color marker was used to write the study word in the drill box to draw attention to it during copying and self-checking. Drill words were varied in their order for each practice day. (A copy of this drill sheet is attached to this section.)

2. Days Two through Four:

Each student completed both the CAI and TI spelling drills each day. Each exercise took approximately 10 minutes, depending upon the number of errors and level of attending. The teacher had general oversight over each child's involvement in these tasks, but did not sit and closely direct each step of the drill. After students became familiar with the drill procedures, they were able to proceed independently except for behavioral re-direction. The teacher varied the order in which each student completed each drill, depending on classroom scheduling and computer availability.

In Spelling Machine, the student typed each word three times:

1. Copy from a model on the screen;
2. Type after the model is removed; and
3. Enter from memory into a sentence.

A flashing cursor cued the child as to the space where a letter was needed. When errors were made, the program did not allow the student to proceed. The program provided the word model, and then directed the student to try again. The child could not complete the drill until all five words were typed successfully in each of the three practice modes.

The structured paper-pencil drill sheets guided the child through a "saying-writing-checking" sequence for each word. Teachers checked their written completion but had little control over the saying and checking routines.

In the typical use of the Spelling Machine program, games are periodically interspersed into the spelling drill for reinforcement. The study teachers instructed the students to skip over these games, as they were not part of the spelling task. The program could be manipulated to move ahead by having the student simply press the "escape" key and avoid the games. Some of the students were being reinforced by classroom point systems, and were allowed to earn "good on-task" points for their work efforts equally under both drill conditions.

Even though Spelling Machine had an option to record each child's performance each day, the computer was stopped immediately after each child's drill to avoid this record being made. This was only avoided for the purpose of the experimental study. Otherwise, a child's success would have moved him/her into new word lists at higher levels.

3. Day Five

The teacher administered a post-test to each child made up of the ten words from the two drills and the five words set aside as control words for the week. Results were computed on the percentage of words correct under each of the experimental conditions. No incorrect words were carried forward for continued study, as this would have allowed unfair practice of such words.

Teachers had the option of providing reinforcement for each correct word, such as marking a progress chart, earning free time or time on the computer for playing games.

Materials

1. Spelling Machine (Southwest Edpsych Services, 1981)

2. Structured drill sheets prepared by teacher.

3. Appropriate spelling word lists.

Results

The data for the current study consisted of the percentage of words spelled correctly for each of the three conditions: CAI, TI, and control words. A 3 X 5 analysis of variance was computed with three levels of spelling practice and five weeks of assessment. The analysis revealed a significant main effect for spelling practice, $\underline{F}\ (2,16) = 14.8$, $\underline{p} < .001$, but no significant main effect for performance over the five weeks, $\underline{F}\ (4,32) = 1.27$, $\underline{p} = .30$, and no significant weeks by practice interaction, $\underline{F}\ (8,64) = 1.33$, $\underline{p} = .25$. Post hoc comparisons revealed that both the computer, $\underline{F}\ (1,8) = 16.7$, $\underline{p} = .003$, and drill, $\underline{F}\ (1,8) = 19.1$, $\underline{p} = .002$, conditions significantly increased accuracy beyond the control condition, but the two practice conditions did not differ significantly, $\underline{F}\ (1,8) = 1.5$, $\underline{p} = .25$. The results are presented graphically in Figure 1.

These results indicate that the two practice conditions were equally effective in improving the number of spelling words the children learned, and that the effectiveness was consistent over the five weeks of the study.

Discussion

The present investigation was designed to contrast computer-assisted instruction with traditional, drill-and-practice instruction among a sample of children experiencing attentional difficulties. The results indicated that the two practice methods were equally and significantly superior to no practice in increasing the number of words the children learned to spell correctly. Reviews of previous studies in the field have generally found CAI to be equal to or superior to traditional instruction (Polsgrove, 1984). However, this is one of the first studies to have employed a sample of children experiencing behavioral (i.e., attentional) problems. Moreover, the present design controlled

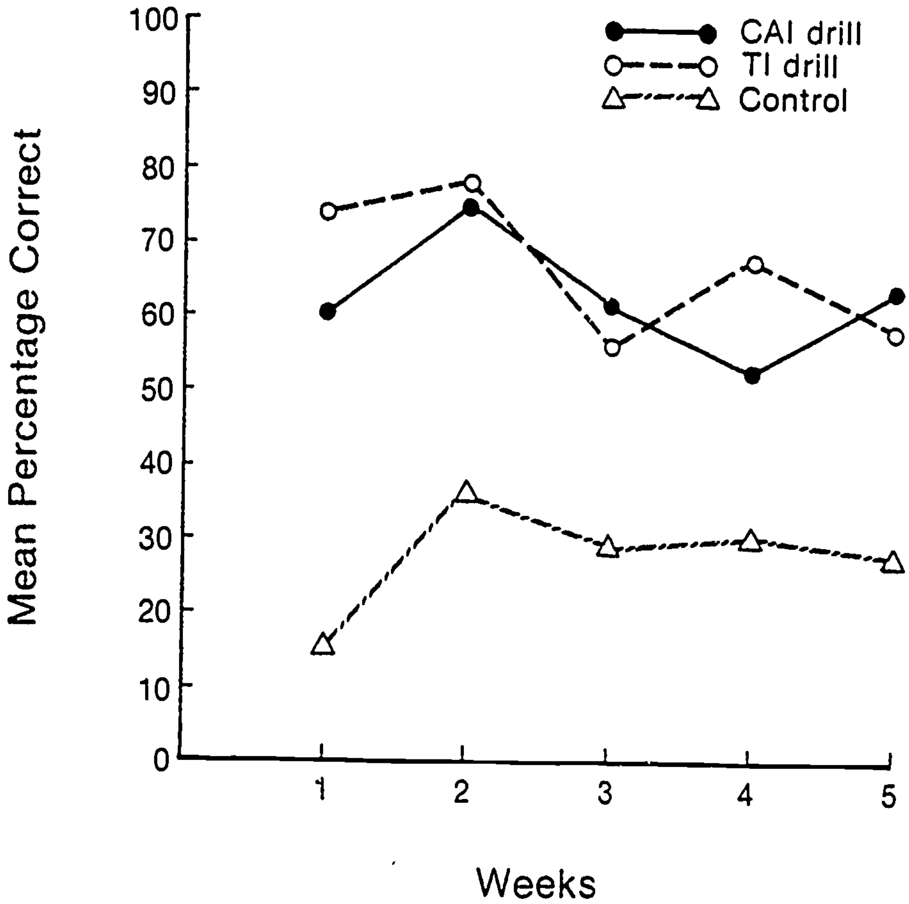

Figure 1

Mean Percentage of Words Spelled Correctly
for the Three Practice Conditions

for many of the problems identified by Polsgrove as limiting earlier studies in this area. Specifically, each child participated in all three spelling conditions so that there was not the problem of inequality of treatment groups. Further, the amount of time the children spent on the two practice conditions was relatively constant, and the number of words to learn each week in each condition was identical. The procedure was run over the course of five weeks so that novelty or temporal factors can probably be ruled out. Finally, the results were collected by actual classroom teachers, indicating that the procedures employed are readily translatable to the school setting.

Although the CAI drill was not superior to traditional drill (TI) practice, the results indicate that it may be possible to free up teacher time for more individualized instruction by having children spend some time on the computer (Polsgrove, 1984). Further, as Polsgrove suggests, it may be that CAI in addition to TI drill would be more effective than either one alone. Future studies can address this issue. Perhaps most importantly, the results of the present study indicate that children noted for having problems sustaining attention can employ computer-assisted instruction to master spelling words at a level comparable to more traditional methods of instruction.

Implications

Once the efficacy of CAI instruction is established for an individual student, similar procedures could be applied to other content for rote mastery. Our "clinical" impression is that such drill-type learning will need to be checked for maintenance and generalization. This requires mastery of material at an automatic rate of recall and periodic refreshers. It seems important to involve each student in charting his/her goals and progress toward those goals. Such self-monitoring of learning may increase the student's responsibility and pride in mastery. The teacher will need to provide examples and situations where the student can use newly learned information outside of the structured practice situation and increase the student's awareness of successful skill usage.

Name ____________

Date ____________

1. ____________
2. ____________
3. ____________
4. ____________
5. ____________
6. ____________
7. ____________
8. ____________
9. ____________
10. ____________
11. ____________
12. ____________
13. ____________
14. ____________
15. ____________
16. ____________
17. ____________
18. ____________
19. ____________
20. ____________
21. ____________
22. ____________
23. ____________
24. ____________
25. ____________
26. ____________
27. ____________
28. ____________
29. ____________
30. ____________

DRILL WORDS

____

____

____

____

____

COMPUTER WORDS

____

____

____

____

____

CONTROL WORDS

____

____

____

____

____

1. ____________
2. ____________
3. ____________
4. ____________
5. ____________
6. ____________
7. ____________
8. ____________
9. ____________
10. ____________
11. ____________
12. ____________
13. ____________
14. ____________
15. ____________

Copy the word:

Say it

Cover and write it:

Check: correct? yes no

Cover and write it:

Check: correct? yes no

Write it 3 times:

All correct? yes no

Copy the word:

Say it

Cover and write it:

Check: correct? yes no

Cover and write it:

Check: correct? yes no

Write it 3 times:

All correct? yes no

IOWA CONNERS TEACHER'S RATING SCALE REVISED

Child's Name ______________________

Information obtained ______________ by ______________________
Month Day Year

	Degree of Activity			
	Not at All	Just a Little	Pretty Much	Very Much
1. Fidgeting				
2. Hums and makes other odd noises				
3. Excitable, impulsive				
4. Inattentive, easily distracted				
5. Fails to finish things he starts (short attention span)				
6. Quarrelsome				
7. Acts "smart"				
8. Temper outbursts (explosive and unpredictable behavior)				
9. Defiant				
10. Uncooperative				
11. Demands must be met immediately - easily frustrated				
12. Disturbs other children				
13. Restless or overactive				
14. Mood changes quickly and drastically				

COMMENTS: ______________________

SECTION 4

COMPUTER-ASSISTED TRAINING IN INTERPERSONAL PROBLEM SOLVING FOR ADOLESCENTS IN BD/LD CLASSROOMS

COMPUTER-ASSISTED TRAINING IN INTERPERSONAL PROBLEM SOLVING FOR STUDENTS WITH LEARNING AND BEHAVIOR PROBLEMS

Rationale

The purpose of the present study was to investigate the potential of computer-assisted training activities as part of an interpersonal problem solving program for adolescent students with learning and behavior problems. The CAI problem solving activities were compared to an identical activities utilizing noncomputer games and simple academic tasks for training activities. For the purposes of this study, training in problem solving was defined as an instructional method designed to provide students with a new set of skills for use whenever situations require them to make a choice in behavior (Nichols & Marshall, in press).

