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ABSTRACT

The 2-year project's primary purpose was to create a consortium, consisting of a teacher training institution, the Massachusetts State Department of Education, local educational agencies, and the research community; the consortium would serve as a mechanism for promoting research, training, and dissemination in the area of innovative microcomputer use in the education of learning disabled and emotionally disturbed students in elementary and middle schools. Learner centered software (LCS), other than drill and practice software, is defined and project objectives (such as developing a practicum course, establishing research collaborations, and writing a handbook for special educators) are specified. Activities included establishing a special interest group (SIG) in the eastern Massachusetts region, developing a graduate program practicum course at Lesley College, surveying the use of LCS with special education students on a national basis, and dissemination through articles and presentations. Appendixes (the bulk of the document) include copies of the SIG newsletters, letters from SIG members, practicum course descriptions, the complete survey report, an article on the survey, the outline of the handbook, and two sample chapters from the handbook titled: "Using the Computer To Teach Writing" and "Using the Computer To Develop Problem Solving and Critical Thinking Skills." (DB)

Microcomputers in Special Education:

Beyond Drill and Practice

FINAL REPORT

Susan Jo Russell
Project Director

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Acknowledgments

This project, by its very nature, depended on collaboration among many institutions and many individuals. Core staff at TERC and Lesley College included:

- Susan Jo Russell, Project Director
- Rebecca Corwin, Lesley College Coordinator
- Peggy Kapisovsky, Special Interest Group Director
- Janice R. Mokros, Evaluator
- June Foster, Project Administrator

The many teachers who contributed their time, thoughts, and expertise to the project include those who have participated in the Special Interest Group meetings and activities and those, from all over the country, who were willing to share their classroom experience in using computers with their special education students. While it is impossible to acknowledge by name all the teachers who contributed in this way, we would like to thank a core of teachers who committed extra time and effort to making this project a success:

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- Linda Ware, El Paso, Texas

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TABLE OF CONTENTS

I. Overview

"Microcomputers in Special Education: Beyond Drill and Practice" is a project of Technical Education Research Centers (TERC) in cooperation with Lesley College. The project was funded from October 1984 through December 1986 by a grant from Special Education Programs of the U. S. Department of Education. Its primary purpose was to create a consortium, consisting of a teacher training institution, the Massachusetts State Department of Education, local educational agencies, and the research community that would serve as a mechanism for promoting research, training, and dissemination in the area of innovative microcomputer use in the education of learning disabled and emotionally disturbed students in elementary and middle schools.

Background and Purpose

In 1984, when the project began, computers were being used in special education settings largely for drill and practice activities or for motivation and reward (see, for example, Mokros & Russell, 1986). Non-drill uses of the computer—word processing, Logo, problem-solving software, non-drill instructional software in mathematics and language arts—were being developed and tested primarily at the grass-roots level. Much of the knowledge about the usefulness of non-drill software was being developed by individual practitioners in isolated settings, but no body of knowledge about how this software could be used effectively with handicapped students had been brought together in one place. Most teachers who wanted to move "beyond drill and practice" with their students had little access to practical information, to research, or to colleagues who might help. The project endeavored to develop a model for professional information-sharing in the eastern Massachusetts area, to gather and synthesize information from practice nationally, and to create research partnerships. Both the eastern Massachusetts collaborative and the research partnerships would be established as permanent entities which would continue beyond the intial two-year funding period, while the gathering of information from practice across the country would result in a book for practitioners about non-drill computer use. In addition, the gathering of information, the collaboration of teachers in the region, and the cooperation of Lesley College

would together make possible the establishment of a graduate practicum in the use of non-drill software with special needs students which would provide another institutionalized mechanism for continued training and dissemination.

The project's intended focus was on mildly handicapped students with learning or emotional problems in grades K-8. However, although this population remained at the center of our work, we found that teacher participation could not be artificially limited in this way. In many states, for example, resource room teachers see a wide range of students with a variety of labels and problems. In our own regional collaborative, while most participants were, in fact, resource room teachers in grades K-8, there were exceptions to all of our stated limits. Teachers of older students, of students with physical handicaps, of students with more severe learning and emotional problems, participated in the project. We were told often that the project's work was applicable beyond the limits we had set for it: the wide variability among special needs students defies adequate classification by age, grade, or diagnosis. The flexibility of much non-drill software allows its application in different ways with different students, so that, for example, the teacher of emotionally disturbed adolescents might use the same piece of software—albeit in different ways and for different reasons—as a teacher of learning disabled third graders.

Learner-Centered Software

One of the first tasks of the project was to define more clearly the genre of computer use we were studying. Defining it negatively as "non-drill-and-practice" seemed unsatisfactory. We were certainly looking at "instructional software", but this appellation is overly inclusive. We also were not concerned with software used solely as motivation and reward, which the student could turn to after his/her "real work" was completed. As we talked to teachers who were developing effective uses of non-drill software with their students, we found that there was a consistent theme in their reasons for use of this software. These teachers were all looking for ways in which their students—many of whom had poor self-images of themselves as

learners—could gradually become more independent in learning tasks, could take more responsibility for their own learning, and could view themselves as able to cope with the learning process, including its inevitable times of confusion, frustration, and difficulty. While teachers were looking to the computer for specific instructional purposes, their search for materials which would teach content was inextricably tied to their desire for contexts in which their students would learn to improve their learning strategies as well. After all, most of these teachers had been teaching for many years and already had many materials and techniques for teaching content. What appealed to them about the interactive nature of the computer was the possibility for their students to become more independent learners.

Given the strength and consistency of this theme in what we heard from teachers—the concern that students become learners—we designated the type of software which these teachers were choosing for their students learner-centered software (LCS). LCS can include interactive games and tutorials, simulations, problem-solving software (including use of programming languages), and tool programs such as word processors, spreadsheets, and data bases. The characteristics of learner-centered software have been discussed and refined over the course of the project. Four defining characteristics of LCS have been identified:

- In using the software, the student has significant control over choosing the goal of the activity, the strategies used to reach the goal, or both.
- The feedback from the computer is informational, not judgmental. This kind of feedback may include a clear presentation of the student's work-in-progress, a comparison of the student's solution to the desired goal, an additional piece of information, a graphic model, a restatement of information which the student needs, an example or hint. This feedback is not simply an indication that a student response is right or wrong but is designed to help the student expand his or her understanding of the problem or content.
- The software allows, emphasizes, or encourages prediction and successive approximation. Using the informational feedback they receive from the computer, students gradually alter their responses to more closely approach the desired result.
- The software provides a meaningful context which emphasizes intrinsic motivation. Rewards and penalties are natural rather than artifical consequences, related directly to the student's work. Rewards are clearly related to mastery and completion. These can include: records of student progress available to the student; promotion to a new level (e.g., from

"rookie" to "detective"); the permanent recording of a student's solution or product; completing or solving a problem or puzzle; producing a finished product.

Project Objectives

The project, then, has focused on designing mechanisms for research, dissemination, and training in the use of learner-centered software with special needs students. The specific tasks of the project were as follows:

- To conduct a national survey of the use of LCS with special needs students which would result in a report on the state-of-the-art and the identification of promising practices.
- To establish a Special Interest Group of educators in eastern Massachusetts who are using LCS in special education.
- To develop a practicum course and practicum sites in local educational agencies as a vehicle for training teachers and prospective teachers in the uses and impact of LCS with special needs students.
- To establish research collaborations which would further explore the impact of LCS on the education of special needs students.
- To write a handbook for special educators on the uses of LCS, to be distributed nationally, which would draw on and synthesize the information collected from participants in all other phases of the project.
- To disseminate through a series of publications and presentations the information collected by the project.

In the following sections of this report, the project's work is divided into efforts in training, research, and dissemination, although all facets of the project overlapped and informed the others.

II. Teacher Growth, Development, and Training

This section summarizes the aspects of the project which have focused on teacher growth and development in the use of learner-centered software with special needs students. We use the terms "growth" and "development", in addition to "training", because of the collaborative nature of this work. The project did not simply devise training which was delivered to teachers; rather, the teachers themselves were primary sources of information and development. It is this sharing

among colleagues which has resulted in a growing community of professionals whose collective experience and practice ultimately benefit the students for whose education they are responsible

The Special Interest Group

The Special Needs and Computers Special Interest Group (SIG), made possible by funding from this grant, is now an ongoing collaborative of teachers, administrators, researchers, graduate students, university professors, and teacher trainers in the eastern Massachusetts region. The SIG has met monthly since November 1984. Meetings usually have an attendance of about 30 people who discuss and try out promising computer applications, preview and evaluate software, share their concerns, questions, and recommendations, and host invited speakers. A lending library of learner-centered software gives teachers an opportunity to determine the appropriateness of software for their particular students and provides an ongoing mechanism for sharing information about what works, what doesn't work, and what instructional interventions are needed. Although microcomputers are gradually becoming more common, the need for this kind of inter-school organization still seems critical for the special education teacher. As one member put it,

> For me, the best part [of the SIG] is the networking, getting to know the ins and outs of what's going on and being able to connect with pilot projects, new programs, etc. I can't get that in my school because everybody is isolated and doesn't know a lot about what's happening. I feel like I'm on the cutting edge, and it's been good for my morale. It's helped me be a resource to other special ed staff at my school.

In addition to monthly meetings, members keep in touch with the SIG through a monthly newsletter sent to approximately 100 area educators. Group members find this newsletter to be a critical component of the SIG's work since they cannot always attend meetings; we often receive notes and phone calls from members who have to miss a meeting, asking us "to make sure I get the newsletter."

During the two and a half years that the SIG has been in operation, highlights of the SIG meetings have included:

- A report by two teachers on classroom uses of a simple data base

- A talk by a SIG member on his use of an electronic spreadsheet for instruction in mathematics applications with h'ı learning disabled students
- Demonstration of new software, such as Gapper (HRM) which uses the cloze technique for instruction in reading comprehension and Explore-a-Story (Collamore) which allows students to create their own stories with text, graphics, and animation
- A presentation on keyboarding skills and keyboarding software
- A presentation by Catherine Cobb Morocco of her SEP-funded research on word processing with learning disabled students
- Small group investigations of the use of Logo and of data bases with special needs students
- A demonstration of Lego-Logo by its inventors, Steve Ocko and Mitch Resnick
- A demonstration of the new Apple-GS hardware
- Sharing of experiences in using word processing with special needs students
- A SIG member's report on her work with teaching fraction concepts by using Logo with her learning disabled students
- A panel of administrators discussing the issues of implementing the use of computers in special education in their districts
- Lots of informal talking, sharing, and software previewing

The newsletters provide complete documentation of the activities of the SIG and are included in Appendix A.

The existence of the SIG has effects beyond a monthly information-sharing session among its members. In addition, the establishment of this collaborative has resulted in:

- the identification of practicum sites for a practicum course in the use of microcomputers in special education (see below)
- information-sharing between practicing special education teachers and teachers-in-training who attend the SIG meetings
- a forum for researchers who have information to share with practitioners
- a forum for practitioners to report on successful practices
- support for practitioners to become leaders in their own settings
- the formation of research collaborations between teachers and researchers (see below)

Participation in the SIG is entirely voluntary and is not related to any in-service or college credit. While a friendly atmosphere (and an afternoon snack!) are essential components of the meetings, teachers come to the meetings, at 4:00 p.m., after a school day, because they find support, collegiality, and useable information that benefits them and, ultimately, their students. Attached (Appendix B) are three letters from active SIG members about the importance of the SIG to their growth and development as professionals. An excerpt from one of these letters follows:

> I consider my experience with the SIG to be truly rare and extremely valuable. Educators are seldom given the opportunity to meet, talk, and exchange this type of information in an open forum. My experience with this group helped me to acquire the knowledge and develop the leadership abilities necessary to disseminate information in a meaningful way. In my opinion, the continuation of this SIG is critical to special educators across the state.

Lesley College Graduate Program

A second training component of the project was the establishment of a practicum course as part of the Microcomputers in Special Education program of the Lesley College Graduate School. This course, designed by the Lesley College coordinator, Rebecca Corwin, and the Project Director, Susan Jo Russell, is a one-semester experience which combines a weekly seminar with work at a field site, giving participants direct experience in using learner-centered software with special needs students and time for guided reflection and analysis. Ms. Corwin and Dr. Russell jointly taught the first section of the practicum in the fall of 1985. Since then, the practicum has been offered every semester and has become a required course for students in the Master's degree specialization in computers and special education. Two additional instructors have been trained to give the course, and during the current semester it is being given both on-campus at Lesley College and at two off-campus sites for the Boston Public Schools. Approximately 30 students have taken the practicum to date. It will continue to be given both on campus and, as instructors are trained, it will gradually be given at further off-campus sites as well. A catalog course description and syllabus are included in Appendix C.

Lesley College Summer Training

An unexpected offshoot of the project has been the creation of a week-long summer institute, Microcomputers in Special Education, at Lesley College Graduate School. While this institute was self-supporting and not funded directly by the grant, the gathering of practitioners, teacher trainers, and researchers through the SIG brought together the people and resources necessary to build a substantive curriculum for this in-service training. The summer institute format, which has traditionally been used by Lesley, allows practitioners who cannot commit time to a semester course during the year to study a topic intensively during the summer. Some elect only to participate in the week of speakers, discussion, and hands-on work with computers, while others also plan and carry out projects in their own classrooms during the following year for an additional graduate credit.

During the summers of 1985 and 1986, project staff and SIG participants contributed substantially to the summer institute programs. Project staff member Rebecca Corwin organized these institutes with other Lesley faculty. Topics and presenters included:

- Using the Bank Street Writer. Donna Simone [SIG member].
- Using tool software (data bases and spreadsheets). Tom Plati [SIG member].
- Relating software to IEP's. Susan Jo Russell [project staff].
- Curriculum integration K-8. Madaleine Pugliese [SIG member].
- Integrating software into the curriculum for emotionally handicapped students. Joe Cambone [SIG member].

Continuation and Expansion of the Regional Collaborative

Since the end of our funding period in December 1986, the regional SIG has continued to meet monthly at TERC. TERC donates space, computers, and some personnel time. Recently, TERC received a $15,000 grant from the Lotus Foundation to continue and expand this growing regional network of special educators. This expansion will not only include continued monthly meetings and an improved newsletter but will also offer a new service: outreach to school systems and

individuals through individual consultati- , workshops, or group gatherings (e.g., open houses) offered by SIG members.

Many of the teachers who have been members of the SIG during the past two years have become leaders in their own schools or districts. Beginning by sharing their work within the SIG itself, they have gained the confidence, experience, and suppor from SIG members and project staff to give presentations, write articles, and offer workshops for their colleagues. A few have moved beyond their own schools to work at the regional, state, or national levels (e.g., one active SIG member is on the Advisory Board for the Council for Exceptional Children's Center for Special Education Technology; two others had articles published in The Computing Teacher and Closing the Gap, respectively). These teachers are now well equipped to take on leadership of the SIG and to oversee this expansion of SIG services.

III. RESEARCH

Survey of the Use of LCS with Special Education Students

The survey was planned to include two parts: 1) an assessment of why and how special education departments are or are not using LCS with their learning disabled or emotionally disturbed students through telephone interviews of personnel in a random sample of school districts nationwide; 2) the identification and description of a sampling of promising practices. These two parts of the survey were completed during the first year of the project.

A full report of the national state-of-the-art survey has been compiled in a separate document, which is appended in Appendix D. The results were summarized and published in the Journal of Learning Disabilities (Mokros & Russell, 1986). This article is the best source for the key findings of the survey and the implications of these findings for research and practice. Rather than repeating these ideas here, we refer you to the article itself (Appendix E).

As described in the Continuation Application for Year 2 of this project (Russell, 1985), promising practices were gathered through the placement of announcements in approximately 60 professional journals. Telephone interviews were used to follow up initial responses, and written information was solicited from teachers who were interested in contributing more substantively to the handbook. Budget for this aspect of the project unfortunately limited the amount of follow-up which could be done. However, a great deal of information about activities and implementation, goals and outcomes, and teacher-to-teacher advice was gathered which has been incorporated into the handbook (see below).

Research Collaborations Emerging from the Project

Several interesting research activities have emerged from the project. For the most part, these projects are based in the classrooms of teachers who have participated in the Special Interest Group. While teachers serve as facilitators for these studies, TERC researchers are conducting the actual investigations. We found that teachers did not have the time to take primary responsibility for research, but were quite interested in participating. As can be seen in the following research descriptions, teachers are participating in the studies in a number of different ways.

- **The Effects of Using Word Processors on the Instructional Context for Teaching Writing to Special Needs Students**

As a result of the SIG's numerous discussions of word processing, Susan Jo Russell became interested in how the presence of the word processor in the classroom and the ways special education students interact with it lead to changes in teachers approaches to the teaching of writing. What are these changes? If they exist, what characteristics of the student-computer interaction are most salient in teachers' reevaluations of their classroom practice? Semi-structured interviews with resource room teachers, members of the Special Interest Group who had been using word processing in their classrooms, probed their goals in using word processing, how these goals had changed over time, and what, if any, changes in their teaching or thinking about teaching had come about during this period. The results of this study, which were reported at the 1986 annual

meeting of the American Educational Research Association (Russell, 1986), indicated that the use of the word processor had led to little change in the definition of student tasks, but to strong changes, which were consistent across teachers with different styles and philosophies, in learning organization. All teachers reported: higher teacher involvement in the writing process itself (as opposed to correcting or reading finished products), lower time spent on management, greater student independence, and use of peer collaboration. These changes in learning organization were accompanied for most of the teachers by attitudinal changes, especially with regard to student independence, expansion and overlap of student and teacher roles, and higher differentiation of goals in the teaching of writing.

- **Microcomputer-Based Laboratories for Special Needs Students**

A second research project, involving the use of computers as tools in science, is being conducted at a private elementary school for learning disabled children. One of the teachers from this school, an active member of our Special Interest Group, suggested that the science teachers at her school would be interested in this project. Researchers at TERC met with the science teachers to set up a project that would test the potential of Microcomputer-Based Laboratories (MBL) in actively involving learning disabled students in scientific investigations. TERC researchers are working with 3 teachers (5th through 8th grades), all of whom take a "hands on" approach to teaching science.

Interestingly, this MBL investigation is one of the first to study the effects of computer tools in science with a population of learning disabled students. Earlier work conducted by TERC researchers suggested a discouraging tendency for teachers to transform MBL investigations into drill and practice routines when working with special needs students. Students were not given access to the power of the tools, because teachers felt that students needed to master a series of procedural steps before they could go on to explore phenomena such as motion, heat and temperature, or sound.

We reasoned that, in the hands of special education teachers who were experienced in using computers to go beyond drill and practice, the classroom would become a place where special needs students could build on strengths they may have in hypothesizing, exploring, testing, and using data. When special needs students are given opportunities to use tools to explore their immediate surroundings (e.g., by measuring the temperature of different objects and seeing it graphed on the computer), they will be empowered to do real investigations and real scientific problem solving. We are assuming that the reasoning and problem-solving behaviors of special needs students and regular students are quite similar. Furthermore, we assume that these skills can be developed equally well among both populations when the tools are used in an exploratory mode. These hypotheses are important ones, as Shirley Malcolm of AAAS recently pointed out at a meeting of Ford Foundation project directors: If we want special needs students to have access to powerful computer tools in science—tools that will enable them to think and act as scientists do—we need to demonstrate that important learning takes place when they use these tools.

Classroom observations and interviews with teachers are currently underway. Results will be available in the summer of 1987.

• The Special Education Classroom of the Future

In this project, we are collaborating with two teachers who are active in the SIG to document the development and effectiveness of their "Special Education Classroom of the Future." This project was initiated by the teachers and funded by their district and by Apple Computer. The teachers commissioned us to help them evaluate their innovative project.

ED and LD students who are involved in the project use computers intensively in their English, mathematics, and skills classes in ways that go beyond drill and practice. The teachers and students make use of data bases, spreadsheets, and word processing tools in a variety of engaging projects that often cross the boundaries of traditional subject areas. In addition, each student in the program is given a personal computer for use at home.

Researchers from TERC (Susan Jo Russell and Jan Mokros) are helping the teachers capture the unique and particularly effective elements of their approach so that the school will be able to modify and expand upon its program. At the same time, we will help teachers identify the progression they went through in developing their teaching approaches, so that they will be able to articulate this process to other teachers. The project is currently underway and will be completed in January, 1988. A joint research article, authored by the teachers and TERC researchers, will result from this project.

• Mathematics Learning among Special Needs Students

Drs. Russell and Mokros are conducting pilot research on children's learning of mathematical concepts in data collection and analysis (ordering, graphing, finding central tendencies) in a mainstream classroom and a class for learning disabled students. The special education teacher who is collaborating with us was active in the SIG. The aim of the study is to better understand how children who are functioning below grade level in mathematics understand and apply mathematical concepts when they are relieved of the burden of calculation. The study will help us understand not only how these students solve mathematical problems, but also how they can more effectively use software tools such as spreadsheets and data bases to solve real mathematical problems.

We will observe and conduct clinical interviews with children who have been identified as having learning problems as well as children who do not have identifed problems. The children will be interviewed as they wrestle with problems involving the use and application of the concept of central tendency (mean, median, and mode). Using some of the mathematics activities being developed for another TERC project, we will then introduce students to the concepts of mean, median, and mode by having them work with personally relevant problems where they need to collect and analyze data to solve a problem. Students will use appropriate software as a tool for

solving these problems. Following the intervention, we will again interview students to determine the effectiveness of the teaching sessions on students' problem-solving skills.

Pilot research is currently underway and will be reported at the June Research Symposium sponsored by the Center for Special Education Technology.

IV. DISSEMINATION

Dissemination is integral to all the facets of the Beyond Drill and Practice project. The Special Interest Group is itself a vehicle for dissemination, both through its newsletter and through the members themselves, who talk with colleagues, give workshops, and often become sources of information within their schools and districts. The collaboration with Lesley College results in dissemination of the project's work through the training opportunities which have been established there (see above, under TEACHER GROWTH, DEVELOPMENT, AND TRAINING). However, there are two additional specific mechanisms for dissemination which have not been covered elsewhere in this report. The first is the book which is being produced by project staff; the second is the presentations and publications which have been made by staff and SIG members throughout the course of the project. These are discussed below.

Beyond Drill and Practice: The Book

An ongoing task of the project has been to compile experiences of classroom teachers who are using learner-centered software with their special needs students. Much of the knowledge base in this area resides with practitioners; it is at the grassroots that new applications of the computer are being developed and evaluated by experienced and committed professionals who know their students and are willing to take the risk of trying something new which just might work. While a slim research base is gradually accruing in the use of, for example, word processing and problem-solving software, research will never provide all the answers that practitioners need. The gathering

and synthesizing of knowledge from practice—what worked with which students under what circumstances—is an invaluable resource for educators. Experiences gathered both from our own regional collaborative in eastern Massachusetts and from the nationwide search for promising practices undertaken by the project in Year 1 provide the basis for our handbook for special educators.

Guided by what is actually happening in the field, we chose four uses of LCS on which to focus: supporting skill development, teaching writing, developing problem-solving and critical thinking skills, and improving "learning to learn" skills (motivation, responsibility, independence). Chapters on these four areas form the heart of the book with additional chapters which introduce learner-centered software, describe the teacher's role in using LCS, and discuss the practical aspects of integrating this software into the curriculum.

The outline of the handbook, tentatively titled, Beyond Drill and Practice: Using Learner-Centered Software in Special Education, is attached in Appendix F. Most chapters are in draft form. Currently the outline and two sample chapters are being considered by publishers. Two of these publishers have expressed interest, and further discussions are underway. The remaining chapters will be finished up in cooperation with the publisher when negotiations are completed. The two sample chapters, Chapters III and IV, are attached in Appendix G.

Selected Articles and Presentations

Throughout the course of the project, both project staff and some SIG members have made presentations, conducted workshops, and written articles which have disseminated the work of the project. These have included:

Articles

Mckros, J. R., & Russell, S. J. (1986) Learner-centered software: A survey of microcomputer use with special needs students. Journal of Learning Disabilities, 19:3, 185-190.

Russell, S. J. (1986, Spring). But what are they learning? The dilemma of using microcomputers in special education. Learning Disabilities Quarterly.

Russell, S. J. (1986, December). "My kids could never do that": Adapting software for the learning disabled student. Churchill Forum, IX: 1.

Presentations

Corwin, R. B. (1985). Computers for learning disabled children: Do they promote learning? Presented at the Boston University School of Medicine conference, Learning disabilities: A new look at unsettled issues, Boston, MA.

Corwin, R. B., & Russell, S. J. (1986, April). Beyond drill and practice: Matching special learner needs, software, and IEP objectives. Presented at the annual meeting of the National Council of Teachers of Mathematics, Washington, D. C.

Corwin, R. B., Russell, S. J., Simone, D., & Ary, T. (1985, May). But what really happens with special education students? Presented at the seventh annual Lesley College Computer Conference. [Ms. Simone and Ms. Ary are SIG members.]

Russell, S. J. (1985, June). Report of research in progress: Preliminary results of national survey. Center for Special Education Technology Research Symposium, Washington, D. C.

Russell, S. J. (1986, April). Creating an environment for change in the teaching of writing. Presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Russell, S. J. (1986, July) Beyond drill and practice: Do we know what we're doing? Presented at the Promising Practices Symposium on Computers and Special Education, San Jose State University, San Jose, CA.

Russell, S. J., Corwin, R. B., Kapisovsky, P., & Mokros, J. (1986, May). Special education: Research into practice. Presented at the eighth annual Lesley College Computer Conference.

Other

1. Staff members Corwin and Russell and SIG member Donna Simone conducted an all-day workshop for the New Jersey State Department of Special Education covering three of the central topics from the project handbook: skill development in mathematics and language arts, critical thinking, and writing.

2. Italian national television filmed at TERC, in the classroom of SIG member Betty Church, a resource room teacher in the Medford public schools, and in staff member Corwin's graduate class (Computers in the Resource Room) for a documentary on computers and special education.

Dissemination of information from both research and practice will continue and expand through the SIG and ongoing research collaborations.

V. References

Mokros, J. R., & Russell, S. J. (1986) Learner-centered software: A survey of microcomputer use with special needs students. Journal of Learning Disabilities, 19:3, 185-190.

Russell, S. J. (1985, April). Continuation application for Microcomputers in special education: Beyond drill and practice.

Russell, S. J. (1986, April). Creating an environment for change in the teaching of writing. Presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

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Appendix A

APPENDIX A

SIG NEWSLETTERS

MICRO AND SPECIAL NEEDS
SPECIAL INTEREST GROUP

NEXT MEETING: Monday, December 3, 1984
4-6 P.M. **We will start promptly at 4 p.m.
TEPC
1696 Massachusetts Ave.
Cambridge, Massachusetts

AGENDA:

4:00 - 4:45 Word Processing

Demonstrations of Bank Street Writer
Milliken
Writer

Every piece of software has different features. At least three pieces of software will be presented so that we can see the special characteristics of each. This will provide an easy introduction to the use of these programs.

We will also have an opportunity to discuss the uses of word processors with special needs children. What successes have we had? What problems have we experienced? Why use these programs?

4:45 - 5:05 Software Browsing

In addition to the software listed above, we will have a chance to look at other language arts programs such as Bank Street Speller, Missing Links and Gapper.

It is also a time to talk informally with colleagues in other schools about their experiences and interests.

5:05 - 5:40 Teacher Initiated Classroom Investigation

Many varied questions were raised in last month's meeting. They ranged from concerns with barriers to acquiring software and integrating it within the classroom, to questions about tapping kids learning strengths through the use of computers(see enclosed notes from the November meeting).

This will be a time to brainstrom about these and other issues. We will also discuss a few teacher-initiated classroom investigations that are just beginning.

5:40 - 5:50 Agenda for Next Month

The group will decide what area and which software to investigate during next month's meeting.

5:50 - 6:00 Conclusion

The final 10 minutes have been set aside for individuals to :

- Sign out software -

  The word processing software will be available for those of you who may wish to take it home or to your schools for a closer look, or to try it out in your classrooms.

- Set a meeting time with a TERC staff member -

  Anyone interested in investigating the possibilities of beginning a research project may set a meeting time with a TERC staff member.

- Software browsing -

  The word processing software will be available for viewing until 6:30.

* For those of you who would like some additional time to view software, we've set aside 3:30 - 4:00 and 6:00 - 6:30 for this purpose.

!!!!!!!!!!!!!WE ALL LOOK FORWARD TO SEEING YOU!!!!!!!!!!!!!

Notes from 1/25 meeting of SE interest group.

Susan Jo began the meeting at 4:20 with an introduction to the project. She explained the reasons for getting the group together and talked about resources that would be available to the group (software library, TERC teaming with teachers for research support). We next went around the room to have each person introduce her or himself.

(We've decided to include this information so that you may get a sense of the composition of the group and of individual's interests and experience. We tried to keep notes during the introduction, but we may have missed or confused facts. Please excuse any misinformation presented).

Vicki-Reading
Doesn't use computers. Interested in computerized IEPs to save time. Works with preschool SPED.

Marty-Reading
Resource room-generic instructor. Wants to be able to use their system's rotating computer for instructing kids.

Debbie-Lexington
consults with many teachers throughout their system re SPED kids and computers. Is interested in research on computer implementation with SPED kids in self-contained classrooms.

Jinny-Cambridge King
Uses computer with SPED kids in regular classroom

Marian-Cambridge King
ld teacher--uses some Logo, some problem-solving software.

Helen-L[illegible]on
[illegible] class, has computer in class. Over the summer, viewed over 100 pieces of software for potential SPED use (working with Debby)

Marie-Shrewsbury
Teaches SPED class in high school

Donna-Shrewsbury
SPED coordinator, resource room teacher. Wants to find interesting, valuable software to use with 15-16 year olds.

Pat-Andover
.4 teacher-interested in developing ways of using computers with her students.

David-Arlington
Works in Learning Center with small groups of kids-has five Apples. Lots of use of computers as motivation, reward.

Judy-Dept of Ed.
will arrange for group to present its findings at State Special Ed conference.

SPED administrator ... using computers with SPED kids for word processing, drill and practice.

Claire-Canton
resource teacher who is using Logo for the first time

Kathy-Canton
needs to solve some technical problems before being able to use computer-a resource teacher

Judy-Canton
principal, interested in using computers with SPED kids.

Louise-Reading
resource room teacher

Joe-Walker School
have two computers, 54 boys between 7-13 years. Using Milliken word processor with much enthusiasm.

Susan-Lesley & Cambridge
SPED teacher on assignment. works with administrators in advocacy role. Works with substantially developmentally delayed kids.

Susan-Cambridge
works in self-contained ld classroom. They have one computer fulltime.

After the introductions, Becky asked the group about software that they liked and had success using. We need recommendations about what to buy for the software library. The group mentioned a few word processors:

Milliken: good because it needs only 7 commands

new Bank St. Writer: has eliminated problems with two modes.

Kidwriter: doesn't print, but has pictures to go with words. good for pre-reading.