It would belabor the obvious to state that many students with learning and behavior problems are cognitively disorganized in their approach to analyzing and solving both social and academic problems. Some have suggested that students have difficulty solving problems because they are deficient in their ability to generate alternative solutions to problems (e.g., Shure, 1980; Platt, Spivack, Altman, Altman, & Peizer, 1974). Kendall (1981) asserts that children with learning and behavior problems fail to engage in the cognitive, information-processing activities of active problem solving, do not initiate reflective thinking that can inhibit impulsive behavior, and essentially lack the cognitive skills necessary to perform certain mental tasks. He also suggests that some children are poor problem solvers because they make cognitive errors such as illogical interpretations of their environment, irrational beliefs about their abilities, and inaccurate perceptions of everyday demands placed upon them (Kendall & Morison, 1981).

Problem solving training programs have been designed and utilized for various populations of school age learners ranging from pre-schoolers and kindergartners (Shure & Spivack, 1979) to junior and senior high schoolers (Marsh, 1981; Platt, et al., 1974). Although the actual teaching strategies utilized with each group may vary depending on the age and cognitive abilities of the learners, many of the currently popular programs are made up of steps based on the following phases: (1) self-inhibition or impulse control; (2) problem identification and definition; (3) generation of alternative solutions; (4) evaluation of alternatives; (5) making a plan; (6) trying out the plan; and (7) evaluation of the outcome.

There are numerous strategies which have been combined and utilized to teach the concepts and skills within these stages of problem solving. Several of the popular programs combine a direct instructional approach with cognitive behavior training activities. Some of the more commonly used activities include verbal self-instruction training, modeling, role-playing and self-evaluation. These activities can be further combined with reinforcement procedures for the purpose of managing inappropriate behavior or to reinforce student participation and performance. One particularly interesting strategy is to present students with simple games and academic training tasks for the purpose of providing a relatively simple and nonthreatening environment in which to practice the new cognitive skills of problem solving (Meichenbaum, 1977; Kendall, Padawar, & Zupan, 1980). The theory behind the utilization of such tasks is that they will facilitate the acquisition of self-instructional skills that can be gradually shifted and generalized to more complex and difficult hypothetical interpersonal situations and finally to real-life interpersonal problem situations (Kendall, 1981).

Computers, because of their ability to present a student with a problem and allow him or her to make choices that will determine the next steps to be taken, have been heralded as effective tools to assist in teaching the skills necessary to solve problems. A primary reason that computers are particularly suited to assist students in the problem solving process is their ability to present the student with random and unpredictable events. This may help students become better prepared to deal with unexpected problem situations by encouraging the generation of back-up plans and alternative solutions. Other potential advantages to computer-assisted problem solving activities are similar to those described previously and include the following: continuous feedback on performance; use of graphics and animation to help clarify information; learner control of sequence and pace of events; and the infinite patience the computer has for slow learners. Perhaps one of the greatest hopes held by educators is that by learning how to systematically analyze information in a highly structured computer environment, students will eventually transfer those skills to help solve everyday academic or social problems. Unfortunately there is little empirical evidence to suggest that such generalization will take place (Hamlett, 1984). The present study was designed to determine whether computer-assisted instruction can be used to effectively help train learning and behavior problem students in interpersonal problem solving skills. These CAI activities were contrasted with traditional noncomputer problem solving activities utilized in a problem solving program.

Subjects

Participants in this study involved 16 adolescent-aged youth (2 girls) with learning and behavior problems from three public school special education classes. The children ranged in grade from seventh to eleventh grade ($M = 8.9$, $SD = 1.3$).

Procedure

The children were randomly assigned to one of two problem solving training groups; a) Computer-assisted (CA; $n = 10$); and b) No computer assistance (NCA; $n = 6$). All of the students received seven problem solving lessons over a five week period. The topics were based on the seven phases of problem solving described earlier in this section, one lesson per topic:

1. Stop and Think

2. What's my problem?

3. How can I solve this problem?

4. What's the best way?

5. What's my plan?

6. Try it out

7. How did it work?

These topics also served as self-instruction training phrases used in each lesson.

The lessons were based on a program developed by Kendall, et al. (1980), which incorporates the use of simple cognitive training activities for children to practice self-instructional phrases before they apply them to interpersonal problems. Each of the seven lessons was divided into three parts:

1. Phase One: All of the children received a presentation by the teacher introducing the general concept and self-instructional phrase to be used in that lesson.

2. Phase Two: During the second phase, the CA group of children practiced the self-instructional phrase with relevant computer activities. The NCA group practiced the same phrase but used noncomputer games and simple academic activities similar to those suggested by Kendall, et al. (1980).

3 Phase Three: During the final phase of each lesson, the children again gathered together to discuss the implications and applications of the skills covered in the lesson to hypothetical and real social situations. Each three-part lesson took approximately 45 minutes to one hour.

Prior to the first lesson, and again after the last lesson, the following measures were collected for each child:

1. Self-Control Rating Scale (SCRS; Kendall & Urban, 1981). This is a teacher rating scale of 20 self-control and impulsivity items, with a range of responses from 1 (favorable) to 7 (negative). The scales were filled out by other teachers who saw the children on a daily basis but were not aware of the training groups.

2. Means-ends Problem Solving (MEPS). This is a measure developed by Spivack and Shure (1981) to measure the number of successful alternatives children can generate to a story in which they are presented with the beginning and the end, and they must create the means to that end. Five different stories were presented both at the pre- and post- evaluations.

3. Porteus-Maze Q scores (Porteus, 1965). The Porteus-Maze Test consists of a series of progressively more difficult mazes that the individual must complete. Q or qualitative scores represent impulsive responding (e.g., cutting corners, bumping lines, lifting the pencil). The total number of Q errors made at the pre- and post-testing was measured.

4. Porteus Maze Test failures. All of the children completed all 16 of the mazes at both the pre- and post- evaluations. This score represented the number of mazes that was not successuflly completed.

Results

The primary analyses consisted of 2 X 2 analyses of variance, with one between factor (treatment group) and one within factor (pre-post scores). Significant training by time interactions would suggest that treatment groups were differentially affecting performance from the pre to the post periods. The following dependent variables exhibited significant treatment by time interactions: the Self-Control Rating Scale, F (1, 14) = 6.4, p = .024; the MEPS, F (1, 14) = 8.0, p = .014; the Porteus Q score, F (1, 14) = 2.4, p = .053; and the Porteus failure score, F (1, 14) = 20.4, p = .039. Figures 1 to 3 present these data graphically.

Relative to the No Computer-Assisted group (NCA), the Computer-Assisted group (CA) showed significant improvement from pre to post in terms of their SCRS scores, as well as the Porteus Q scores and Porteus failures. However, the NCA group improved significantly over time, relative to the CA group, in terms of the number of alternatives generated on the MEPS.