Other software discussed included Gertrude's Puzzles & G's Secrets, Missing Links, the new Delta Drawing, Sticky Bear, Memory (a package with a comprehensive system for teaching problem-solving), and Odd One Out (for younger children.) Someone mentioned that Closing the Gap and the Insider were good sources of software reviews.

People talked about how the effectiveness of any piece of software was closely related to the instructional strategies used and to the characteristics of the student.

We also talked about typing tutors, and the extent to which kids needed to have well-developed fine motor skills in order to use word processors.

Becky said we could get a batch of wordprocessing software together for next time (December 3rd), and have people describe the ways in which they had used this software effectively with different types of kids. Anyone who'd like

Becky.

Other issues of interest to the group included the following:

- What are other schools doing in terms of getting computers used with SPED kids? Is this happening primarily in a "top-down" way (administrator initiative) or in a "bottom-up" way (teacher initiative)?

- How do you convince administrators that computers can be effective in instructing SPED kids?

- How do you decide what programming languages to teach?

- Why are we using computers with special needs kids--or with any kids? What can we accomplish that we couldn't otherwise?

- Are there any patterns in children's responses to Logo? For example, some kids get turned on, some "shut down" to Logo. Can you predict what kind of kid is going to react in a certain way?

- Are there skills--such as problem-solving skills-that are developed via computer and then generalize to real life settings?

- Is the computer useful? Is it useful in terms of. . .
  motivating kids?
  getting them to feel more like regular kids?
  as a theraputic tool (less threatening than a person?)
  promoting communication?

- What can we do with the computer to develop skills in science, history, and social studies?

- How can we use the computer to tap kids' learning strengths?

- How can the computer help kids with particular kinds of attentional problems? (e.g., does it help the kid who's easily distracted?)

- How is the computer being integrated into other curricular areas?

Finally, someone mentioned the importance of gathering real data to answer some of these questions. "We have to have some convincing arguments to bring to our schools"

At the next meeting, we'll discuss how we can begin investigating some of these questions.

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: Monday, January 14, 1985, 4-6 p.m., at TERC

(Software and computers available: 3:30-4:00, 6:00-6:30)

Word processing. A large portion of December's meeting was used to demonstrate several word processors (see enclosed notes). By the end of the meeting, people had just begun to share their thoughts and experiences about the problems, advantages, and issues of using word processors with special needs students. Some of the questions/issues raised included:

1. Do students write more using a word processor?

2. Are students better able to see and correct spelling, punctuation, and other syntactic errors because what's on the screen looks like "real print"?

3. Do students use the word processor to move text around to improve the structure and sense of their writing?

4. What is the teacher's role in the student-word processor interaction?

5. How much of a barrier to using a word processor is lack of typing skill?

We will continue this discussion, shifting our focus from the characteristics of word processors to actual classroom practice. Special Interest Group members who have used word processing with their students will share their experiences and student work.

*Software library. Software will be available before and after the meeting. If you borrowed software this month, please bring it with you to the January meeting. We also need suggestions for software to be purchased (call Susan Jo).

*Print library. Please give any articles you have found useful to Susan Jo for inclusion in our library. Remember to return borrowed articles.

*IEP management systems. Several members of the Special Interest Group are exploring IEP management systems for their schools. They are especially interested in contacting people who are currently using some system in their schools and can share their experiences. We'll make a list of who's using what next meeting. If you are using such a system, please bring any information you have (the name of the system, where information about it can be obtained, who in your school system to contact to find out how it's working).

*Tape recording. Although we are taking notes of the meetings, we feel like we are missing a lot of the richness of what people have to say. We are wondering how people would feel about tape recording at least some of the meetings. We could transcribe the tapes and use portions of them later for the project handbook. Susan Jo is exploring rental of a microphone which would be able to record a group of our size (or does anyone have one which could be borrowed for meetings?). We'll talk about this in January.

December 19,1984

TO: Beyond Drill and Practice Group Members

FROM: Jan Mokros (TERC)

RE: Notes from December 3rd Meeting

Susan Jo Russell (TERC) began the meeting at 4:20 and distributed a bibliography of resources on word processing, along with other materials on using the computer to help teach writing. We spent the next hour and fifteen minutes reviewing word processing software. The following software was reviewed:

1. Milliken

Joe Cambone (Walker) demonstrated the Milliken word processor, which has a fairly simple system of commands (you only need to use a few keys). One different feature of this software is its pictorial metaphors (e.g., a desktop and filing cabinet.) Joe said that kids found the filing system very easy to use, because they can easily visualize what they're doing.

2. Kidwriter

Becky Corwin (Lesley College) demonstrated this piece, which combines story illustrations with writing. Students can select f... ...t of standard pictures or symbols, arrange these pictures on part of the screen, and type their stories on the other part of the screen. Limitations include the fact that the text runs only 6 lines and the screens are somewhat clumsy to handle. Also, the commentary, "It will be very easy to do!" appears frequently in the instructions.

One of the group members commented that Kidwriter might be a very useful tool in helping young children learn to plan and sequence their thoughts.

3. Magic Slate

Becky showed that the unique feature of this piece is a large type face. The instructions are straightforward and the word processor has most of the standard features (centers, underlines). It is fairly easy to write over the text--which some of us saw as a problem and others thought was an advantage.

4. Bank Street Writer

Susan Jo demonstrated this word processor, pointing out that the New Bank Street Writer no longer has two modes, one for writing and one for editing. There are <u>two</u> new Bank Street Writers, one for 64K machines, one for 128K machines.

5. Bank Street Speller

This piece is used in conjunction with Bank Street Writer, and allows the user to check on the spelling of a particular word, list all the times this word appears, and see these words in context to determine whether the spelling is correct. It also allows you to add words to the dictionary. Another important feature is that it provides suggested spellings of words like the one that has been misspelled. It allows you to get printouts of all the words you've used or of the misspellled words with their correct spelling.

After reviewing the software, we continued with a brief discussion of research that people are planning and undertaking. Susan Jo told about the project that Jinny Chalmers (Cambridge) is working on with Logo and an 1d student. Susan Jo and Jinny are taking turns observing the student to see what she does with Logo. After each session, they discuss their observations and tape record their discussion. This documentation is useful in figuring out next steps--things to try out with the student.

Arthur Wood (TERC) and Virginia Hutchison (Cambridge) also described a project that they are doing with a 7th grader who has problems spelling. Arthur is working with him to teach him how to use the computer to improve his writing. Virginia noticed that the student successfully used the computer to resequence his thoughts and to put his ideas in the appropriate order.

A general discussion ensued, with many people mentioning that when students see their writing in print it helps them recognize the problems in their writing. One teacher mentioned that a student had said to her, "When I can see it on the screen, my sentences are better." Another mentioned that students write "three times as much when they use a computer", compared with when they are writing by hand. One teacher said that she had good documentation of a student's original writing--and the fact that the student often refused to write--and that she could see a clear improvement once he started to use the computer. The issue about typing skills, and whether the inability to type made it difficult to benefit from word processors, was also discussed.

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: Tuesday, February 26, 1985, 4-6 p.m., at TERC

(Software and computers available: 3:30-4:00, 6:00-6:30)

Thanks to everyone who returned questionnaires. They were very helpful in planning this meeting and subsequent meetings. It's clear that different people are in the group for different reasons and that there is a variety of needs among us. It seems like we may need to structure some parts of our meetings in small groups, so that people can work with the ideas and content which most interests them. We'll report to you in more detail on the results of the questionnaires at the next meeting. In the meantime, here's the agenda.

4:00-4:15 Food, browsing, talking

4:15-4:45 Whole group meeting--announcements, reporting on questionnaires, new articles of interest, feedback from people who've borrowed software

4:45-5:45 Three small group meetings (choose one)

Evaluating software for special needs children--to discuss a way for us to get systematic feedback from people in the group who try out software and to eventually organize that information in a way that could be helpful to others (this can benefit us directly and can also later be used in the handbook)

Word processing activities and issues--to begin work on a section of the handbook which will deal with word processing: how to do it with special needs kids; what are the advantages, problems; what are issues to keep in mind (this group will meet in March also)

Trying out software--hands-on time for trying out software; someone will be available to help

5:45-6:00 Demonstration of the Koala Pad for anyone interested, informal time, borrowing software and articles

March meeting: Monday, March 25, 4-6 p.m.

1/30/85

Notes from 1/14 Meeting of Special Interest Group
Recorded by Jan Mokros

Announcements
Susan Jo began the meeting by reviewing recent software acquisitions and encouraging people to check out and use the software with their students. Becky reviewed several articles that might be of interest to the group--these also may be checked out. Susan Jo gave information about the Lesley Computer Conference (early May) and explained that our group would be making two presentations. Susan Jo also announced that she knew about four other special interest groups dealing with special needs individuals and computing, including. . .

- Boston Computer Society's newly formed group
- a group of teachers meeting at the Springfield Regional Center in western Mass.
- Mass CUE
- city of Boston special ed teachers

Discussion of Word Processing

Members of the group talked about how they were using word processing with their students, the benefits they had seen, and questions they had about possible outcomes. Below are some comments from this discussion.

- One teacher has collected writing samples from her students over a period of time, and has seen considerable development of sentence structure. She also noted that when using the computer, kids don't seem to mind making corrections.

- Another teacher particularly liked the fact that students were enthusiastic about writing when using the computer, and that kids maintained this enthusiasm over the summer--looked forward to writing.

- When students see the printed text (as opposed to their own handwriting), errors in punctuation, capitalization seem to become more apparent. (One teacher wondered whether this is because typing is not as automatic as writing. Students have to think more about each step. She also wondered whether a regular typewriter might have the same effect in this respect as would a word processor.)

- With the word processor, kids make the same types of errors and the same number of errors, but it's not as difficult to fix the errors.

- Kids may be getting the message that it's allright to make mistakes, that what matters is what you do to correct the mistakes.

Questions:
Are students more willing to correct their writing when using the computer than when writing by hand?

Do students catch more of their errors when using the computer?

Does the computer help the student improve his/her self-image as a writer? to take more responsibility for his/her writing? Are feelings about self as a writer different?
(One teacher suggested that kids have more confidence that their final product is going to be excellent)
Another teacher noted that there may be more of a sense of security, of "I know how to do this myself."

Does writing content improve when a word processor is used?

Do the mechanics improve?

Is there a tension between helping kids improve the mechanics vs. the content of their writing? Can a word processor be used to teach both things simultaneously?
(One teacher noted that kids like working on their own stories but are far less enthused about working on mechanics.)

What do students like best about using word processors? How do they think writing is different when using a word processor?

Other Comments

- One good thing about writing on computer is that it can be easily set up so that students work in pairs, and can talk about their work. One teacher finds that students do talk more about the content of their writing.

- Using word processors is labor intensive, from the teacher's perspective. One person said that she had two teachers working with three kids. Another mentioned that perhaps it was the added teacher attention that produced positive outcomes.

- Perhaps when using computers to do writing, teachers begin setting higher expectations for their students, and there is a self-fulfilling prophecy.

- One teacher asked about applications with kids who are moderately retarded. Can word processing improve their writing?

- Several people asked, "How do you know when a student's writing has improved? What are the criteria for judging?"

Summary

Many of the questions we asked related to kids' attitudes about writing, and how these were affected by using word processing software. (See above Questions) Some group members seem interested in starting to explore these questions. Jan, Becky, or Susan Jo will contact these people during the next month and encouraged other interested individuals to call them.

Next Meeting: Tues. Jan 26th. 4:00

Meeting after that: Monday, March 25th, 4:00

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: Monday, March 25, 1985, 4-6 p.m., at TERC

(Software and computers available: 3:30-4:00, 6:00-6:30)

Agenda

4:00-4:15 Food, browsing, talking

4:15-5:00 Small group meetings (choose one)

Word processing activities and issues--this group, which began at the February meeting, will meet again (notes from the previous meeting are enclosed) to continue its discussion

Software testing--this group will share information about software they have tried and think about how we can develop ways of sharing experiences, both within our own group and with a larger audience

5:00-5:30 How does "learner-centered" (non-drill-and-practice) software fit with IEP objectives? This will be the beginning of a discussion on this issue which we may want to continue in future meetings.

5:30 Demonstration of Special Net--an electronic bulletin board for special educators--for those interested. Also, time for browsing, borrowing software and articles. Those interested in participating in panel at Lesley Conference (see next page) will set a time to get together.

April meeting: Tuesday, April 23, 4-6 p.m.

May meeting: perhaps a joint meeting with several other special education and microcomputer special interest groups. A Saturday event?

Announcements

~~~~~~~~~~~~~~~~~~ The Lesley Computer [illegible] up on May 4. Our group has a slot [illegible] teachers to talk about "classroom-based [illegible] the use of microcomputers with [illegible] emotionally disturbed students. People [illegible] in participating will get together [illegible] March meeting and set a time to plan [illegible] meeting closes April 12 (no on-site [illegible] further information about the conference [illegible] Karen Gremley, or Nancy Roberts at 868-[illegible]

~~~~~~~~~~~~~~~~ Brief descriptions of [illegible] systems will be available at the March me[illegible]

~~~~~~~~~~~~~~~~ PLEASE bring back borrowed so[illegible] members of the group have access to it. [illegible] you can, of course, sign it out again.

~~~~~~~~~~~~~~~~ The Council for Excep[illegible] sponsoring a conference on software [illegible] evaluation for special needs students [illegible] Alexandria, Virginia. Deadline for reg[illegible] We just received information about this [illegible] know more before the March meeting.

~~~~~~~~~~~~ Interest in a Logo subgroup has [illegible] but too many of the interested people seem [illegible] involved in the word processing group. Per[illegible] start such a subgroup at the April meeting?
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Notes from software viewing group, 2/26/85 meeting:

People looked at the new Bank Street Writer and Speller, Kidwriter, Gapper, Rocky's Boots, and Storymaker. After viewing Kidwriter, one teacher borrowed it, saying it looked good for younger kids. Also several positive comments about Gapper. Rocky's Boots "takes a long time to get into," according to one teacher. Someone asked if there were any map skills or animal identification software available. Arthur Wood told her about forthcoming map skills software from D. C. Heath. Some people were interested in software not just for their classroom use but also because parents often ask about software to use at home with their learning disabled children. Nobody tried Terrapin Logo, Factory, Snooper Troops, or Gertrude's Puzzles, which were also available.

Notes from Word Processing Group, 2/26/85 meeting:

The word processing group met for 50 minutes at the SIG meeting on Feb 26th and produced an incredible number of good suggestions concerning material we should cover in the Handbook. Here's what we covered:

Word Processing Topics for the Handbook--and Content Suggestions

1. Acquainting Kids with Word Processing
What do kids need so they can get started quickly?
Good idea to give them a few necessary commands, then let them work with it themselves. Don't spend a lot of time at the beginning teaching all of the commands. As you work with word processors, you'll learn from each other.

A good idea for beginning: Have kids take turns, each writing one sentence on the machine. They could make a story this way, then take turns editing the story. Or, you could give each child a word, and ask her/him to include this word in the sentence.

2. The Typing Issue
Do kids have to have good typing skills in order to use the word processor successfully?
Group members didn't agree on the answer to this: One person said that kids quickly learned to hunt and peck, and weren't held back by lack of typing ability.

If typing is a problem, there are some ways a teacher can make it easier: 1) Teacher can type for the kid; 2) have a software typing tutor available; 3) have a typewriter in the classroom so kids can practice; 4) put a mimeographed copy of a typewriter keyboard on each child's desk, so kids can practice when they have a free moment.

Typing is really a systemwide problem: Schools need to deal with the issues of when, how, where to introduce typing.

3. Logistics
How do you handle different configurations of kids, computers, and software?

If you have only one computer. . .
What do kids do when it's not their turn on the computer?
How do you encourage turn-taking?

If you have many computers. . .

How do you handle [illegible] student questions/requests at once? What to do if no one [illegible] a problem.

4.The Nitty-Gritty
Things that can make it easier for the teacher. . .
1) each student should have her own disk.
2) disks should be kept in a storage box (kids leave them at school).
3) should be time at the end of each session for kids to save what they've written.
4) should be able to print out what you've done.

5.Special Issues with Special Needs Students
1) Students may have problems in quitting when they're supposed to. (Colin mentioned that "kids just don't believe it when you point to the clock and explain that their 15 minutes is up").
Solution: Put a timer on top of the computer,. when it rings, it's time for the next person.
2) Students may lack self-confidence, not feel confident they can explore more word processing applications.
Donna said she encouraged students to use the word processor for their homework in other courses, but they didn't quite feel confident enough to do it. She felt her learning disabled students were more dependent on her, on the structure of the class.
3) Students may have problems collaborating. Colin suggested the "pilot/copilot" arrangement. The pilot is in charge, gets to work on the machine, while the copilot can't interfere. (Let's get more detail on this.)

6.Mainstreaming Issues
What are the advantages/disadvantages of teaching wordprocessing to id kids in a mainstreamed setting?

Teachers in the group talked primarily about the disadvantages: Peer rejection is a primary concern. One teacher mentioned that her students do not like to work on any software that makes sounds (either positive or negative) in a mainstreamed group, because they don't want the other kids to know what they're doing. The privacy issue is important. One teacher commented that if she had to do word processing in a mainstreamed setting, she probably wouldn't do it.

7.Outcomes & Perceptions
What happens to kids writing when the use word processors?

Does it effect their perceptual skills?) What do kids think about word processors?

8.Software (too big to get into at our meeting)

9.How Teachers Learn about Word Processing
We talked about effective/ineffective ways to learn to use word processors. The group agreed that it is not a good idea to go through the manual page by page (too time consuming and not necessary). An effective way of learning is to sit down with another person, review and talk to each other about a few pieces of software. Use it awhile yourself, but don't be afraid of making mistakes from the kids. You can all learn from each other.

10.The word processor and approaches to teaching writing
We talked about two very different approaches used by teachers: 1) have kids write first copy on computer, do editing on computer, learn to compose while they're working on the machine. 2) have kids write out their piece first, then copy it onto the computer. Copying approach seems to be problematic in that kids often have perceptual problems, and the copying results in more errors. But it is an approach many people use.

We want to meet again next time to continue this discussion.

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: Monday, April 23, 1985, 4-6 p.m., at TERC

(Software and computers available: 3:30-4:00, 6:00-6:30)

Agenda

4:00-4:15 Food, browsing, talking

4:15-5:00 Keyboarding Skills

Joan Hamilton, language arts teacher and computer coordinator at a school in Bolton, Mass., will talk about keyboarding skills--when, what, for whom. She has done a great deal of thinking about this issue for the students in her school system and has previewed and evaluated much of the typing software (some of which she will demonstrate).

5:00-5:40 Small Groups (choose one)

How does "learner-centered" (non-drill-and-practice) software fit with IEP objectives? This will be the beginning of a discussion on this issue which we may want to continue in future meetings. At the last meeting, the software group noted that it is much more difficult to articulate goals for problem-solving software, such as simulations or programming, than for something like word processing, which more clearly fits with the usual curriculum goals. Once goals are stated--e.g., "improves critical thinking"--it is still unclear how to monitor students' progress in attaining such goals. Is it possible to use "problem-solving" software in the special needs student's curriculum? We will look at one or two specific pieces of software to help us think about this issue.

Logo use with special needs students. We will begin with sharing experiences, then move to a discussion of the problems and benefits of using Logo as a learning tool. This group can serve both as a forum for sharing experiences and as a nucleus for contributing to a section of the teacher handbook about Logo.

5:40 Demonstration of Special Net--an electronic bulletin board for special educators--for those interested. Also, time for browsing, borrowing software and articles.

May meeting: Monday, May 20, 4-6 p.m. (* Last meeting for this year *)

Notes from March Meeting of Software Group
Recorded by Becky Corwin and Susan Jo Russell

Discussion centered around ways of communicating about software, both in the group and to a broader audience. Topics included:

Evaluating software borrowed from the SNC-SIL

Currently we have no way of sharing information when SNC-SIG members borrow software. Becky's class at Lesley developed the attached form, which we thought we might use as a guide for getting feedback. It includes brief questions on content and use and gives space for some anecdotal material on how the software actually worked with a student.

Issues in software use

Time. It appears that one of the hardest things to assess is the amount of teacher time a piece of software will demand, both in learning how to use it and in setting up. While more interesting pieces of software may require more teacher time, it is important for teachers to have a realistic view of these requirements. Another time-related issue is how long a period of time is needed for students to have an adequate experience with a particular piece of software. Since problem-solving or simulation software often requires extended periods of time, decisons to use such software have real scheduling and educational priority implications.

Reading and Directions. There was a great deal of discussion about where in a piece of software the directions should be and how extensive they should be. Some teachers found that they wanted students to be able to engage with the substance of the program quickly without going through a lot of written directions. Others wanted tutorials available as an option; there was a strong feeling that a sample run of the program should be available to both students and teachers to give them a sense of how the program operates, what it does. Some people liked the idea of "help screens" available at any time during the program and keyed to the kind of help a user would be likely to want at that point in the program. Reading level and amount of reading required are real issues for students with reading problems; it would be good to be able for the teacher to vary the reading level and/or the amount of directions presented at once.

Learning objectives. We talked about the problem that it's hard to know what some software is about when no objectives are given in the accompanying material. An even more serious issue that was raised was that objectives that

are stated are often misleading or vague. One teacher mentioned that for some programs which claim to "teach problem solving skills," it would be more accurate to say that they "encourage use of problem-solving skills." This led to a discussion of how we can articulate objectives for problem-solving software which are meaningful and which allow us to monitor progress. Sandy volunteered to bring in a piece of software she has been using with her students (Moptown) so we could use it as an example to help us think about this issue of formulating appropriate objectives.

SOFTWARE EVALUATION
SPECIAL NEEDS

Name of software:
Publisher:
Publisher's address:
Price: Catalog?:

Hardware required (Apple? IBM? other?): Memory:
Any peripherals needed (joystick, 2 drives):

Type of software (simulation, game):
Content:

Relation to the curriculum:

Necessary skills:

Visual appearance:
Reliance on reading (approximate reading level?):

Control, flexibility:
Pacing:
Demands on teacher time:

What type of student need does this software address?:

Do you recommend it?:

Do you have reservations?:

Reviewer's name: Address:
Phone:

Data on work with a student:

April 5, 1985

Notes from March Meeting of Word Processing Group
Recorded by Jan Mokros

The word processing group continued its discussion, focusing on the educational goals we are trying to accomplish with the aid of word processing and on the outcomes we have observed. Logistics of implementing word processing were also discussed. Finally, we talked about how word processing activities can be justified in terms of overall learning goals.

Logistics

The major problem here is finding the time for students to work on the computer. In many cases, it is impossible to have students use the computer for their first draft, so they may need to write it out first. Or, they could dictate it to the teacher (aid) while she types it in. This eliminates the frustration of having to produce a carefully-written first draft; a task which is sometimes beyond the capabilities of the students.

Overcoming Reading Difficulties

Some people felt that it was important for kids to have fairly good reading skills before they began using the word processor. Others felt that the word processor could be used as a tool in teaching reading. Betty suggested that by having kids type in the story while she dictates, you could help them improve their perceptual and letter recognition skills.

Outcomes

We reiterated the kinds of outcomes we've observed in students who have been using the word processor, and got some first hand examples of stories that Betty's students had written on the word processor. Outcomes we discussed include:

1) increased interest, motivation.
2) pride of ownership, delight in being a writer.
3) carryover into handwritten work--students often enjoy writing more, even when they can't use word processor.
4) but, in many cases, an outcome is that students get hooked on the word processor and want to use it whenever they can.
5) greater willingness to make corrections. enjoyment of making corrections.
6) becoming better proofreaders--but maybe only if you print out their work. One person said that her 4th graders were willing to go through their work several times, each time focusing on catching a parti-

cular kind of error.

Justification

The consensus was that since the word processor is a tool which is easy to incorporate into many subject areas, it is not difficult to justify its use. The advantages of word processing, compared to other computer applications are that 1) you have a convincing product (better writing) to show some effects; and 2) you are clearly working at teaching a basic skill. There's no need to convince teachers, and administrators are usually fairly quick to see the need for this. Typically, word processing fits in with many existing IEP goals for each child.

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: Monday, May 20, 1985, 4-6 p.m., at TERC

(Software and computers available: 3:30-4:00, 6:00-6:30)

Agenda

4:00-4:15 Food, browsing, talking

4:15-4:45 Demonstration of SpecialNet, an electronic bulletin board with information about conferences, assessment, management systems, sharing ideas about software and special needs in general. (We tried at the last meeting at 5:30, but found that the lines are tied up by then, so we're trying earlier this time.)

4:45-5:15 Small groups (choose one)

Demonstration of GAPPER, an interactive reading comprehension program which uses the cloze procedure, focuses on main ideas, allows teachers to enter their own text, and appears to have particular utility with special needs students.

Logo use with special needs students. The Logo group which met at the April meeting hopes to plan some joint classroom investigations for next year. Others are welcome to join us as we continue thinking about what we are doing and hope to do with Logo.

5:15-6:00 Summing Up and Planning for Next Year

We'll share the results of the recent TERC national survey of software use by special educators as a context for this group's planning for the future. What would you like to plan for next year? Can we form a planning group which would meet a couple of times before next fall? Are there people who would like to participate in formulating portions of the handbook during the summer? (We could consider starting chapters on word processing, matching IEP objectives to software, Logo.)

RETURN SOFTWARE

PLEASE PLEASE PLEASE PLEASE PLEASE

(So we can set up the lending library for the summer)

Notes from Joan Hamilton's talk on Keyboarding

April 23, 1985

Joan Hamilton, from the Bolton Schools, gave a presentation on her thinking about keyboarding skills. Joan is a language arts teacher and coordinates computer education at her school. Joan feels that there are two extreme positions about keyboarding skills: 1) students must learn keyboarding before they use the computer, and 2) students will just pick up keyboard skills; don't worry about it. She thinks that neither extreme is necessary, but that keyboarding awareness from the very beginning of working with the computer is helpful. Joan described what she does with students at different age levels and showed some of the software that is available to help teach typing. She also recommended some print materials.

The initial objectives of Joan's approach are to get students to:

. keep both hands on the keyboard

. use the right hand for keys on the right side of the keyboard and the left hand for keys on the left

. avoid 2-finger typing

Joan asks her students to spend part of their computer time on keyboarding. They sign a list showing what typing activities they have done; this record-keeping has worked well for her.

Some extra copies of Joan's handout, which includes an annotated list of typing software and several lesson plans, will be available at the May meeting.

Notes from the Logo Small-group Meeting

April 23, 1985

The teachers in the Logo group shared what they have been doing with their students and what materials they have found to be helpful. Themes which came up during the discussion included:

. some students' reluctance to explore, preferring activities with a definite goal that is more immediately satisfying

. lack of time: finding ways in school to spend time on a long-term problem; kids aren't used to going back to a problem and continuing to work on it

. integration of Logo with other curriculum areas, especially writing which came out of Logo activity; one teacher has developed a unit on architecture related to the Logo drawings of her learning disabled students

. the need to have <u>interesting</u> curriculum for special needs students

. parent and administrator reactions to the students' interest (in this case, positive)

. older kids feeling that they've "done enough" with Logo because they don't think it's as sophisticated as, for instance, BASIC

. the chance to see students' spatial ability

. do we need to justify use of Logo? if so, how?

The group is interested in undertaking some joint classroom investigation next year. Others are welcome to join us.

Notes from the Software Objectives Small-Group Meeting

One of the groups wanted to look at software objectives and how they related to IEP objectives. We know that one of the reasons that problem-solving software isn't more wodely used in special education may be that the objectives don't match up with those recommended on the IEP -- at least not obviously. Sandy from Reading, presented two pieces of software which she uses with her special needs students, and which they enjoy using.

Sandy decided which to use by first looking at students' IEP needs. She then grouped them by the types of needs, and matched software to those needs. This procedure has been very successful, since the students really do enjoy working with the ones she selected. She shared two with us:

-- Moptown Hotel, by Learning Company

In this software children sort animals by four attributes: height, color, girth, and type. The games involve sorting and classifying, and a great deal of logical reasoning. These activities are designed for grades two and up, and there is a simpler disc, for younger children, called "Moptown Parade".

After looking at the games, the group determined that they involved five areas often mentioned in IEP plans: visual discrimination, planning, problem-solving, logical thinking, and reasoning. This makes them appropriate for many students.

-- Bumble Games, by Learning Company

This is the first of a set of two discs (the second is called "Bumble Plot") which have games about coordinate graphing. They start very simple, using number line locations, but graduate to plotting points using signed numbers. It has the advantage of using very little text, so children don't feel overwhelmed when they look at the screen.

Skills involved included directionality, sequencing, and planning. There are, of course, also the math skills of signed numbers and plotting points, often included in curriculum from the third grade up.

It seems to us that once a teacher takes the time to look hard at a piece of softwa , and to think about what that software does, that there's a good deal in the problem-solving software which does indeed match the IEP objectives. There ought, however, to be more of those objectives included in the writeups of the software. Perhaps that is something our special interest group can begin to do, in the handbook.

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: Monday, September 30, 1985, 4-6 p.m., at TERC

(Software and computers available: 3:30-4:00, 6:00-6:30)

Notes

MAY MEETING SUMMARY

At the May meeting, one group previewed the HRM program, Gapper, while another group focused on use of Logo with their students. We'll send out more complete summaries of these two groups later in the summer.