▲ = Noncomputer Training

● = Computer Training

MEPS

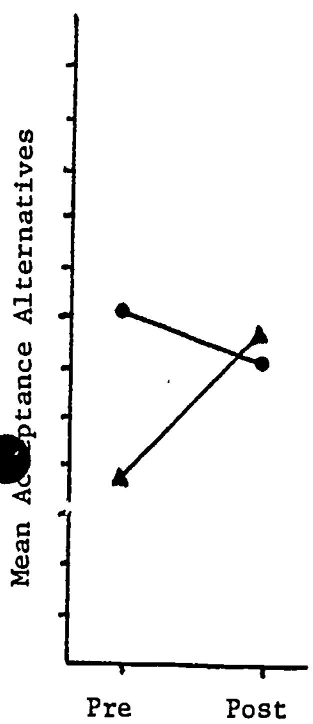

Figure 1

Porteus Q Scores

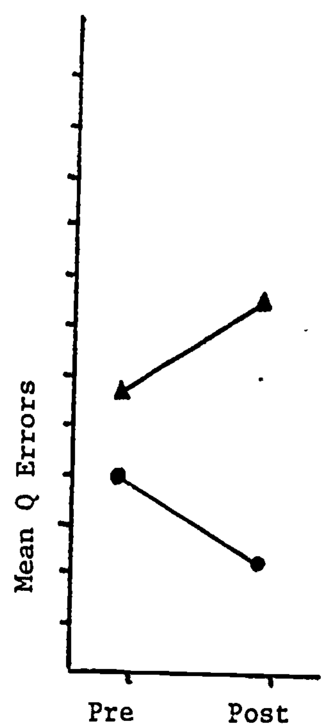

Figure 2

Porteus Failures

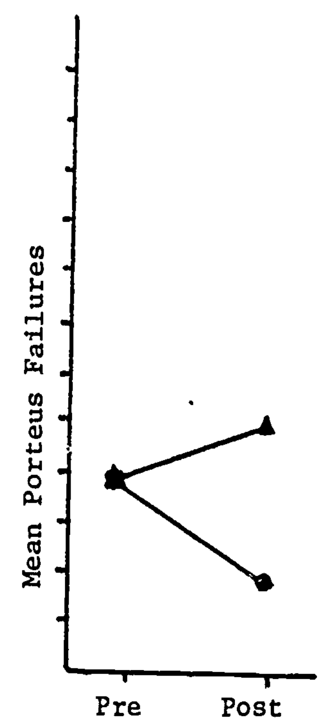

Figure 3

Problem Solving Results

Since the two groups differed significantly in terms of their scores on the SCRS at the pre evaluation, $\underline{t}$ (14) = 3.6, $\underline{p}$ = .003, these data were reanalyzed, comparing the post scores after controlling for the pre scores. An analysis of covariance, with the pre-score SCRS serving as the covariant, did not reach significance, $\underline{F}$ (1, 13) = 1.8, $\underline{p}$ = .21. The other results remained the same even after statistically controlling for the pre scores.

Discussion

The results of the present study were somewhat inconsistent, with the computer-assisted training group (CA) leading to significant improvement over time in terms of performance on the Porteus Mazes. However, the no computer group (NCA) group did significantly better over time, relative to the CA group, on generating alternatives on the MEPS. It is difficult to reconcile these differences. One possible explanation has to do with the nature of the training activities and the pre and post measurement devices. The Porteus is a visual-motor task whereas the MEPS primarily taps into verbal skills. The computer-assisted training activities included arcade games (e.g., Miner 2049er, Micro Lab) which require visual-motor skills as well as simulations (e.g., Oregon Trail, MECC) which require both verbal (reading) and visual-motor skills. The noncomputer activities were more verbally oriented (e.g., story problems and brain teasers). In other words, the computer-assisted training may have improved performance on nonverbal measures whereas the converse was true for the more traditionally-employed problem solving training tasks. However, this must remain a very tentative hypothesis. Perhaps the most important point to note from the results is that even relatively brief exposure to computer-assisted training did lead to significant improvement on the self-control measures employed in the study. This is particularly encouraging in suggesting that future investigations may reveal further significant effects associated with computer-assisted training in the self-regulatory areas of the curriculum for students with learning and behavior problems.

Implications

This pilot study was an attempt to investigate the computer's role in a program designed to teach children the skills associated with interpersonal problem solving. The results, at best, are tentative for several reasons, including the following: a) the software selected for use in the computer-assisted training activities was minimally optimal for the purposes they served in the training program--since no software existed that was designed for the specific purpose of teaching interpersonal problem solving skills to individuals with learning and behavior problems, the choices were limited to software designed primarily for other purposes (e.g., social studies and entertainment); b) it was extremely difficult to match the noncompter tasks with the computer tasks and; c) only 16 students were used in the study when a much larger number of subjects might lead to more conclusive results. However, this study did demonstrate that the computer might be incorporated into a program designed to train students in self-regulatory behaviors, and that the computer has excellent potential in the special classroom as a tool to assist traditional instructional methods.

KENDALL SELF-CONTROL RATING SCALE

Name of Child ______________________________ Grade ______

Rater ______________________________

____ Pre test (date)

____ Post test (date)

Please rate this child according to the descriptions below by circling the appropriate number. The underlined 4 in the center of each row represents where the average child would fall on this item. Please do not hesitate to use the entire range of possible ratings.

Item	1	2	3	4	5	6	7
1. When the child promises to do something, can you count on him or her to do it?	1 always	2	3	<u>4</u>	5	6	7 never
2. Does the child butt into games or activities even when he or she hasn't been invited?	1 never	2	3	<u>4</u>	5	6	7 often
3. Can the child deliberately calm down when he or she is excited or all wound up?	1 yes	2	3	<u>4</u>	5	6	7 no
4. Is the quality of the child's work all about the same or does it vary a lot?	1 same	2	3	<u>4</u>	5	6	7 varies
5. Does the child work for long-range goals?	1 yes	2	3	<u>4</u>	5	6	7 no
6. When the child asks a question, does he or she wait for an answer, or jump to something else (e.g., a new question) before waiting for an answer?	1 waits	2	3	<u>4</u>	5	6	7 jumps
7. Does the child interrupt inappropriately in conversations with peers, or wait his or her turn to speak?	1 waits	2	3	<u>4</u>	5	6	7 interrupts
8. Does the child stick to what he or she is doing until he or she is finished with it?	1 yes	2	3	<u>4</u>	5	6	7 no
9. Does the child follow the instructions of responsible adults?	1 always	2	3	<u>4</u>	5	6	7 never
10. Does the child have to have everything right away?	1 no	2	3	<u>4</u>	5	6	7 yes
11. When the child has to wait in line, does he or she do so patiently?	1 yes	2	3	<u>4</u>	5	6	7 no
12. Does the child sit still?	1 yes	2	3	<u>4</u>	5	6	7 no
13. Can the child follow suggestions of others in group projects, or does he or she insist on imposing his or her own ideas?	1 able to follow	2	3	<u>4</u>	5	6	7 imposes
14. Does the child have to be reminded several times to do something before he or she does it?	1 never	2	3	<u>4</u>	5	6	7 always
15. When reprimanded, does the child answer back inappropriately?	1 never	2	3	<u>4</u>	5	6	7 always

16.	Is the child accident prone?	1 2 3 4 5 6 7	no	yes
17.	Does the child neglect or forget regular chores or tasks?	1 2 3 4 5 6 7	never	always
18.	Are there days when the child seems incapable of settling down to work?	1 2 3 4 5 6 7	never	often
19.	Would the child more likely grab a smaller toy today or wait for a larger toy tomorrow, if given the choice?	1 2 3 4 5 6 7	wait	grab
20.	Does the child grab for the belongings of others?	1 2 3 4 5 6 7	never	often
21.	Does the child bother others when they're trying to do things?	1 2 3 4 5 6 7	no	yes
22.	Does the child break basic rules?	1 2 3 4 5 6 7	never	always
23.	Does the child watch where he or she is going?	1 2 3 4 5 6 7	always	never
24.	In answering questions, does the child give one thoughtful answer, or blurt out several answers all at once?	1 2 3 4 5 6 7	one answer	several
25.	Is the child easily distracted from his or her work or chores?	1 2 3 4 5 6 7	no	yes
26.	Would you describe this child more as careful or careless?	1 2 3 4 5 6 7	careful	careless
27.	Does the child play well with peers (follows rules, waits turn, cooperates)?	1 2 3 4 5 6 7	yes	no
28.	Does the child jump or switch from activity to activity rather than sticking to one thing at a time?	1 2 3 4 5 6 7	sticks to one	switches
29.	If a task is at first too difficult for the child, will he or she get frustrated and quite, or first seek help with the problem?	1 2 3 4 5 6 7	seek help	quit
30.	Does the child disrupt games?	1 2 3 4 5 6 7	never	often
31.	Does the child think before he or she acts?	1 2 3 4 5 6 7	always	never
32.	If the child paid more attention to his or her work, do you think he or she would do much better than at present?	1 2 3 4 5 6 7	no	yes
33.	Does the child do too many things at once, or does he or she concentrate on one thing at a time?	1 2 3 4 5 6 7	one thing	too many

SECTION 5

COMPUTER-ASSISTED TRAINING IN IMPULSE CONTROL: A CASE STUDY

COMPUTER-ASSISTED IMPULSE CONTROL ACTIVITIES: A CASE STUDY

Rationale

Many students with learning and behavior problems have excessive impatient and unreflective behaviors that impede learning and social maturity. These students often do not take the time to recognize and understand a problem, give careful thought as to how to proceed through the problem, or consider a range of solutions and consequences. Impulsive or automatic reactions to stressful situations frequently lead to acting-out behavior, which in turn often becomes the behavior that is treated rather than the problem of impulsivity itself.

Within the last few years, however, many teachers have taken an interest in curricular programs that are actually designed to train impulsive students to become more reflective. Some of the more popular methods in such programs include self-instructional training, modeling, and role rehearsal. Frequently these programs are accompanied by contingency plans to reinforce the use of reflective skills in practice sessions and in real situations where reflective skills are necessary.

The purpose of this study was to investigate how interactive microcomputer arcade games might be incorporated into a cognitive-behavioral training program for students who exhibit impulsive behavior. This was purely an attempt to explore and define the role of computer activities in such training programs. Since the program was not contrasted to similar programs that do not employ microcomputers as a training aid, the comparative effectiveness of this program could not be determined through this study. However, practical suggestions for selecting software and using arcade games as a practice tool for learning reflective skills will be stressed.

Subjects

The subjects chosen for this study were two boys (subjects A and B) aged 10-8 and 13-7, respectively. Both boys were referred for problems associated with attention deficits and impulsive behavior. Subject B was given the diagnosis of Attention Deficit Disorder with Hyperactivity while subject A had an Attentional Deficit without

Hyperactivity. Both boys were given the Matching Familiar Figures test (Kagan, 1964). Both boys scored in the range of boys referred to the clinic in 1981, i.e., scores were above the normal range of distribution for attention deficits. Student A had a total of 15 errors and an average latency of 11.9 seconds per initial response (includes both correct and incorrect initial responses). Student B had a total of 16 errors and an average of 6.2 seconds per response.