LOGO RESEARCH

The Logo group is planning to meet once during the summer to plan some classroom-based research for next year. We are interested in gathering some case study material as well as some specific data on what learning is taking place. We will be having a meeting (supper provided) on Tuesday, July 9 from 4-7 p.m. at TERC. If you are interested in participating in this project, you are welcome to join us (but let Susan Jo know so she can arrange supper).

SNC-SIG PLANNING GROUP

Several people volunteered to become part of a planning group to plan for next year. We will also try to meet once during the summer, but no date has yet been set. We'll call people who volunteered (Betty Church, Kristin Eichlear, Donna Linn, Joan Thormann, Becky Corwin, Susan Jo Russell) at the beginning of July to set up a meeting time. If we don't have a number where you can be reached during the summer, please call TERC and leave it for Susan Jo. Anyone else want to join us? Please call.

THINGS PEOPLE LIKED ABOUT THIS YEAR'S ACTIVITIES

--notes from the meetings

--borrowing and previewing software

--hearing how people use things in their classrooms

--learning about new areas

THINGS PEOPLE ARE INTERESTED IN FOR NEXT YEAR

--using data bases with students

--tying problem-solving software into IEP objectives; articulating general problem-solving goals which could be applied in many areas

--clarifying what skills are being developed and how with various kinds of software

--learning about authoring systems

--access to programming expertise (we probably have this among us--it's a matter of identifying people)

--more systematic feedback from small groups

[If you have other interests/ideas, get them to Susan Jo so the planning group can consider them.]

NEXT YEAR'S MEETINGS

The consensus is that we keep meeting on each Monday and that we make it a regular Monday, probably the last Monday of the month. Our first meeting in the fall will be on Monday, September 30. You'll get a mailing with the agenda early in the fall.

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: Monday, September 30, 1985: 4-6 PM, at TERC (1696 Massachusetts Avenue, Cambridge)

(Software and computers available: 3:30-4:00, 6:00-6:30)

Agenda

4:00-4:15 Food, browsing, talking

4:15-4:45 Introductions, brief overview of the project. We want to spend some time orienting everyone to the handbook, which will be written this year (in fact, we've begun a sample chapter). This is the "product" for the group, sharing all of your expertise with others, and now it's coming closer to a reality. We'll share the outline of the book with the group, and discuss how everyone is involved and can become more so.
There's also a report from the people who worked on the planning this summer, and some other odds and ends.

4:45-5:15 Database demonstration:

Databases have tremendous potential in all areas of education. They can be used for children to store their own information, to retrieve it, and to change it over time. This is the kind of application which truly fits into many types of classrooms and can be used at many grade levels for a wide variety of purposes. We'll have a demonstration of database use with children, and this will provide many stimulating ideas and possibilities for using them with your students.

5:15-5:45 There will be two smaller group meetings:

The Logo group, which has met over the summer, is pursuing some exciting goals and sharing some very interesting work. They'll meet for this time to catch up with each other and to share their recent findings.

A database group will form after the formal presentation. We'll have some database software available for people to try out, and the group will have time to continue the discussion with the presenters, asking questions, generating ideas, and developing some ideas worth trying out with children.

5:45-6:00 We have some new software and some new procedures for signing it out. We'll announce those at this time.

At this meeting, too, we'll want your ideas about software we ought to purchase for the group to borrow, and will be asking for people who want to be on a planning group to plan some more of the meeting topics for the year. If you're interested, be sure to let us know!!

Welcome back after your summer time!!!

Feel free to bring a colleague....

NOTES FROM LOGO GROUP

1. May meeting of BNC-SIG (5/20/85)

This was the second meeting of the Logo subgroup. We had decided to talk about the possibilities of a joint (cross-school) project for the fall of 1985. Some of the time was spent in describing what students were doing with Logo; Betty talked about her architecture project and her plans to use some of the new Microworlds materials in the fall (one program which combines animated "puppets" on the screen and a voice synthesizer so that children can develop and enact plays; a second program combines Legos with Logo, allowing kids to build and animate constructions made with Lego--really!). Some time was spent mentioning resources; resources cited included the DLM book for special education students; Dan Watt's book, Learning with Logo (there is also a new one called Teaching with Logo); Louisa Birch's Logo curriculum for young children, published by **; and Glen Bull's work with Logo and voice synthesizer (SJ now has copies of his materials). Then we talked about issues and topics we are interested in pursuing. We focused largely on learning disabled students; issues mentioned included reading problems (poor comprehension and vocabulary), visual-motor integration, directionality, and numerical relationships (what numbers are in-between other numbers?). In planning classroom investigations, the group thought it was important to define learning objectives clearly, to choose some that are measurable, and to use some simple pre-post measures. We also talked about the fact that there is so much variation within the learning disabled population, so that it will be important to look at individual differences, not just group progress.

2. Jul. meeting of Logo group (7/9/85)

We met for two hours to plan for the fall classroom investigations. We spent time describing the learning and emotional characteristics of students with whom each of us will be working in the fall, what we consider the most important issues to be for them, how use of Logo might bear on these issues, and what questions we are most interested in asking about their use of Logo.

The conversation was wide-ranging. Here is an attempt to summarize what we felt were the areas we were most interested in pursuing:

1. Verbal skills: when students work in pairs, what is the quality of their interactions? what is the quantity and quality of their questions? how much do they talk about the content of what they are doing, how much about procedures?

2. Emotional growth: Teachers felt that while kids use Logo they express things they don't express elsewhere, that emotions are closer to the surface. Students make comments about their own abilities, about frustration and success. In what way is their time with Logo different from other times during the school day in terms of what they will express about themselves? How does this appear to affect their learning? Does self-confidence improve?

3. Perceptual skills: Does Logo help students improve spatial skills like visual-motor integration? What kinds of Logo-based visual models can be developed to help students understand concepts in mathematics?

4. Problem solving and metacognition (the process of thinking about one's own thinking): Does working with Logo help students develop the ability to stick to a long-term problem, including making mistakes and getting through frustrating periods? What strategies do students develop to solve Logo problems? How do students think and communicate about their own problem solving? For instance, can they (or do they develope the ability to) determine when they're ready to go on to the next step, think about what they need to solve a problem, say what they know and what they don't know, determine what's too hard and what's within their grasp?

5. School system issues: What makes the difference in schools accepting the use of Logo with special education students? What are the skills that teachers need to help convince other people? What factors enable administrators, teachers to try something new?

Obviously, we have many interesting questions and limited time and energy! At our first meeting in the fall, we will begin to select from this list according what we're most interested in and to what seems practical to pursue in a meaningful way. Before the September meeting, Susan Jo will talk with Jan about how to best design classroom investigations around one or more of these questions and will report to the group at the first SNC-SIG meeting. As far as we know, Temple, Betty, Marty, and Louise have expressed interest in pursuing this project next year. Susan Jo and/or a student from the Lesley practicum will be available to do classroom observations. Jan will be helping us with methodology. Others are welcome to join us at the first SNC-SIG meeting on September 30th. See you there!

Notes on the GAPPER demonstration, May 20, 1985:

GAPPER is an interactive reading comprehensio program developed for older students (grade 4-6 was the original prime target) by Human Resources Media (HRM). We looked at the five parts of the program: 1) You can choose to see the comprehension questions before you read the selection. This serves to orient the student to the kinds of information they should look for. 2) Students read the selection. Their reading time is scored. 3) Students answer the comprehension questions. Their score here earns them points, which are entered and displayed on a scorecard. 4) A cloze procedure drops out words, which the student is asked to supply. By this time, they've read the selection twice. 5) The last step drops out all of the letters, leaving asterisks in their places. Students supply the words, and they build back the seletion. Many kids like like its game-like characteristics, building scores and trying to outdo themselves; others like to work without scores being kept. Teachers can get access to scores and can adjust all sorts of parameters of the tasks.

GAPPER's Anthology comes with four selections at each of the middle grade levels (grades 4-6). Each selection stresses a particular reading skill. You can also enter your own text, so that it can be used at lower grade levels and with students whose effective reading level is less than four years. It has a good deal of potential for remedial work, since it maintains some of the characteristics of a good reading environment: words are kept in context, meaning is always important, and prediction and self-correction are encouraged. We have a copy to loan out. In fact, we are eager to get feedback from you about its use.

Notes from the SNC-SIG Planning Meeting

August 21, 1985

Present: Betty Church, Joan Thormann, Becky Corwin and Peggy Kapisovsky.

We discussed the following agenda items:

Topics/Ideas for Future Meetings

- Databases. This will be the focus of our September meeting. Becky will arrange the presentation and try to involve staff from the School of the Future (Cambridge), which is using databases in interesting and effective ways. We would like to start a databases small group - members can borrow software from the SIG library and report back to the group on how they used the database, how well it worked, etc. One question which arose within our planning group: At what age to start using databases?

- Problem-solving software (possibly for the October meeting). We'll have a demonstration of specific software and then discuss objectives -relating software to IEP objectives. Also, how does the software fit into the curriculum and what skills can be developed. We'll try to start a small group on problem-solving.

- Leggo Logo demonstration. Steve Ocko and Mitch Resnick, who have developed a way to use Logo to creat Leggo constructions, will give us a demonstration, tentatively scheduled by Betty for November.

- "Bring a friend" day. We'll ask members to invite their administrator to a specific meeting and a regular class teacher to another meeting. At each meeting we'll have a presentation relevant to that particular group. Possible topics for the administrator meeting: administrative decision-making, organizational structure around computers, increasing beyond drill and practice software in the classroom, Specialnet demonstration. For regular teacher meeting: mainstreaming models, regular-sped teacher communication/cooperation around computers.

- Parents as computer volunteers. Betty will ask her parent volunteers if they would like to speak at a meeting. She's willing to talk about how she got started, how it's working, training, etc.

- Authoring languages. We decided we needed to do more background research before planning a presentation.

- Sylvia Weir. Perhaps invite her to talk about the resource center she is starting for parents and special needs kids.

- To encourage sharing of information and expertise, at the end of every meeting give people a chance to ask questions on needed programming assistance or on any other topic. Hopefully people will be able to connect with someone who can help. Also, we will distribute a list of

members with phone numbers to facilitate exchanges. Also, we would like to solicit members' interests, expertise, etc. and circulate an annotated list.

Membership

We talked about whether to try to increase membership and felt that if the roup were to become too large, it would be harder to get to know each other and exchange ideas/assistance. So we won't make a big push to increase membership at this time, but new members are always welcome.

To try to increase the diversity of the group, we thought of "Bring a Friend" day. We'll ask members to invite a specific type of person such as their sped administrator or a regular class teacher with whom they are working and then have a pertinent presentation (see discussion above). Hopefully, some of the guests will want to become members.

Handbook

We'll describe the handbook and distribute outlines at the September meeting, as well as let members know where we have info gaps. We'll distribute a list of areas where we need members' input and, if interested in participating, a member can check off the areas and how they would like to present the information to us - verbal, written or taped.

The Planning group will meet once or twice again during the year. If you're interested in joining us, please tell Becky or Peggy.

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: Monday, October 28, 1985, 4-6 P.M., at TERC
1696 Massachusetts Avenue, Cambridge
547-0430

(Software and computers available:
3:30-4:00, 6:00-6:30)

Agenda

4:00-4:15 Food, browsing, talking

4:15-4:45 Software previewing. There will be an opportunity to preview the software we've recently bought for the SIG library and to get your ideas for other software we should buy. We will set a meeting date for the planning group, which plans meeting topics for the year; additional members of the group are needed. Announcements will be made at this time too.

4:45-6:00 There will be three subgroup meetings:

The Logo group is an ongoing group which is beginning classroom investigations on using Logo with special needs students.

The Database group began at the September meeting after a presentation on using databases with students. A few members borrowed databases to introduce in their classrooms during the month, and they will share their experiences. The group will decide how it wants to proceed - trying out databases, generating ideas, discussing applications, etc.

The Handbook group will meet for the first time. At the September meeting Susan Jo Russell presented an overview of the handbook the Project is writing for teachers on the use of Learner-Centered software with learning disabled and emotionally handicapped students. We are seeking members to contribute to the Handbook by using and reporting on (in written or verbal form) specific pieces of software. At the present time we are interested in the following titles: Crossword Magic, Explorer Metros, Power Drill, Gapper, Puzzler, and Bumble Plot. During the meeting we will preview the software and discuss how we might want to use it with a group of students. If you are interested in contributing and are also interested in one of the other groups, don't worry - we want you too. Just see Peggy Kapisovsky at the meeting.

Notes from Special Interest Group meeting, September 30, 1985

At this first meeting of the year we welcomed several new members and were pleased to see the familiar faces of our "regulars". Susan Jo Russell gave an overview of the Micros and Special Needs Project (which the SIG is part of) and briefly explained the handbook which we will write during this year. The handbook will assist teachers in using Learner-Centered software, such as word processing, problem solving, Logo, and tools, with learning disabled and emotionally handicapped students, grades K-8. We are seeking SIG members who would like to contribute by using and reporting on specific software. (Contact Peggy Kapisovsky at TERC.)

As part of the Project we conducted a nationwide survey of microcomputer use with special needs students. Copies of the survey report were distributed and will also be available at the October meeting.

Evelyn Woldman, former elementary computer coordinator in the Holliston Public Schools, gave an informative and enthusiastic presentation on using databases in the classroom. This was a good introduction for members, none of whom had used databases. A database is a system to structure, store, and retrieve information. There are several terms to be familiar with: file, field, record, and data. All database software should allow sorting (usually alphabetically) and searching (by topic, key word, etc.); otherwise, it is of little value in the classroom.

Once an overall subject (the file) is selected for study, it is important that the students generate the fields (the categories to research). Let them brainstorm on what they want to know about the subject. Then each student will do research on one particular person, item, etc.(the record). For example, if you are studying states, each child will research one state. After the research is done, each child inputs her/his information (the data) on the same disk.

Evelyn has used databases successfully with students as young as first grade (including some mainstreamed special needs students) by limiting the number of fields to be researched. With young children she uses worksheets (in the same form as on the computer screen), and the students write in their info on the sheet before inputting into the computer.

After all the data is in the computer, then what? Don't stop now! This is the exciting part! There are myriad activities to try. The students can create stories, riddles, puzzles, math problems. They can use the data as a starting point for writing reports, biographies, etc. (especially good for students who have trouble beginning to write).

Databases can help develop skills in selection of key words and main ideas; classification; organization; and outlining.

A few extra copies of the handouts - three articles and a brief overview - will be available at the October meeting.

Notes from the two subgroups - Logo and databases - are presented below.

Notes from the Database group meeting, September 30, 1985

Evelyn Woldman continued to discuss databases with the group. She demonstrated Bank St. Filer, which particularly interested several people because of their familiarity with Bank St. Writer. We discussed how teachers, especially resource room teachers, might use databases and the logistics of getting all the data on one disk (in settings with limited computer time). It was suggested that this might provide an opportunity for the resource room teacher and the regular classroom teacher to work cooperatively in planning and implementing a database activity. If there's a computer in the resource room, all students could come from the regular class to input their data. We also wondered what, if any, problems LD students might encounter in using databases (e.g., organizing the data?) but decided that members should try out the activity first.

Because so little is known about using databases with special needs students, we're hoping that many of you will contribute to the knowledge base. We now own 5 database programs and are collecting information/articles on their use. Please try out the programs, think about the skills your students are developing, and share the information with your colleagues at forthcoming meetings.

Notes from the Logo group meeting, September 30, 1985

We are beginning a classroom investigation focused on students' verbal skills while engaged in using Logo. We are interested in observing, recording, and analyzing the conversations of students working in pairs to solve Logo problems. Eventually we may also compare the verbal interactions of students in this setting with their interactions in other settings. Some issues we may consider include:

--How much of the time are students talking about the task? How much conversation is off-task?

--What kinds of questions are being verbalized?