Procedure

The procedure used for impulse control training was very similar to the procedure described in the problem solving training section of this manual except only three training sessions were employed instead of the seven used in problem solving. The three sessions were entitled "STOP" (STOP-the automatic response), "THINK" (THINK about different alternatives), and "ACT" (Take ACTion to solve the problem). These words also served as the verbal cues used in each lesson. Each training session was made up of three components: 1) introduction and discussion of the self-instructional cue and when to use it; 2) practice using the cue on a computer activity; and 3) discussion of and practice using the cue in hypothetical social situations. The following is an example of the procedures used throughout the study, using the STOP lesson as an example.

Part 1. Discussion: Learning how to STOP an automatic response. the teacher explained that automatic responses are things we do without thinking about them first. Sometimes automatic responses cause problems and later we wish we would have done something else. One way to help stop an automatic response is to say "STOP" to ourselves. We need to say "STOP" to ourselves when we see a problem occurring or about to occur where we might make an automatic response. This is called a "critical moment" and it is the time to say "STOP" to ourselves and think about what might happen if an automatic response is made.

Part 2. Practice: The student played a computer game and practiced using the self-instructional cue STOP. The student was offered one of two games to practice with, Miner 2049er (Microlab Software) and Crisis Mountain (Synergistic Software.) Both games are arcade style games that involve moving an animated man through tunnels and over obstacles while avoiding treacherous villains and rolling boulders or falling from high places. A joystick is needed to play these games. Both games have multiple screens, each being more difficult as the player advances to a new level by successfully completing the previous screen. The game can be stopped at any time with no penalty to the player by pressing the escape key which causes the action to freeze on the screen. Another press of the escape key resumes play at the stopping point. The student was instructed to say "STOP" to himself and press the escape key when he noticed trouble or impending doom. Each student played the game twice, one time with the trainer as coach to help cue the student and once without trainer assistance.

Part 3. Application: How to use the STOP cue in interpersonal problem situations. The teacher explained that "STOP" can be used in other problem situations to prevent an automatic response that might be regretted later. Situation cards (Argus Communications) depicting hypothetical social and interpersonal problem situations were presented by the trainer for the purpose of having students recognize when to say "STOP" and to discuss what automatic responses might occur. Saying "STOP" covertly was modeled by the trainer and rehearsed by the students.

Each of the three complete training sessions lasted approximately 60 minutes with about 20 minutes for each part of the lesson. The computer practice sessions and the hypothetical situation sessions tended to last slightly longer than the introductory sessions. Each of the other two lessons (THINK and ACT) were similar in design and procedure. The same arcade games, e.g., Miner 2049er and Crisis Mountain, were used to practice THINKing and ACTing skills.

Prior to and following the training, the students were given five questions from the Means-End Problem Solving Test (MEPS) (Spivack & Shure, 1981). This was given to provide an indication of the students' ability to generate the means to an end in contrast to "one-shot" automatic responses. They were also required to complete a stay-between-the-lines task. In this paper and pencil task, the students were instructed to stay between the lines of a double-lined six-pointed star and draw a pencil trail completely around the shape without touching either of the lines. This task was completed three times as the students went over the stars at their slowest, fastest, and regular speeds. Speed and accuracy of performance (number of line touches) were recorded by the observer.

Results

On the MEPS there was little difference between pre and post scores for either student. Student A's score on the pre-test was 6, while the post-test score was 5. The pre-test score for Student B was also 6, while on the post-test he obtained a score of 7. There was, however, a fairly consistent improvement in the number of errors on the stay-between-the-lines task as both students increased their accuracy. Student A went from 6 total errors to 4 and Student 8 went from 21 errors to 8; a 62 per cent improvement. The speed at which the boys completed the task was not consistent. Student A was approximately 3 seconds faster under all three speeds. Interestingly enough, however, Student B was considerably faster under the directions to go slow and at a normal speed, but slowed down to become more accurate under the directions to go as fast as he could without touching the lines. (See Table 1.)

Discussion

The results suggest that both students benefited from the impulse control training in their ability to control their fine motor performance on a paper and pencil task. There was no improvement, however, in their ability to generate the means to solve a problem in a hypothetical social dilemma. These results were similar to those in the problem solving study previously discussed. In that study students who received computer-assisted practice on problem solving skills demonstrated greater improvement in Porteus test scores than those students who did not receive computer-assisted practice; the opposite was true of the MEPS scores. This might suggest that computer-assisted impulse control training may be more beneficial in helping impulsive students become more reflective with regards to their task performance than with their socially impulsive behaviors. Perhaps the most interesting and encouraging finding was that Student B, who had severe attention deficits with hyperactivity, was able to use the training to regulate his motor behavior in order to become more accurate on his task performance. (Student A did not display behaviors associated with hyperactivity.)

Implications

Arcade games do have a legitimate purpose in the classroom for students with learning and behavior problems. Not only are they a popular and effective reinforcer for increasing appropriate classroom behavior when used in a contingency program, but they also can be used as a curricular tool to help students learn the cues necessary to regulate their own behavior. Furthermore, since there is so little software available in the area of the curriculum that deals with helping students regulate their own behavior, these studies demonstrate that existing software can be utilized with traditional methods of instruction to help make instruction more fun and effective.

Table 1

Stay-Between-the-Lines Task

	Student A				Student B			
	Pre		Post		Pre		Post	
Speed	Time	Errors	Time	Errors	Time	Errors	Time	Errors
Normal	31	4	28	3	21	6	30	2
Fast	21	2	18	1	14	9	18	3
Slow	30	0	27	0	39	6	23	3

SECTION 6

COMPUTER-BASED ACTIVITIES FOR FOSTERING COOPERATIVE GROUP SKILLS: CASE STUDIES

COOPERATIVE GROUP SKILLS

Rationale

Although teachers are not always aware of it, many of their instructional activities are designed in such a manner that they place the student in a position to individually compete with and be compared to his or her peers. Furthermore, it is recognized that many students with learning and behavior problems are threatened by academic comparisons and competition in performance, and as a result, react negatively to instruction. In contrast, cooperative learning involves a noncompetitive approach to instruction where students work together in a joint effort to reach an instructional goal. Cooperative learning activities have several advantages over competitively-based individual instructional activities. Advantages that are particularly pertinent to the instruction of students with learning and behavior problems include: greater motivation, better attitudes toward teachers and school, higher achievement and greater retention, better attitudes toward peers, and the fostering of skills necessary for working effectively with others (Johnson & Johnson, 1975; 1978).

One commonly held misconception concerning the use of computers in education is that they are strictly tools for individual use and instruction. Furthermore, concern has frequently been voiced over computer arcade games in that they contribute to aggressively competitive behavior in children. These ideas have led many people to object to computer-based instruction because they have an image of the computer as a cold and impersonal machine that inhibits interpersonal growth and human interaction. Although many computer-assisted instructional activities are designed for the individual student and have a strongly impersonal and competitive nature about them, numerous opportunities exist for cooperative learning ventures via the computer for small groups and pairs of students working together to reach a shared goal. The purpose of the present study was to investigate student reactions to computer-based cooperative learning activities and compare those to reactions on noncomputer-based cooperative activities. A case study format was used in describing these results.

Subjects

Four males, two from an adolescent inpatient classroom and two from an elementary inpatient classroom, were chosen as subjects in the present investigation. The two boys from the adolescent classroom (subjects A and B) worked together as a pair and the two boys from the elementary classroom (subjects C and D) made up the other pair of cooperative workers. The ages and full scale I.Q. scores (WISC-R) of subjects A and B are 13-6, 114; and 15-6, 91, respectively. Subject A was referred to the inpatient program for severe attentional deficits with hyperactivity and subject B was referred for immature social behavior and problems associated with an aggressive conduct disorder. Both subjects attended public school programs for students with learning and behavior problems. The ages and full scale I.Q. scores of subjects C and D are, respectively, 10-1, 88; and 9-10, 71. Subject C was referred because of attentional deficits and immature social behavior and subject D was also referred for attentional deficits and to validate the diagnosis of Huntington's Disease as the cause for a deteriorating mental state. Subject C attended a public school program for students with behavior disorders and subject D attended a program for students with mental disabilities.

Procedure

The study was held over consecutive days consisting of four sessions with subjects A and B and three sessions for subjects C and D. Each session lasted a total of twenty-five minutes, broken up into two ten minute cooperative activity periods with a five minute break in the middle. During one of the two ten minute periods the students worked on cooperative computer activities (C) while the other period was made up of a matched noncomputer activity (NC). The order of the activities was alternated each day. The five minute break was designed so that student behaviors during the first period could be rated by the observer. Student behaviors in the second period were rated immediately following the activity.

The computer activities for A and B consisted of simple programming activities with Delta Drawing (Spinnaker Software). This program allows learners to draw graphics similar to those in LOGO programming except that it is easier; the graphics curser can be programmed to move about the screen with very simple and logical keyboard commands (e.g., "D" for Draw and "R" for right turn). At the onset of this study the boys were given an introduction to the commands with a practice session utilizing "fast start cards" provided with the program. At the beginning of each computer activity the students were told to decide on a design (goal) that they would attempt to complete by the end of the period by working together in a shared and cooperative manner. The noncomputer activities were similar in nature but involved paper and one set of the following materials: a bottle of glue, a pencil, a pair of scissors, a ruler, a drafting compass, and colored felt-tipped markers. Before commencing each activity the students were encouraged to plan and work on their designs together. The nature of the activities, however, only permitted one student at a time to actually manipulate the computer or drawing materials.