--What reasoning skills are being used?

--How do students with different learning styles and problems contribute to the interaction?

This month we are doing preliminary observations of several pairs of students to help us more clearly formulate the questions we will pursue. Bring your observations to the October meeting.

New participants interested in this project are welcome, too.

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: Monday, November 25, 1985, 4-6 P.M., at TERC
1696 Massachusetts Avenue, Cambridge
547-0430

Agenda

4:00-4:15 Food, browsing, talking

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4:15-5:30 ** Lego/Logo Demonstration ** Steve Ocko and Mitch Resnick from Microworlds Learning, Inc. will give us a special preview of Lego/Logo -- a system which allows children to build Lego constructions (toaster, windmill, truck, etc.) and then write Logo programs to move their machines. The speakers will show a videotape of students using Lego/Logo and demonstrate samples of machines made by 4th graders at the Henrigen School in Boston. SIG member Betty Church is field testing Lego/Logo with her LD students in Stoneham and will present her observations. We'll also talk about the kinds of learning that may be taking place. And--there will be a chance for you to try out Lego/Logo!

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5:30-6:00 There will be short meetings of the three subgroups: Logo, databases, and handbook. See group minutes for details. New members are welcome at these group meetings.

Notes from Special Interest Group meeting, October 28, 1985

This month's meeting was planned so that we would spend most of the time in our three small groups, allowing for lengthier discussion than usual. So there's not much to report.

We have added a number of new titles to the SIG software library, including: Crossword Magic, Jenny's Journey, Number Quest, Power Metrics, Power Drill, Print Shop, Quations, and Puzzler. We encourage everyone to borrow the software and try it out with their students. But please return software at the next meeting in case someone else would like to try it out. If not, you're certainly welcome to borrow it again.

Donna Simone reported on a recent Council for Exceptional Children meeting she attended as a representative to a CEC project on special education and technology. The CEC project is currently gathering information on promising computer practices. Among the issues of concern to the project are less access of computers to special needs students and state level plans for implementing computers and other technologies in special education.

Congratulations to Shrewsbury High School - and SIG members Donna Simone and Mickey Brandsmeyer - for the award by Apple Foundation of 44 computers for special needs students!

Notes from the Logo group meeting, October 28, 1985

The Logo group members shared their preliminary observations of students' verbal interactions while working with Logo. We are in the process of developing a category structure to help us more accurately describe these interactions, and we will be continuing this study during the next few months. We are still interested in adding one or two more classroom sites to the study. Let Susan Jo Russell at TERC know if you are interested.

Notes from the Handbook group meeting

Members of this group will contribute to the handbook by using and reporting on specific pieces of software. We previewed the following software: Crossword Magic, Bumble Games/Plot, Fractions, Power Drill, and Jenny's Journey. Members will try out the software with their students.

Notes from the database group meeting

The group met to generate ideas and questions about using databases. Sue Turner used them last year and she shared many of her experiences, describing off-computer as well as on-computer activities she used. Many of the group's questions revolved around how to approach databases initially -- making them more concrete at first, teaching for transfer to other databases, what conceptual development databases foster or require. The group saw using databases as a promising way of integrating special needs students into the mainstream classroom. At the next meeting people will have tried some databases and will address the question of how and what students are learning, looking at skills and relating them to ed plans.

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MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: WEDNESDAY, NOVEMBER 19,1986, 4-6 P.M. at
Technical Education Research Centers
1696 Massachusetts Avenue, Cambridge, MA 02139
547-0430

AGENDA

4:00-5:30 EXPLORE-A-STORY AND EXPLORE-A-SCIENCE. An opportunity to preview brand-new language-based software. HENRY OLDS of Learning Ways in Cambridge (and Senior Advisor to Classroom Computer Learning magazine) will demonstrate and discuss his soon-to-be-released interactive programs. Each EXPLORE-A-STORY package (for grades K-4) comes complete with a storybook that children read with their teacher before venturing to the computer, where the story is depicted graphically. Here children can create new characters, endings -- or an entirely new story. As for EXPLORE-A-SCIENCE, one of the programs is the Dino Construction Kit, a simulated dig for a tyrannosaurus rex skeleton. Need I say more?

Note: We'll begin right at 4 o'clock, since Henry Olds has to leave at 5:30.

5:30-6:00 Now we'll do the eating and meeting that we usually do at the beginning. Also a chance to borrow software and share your experiences with the software you've recently used. Have you found a terrific program for your 3rd grade readers? Let others in the group know about it.

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Notes on the Talking Textwriter session, October23

Talking Text Writer (Scholastic) is a sophisticated word processor which allows students to write with auditory input from the Echo speech synthesizer. It comes with three discs: a disc for writing, one for reading, and one for teacher/utility use. Students boot the machine with the write disc and are given a number of choices: Type can be set for 20-, 40-, or 80-column print, and the Echo can be set to read every letter as the student types, every word, or only upon request.

This has been the exciting feature of the program: students can control the kind and amount of auditory input from the Echo. Many of the young learning disabled students who used it have shown tremendous variation in their preferences for input styles, and they have also shown significant gains in their reading scores.

However, because the Echo will pronounce phonetically, it is liable to mispronounce words as well. In order to alleviate this problem, the Text Writer can be programmed to allow a phonetic pronunciation to be inserted under the word. Thus, although a student will see "really", rather than to hear 're-all-y", s/he will hear "reely". This is a wonderful source of learning about the deviations from our phonetic rules, and an excellent way for students to take comfortable control of their own writing. Instead of their invented spellings having to be erased and corrected, they can get appropriate results in many cases by imbedding the invented spelling as the phonetic spelling, and finding the formal ones from other sources when it's appropriate.

Another wonderful option is the definition option. The teacher or the student can imbed definitions in the text so that unfamiliar words can be explained as they are encountered. This can mean a great deal to a student who is struggling to read an assignment which uses difficult words. Those can be noted by the teacher, and the definition sought when needed without interrupting the work at hand. This definition function works well for the writer, too--students who are writing fantasy stories can define made-up words in the context of the space fantasy.

Perhaps the theme of this software is control. The learner is in control of the way the Text Writer works, can control the content of her work, and is in control of many extra features such as pronunciation and definitions. The possibilities are exciting, and the grade level range is enormous because of the added flexibility of the speech synthesizer.

The consensus of the group seemed to be that the writing feature was important but that the reading capability of the program was limited. One could not imagine turning to the Echo to read one a story--unless you or someone you knew had written it and you wanted to decode it right then and there. On the whole, that aspect of the program was of more limited utility. The writer seemed to be considered potentially very useful and effective.

We'll be purchasing both the Echo and the Talking Text Writer from Scholastic for the SIG software collection, so members will be able to try it out on their own.

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: TUESDAY, JUNE 17, 1986, 5-7 P.M. at
Technical Education Research Centers
1696 Massachusetts Avenue, Cambridge, MA 02139
547-0430

AGENDA

This will be a special end-of-the-year supper meeting to celebrate two years of the Special Needs and Micros Special Interest Group! There will not be a formal agenda - we'll talk informally about the year and about ideas for next year. Bring your ideas, including ones about securing funds for continuing the SIG. Bring your appetites too, because we're planning supper. That's why the meeting will begin at 5 o'clock.

We'll provide a deli-style supper and drinks. Please bring dessert or salad to share with a few people. (Incidentally, in case you're in a rush, there are a few stores near TERC - All You Knead and The Black Forest - where you'll be able to find something tasty.)

See you on the 17th!

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SOFTWARE. Please remember to return software on June 17th. If you're unable to come then, you can drop it by at TERC or mail it. If you do either, direct it to the attention of Peggy Kapisovsky. Thanks.

We asked administrators to bring the administrative point of view into the meetings, and the participants in the panel discussion were:

Alex Alexanian, Director of Special Needs, Reading
Frank Gagliardi, Director of Special Needs, Stoneham
Thomas Latus, Principal, Walker School, Needham
Donna Simone, Coordinator of Special Needs, Shrewsbury

Each of the participants presented information about what his or her school or system was doing and talked for a bit about what they planned to do to support teachers, facilitate their growth in knowledge about computer use with students, and the possibilities of using computers in developing curriculum.

In Reading, Alex Alexanian reported that the principal is trhe key to the curriculum in each school, and that the computers have entered the school through the principals. There was a common learning experience (an orientation workshop) for all, and the principals were those who fielded the requests and made recommendations for priorities (including special needs). He recommended that people 1) Define their local situation (who makes recommendations? What is the procedure?); 2) Develop and support those important cases which will bolster and demonstrate the need for computers, and 3) explore many possibilities on the grassroots level.

In Stoneham, Frank Gagliardi reported that the special needs director is directly in charge of all special needs budgets. Through extra funding (state, national, some other sources) he has been able to get a computer for each resource room and self-contained classroom. Town-wide committees made decisions, and all administrators were sent to a MEC workshop before computers were introduced to the staff. The administrators in this system are generally computer users who disseminate information. The challenges facing Stoneham now include upgrading computers, getting enough software, and time.

At the Walker School, Tom Latus sees the overall goal of fostering research and study of kids' uses of the computers. Recently Walker has gone from sharing computers among classrooms to having a computer in each classroom, and this has put more pressure on the teachers to look at a number of options for their uses. Walker has used the word processor as part of a highly developed writing program and Tom is interested in the fact that some problems (expressive language, spelling, others) seem to show up less often on

the computer than in "regular" paper and pencil writing. He stressed issues of control, and is interested in locus of control issues with these students and their interaction with the computer.

In Shrewsbury, Donna Simone works in a computer-saturated environment, because Apple has donated computers to the school. She has seen the computer coordinator advocating the uses of the computer with special needs students, and sees developing ongoing support systems as one of the most important elements in successful computer integration. Ideally a team meets on a day-to-day basis to include previewing software, looking at both regular and special education teaching techniques, and planning ways to help train some of the regular teachers with computers. Donna described Shrewsbury's generic model, in which each of the special needs teachers also teaches in a mainstreamed setting some of the time. She reminded everyone that the key issue is finding the time to plan ahead/organize instructional delivery.

Themes emerging from the discussion included: 1) trusting the grassroots is a good place to start; 2) supporting teachers is viewed somewhat differently in each system or school; 3) teachers must be willing to learn along with the students and not feel compelled to be experts in all fields; 4) teachers need to see gains for themselves in using the computer, not only for their students.

The meeting was extremely thought-provoking and helpful, particularly for those who are planning further work in their own systems. The processes and the plans for the future were different in each of the schools or systems, and the work which has been done is very exciting.

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: TUESDAY MAY 27, 1986, 4-6 P.M. at
Technical Education Research Centers
1696 Massachusetts Avenue, Cambridge, MA 02139
547-0430

AGENDA

4:00-4:15 Meeting, eating, greeting

4:15-4:30 Announcements of new software and other items of interest

4:30-6:00 "BRING YOUR ADMINISTRATOR" MEETING. This month's meeting will feature several local administrators who will discuss their system's approach to integrating computers into special education, key issues and problems that have arisen, the relationship between special education and regular education with regard to technology, and the administrator's role in computer implementation in special education. Our panel will be:

DR. ALEX ALEXANIAN
Director of Special Education
Reading Public Schools

DR. FRANK GAGLIARDI
Director of Special Education
Stoneham Public Schools

THOMAS LATUS
Principal and Education Director
The Walker School
Needham

DONNA SIMONE
Special Education Coordinator
Shrewsbury High School

Please invite your administrators to the meeting!

****** please return software **** return software **** software**

ANNOUNCEMENTS

We would like to have a pot luck supper or similar celebratory event at our last meeting of the season, tentatively set for Monday, June 16 from 5 to 7 P.M.
We will poll members at the May meeting to see if that's a good date.

Help us continue SIG meetings next year -- join the Planning Committee. As many of you know, the grant which supports the SIG ends in September. We very much want to continue the group and will be working on ways to do so this summer. If you're able to help or have ideas on funding possibilities, please let Peggy Kapisovsky (at TERC) know.

Remember Temple Ary's presentation? Now you can read about her work : "Exploring fractions with Logo" in the June issue of The Computing Teacher (pages 47-50).

Did you get your copy of Special Times, a catalog of software selected specifically for LD students? If not, call CDL at 491-0037. (Several TERC staff members were involved in the catalog's production.)

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Notes from the April 24th meeting

In a report to the members of the Special Interest Group, Susan Jo Russell and Rebecca Corwin looked at uses of problem solving software with special needs learners. First Susan Jo described the "Beyond Drill and Practice" project to put the current work in context. She then went on to discuss special needs learners' needs:

1. Schoolwork is often seen as an arbitrary system that doesn't relate to the real world. E.g., students who can subtract 25 from 100 may not be able to make change from $1.00.

2. Not all students learn best through words and symbols, but that is usually the way subjects are taught. Memory, however, is not a simple retrieval process, but instead we remember chunks and networks of information. If you forget a familiar phone number, you may not be able to retrieve it because you had memorized it and had not related it to other familiar things. On the other hand, you know what time you must leave the house in the morning because that information is part of a network (not always brought to consciousness).

3. Students may lack confidence in themselves as learners, and a person's attitude about him/herself as a learner affects learning. (Research is emerging that shows that once a child develops a poor attitude about him/herself as a learner, it is difficult to change this perception even if the child experiences many successes. Might this be related to a feeling of lack of control over one's learning? If you fail, it's not your fault; if you succeed, it's not because of you, it has to do with something else.) The computer may be able to give regular feedback about a student's degree of success

Problem solving software may help meet these needs, because of some of its unique characteristics (creation of a context, appeal to many methods of solution, open-endedness, among others).

Teachers noted that their students often are much more patient and willing to stick with it to figure out how to use a particular piece of software - often more so than the teacher! Why is it that these students who won't stay on task with workbooks will do so with the computer? Why will they persevere during the learning process to figure out how to play a game (although once they learn the game, they may become frustrated by their low scores and inability to play better)? One speculation was that the computer is seen as an appropriate style of learning for these children of the

technological age, surrounded as they are by video arcades, compact disks, and other electronic devices. They know they have problems and are "different", but at least with the computer they are the same as others.

Some teachers observed that enhanced self images from computer use affected some students' everyday lives. The mother of an LD boy commented to one teacher about her son's willingness now to stick with batting practice. He still wasn't very good but kept trying to improve. The mother attributed this to his computer experience. Another boy initiated a "save the pond" campaign in his town, even going so far as to talk with town officials - a very unlikely behavior for this boy. Again, the perseverance was attributed to skills learned in using the computer.

Another teacher noted that students often do not wait for introductions about software. They take it upon themselves to figure out how it works. There was agreement that students don't read directions, but disagreement as to whether reading directions was a necessary skill.

Rebecca Corwin then described a list of "non-trivial skills" which she and a colleague have been developing. They underlie the content-specific skills of most subjects, but usually don t appear on any Ed Plans. Instead, we tend to focus on more surface, content-specific skills, yet these deeper skills underlie most learning.

The meeting then broke into small groups which each previewed a piece of software and thought about the underlying skills addressed in the software. Then we returned to our large group for discussion. Unfortunately, not much time remained for discussion, but the software previewed and examples of underlying skills are presented here:

The Pond -- thinking flexibly
Gertrude's Secrets -- using inaccuracies as feedback, seeing patterns
Word Quest -- Seeing patterns, ordering
Quations -- putting things in order, following directions
Enchanted forest -- seeing relationships

A good deal of interest was generated in using the skills list as a checklist with previewing software -- and there is new software in the collection for borrowing at this time...

Handouts distributed at the meeting are enclosed.

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Notes from the March meeting:

SPECIAL INTEREST GROUP:

Catherine Cobb Morocco, who has been co-directing a research grant at Educ tion Development Center in Newton, came to give us some preview of her work to date and to share some of their findings about effective ways of working with writiing disabled students (grades 4-6) and computers.

The first topic was keyboarding skills. Cathy reported that some keyboard training does make a difference; children seem to respond to brief and frequent practice sessions which are monitored. The software needs to provide directions on screen and should note (but not show) the child's errors. Cathy noted that the Stickybear series has a practice program which seems adequate.