The activities for boys C and D were considerably different. The computer activity consisted of playing a game called Cooperation Maze (Edu-Tech Software). The objective of this game is for both players to work together in order to reach a flag at the end of a maze.

In this activity the two players simultaneously control the movement of a white dot with game paddles while trying to avoid the walls of the maze. One paddle moves the dot vertically while the other controls horizontal movement. If the dot comes in contact with a wall or obstacle the game ends with sound effects and prints, "Too bad (name) and (name). Want to try again? Press Y for yes and N for no." If the players end a game successfully the program provides graphics and sound along with verbal praise for reward. The noncomputer activities were very similar except mazes were drawn on templates and placed on the screen of an Etch-a-Sketch (Ohio Art) graphics design toy. The two knobs on this toy work similarly to those on the game paddles. The boys were given the goal of trying to reach the red square at the end of the mazes without touching the walls of the maze. During each of the activity periods, the boys were told to keep working on the mazes until their ten minutes were up.

Each boy was rated via a delayed report rating form (Morris & Fitzgibbon, 1978). The Cooperative Group Skills Rating Scale (Fitzgerald, Milich, and Fick, 1983) was designed to rate students on the frequency with which they exhibit behaviors associated with cooperation. (A copy of this scale is attached at the end of this section). Statements pertaining to both positive and negative behaviors were grouped under four factors of cooperative group skills: 1) Mechanics of Group Membership; 2) Activity Involvement; 3) Communication Skills; and 4) Peer Interaction. Ratings were based on a scale of 0 (none of the time) to 4 (consistently). Uncooperative behaviors were given a negative rating (0 to -4), while positive behaviors were given positive scores (0 to + 4). A rating for each factor was determined for each student by combininb both the positive and negative scores. A total cooperative group skills score was also determined for each student by combining the factor scores. The means of the combined daily factor scores and the total cooperative skills score for each student under both conditions were tabulated to determine variance between conditions within individuals. The means from the combined separate factor scores and cooperative skills scores from all the students were also established to determine variance between conditions for the group.

Results

Due to the small number of students involved, the results of this study were not statistically analyzed. The means of the combined daily scores for each student are presented in Table 1 along with the means of the combined factor scores of all four students. Only the total scores of one student, subject A, demonstrated noticeably more cooperative behavior with computer activities than with noncomputer activities (C = 12.75; NC = 6.50). Student B cooperated slightly better on computer activities (C = 16.5; NC = 15.25), as did student C (C = 5.34; NC = 4.0). Student D, however, demonstrated slightly more cooperative behavior on noncomputer cooperative activities (c = 15.0;

NC = 16.33). As a group, the students did slightly better on computer-assisted cooperative activities, but again the difference was not large (C = 12.39; NC = 10.52). The only factor area where a trend in ratings was noted across all four students was Activity Involvement. Each student was considerably more actively involved in the computer activities than the noncomputer activities, ranging from a 5 point difference (C = 2.5; NC = -2.5) for student A to a 1.25 point difference for student B (C = 3.75; NC = 2.5). The average point difference for all the boys was 2.47 (C = 2.64; NC = .17). The students as a group cooperated slightly better on the computer activities in one other factor area, Communication Skills (C = 1.70; NC = 1.43). The difference, however, is very small. Students as a group demonstrated slightly more cooperative behavior under the no computer condition in Mechanics of Group Membership (C = 5.15; NC = 5.67) and Peer Interaction (C = 2.90; NC = 3.23) but these differences are also small.

Discussion

Of the four boys who were subjects in this study only one, student A, demonstrated a noticeable difference in the total ratings of cooperative behavior between the two conditions. His behavior was nearly twice as cooperative under the computer condition than the noncomputer condition. It might be noted that he was also the brightest of the group (FSIQ = 114). Since the computer task students A and B participated in was a programming activity, student A may have been more challenged and motivated than doing the noncomputer activities, this in turn might have affected his willingness to cooperate with his partner. The greatest difference in his factor scores was in Activity Involvement where he showed more interest in the computer task, was more attentive, had a greater level of participation, and was less likely to clown around and be disruptive. In fact, all the boys were more likely to become involved in the cooperative computer activities than with similar noncomputer-based activities. This observation supports research findings indicating that learning and behavior problem students are more attentive to computer-based activities than to traditional activities (e.g., Kleiman, Humphrey, & Lindsay, 1982). This finding is encouraging since getting students actively involved in instruction is a paramount problem for many teachers of students with learning and behavior problems. Furthermore, since these computer activities required students to work together to reach a common goal, it appeared that computer-assisted cooperative projects were a viable method for learning and practicing the social skills associated with getting along with others.

Implications

Teachers need to continually provide situations where learners can work together. Group activities provide opportunities for students to practice the social and interpersonal communication skills necessary

Table 1

Cooperative Skills Rating Scores

Subject	A		B		C		D		Group Means	
Condition	C	NC	C	NC	C	NC	C	NC	C	NC
M. G.	4.75	5.00	4.50	5.75	5.67	5.33	5.67	6.67	5.15	5.69
A. I.	2.50	-2.50	3.75	2.50	1.00	-1.33	3.33	2.00	2.64	.17
C. S.	2.00	1.25	4.50	3.50	-3.00	-2.33	3.33	3.33	1.70	1.43
P. I.	3.50	2.75	3.75	3.50	1.67	2.33	2.67	4.33	2.90	3.23
TOTAL	12.75	6.50	16.50	15.25	5.34	4.00	15.00	16.33	12.39	10.52

C = Computer activities

NC = Noncomputer activities

M. G. = Mechanics of Group Membership

A. I. = Activity Involvement

C. S. = Communication Skills

P. I. = Peer Interaction

for appropriate social functioning. Many teachers of students with behavior problems tend to avoid such situations for fear of creating a conflict-prone situation. Just as there are times when working alone, free from distractions is the best educational environment, there are also times when working with a partner or in a small group is most appropriate.

One area where cooperative computer activities are particularly appropriate is problem solving. There are several types of programs that can provide problem solving ventures for pairs or small groups of students. Computer programming is one such activity. LOGO, BASIC and PILOT are all programming languages that students can use and be involved in mutual goal setting, brainstorming, planning, and implementing. The only problem with programming as a cooperative problem solving venture is that many teachers, because they do not have the expertise to do programming themselves, cannot provide the guidance necessary to help teach the students. Simpler programming software, such as Delta Drawing (Spinnaker Software) and Poster (Microzine, Scholastic), is an alternative to the more sophisticated languages and can still provide hours of cooperative problem solving enjoyment.

Alternatives to teaching programming as a cooperative problem solving activity are role-play simulations. Adventure and mystery simulations are very appealing to students of all ages and provide many opportunities for students to use all the elements of problem solving. Students can jointly collect clues and information and evaluate their usefulness for helping solve a mystery or complete an adventurous journey. In adventure simulations, problems are solved through persistence, ingenuity, and correct reasoning. With some adventure simulations students can even develop maps to help in the problem solving quest. Snooper Troops (Spinnaker Software) is a series of mystery adventures where the student takes on the role of detective and systematically collects clues by interviewing suspects to solve the crime. The Microzine series (Scholastic, Inc.) provide similar adventure stories that are not nearly as complicated and lengthy to solve. Excellent examples of these are Northwoods Adventure (I-2), Haunted House (I-1), Fossils Alive (I-6), and Mystery at Pinecrest Manor (I-3).

COOPERATIVE GROUP SKILLS RATING SCALE

Directions: Fill out this questionnaire each 10 minutes as you observe.

Student: ______________________________ Date: ________________

Group Peers: ____

Observer: _____________________________ Time: ________________

0 = none of the time
1 = less than half of the time
2 = about half of the time
3 = more than half of the time
4 = consistently

Mechanics of Group Membership							
1.	Stays on chair in defined area		0	1	2	3	4
2.	Looks at person who is talking		0	1	2	3	4
3.	Touches; bothers others		0	-1	-2	-3	-4
Activity Involvement							
1.	Participates; shows interest in task		0	1	2	3	4
2.	Inattentive		0	-1	-2	-3	-4
3.	Clowns around; disruptive		0	-1	-2	-3	-4
Communication Skills							
1.	Contributes relevant suggestions		0	1	2	3	4
2.	Makes irrelevant suggestions		0	-1	-2	-3	-4
3.	Interrupts others		0	-1	-2	-3	-4
4.	Facilitates decision-making: compromises or summarizes		0	1	2	3	4
5.	Monopolizes group decision-making		0	-1	-2	-3	-4
Peer Interaction							
1.	Makes positive response to others' ideas		0	1	2	3	4
2.	Argues; rejects; belittles others' ideas		0	-1	-2	-3	-4
3.	Shares materials; takes turns in carrying out activity	NA	0	1	2	3	4

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A P P E N D I X

SOFTWARE EVALUATION GUIDE

SOFTWARE EVALUATION FORM†

Directions: This form is intended to aid your decision-making in selecting appropriate software for use with LBD students. To use it, simply place your ratings and comments in the boxes to the right of each item. Use the following scale to arrive at a total weighted score for each software program. Note that four programs of similar type can be rated and compared on this form.

- 2 = Omission of or problems with this aspect of the program may have detrimental effects on students' learning and/or behavior

- 1 = Omission of or problems with this aspect of the program presents real difficulties in using it.

+ 1 = Program meets minimal acceptable standards on this aspect.

+ 2 = Program exceeds minimal acceptable standards on this aspect.