Second, the project looked at the characteristics of good writing instruction. Writing encompasses three areas: cognitive, motoric, and social-emotional; and the attributes of good writing are abundance (of ideas), strategies for writing, meaningfulness of the writing to the writer, ownership of the task -- and, most of all, Cathy emphasized that in good writing instruction, content precedes form. She added a number of other points, including the fact that modelling is important: the teacher should also be a writer.

Lastly, the project considered how word processing can support good writing. Certain features of word processing seemed particularly salient as advantages: it is interactive, makes print accessible, and is neutral and public in nature. Its disadvantages seem to focus on the fact that the child is potentially more vulnerable, open to ridicule and manipulation because of the nature of the medium.

Cathy gave an example of an activity from the project's forthcoming teachers' manual of effective writing activities on the word processor: the one she illustrated was an activity initially focussing on describing an object carefully enough so that another student could guess it. This leads into full description writing, and in the case shown, drew a child into an extremely well-written, moving piece of work which easily illustrated the principles of abundance, ownership, and meaningfulness.

This presentation was full of helpful suggestions and interesting ideas -- we encourage the membership to look for the teachers' guide which Cathy and Susan Neumann are writing. We'll try to keep you apprised of its status.

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: TUESDAY, APRIL 29, 1986, 4-6 P.M. at
Technical Education Research Centers
1696 Massachusetts Avenue, Cambridge, MA 02139
547-0430

AGENDA

4:00-4:15 Meeting, eating, greeting

4:15-5:15 SUSAN JO RUSSELL, project director of "Microcomputers in Special Education: Beyond Drill and Practice", will share her thinking about INCORPORATING PROBLEM-SOLVING SOFTWARE INTO THE CURRICULUM. Her presentation will include a discussion of the characteristics of problem-solving software, how it fits into the curriculum for students with special needs, and how to develop and document student goals. We will preview some of the most recent examples of problem-solving software.

5:15-6:00 Announcements, small groups. The ongoing groups focusing on Logo, databases, and the software section of the handbook-in-progress -- which did not meet in March -- will meet.

****

UPCOMING MEETINGS

The upcoming MEETING ON MAY 27 will feature a group of administrators addressing questions about how they have dealt with supporting the use of technology in special education; how teachers deal with technology; and how administrators' roles can be used to support teachers' work.

MORE INFORMATION WILL BE FORTHCOMING!!

The June meeting will be a celebratory one. We've been batting around ideas -- a pot luck dinner, an organized event of one kind or another, time to talk and share ideas and plan ways to continue with this work in the coming year. Let us know if you have any ideas: call Peggy Kapisovsky at TERC at 547-0430.

[And, of course, don't forget to return software!!]

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: TUESDAY, MARCH 4, 1986, 4-6 P.M. at
Technical Education Research Centers
1696 Massachusetts Avenue, Cambridge, 02139
547-0430

AGENDA

4:00-4:15 Meeting, eating, greeting

4:15-5:15 Catherine Cobb Morocco of the Education Development Center, Newton, will speak on USING WORD PROCESSING TO IMPROVE CHILDREN'S WRITING SKILLS. Her presentation will focus on the findings of EDC's study that explored how teachers can integrate computers into their writing activities in resource rooms and substantially separate classrooms. She will discuss the teacher's role in the writing process, two teaching models which are commonly used, and a number of activities to help students write. The activities will include both pre-writing activities done off the computer and on-computer writing activities. The study was conducted in Massachusetts school districts, and several SIG members were involved. We know there's a big interest in word processing, and we're looking forward to discussing this timely topic. Bring your questions and your friends too!

5:15-5:00 Announcement, small groups. The ongoing groups focusing on Logo, databases, and the software section of the handbook-in-progress will meet.

By the way, if you receive this announcement when you return to school after winter vacation - rather than at home - that's because we don't have your home address. It's for times like this that we would like to know where you are when you're not at school. So please jot down your home address on the sign-in sheet at the next meeting. Thanks!

Notes from the January 21st Special Interest Group Meeting

Temple Ary, a math teacher at the Carroll School in Lincoln and a SIG member, gave a presentation on her innovative approach to teaching basic math concepts such as fractions through the use of Logo. Temple's concern and sensitivity towards her students were apparent as she set a context for her presentation by describing her students and the principles she follows in teaching. Her students are intellectually-able LD children who learn best with opportunities for manipulating objects, finding patterns, and logically analyzing math concepts, and who are not successful in memorizing math facts. It is important to Temple that the children use manipulatives to develop models so that they can progress from concrete representations to abstract ones and experience success manipulating the algorithms. In her teaching Temple finds ways to apply the math concepts under study and to teach according to the way the child learns.

In order to follow these principles, Temple needs good teaching tools, and she has found that Logo is an excellent tool to teach math concepts because it encourages the development of thinking and problem solving skills; provides an environment where math concepts are discovered and explored; and provides functional models to help the students understand math.

Temple described how she uses Logo to teach fractions. She begins with the idea of a large rectangle - a "Giant Inch" - and students, working in pairs, write a procedure for a rectangle of their choice. As they are working, there's discussion all along on terminology and definitions - whole/parts, numerator/denominator, etc. Once everyone has a Giant Inch, they divide it into two equal parts by using a "move" procedure. Then they divide it into four equal parts by using a different color on the same rectangle and "move" procedures again. At this point they begin working on equivalents - "oh, 2/4 is the same as 1/2." They continue dividing the rectangle using different colors - into 6, 8, etc. equal parts. Judging from several samples, students get quite involved in their Giant Inch! They experiment and come up with their own theories on methods of finding fraction equivalents, adding fractions, or other fraction

operations, which the discuss and try out. This way of learning fractions is particularly good for visual learners and logical thinkers.

We're intrigued with Temple's approach and hope she will give another presentation sometime on teaching other basic math concepts using Logo.

Notes from the Handbook group meeting

We previewed Right Turn, Number Quest,and The Puzzler, all from Sunburst, and Fractions from Control Data. In Right Turn students create patterns, which they rotate or flip, and then the computer shows what the transformation does to their pattern. The program helps students to predict and learn about the math concepts of rotation and transformation. Number Quest focuses on binary search strategies, and The Puzzler presents stories in which students must solve problems by predicting and confirming solutions. Fractions is a simple dart game that gives students practice in estimating the placement of balloon targets on a number line. These programs are all available for loan from our software library. Why not try them out!

Notes from the Logo group meeting

As part of the group's ongoing observations of children's verbal interactions while working with Logo, members decided they would each tape a conversation between two children during a Logo session. After transcribing the tapes, the group will analyze the children's interactions.

Notes from the Database group meeting

We previewed Evye Woldman and Phyllis Kalowski's "Database Junior", and found a Giant Bug. Luckily, Evye's programmer husband has fixed it immediately, so we can spend time this meeting seeing it "really" work! Plans are to spend the time first looking for good opportunities for using databases with children, and potential off-computer activities; then we'll have three databases for people to try: Database Junior, Informaster, and Friendly Filer. Let's get some classroom feedback, too -- have you used

them? If you'd like to, please borrow them next time and let us know what happens.

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ANNOUNCEMENTS

Remember our **Lego/Logo** demonstration and Betty Church's description of the work she has been doing in her resource room? Well, Betty and her LD students will be demonstrating their use of Lego/Logo at the upcoming Kid's Computer Fair at the Computer Museum on Friday, February 21, from noon until 2 P.M. The Fair itself will run from Febrary 21-23, and the Computer Museum is on Museum Wharf in Boston (next to the Children' Museum).

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Mike Feer has written an article on using a science fiction software game, **Sundog**, with brain-damaged students at the Cotting School in Boston. We have a copy in our library. "Sundog and cognitive therapy." M. Feer. Closing the Gap, December-January 1986, 4,1.

Have you written an article lately that may be of interest to our members? We would like to share information, so if you have written an article, report, or book related to special needs learners and technology, send a copy to Peggy Kapisovsky at TERC. We will list it here and have the copy available in our library.

MICROS AND SPECIAL NEEDS

Special Interest Group

Next meeting: TUESDAY, JANUARY 21, 1986, 4-6 P.M.

Meeting will be held at Technical Education Research Centers
1696 Massachusetts Avenue, Cambridge 02138
547-0430

AGENDA FOR THE MEETING
(NOTE: This is a TUESDAY meeting)

4:00-4:15 Meeting, eating, greeting

4:15-5:15 Temple Ary, who teaches at the Carroll School in Lincoln, will present the work she has done using Logo to teach math concepts. She will present her work on fractions as an example of a way of approaching math instruction using Logo as a tool. This will be an investigation of children's learning in one topic area, and she will expand the general principles involved to include other areas as well. Be sure to bring other people from your school if this strikes an interest for them.

5:15-6:00 Announcements, small groups. The ongoing groups focusing on Logo, on databases, and on the software section of the handbook we're all writing will meet during this time. There's new information for the database group, and if we're lucky we'll have the opportunity to see the database developed by Evye Woldman and Phyllis Kalowski (which is now commercially available at a very reasonable cost). The Logo group will report in on its ongoing research, and the handbook group will be giving input about software for the handbook writeups as well as trying out some new pieces.

See you there, and Happy New Year.....

Notes from the November 25 meeting:

SPECIAL INTEREST GROUP: COMPUTERS AND SPECIAL NEEDS

The meeting was truly exciting. First, Betty Church described the work she has been doing with her resource room students, using Lego/Logo (being developed by Microworlds Learning, Inc., in Cambridge). Basically, this involves hooking up devices made with Lego building blocks (a very sophisticated set of mechanical devices, if you haven't seen a Lego set for a few years) to a computer interface which allows you to program the motors in Logo. Betty set up materials and showed some of the ways she got her students started, including off-computer activities and some design planning projects.

Next, Steve Ocko and Mitch Resnick, the developers of Lego/Logo, showed a videotape of elementary/middle school students using the blocks and the computer to develop terrific machines. Then they demonstrated more possibilities using the computer/blocks interface, including programs they're developing to play with programming ideas on-screen. There's a particularly engaging ferris wheel with people who can be programmed to get on and off after a specified number of revolutions, for instance.

The remainder of the time, after questions, was spent in working with the Legos, building machines and devices, exploring their possibilities, and looking at the learning possibilities for special populations. We had a terrific time.

Because Logo hits so many responsive chords, and because there's been such interest in using it as an integrated part of subject areas, we're planning to spend the January meeting developing this aspect of its use. The agenda is attached. (NOTE: In an attempt to be flexible to the needs of folks who can't come to Monday meetings, this is a TUESDAY meeting, scheduled for the 21st.)

The February meeting, which returns to the Monday time, we hope to schedule around administrators' ideas about using computers with special needs students. We'd like to have a panel of administrators who will present some of their views. If you know an administrator who's especially interested in computers and special needs, please contact Peggy Kapis vsky at TERC (547-0430).

NOTE: Please complete an evaluation form for each piece of software you borrow from the Micro/Sped library. We would

like to develop an evaluations database that could help our members select appropriate software for their students. We would also like to use some of the evaluations in the teacher's handbook we're writing. If your software lacks an evaluation form, there will be copies on the library's "shelf."

Don't forget: When you borrow software, please bring it with you to the next meeting. If you can't come to the meeting, please make arrangements to return the software before the meeting so that others may use it too.

THANKS!!!

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ANNOUNCEMENTS

The Massachusetts Vocational Curriculum Resource Center, located at 785 Marrett Road, Lexington, welcomes SIG members to use its facility. The Resource Center has a library of software in varied subject areas - vocational, computer literacy, language arts, math, etc. All software is available for preview, and some titles circulate for two-week periods. SIG member Janet Smizer of the Resource Center has extended this invitation. Call the librarian, Virginia Day, at 863-1863 or (800) 362-4371 for further information.

APPENDIX B

LETTERS FROM SIG MEMBERS

Shrewsbury High School
45 OAK STREET
SHREWSBURY, MASS. 01545
CHARLES H. FERRIS JR. HEADMASTER
TELEPHONE 845 4041

August 20, 1986

Ms. Peggy Kapisovsky
Technical Education Research Center
1696 Massachusetts Avenue
Cambridge, Massachusetts 02138

Dear Peggy:

I am writing to express my support and special interest in the continuation of TERC's Special Interest Group (SIG), Computers and Special Education.

Through my association with the group I have greatly enhanced my teaching and consulting abilities. I attended sessions as a true novice, anxious to learn and experiment with education and technology. With the help, education, and on-going support of the SIG, I am now using technology on a regular basis with my students as well as providing in-service training and workshops on the local, state, and national levels.

I consider my experience with the SIG to be truly rare and extremely valuable. Educators are seldom given the opportunity to meet, talk, and exchange this type of information in an open forum. My experience with this group helped me to acquire the knowledge and develop the leadership abilities necessary to disseminate information in a meaningful way.

In my opinion, the continuation of this SIG is critical to special educators across the state. While we have made a good start in informing and involving teachers, we need to continue working to develop and refine our skills. It is through the efforts and dedication of the SIG members that we are able to use technology effectively with special learners.

Please do not hesitate to contact me if I may be of assistance in supporting this most worthwhile organization.

Sincerely,

Donna E. Simone

Donna E. Simone
Special Education Coordinator

14 Lancaster Street
Cambridge, MA 02138
August 20, 1986

Peggy Kapisovsky
Technical Education Research
Centers, Inc.
1696 Massachusetts Avenue
Cambridge, MA 02138

Dear Peggy,

As a member of the Special Interest Group for the past year and a half, I realize how much my participation has affected my teaching. I'm a special education teacher in a resource room for learning disabled children. The general thrust of the curriculum is traditional with much emphasis on textbooks and worksheets, an approach that is often not successful with children who have learning problems. I saw possibilities in the computer but knew very little about it. Since there was no one in my school at that time who felt the same, I joined the SIG. It has been great to learn from other teachers and share our experiences -- I feel much less alone.

As a result of the support I've received from the teachers in the SIG and my administrators, I find that I'm much more willing to experiment with new ideas and activities. Sometimes I myself wonder how things will turn out, but I'm willing to take the risks because I see the potential for my kids. Very often I'm pleasantly surprised with the results. For example, my learning disabled third graders wrote poems on the computer, and with the help of the music teacher, they created music and dance to accompany the poems, which were presented to parents in a special program. A number of parents have talked with me about changes they have seen in their child's behavior or attitude.

It is the children I teach who have benefited the most from my participation in the SIG. I am presently using written language as the major focus of my curriculum. The children are writing about topics that interest them, such as families, feelings, pets, and dinosaurs. They often illustrate their stories and poems and always type them using the Magic Slate word processing program.

The level of interest in reading and writing has increased significantly. Last year the children spent a great deal of time studying Halley's Comet, Paris, and dinosaurs. They approached their research with enthusiasm and often struggled with difficult library books, newspaper articles, maps, and interviews. Rarely did the children say they didn't want to write. This level of interest is very unusual for children who have significant learning problems. One first grader said "I like writing stories on my computer. I just want to write stories all summer. I'll make copies of my stories for all of my friends."

I have found that the children are eager to share their stories with each other and are learning to give and accept constructive criticism. They are concerned about the quality and clarity of their writing and often make additions or corrections using the Magic Slate program. This is the first year of my teaching in which I felt that children with learning disabilities perceived themselves as writers and were able to reflect on their writing experiences. In fact, I'm beginning to forget that these children were referred to me because they were having severe learning difficulties in their own classrooms!

The children and I have also begun to realize that we can establish relationships with people outside our school by responding to newspaper articles we have read. A group of learning disabled fourth graders used the word processor to write to Agnes James after reading about her in the Globe. Agnes is an 88 year old woman who traveled to South America to see Halley's Comet for the second time. Agnes came to our school as a result of the letter and gave a wonderful two-hour presentation on her travels, Halley's Comet, and her philosophy of life. Agnes has enriched our lives as well as provided us with a better understanding of Halley's Comet.

As you can see, I'm excited about the changes that have occurred in my classroom. Many of these changes would not have happened if I hadn't been part of the SIG.

Sincerely,

Betty Church

Betty Church

41 Wells Road
Winchester, Ma. 01890
August 15, 1986

Ms Peggy Kanosovsky
Technical Education Research Centers
1696 Massachusetts Avenue
Cambridge, Ma. 02138

Dear Peggy,

As the summer draws to a close I am writing a note of encouragement for the continuance and possible expansion of our network of Special Education educators. Over the past two years our gathering of Special Education folk from public and private school settings has been a source of stimulation and enrichment for me as a Resource Room teacher. I doubt that I would have gained such exposure to creative uses of computers and software as presented by fellow teachers, administrators and TERC staff members without the format provided by TERC. It has broadened my teaching skills and has provided me with comparative expertise to share with teachers in my building as well as my colleagues in the Special Needs department in Reading, MA.