	Program Evaluated	Developer	Type of Program (e.g., CMI, CAI, Tutorial, Game)
1.			
2.			
3.			
4.			

CONTENT FEATURES

		1	2	3	4
1.	The teacher's manual provides enough information to use the program effectively.				
2.	The teacher's manual suggests appropriate supplemental materials and activities.				
3.	Students can follow the directions without aid.				
4.	The reading level of the video text is appropriate for students.				
5.	The content matches stated program objectives.				

† The author is indebted to F. Tabor for ideas on some items and general format.

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SOFTWARE EVALUATION FORM

	1	2	3	4
6. The content corresponds to students' IEP objectives.				
7. The content is age-appropriate for students' social and intellectual developmental level.				
8. The program teaches important skills/information.				
9. The content is culturally appropriate for students.				
10. The content is free of cultural biases and stereotypes.				
11. The program holds students' attention.				
12. The content uses correct language and grammar.				
13. The content contains examples to clarify the material to be learned.				
14. The content adequately covers the topic to be learned.				
15. The information presented is accurate.				

INSTRUCTIONAL FEATURES

1. Long and short range program objectives are stated in observable and measurable terms.				
2. The instructional objectives are appropriately sequenced.				

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SOFTWARE EVALUATION FORM

	1	2	3	4
3. Prerequisite skills are clearly specified.				
4. The program assesses student beginning skill-levels on various tasks.				
5. The program places students in the program according to their assessed skill.				
6. The instructional material in the software follows an appropriate sequence.				
7. The program presents concepts that are likely to be confused, separately.				
8. The program attempts to teach strategies.				
9. Strategies are taught after students have mastered the prerequisite skills.				
10. The program monitors students' responses and branches them to appropriate instructional levels.				
11. The program provides specific tutoring or instructions when students respond incorrectly.				
12. The program appropriately prompts stud'rts who are having difficulty.				

TECHNICAL ADEQUACY

1. The program operates smoothly even when students make unexpected or "trick" responses.				
2. The program appropriately limits the time that students spend on it.				

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SOFTWARE EVALUATION FORM

	1	2	3	4
3. The program safeguards confidential information on each student.				
4. The program has a foolproof "log-in" procedure that keeps individual students' data separate.				
5. The program is free from idiosyncrases that would frustrate students.				
6. Program operations are reasonably fast.				
7. Program menus are easy to use.				
8. The program has easily accessible "help" menus.				
9. The program records lapses in student responding (e.g., discontinuance, long latencies).				
10. The program has an "escape" key that allows students to leave it when necessary.				
11. The program allows teachers to change critical instructional features (e.g., rate of feedback, branching criteria).				
12. A teacher can easily access student records.				
13. Student records are easy to read and interpret.				
14. Hard copy printout of student records is available.				

Polsgrove 1984

SOFTWARE EVALUATION FORM

	1	2	3	4
15. The program provides appropriate feedback for correct responses.				
16. The program provides appropriate feedback for incorrect responses.				
17. Students are given immediate feedback.				
18. The program provides accurate records of student performance. (e.g., bar graph, line graph, tables)				
19. The graphics, color, sound, and illustrations used enhance the instruction.				
20. The program presents concepts and feedback at a reasonable rate (i.e., is adequately paced).				
21. The amount of time spent in the program is instructionally beneficial.				
Total Score:	______	______	______	______

NOTES

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SOFTWARE SOURCES

Sell Lemonade; Elem. Vol. 3, Version 4.6 (Soc. St.)
Oregon; Voyageur; Elem. Vol. 6, Version 1.2 (Soc. St.)
Odell Lake; Elem. Vol. 4, Version 4.1 (Math-Sci.)
Minnesota Educationa Computing Consortium (MECC)
2520 Broadway Drive
St. Paul, MN 55113

Delta Drawing
Face Maker;
Snooper Troups;
Spinnaker Software Corporation
215 First Street
Cambridge, MA 02142

Cooperation Maze;
Edutek Corporation
415 Cambridge #14
Palo Alto, CA 94306

Microzine;
Scholastic Inc.
902 Sylvan Avenue
Englewood Cliffs, NJ 07632

Rocky's Boots,
Gertrude's Secrets;
The Learning Company
4370 Alpine Road
Protola Valley, CA 94025

Spelling Machine;
Southwest EdPsych Services, Inc.
P.O. Box 1870
Phoenix, AZ 85001

Choplifter;
Broderbund
17 Paul Drive
San Rafael, CA 94903

Crisis Mountain;
Synergestic Software
1830 North Riverside Drive, Suite 201
Renton, WA 98055

Miner 2049er
Micro Lab, Inc.
2699 Skokie Valley Rd.
Highland Park, IL 60035

Sneakers;
Sirius Software, Inc.
10364 Rockingham Dr.
Sacramento, CA 95827

Mix and Match
Children's Television Workshop
Apple Computer
20525 Mariani Avenue
Cupertino, CA 95014

Koala Pad
Micro-Illustrator;
Koala Technologies Corp.
3100 Patrick Henry Dr.
Santa Clara, CA 95050

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Technology and Special Education: A Resource Guide

M. Ne'. Bailey
Sharc.a L. Raimondi

■ The rapid proliferation of microcomputers in education has been paralleled by the emergence of related journals, associations, user groups, and other resources. To assist special educators in reviewing this growing list of materials and resources, the Office of Special Education Programs, U.S. Department of Education, provided funding for Project EduTech. Among the ongoing activities of this project is the maintenance of an information base focusing on the applications of technology to special education, as well as the dissemination of that information to educators and other interested groups.

This article presents a selection of resources, periodicals, books, organizations, projects, and networks designed specifically for special educators. In some cases, resources of a general nature have been included because of their usefulness and applicability to special education.

PERIODICALS

Subscription rates for periodicals are for the Continental United States only, and are current as of January 1984. Subscription rates for other countries may be slightly higher.

Catalyst. Western Center for Microcomputers in Special Education, 1259 El Camino Real, Suite 275, Menlo Park CA 94025. $12.00/6 issues, individual subscription. The *Catalyst* is intended to interpret, clarify, and communicate the latest microcomputer research, developments, products, and applications to special education users.

Closing the Gap. P.O. Box 68, Henderson MN 56044. $15.00/6 issues. This newsletter explores the uses of computers (including peripherals and software) with the handicapped and special education students. Special modifications and applications for the deaf and hearing impaired, blind and visually impaired, mentally handicapped, learning disabled, and severely physically handicapped are also addressed.

Communication Outlook. Artificial Language Laboratory, Computer Science Department, Michigan State University, East Lansing MI 48824. $12.00/4 issues. This quarterly newsletter on electronic aids for the handicapped is a publication of the International Society for Augmentation and Alternative Communication, and is published jointly by the Artificial Language Laboratory and the Trace Research and Development Center at the University of Wisconsin.

The Computing Teacher. 1787 Agate Street, University of Oregon, Eugene OR 97403. $21.50/9 issues. Published by the International Council for Computers in Education (ICCE), this journal is geared toward persons interested in the instructional use of computers. It emphasizes teaching about computers, computer applications, teacher education, and the impact of computers on curriculum.

Journal of Special Education Technology. Exceptional Child Center, Utah State University, UMC 68, Logan UT 84322. $17.00/4 issues. Directed primarily to administrators, researchers, and teachers, this journal publishes information, research, technology reviews, and reports on innovative applications of educational technology furthering the development and education of exceptional children.

School Microcomputing Bulletin. Learning Publications, Inc., P.O. Box 1326, Holmes Beach FL 33509. $28.00/10 issues. Microcomputing trends and educational computing applications are reported in this *Bulletin*, which also includes information on sources of materials, software evaluations, workshops, and special field reports by educators.

Teaching, Learning, Computing. Seldin Publishing, Inc., 1061 South Melrose, Suite D, Placentia CA 92670-7180. $24.00/10 issues. *TLC* is a new magazine geared toward classroom teachers who are interested in personal computing. Readers are kept up-to-date on developments in computer legislation, special education, administrative planning, and the academic disciplines. Each issue is planned to include current computer trends and predictions, indepth product reviews; computer management techniques, software test results and evaluations, and profiles of innovative educators.

Computers for the handicapped in special education and rehabilitation: A resource guide. Eugene: University of Oregon, Rehabilitation and Training Center, 1982. This resource guide includes more than 180 annotated citations from 39 journals, over half dated since 1980. The entries focus on computer-assisted instruction in both an educational and client setting and computer-managed instruction. Available from ICCE, 1787 Agate Street, University of Oregon, Eugene OR 97403.

Dominguez, J., & Waldstein, A. (Eds.), *Educational applications of electronic technology*. Monmouth OR: WESTAR, 1982. This collection of articles assembled by WESTAR staff is designed to enhance the reader's awareness of developments, issues, and applications of electronic technology in education.

Goldenberg, E. P. *Special technology for special children: Computers to serve communication and autonomy in the education of handicapped children*. Baltimore MD: University Park Press, 1979. The use of LOGO with cerebral palsied, deaf, and autistic students is described, as well as an innovative view of computer use in special education.

Hagen, D. *Microcomputer resource book for special education*. Reston VA: Reston Publishing Company, 1983. Available from The Council for Exceptional Children (CEC). This book provides an understanding of the microcomputer as a life competency tool, and shows how computers can work for children at home and in the classroom. The full spectrum of software and adaptive devices is described. Disabilities are looked at, one at a time, and the computer needs of each disability group are examined. The advantages and disadvantages of each type of program are weighed. A series of appendices provide information about more than 200 publishers of software products. Products are grouped by disability area and detailed information is provided about each program's use.

Personal computers and the disabled: A resource guide. Cupertino CA: Apple Computer, Inc., 1983. This resource guide was prepared as a public service document to stimulate research into personal computer applications for the disabled. The guide features articles on how the computer is helping the disabled to overcome obstacles and to deal with their limitations. A section on products for special needs, a list of organizations, and a section citing over 60 resources are included. A copy is available free by writing to Apple Computer, Inc., 20525 Mariani Avenue, Cupertino CA 95014.

Taber, F. M. *Microcomputers in special education: Selection and decision-making process*. Reston VA: The Council for Exceptional Children, 1983. The author provides special educators with an introduction to the microcomputer and its uses in both general and special education. Six chapters cover subjects ranging from software considerations and evaluation to media selection and elementary programming for the microcomputer. Each chapter includes a summary, a list of sources for more information, and bibliography.

ORGANIZATIONS

The sharing and exchange of information and ideas with fellow members can reduce time spent in the search for technology news and information. Organizations specifically concerned with technology and the handicapped, as well as others that have special interest groups in this area, are listed in the following section. Local user groups are extremely popular and provide an excellent resource for educators. Seek out computer user groups in your community.

Association for the Development of Computer-Based Instructional Systems (ADCIS). ADCIS Headquarters, Miller Hall 409, Western Washington University, Bellingham WA 98225. Individual non-affiliate membership fee: $40.00/year.

ADCIS is an international not-for-profit association for professionals in the field of instructional technology. This association facilitates communication between product developers and users to reduce repetitive efforts among developers of CAI materials. ADCIS provides a variety of membership services including annual conferences, workshops, CBI publications, and local chapter affiliations. It also sponsors several special interest groups, including Educators of the Handicapped.

Association for Special Education Technology (ASET). P.O. Box 152, Allen TX 75002. Membership fee: $25.00/year.

ASET, a national affiliate of the Association of Educational Communications and Technology, was established for the following purposes: to bring together disciplines sharing a common interest in improving the use of technology in special education; to identify and publicize unique instructional needs of special education students; and to promote improved federal legislation for technology in special education. Membership in ASET includes the quarterly publication, *The Journal of Special Education Technology*, four issues of *ASET Report*, presentations at national conventions, and an ongoing forum for members to focus on those needs of handicapped students which can be assisted through improved technology.

Computer-Using Educators (CUE). P.O. Box 18547, San Jose CA 95158. Individual membership fee: $8.00/year.

This membership organization is committed to expanding the use of computer technology in education. Initiated in California, CUE has expanded to include members in 44 other states and 12 foreign countries. Membership includes a subscription to the CUE Newsletter.

The Illinois Council, Congress of Organizations of the Physically Handicapped, Committee on Personal Computers and the Handicapped (COPH-2). 2030 Irving Park Road, Chicago IL

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60616. Membership fee: $8.00/year.

The purpose of this organization is to search out, evaluate, and share information on hardware, software, software modifications, educational materials developed for disabled people, and use of computers as part of the personal development of handicapped children. Members benefit from hardware and software demonstrations, computer loans, technical assistance, a membership list (ENTER-ACT), a quarterly publication (*Link and Go*), the testing, manufacture, and distribution of low-cost, computer-related hardware, and all-day meetings every other month.

Michigan Association for Computer Users in Learning (MACUL) P O Box 628, Westland MI 48185 Membership fee: $5.00/year.

MACUL is an organization of Michigan educators that coordinates instructional computing activities throughout the state and sponsors a yearly conference Founded in 1975, its membership is now 6,000 (10% out-of-state) and includes a subscription to the MACUL newsletter. MACUL also has a small collection of programs for the Apple II, the PET, and the Atari 800. The cost of each diskette is $10.

Technology and Media (TAM). Dr. Charles McArthur, Membership Chairperson, University of Maryland, Institute of Exceptional Children and Youth, College Park MD 20742. Membership fee: $10.00/year

TAM, an international association of special education professionals interested in technology and media, was recently organized by members of The Council for Exceptional Children (CEC). Formal application has been made by this organization to become a Division of CEC. TAM is an organization for professionals, parents, handicapped persons, and members of the business community who are concerned with the impact of technology and media upon the diagnosis, treatment, and educational rehabilitation of exceptional persons. Membership dues support the development and dissemination of a journal and newsletter which contain information on the diverse topics related to technology and media in special education.

The Young People's LOGO Association (YPLA). 1208 Hillsdale Drive, Richardson TX 75081. Membership fee. $9.00/year (under 18), $25.00/year (adults).

YPLA is an independent, nonprofit national computer club run for and by young people. A subscription to *Turtle News*, a monthly magazine, is included with membership. Members also have access to a software exchange, an electronic bulletin board, and a resource library. The software exchange, for all popular personal computers, includes teacher and user developed software ranging from simple to complex games and educational and business software. Also available is software developed by and for the handicapped.

RESOURCE GROUPS

A growing number of specialized groups address specific aspects of computer use Those listed here will be of special interest to educators.

Artificial Language Laboratory. Michigan State University, Computer Science Department, East Lansing MI 48824.

The Artificial Language Laboratory is involved in basic research in the field of computer processing and formal linguistic structure. Research includes speech analysis and synthesis, interspecific communication, pattern recognition of human electromyographic (EMG) signals, and neurolinguistics. The Laboratory is also involved in developing vocational and educational aids for the blind.

Center for Computer Assistance to the Disabled P O Box 314, Hurst TX 76053 No membership fee.

This independent nonprofit organization is less than a year old It provides a location where disabled persons can gain assistance with the application of microcomputers This organization encourages the use of off-the-shelf hardware, currently available technology, and products as a means of aiding the education and training of mentally and physically handicapped persons.

MicroSIFT. Northwest Regional Educational Laboratory, 300 S.W. Sixth Avenue, Portland OR 97204.

MicroSIFT is a clearinghouse for descriptive and evaluative information about microcomputer instructional software and teacher information. Provided in print form, this information is distributed to state and local education agencies and selected commercial and professional periodicals.

Minnesota Educational Computing Consortium (MECC). 3490 Lexington Avenue, North, Saint Paul MN 55112.

MECC is a nonprofit publisher of training materials and educational courseware for most popular personal computers. MECC can help any teacher or parent interested in putting personal computers in the classroom. The Consortium has also directed a project to develop computer learning packages for use in science, mathematics, and social studies courses. *Network*, a bimonthly instructional newsletter listing available materials, as well as MECC's catalog, are free upon request.

National Center for Research in Vocational Education. 1960 Kenny Road, Columbus OH 43210.

Materials on various aspects of career and vocational education, including programs for special needs populations, are available from the Center. Also available are several publications including a discussion guide on microcomputers in vocational education, an administrator's guide to microcomputer resources, and a system for evaluating microcomputer courseware for vocational and technical educators.

SOFTSWAP/CUE. Microcomputer Center, SMERC Library, San Mateo County Office of Education, 333 Main Street, Redwood City CA 94063.

SOFTSWAP is a joint project of the San Mateo County Office of Education and Computer-Using Educators (CUE);

it serves as a clearinghouse of public domain educational software Programs are available free of charge to educators who copy them onto their own disks at the Microcomputer Center, or may be ordered for $10 00. SOFTSWAP is also a software exchange. Any educator who contributes an original program on a disk may request any SOFTSWAP disk in exchange BLOCKS, the courseware development system developed at the California School for the Deaf, and other courseware are available from this source.

Technical Education Research Centers, Inc. (TERC). Computer Resource Center, 8 Eliot Street, Cambridge, MA 02138.

TERC is a nonprofit, educational research corporation that has been in existence 16 years. TERC's mission is to study social and technological changes and to apply that knowledge to improving education. Two centers currently constitute TERC—the Special Needs Center and the Technology Center. TERC also publishes a newsletter entitled *Hands On*.

Trace Research and Development Center. 314 Waisman Center, University of Wisconsin-Madison, 1500 Highland Avenue, Madison WI 53705.

In cooperation with the Communications Aids and Systems Clinic of the University of Wisconsin Hospitals, this Center studies and develops techniques and aids to augment communication skills of clinical patients. The Center collects, documents, and disseminates information on these and other communication aids and techniques.

NETWORKS

Electronic networks for special educators are a new and rapidly growing resource which provides subscribers an opportunity to receive and share professional information about special education This service involves the use of computers which are linked to a central information center.

SpecialNet. National Association of State Directors of Special Education, 1201 16th Street, N.W., Suite 404E, Washington DC 20036. (202/822-7933)

SpecialNet provides current information and electronic mail capability for persons interested in services and programs for the handicapped. Over 1500 users in all 50 states subscribe to SpecialNet, and 50 national and state bulletin boards provide information relating to special education that ranges from federal news to technology. Several state departments of special education have established state bulletin boards and now use SpecialNet exclusively to support in-state networking systems. SpecialNet is available to anyone who has access to a computer terminal or microcomputer.

The Handicapped Educational Exchange (HEX). 11523 Charlton Drive, Silver Spring MD 20902. Computer access phone. 301/593-7033. For information about the Exchange, call 301/681-7372.

HEX is a free national computer network devoted to the exchange of ideas and information on the use of advanced technologies to aid handicapped individuals. This information bank includes source listings of computer-assisted instructional materials, software, and machinery for the handicapped. It can be assessed via telephone (and modem) or TDD.

The Electronic Information Exchange System (EIES). New Jersey Institute of Technology, Newark NJ 07102. (201/645-5503)

EIES is a national computer conferencing system and information network that hosts many conferences, one of which is EIES/Handicapped. This conference is designed for exchanging information concerning disabled persons.

PROJECTS

The growing support of technology at federal and state levels is reflected in the increase in the number of technology projects being funded. Three projects funded by the Office of Special Education Programs (SEP) are described in this section, as well as three that are funded at the state level.

Please be aware that there are many states conducting projects on technology and the handicapped. To list them all would be a monumental task. For information about other states who have unique and exemplary projects in special education, consult the *Training and Model Exchange Project* (EC 160811, 58 pp), a publication prepared annually by the Council of Administrators of Special Education, Inc (CASE), a Division of CEC. (Order from ERIC Document Reproduction Service, P.O. Box 190, Arlington, VA 22210.)

Project C.A.I.S.H. (Computer Assisted Instruction and Support for the Handicapped). 3450 Gozio Road, Sarasota FL 33580.

Project C.A.I.S.H. is a Title VIB project funded through the State of Florida to provide hardware and software for all exceptionalities. The project provides teacher training, consultation for implementation workshops, using the Apple II Plus and Apple IIe microcomputers exclusively. The first year of the project was devoted to the physically handicapped, the second year to the mentally and emotionally handicapped. Currently, the project is addressing the remaining exceptionalities with appropriate hardware and software. An interim report is available free from the FDLRS Clearinghouse, Bureau of Education for Exceptional Students, Division of Public Schools, Florida Department of Education, Knott Building, Tallahassee FL 32301.

Project EduTech. JWK International Corporation, 7617 Little River Turnpike, Annandale VA 22003.

Project EduTech is designed to provide technical assistance to state and local education agencies in the appropriate use of technology in special education. Ongoing activities include selecting widespread special education issues on which to focus each year, developing reports and other modes of disseminating information on technological advances that may help resolve these issues, and maintaining an informative system on technological advances.

Market Linkage Project for Special Education. LINC Resources, Inc., 3857 North High Street, Suite 225, Columbus OH 43214.

Through its contact with the Office of Special Education (OSE) of the U.S. Department of Education, the Market Linkage Project for Special Education offers product developers assistance in understanding how to develop educational products to meet national distribution standards and to assure that these products are available in the classroom. Initiated in 1977, it has assisted dozens of projects to get several hundred products into the marketplace. Any project funded by ED/OSE can take advantage of this program, which gives free technical assistance, helps develop your products, and assists in locating a publisher.

Microcomputers in the Schools—Applications in Special Education. SRA Corporation, 901 South Highland Street, Arlington VA 22004.

In a joint effort with the Cosmos Corporation, this two-year project will analyze the experiences of local schools currently using microcomputers with programs for the handicapped, and then develop and disseminate useful, research-based information to assist administrators and educators in introducing microcomputers in special education programs.

Project RECIPE (Research Exchange for Computerized Individualized Programs of Education). 1001 South School Avenue, Sarasota FL 33577.

Project RECIPE is a nationally validated instructional management system designed to help educators create and implement individualized education programs (IEPs). The RECIPE system includes instructional objectives, a criterion-referenced assessment system, and instructional strategies. A management component is designed to track and record student progress. The system provides progress reports to parents and annual progress reports. It may be used at the classroom, building, or district level by teachers or administrators to store and manipulate student demographic and program data, as well as to fulfill the requirements of IEP and progress reporting.

SECTOR Project. Exceptional Child Center, UMC-68, Utah State University, Logan UT 84322.

The SECTOR project is a state-funded special education computer technology resource located at Utah State University. SECTOR conducts overviews of adapt . and communication devices, reviews of courseware for handicapped students, software for special education management, and maintains a bibliographic information base for special education. The Center is also conducting research on the interactive videodisc.

ERIC

M. Nell Bailey *is a Research Analyst, and* **Sharon L. Raimondi** *a Senior Research Analyst, with JWK International Corporation, a research firm in Annandale, Virginia. They are currently working on Project EduTech assisting state and local education agencies in the use of technology in special education.*

Project EduTech is funded by the U.S. Department of Education, Office of Special Education Programs. For more information, contact Project EduTech, JWK International Corporation, 7617 Little River Turnpike, Annandale VA 22003.

R E S O U R C E   G U I D E

COMPUTER JOURNALS/MAGAZINES

AEDS Journal
The official publication of the Association for Educational Data Systems (AES)

AEDS
1201 Sixteenth Street NW
Washington, DC 20036

$25.00 per year, (non-members), published quarterly

9 X 6 scholarly, research articles. A refereed journal, many articles by university and college persons. Sample Articles: "The Use of Geoprocessing in Educational Research and Decision Report," "Computer School Bus Routing for Rural Districts."

Byte
The small systems journal published by McGraw-Hill

Byte Subscriptions
P.O. Box 590
Martinsville, NJ 08836

$21.00 per year, 12 issues

Well designed journal. Much advertising. Includes a "Microbyte" feature patterned after a newsletter. Extensive listing of upcoming events (courses, shows, meetings, exhibits). New product announcements, book reviews, some technical articles. Large "catalog" type section in last part of issue including ads for every kind of computer product in existence. This journal is more suitable for the advanced computerist.

Classroom Computer News

The magazine for teachers and parents

341 Mt. Auburn St.
Watertown, MA 02172

$19.95 per year, 8 issues

Devoted to the use of computers in education. Designed for educators, administrators and others involved in educational computing. Provides industry trends, short programs, and beginning level articles. Good quality.

Compute!

The journal of progressive computing

Compute! Magazine
P.O. Box 5406
Greensboro, NC 27403

$20.00 per year, 12 issues

Large, economy-sized journal; one recent issue was 346 pages. General and popular in tone, covers all micro systems. Provides a good guide alongside table of contents showing which systems articles relate to: AP, P, C, TS, AT, V, 64, TI. In the October, 1983 issue there were five features related to Apple and eighteen related to Commodore 64.

Computers in the Schools

The interdisciplinary journal of practice, theory, and applied research

The Haworth Press, Inc.
28 East 22 Street
New York, NY 10010

$24.00 per year, 4 issues

Educationally-focused articles and features, including trends, research results and book reviews. Edited by major University faculty in computer education.

The Computing Teacher

The journal of the International Council for Computers in Education (ICCE)

The Computing Teacher
135 Education
University of Oregon
Eugene, OR 97403

$16.50 per year, 9 issues

Designed for those interested in the instructional use of computers. Emphasizes teaching about computers, using computers, teacher education, and impact of computer on curriculum. Useful to the beginner as well as experienced computer user. Articles cover research findings, reports on specific applications, software reviews.

Creative Computing

P.O. Box 5214
Boulder, CO 80321
Toll free subscription number: 1-800-631-8112

$24.97 per year, 12 issues

Thick volume, full of full page, color ads. Treats a variety of computer topics over a broad range. One of the more popular magazines. Sample articles in the May, 1983 issue: "TI/994A More than just a pretty keyboard," "Apple Business raphics," "747 Landing Simulator."

The Courseware Critique

The newsletter of educational software reviews.

The University of Iowa College of Education Office of Research and Development
224 Lindquist Center
Iowa City, IA 52242

free quarterly newsletter

Evaluations of educational software by teachers and University faculty.

Educational Technology

The magazine for managers of change in education

Educational Technology Publications
140 Sylvan Avenue
Englewood Cliffs, NJ 07632

$49.00 per year, 12 issues

Aimed at the technical, educational computer specialist. Provides literature reviews, product reviews and ERIC updates. Few ads, mostly articles and regular features. Some recent titles: "Educational Technology: Its Impact on Culture," "Video disc Bibliography," "Three Roles for the Computer in Education."

Electronic Education

Suite 220
1311 Executive Center Drive
Tallahassee, FL 32301

$18.00 per year, 8 issues

Short and sweet: aimed specifically at educators. Well designed and well edited. Bright tone and lively features. Typical articles: "Computer Camp News," "More Affordable Now, Computers are Opening Doors." Moderate mix of text and advertising throughout.

Journal of Learning Disabilities

5615 W. Cermak Road
Cicero, IL 60650

$36 per year, 10 issues

This journal now has a section devoted to articles pertaining to the use of computers in the education of students with learning disabilities and the review of new courseware that can be used with this learner population.

Electronic Learning

Scholastic's magazine for educators of the 80's

Electronic Learning
Scholastic Inc.
P.O. Box 645
Lyndhurst, NJ 07071-9986

$19.00 per year, 8 issues

Flashy and colorful. Written for elementary and secondary teachers. Many ads for many computers and computer products. Sample articles: "What to know before you invest," "The Computer Primer," "A Computing diary, journal of a first-year computer user."

Infoworld

Newsweekly for Microcomputer Users

375 Cochituate Rd.
Box 880
Framingham, MA 01701

$31.00 per year, 53 issues ($1.25 per issue)

Newspaper format, 11" X 15" pages. A standard in the small computer industry. Timely articles and news; regular section on software reviews. Includes a Rapid Access Marketplace, a kind of yellow pages of computer products. Numerous classified ads.

Personal Computing

P.O. Box 2941
Boulder, CO 80321

$11.77 per year, 12 issues (introductory rate)

Cuts across business, home, and educational uses of computers. Less about education than business and home. One of the leading computer magazines with articles on the basics of computers and wide applications. Colorful and trendy; includes a Question and Answer advisor section. Examples of articles: "How to Beat a Bad Memory," "The Helping Hand of Computer Clubs."

Softalk

Softalk Circulation
Box 60
North Hollywood, Ca 91603

$18.00 per year (with sponsor)

Designed for Apple owners. Similar to Nibble, another Apple journal. Many flashy ads. Typical article: "This Apple's Got Guts," "The Animated Apple."