Of course, the most important outcome and benefit has been for the children I teach. There is no question that learning is enhanced by the multisensory attributes of computer use and the fresh approach to learning it provides. Learning becomes less teacher-directed, giving the children more sense of empowerment in their learning. The fear of making mistakes and failure appears lessened when the children interact with the computer on their own. Their self-esteem has been bolstered even further on their return to their mainstream classroom where they can demonstrate knowledge of programs that they have had the benefit of extra exposure to in the Resource Room.

In closing, may I also recommend that more software companies be encouraged to send software samples for our use and evaluation. It was extremely helpful to be able to borrow software from TERC and ascertain its suitability before committing school budget funds to the purchase of software.

I look forward to seeing you in the Fall.

Sincerely,

Louise Flippin

Louise Flippin

APPENDIX C

PRACTICUM COURSE DESCRIPTIONS

LESLEY COLLEGE GRADUATE SCHOOL

in conjunction with T.E.R.C. (Technical Education Research Centers)

announces
a practicum course in

Microcomputers and Special Education
(COMP. 71.840)

This course is designed for special needs teachers as well as graduate students who are seeking field experience in observing and working with special needs learners using computers. Participants will meet weekly in a three-hour class which will provide input about new programs and practices as well as time for discussion and reflection. Assignments will focus on using the computer with special needs children in a variety of ways. Those participants who are currently teachers will be encouraged to use their own classrooms as their field sites if they wish to do so. Graduate students without field sites will be helped to find appropriate placements. Work with learners in the field will constitute approximately a half day per week.

The practicum course will be co-taught by Susan Jo Russell, director of the federally-funded computers and special needs project at T.E.R.C., and Rebecca B. Corwin, coordinator of the computers and special needs focus of the Lesley degree program. Course content will include specific software applications, curriculum development, children's learning needs, and implementation of programs with special needs learners. Input about new programs and practices in the field of microcomputers and special education will be an ongoing part of each meeting. Classes will meet on Mondays from 4-7 PM.

Experience either with computers or with special needs learners will be necessary, but extensive experience is not needed. Regular classroom teachers are encouraged to participate in order to learn more about using computers with all their students, particularly those with special needs. We are excited about this new venture, and look forward to an outstanding first semester group. The course will be offered again in the spring semester. If you or others are interested in taking the course or in being one of the field sites, please call:

Rebecca B. Corwin
Lesley College
29 Everett Street
Cambridge, MA 02238
868-9600, ext. 371

2/85
Date Received

Approved by Division Dean

Approved by Graduate School

Lesley College

The Graduate School

COURSE APPROVAL REQUEST

(All items must be completed.)

PLEASE TYPE:

Title: Practicum in Computers and Special Education

COURSE NUMBER: (Leave Blank)

DIVISION: EDUC/SPED Comp M. 840

RELATIONSHIP TO OTHER DIVISION: (when appropriate)

SPONSORING FACULTY MEMBER: R.B. Corwin

NUMBER OF CREDITS: 3 NUMBER OF SESSIONS 15 LENGTH OF SESSION* 3 hours

GRADE DESIGNATION: (Refer to Graduate School Guidelines.) Letter Grade

Pass/Fail X

OFFERED: Fall X January Spring X Summer X

On-Campus X Off-Campus Where:

COURSE FORMAT:

Needs a demonstration monitor in classroom: 2C3, 2C4 or other (video accessible)

Workshop

Seminar (10-15) X

Lecture

CATALOGUE DESCRIPTION: (20 words or less):

Students will work in a field site using computers with a special needs population. Weekly seminars will provide input as well as facilitate reflection on the field work. Previous computer work is required.

*Each credit earned requires 15 hours of classroom instruction.

RESTRICTIONS ON REGISTRATION: (e.g. degree candidates only, students in specific programs, pre-requisites, etc.)

Prerequisites: Computer literacy or permission of instructor.

FACULTY:

Qualifications (specific to the course) Experience and expertise in computer use with special needs with emphasis on work beyond drill and practice; Qualitative research training;

Name(s) of faculty (adjunct or contract) who are qualified to teach:

R.B. Corwin, S.J. Russell, (Arthur Wood, Dina Wischkin)

CRITERIA USED FOR STUDENT EVALUATION:

Attendance and participation: quality of observations and analysis on two written observation papers: faithful journal-keeping.

EXPANDED COURSE DESCRIPTION: This course will provide a field-based opportunity for students to discuss their work with special needs learners and computers, as well as providing a classroom-based research framework for interested students. Students will choose one sit from a variety available; working teachers can observe in their own classrooms. Seminars will include input on a variety of selected software uses as well as time to develop some shared theory about computer use. Students from a variety of programs are welcome.

MAJOR COURSE OBJECTIVES: Students will:

1) Participate actively and effectively in ng with students with special needs and computers.

2) Learn to observe and describe their ork th cfily.

3) Learn a variety of software uses with special learners.

4) Analyze the results of their work to develop sen ive IEP's and curriculum plans.

5) Develop expertise in one software application.

6) Participate in classroom-based research.

COURSE OUTLINE

THIS MUST BE COMPLETED IN DETAIL PRIOR TO SUBMITTING COURSE APPROVAL REQUEST.

Session	I.	Overview
	II.	Word-processing and tool use
	III.	Participate in special interest group
	IV.	Evaluation of interactive tutorials and games
	V.	Simulations and microworlds
	VI.	The teacher as researcher
	VII.	Special Interest group
	VIII.	The teacher's role in use of computers in special education
	IX.	But what are they learning? The I.E.P.
	X.	Social and emotional growth
	XI.	Special Interest group
	XII.	Use of computer to assess students
	XIII.	Developing and modifying software
	XIV.	Practical problems
	XV.	Special interest group report

TEXTS AND READINGS (Include title, author and publication dates): If no text or readings, indicate why.

Goldenberg, Russell, Carter Computers and Special Needs: Addison-Wesley

Hagen, D. The Microcomputer and Special Needs: Reston

Selected readings from recent periodicals

1/81

COMP 840: PRACTICUM IN COMPUTERS AND SPECIAL EDUCATION

Susan Jo Russell
T.E.R.C.
1696 Mass. Ave.
Cambridge, MA 02138
547-0430

Rebecca B. Corwin
Lesley College Graduate School
14 Wendell Street
Cambridge, MA 02138
868-9600x371

COURSE REQUIREMENTS

The field study/practicum will focus on two themes: use of computers with special needs students (we will emphasize software, since that often determines the uses), and skills necessary to become a teacher/researcher. Both elements will be emphasized in the seminar meeting.

This course will require attendance at the seminar, one half-day a week in a special education classroom, and written reports of work done in the field placement. The placement will be chosen in conjunction with the course faculty, and students will be placed so that they may explore settings which are of interest to them.

Two more formal papers will be required: On October , a summary of all observations to date will be due, and on the last session of the class a case study of special needs students' use of a tool application will be due. More information about both papers will be due in class.

BOOKS

These books are recommended. If you haven't read them, we will require that you do. They are available at the Harvard Coop, alphabetically under "C" for Corwin.

Goldenberg, P.E., Russell, S.J., and Carter, C.C. Computers, Education, and Special Needs. Addison-Wesley

Hagen, D. Microcomputer Resource Book for Special Education. Reston.

Hunter, B. My Students Use Computers. Reston.

APPENDIX D

COMPLETE SURVEY REPORT

Special Needs Teachers' Uses of Learner-Centered Software

8/8/85

Background and purpose

While drill and practice applications of microcomputers are proliferating rapidly with students who have special needs, we know little about the uses of more powerful and innovative educational software ("learner-centered software") which opens learning realms beyond the world of drill and practice. Recent surveys (Crowner 1984; Hanley n.d.) indicate that, of all the possible applications of the microcomputer in special education, drill and practice programs are by far the most widely used. With drill and practice software, the computer is a patient, accurate, and nonjudgmental tutor which functions as an interactive workbook. But drill and practice is only one small part of teaching and learning. We often want to provide feedback to students that tells them more than "right" or "wrong"; we are concerned with more than rote skills. The computer is a powerful and extremely versatile tool which can offer a great deal more than drill and practice sessions to special needs students.

We define learner-centered software as that which: 1) gives students control over the activity, the strategies to reach the goal, or both. 2) provides feedback that is informational--feedback that is designed to expand students' understanding of the content area; 3) helps students develop skills in problem solving; and 4) allows students to use their own unique learning styles in approaching a problem. Learner-centered software is versatile, in that it can be incorporated into different subject areas and used for a variety of purposes by students who approach learning in different ways. (Drill and practice software, in contrast, usually covers a very specific content area and can be used in only one prescribed manner.)

There are several categories of learner-centered software which can be used effectively with students who have learning disabilities. These include tool programs such as word processors, data bases, and spread sheets; problem-solving software such as interactive games and simulations; and programming in powerful languages like Logo. Although largely anecdotal, evidence is emerging that learner-centered software can be a very effective vehicle for closing the gap between the potential and the achievement of special needs students. Foster, Mokros, & Russell (1985) provide a detailed description of the uses of

learner-centered software to enhance the learning skills of children with learning problems.

But how are special needs teachers--particularly those who work with learning disabled and emotionally disturbed children--using this powerful new software? The survey reported in this paper is a first attempt to describe special needs teachers' familiarity with and use of learner-centered software. In addition, the survey provides important information concerning the reasons for teachers' use or non-use of particular categories of software with K-8 students who have learning problems.

Method

A nationwide survey on the use of microcomputers with special needs students was conducted from December, 1984 through early March, 1985. The target population was teachers of learning disabled and emotionally handicapped students in grades K-8. We briefly interviewed, by telephone, a random sample of 50 special education administrators selected from all school districts using computers at the elementary level for instructional purposes. These schools were selected from a current list provided by Market Data Retrieval. In all school districts in which computers were being used for instructional purposes with special needs students (a total of 44 schools), the special education administrator identified a teacher who was knowledgeable about computer use in the classroom. A total of 35 teachers were identified in this manner, and 33 of the teachers were interviewed by phone.

Interviews generally lasted from 10 to 15 minutes, and almost all teachers were eager to share their experiences with the interviewer. The interviews focused on (1) uses of learner-centered software with children who are learning disabled and emotionally handicapped; (2) teacher training; (3) factors which facilitate the use of microcomputer; and (4) barriers to microcomputer implementation.

Characteristics of Respondents

Because administrators were often unable to give us detailed information about the use of computers for instructional purposes, the results which follow are based primarily upon information provided by teachers. Most of the teachers in our sample (19 of 33) worked with learning disabled students, usually in a resource room (13 of 33 teachers). A fairly large proportion of teachers (12 of 33) worked with children who had other types of handicaps, such

as emotional disturbances or mild mental retardation. Many of these teachers indicated that they worked with children who had a range of emotional and learning problems, including learning disabled, emotionally disturbed, and "low group" students. About one quarter (8 of 33) of the teachers worked in self contained classrooms, and less than 10% worked in regular classrooms. Most of the teachers had in-classroom access to one computer--usually an Apple--for at least a small percentage of time during the school week.

Becasue the majority of the teachers that we interviewed (28 of 33) were women, we will use the female pronoun when referring to an individual teacher.

Results of the Teacher Survey

What beyond drill and practice applications were SPED teachers using?

1. General Patterns

First, we found that slightly more than half of the teachers in our sample had at some time used learner centered software with their students. It is important to note, however, that simply because we had characterized a piece of software as being "learner centered" did not mean that teachers used it to go beyond drill and practice. In incorporating new software into existing instructional practices, teachers commonly used learner centered software for drill and practice. For example, several teachers had students use word processors to list spelling and vocabulary words.

A number of teachers used the more powerful learner centered software as well as the commonly used drill software for motivation or reward, rather than for instruction. It was typical for teachers to identify the software that children enjoyed (sometimes a collection of games, Logo, simulations) and allow children access to this software when they finished their regular assignments. While these children sometimes had opportunities to use learner centered software, this software was rarely incorporated into regular lessons.

In the section which follows we will explore teachers' use of word processing software, both because this software represents the most commonly used application beyond drill and practice and because it demonstrates the types of applications, instructional goals and outcomes, and problems that are typical when using tool software. Following the

word processing section is a discussion of the uses of other beyond drill and practice software.

2. Word Processing Tools

Word processing software was used by 27% of the teachers who were interviewed, making it one of the most popular types of learner centered software. These teachers invariably used the Bank Street Writer, which typically had been purchased by the school or by another teacher. The ways that teachers used word processors, the problems they had in using them, and the instructional goals and outcomes they associated with word processing varied considerably from teacher to teacher.

Despite this variation, we found that almost all teachers who used word processing did so at least some of the time to have students produce a piece of writing (stories, assignments, and ingenious products such as cookbooks). Concern with developing the quality of students' written expression was evident among about one third of these teachers, while others used the software to increase children's interest in writing or to increase the quantity of written work. As one teacher specified, "the objective is to have students produce a paragraph of at least 50 words; then they work on producing a story of at least 150 words by the end of the unit." Here one sees an emphasis on raising the overall level of productivity via the word processor.

About half of the teachers who used word processors had children work on the mechanics of writing by means of teacher-directed exercises in editing, vocabulary, spelling, and dictation. For example, one teacher typed sentences that included many mistakes in punctuation, grammar, and spelling. Students were instructed to find the mistakes and edit the teacher-generated sentences. Another teacher had children type in their vocabulary words and the dictionary definitions of these words.

While these more mechanical activities could easily be accomplished without the aid of the computer, many teachers indicated there was some value in having the child type the assignment. Some teachers emphasized the perceptual-motor skills that children could develop in entering words, while others discussed the fact that it was easier for children to see their mistakes when the product was typed. One teacher said that the value of the word processor was that it helped slow down the impulsive kids "by making writing more deliberate and forcing them to look at the screen."

When discussing the benefits of using word processors, a common theme was that this tool improved students' motivation to write. While no teachers indicated that word processing had yet influenced the quality of student writing, many expected to see writing improvement once students used the tool for a longer period of time. A few teachers had seen an increase in the quantity of writing. The teachers who stated that they saw an increase in quantity were those who had specifically asked students to write papers of a given number of words. Several teachers indicated that they had seen an impressive increase in children's willingness to write. Students were not as resistant to writing when they were able to use the word processor.

About half of the teachers who used word processors said they had experienced no problems in using them--primarily because student motivation was so high that it seemed to carry them through minor difficulties. One major problem for the remaining teachers was the feeling of being overwhelmed by learning how to use the word processor. There was little time to read the necessary manuals and explore on one's own before introducing the software to students. Teachers often felt they needed to thoroughly master this or any other software before they could use it with their students.

Perhaps the reason that word processing software is such a commonly used tool with learning disabled and emotionally disturbed students is precisely because its use meshes so well with 1) existing curricula and 2) Individualized Education Plans. It is easy for teachers to transfer editing and grammar exercises to the machine, using the same instructional mode that has been used all along. Writing assignments can easily be typed and saved on the computer, and the result is far more pleasing to the eye of both student and teacher. Here is an instance where the transfer of existing learning activities to the computer is quite clear cut.

It was also clear that the use of this software could be easily integrated with the learning objectives that typically appear on a student's Individualized Educational Plan. The teacher who spoke of increasing the number of words that a student put into a paragraph nicely exemplifies this potential match between software and learning objective.

Few teachers were making maximal use of the power of word processors. What the teachers did not tell us about word processing is as important as what they told us. None

of the respondents spoke about students using the editing potential of the machine to improve the pieces they had written. When they talked about the revision process, they were referring to correcting spelling, punctuation, and grammar--not to improving content and style. As they were revising their papers, students were frequently asked to make corrections on handwritten papers, then enter the final copy into the computer.

Why was there such a lack of emphasis on using the computer as part of the writing process? Perhaps because many teachers did not have enough computers to make it feasible for students to compose and revise at the machine. It is also possible that teachers simply did not know enough about word processors in order to use them in a flexible manner to improve writing. Many of the teachers in the sample indicated that they were just learning to use these tools, and that it was a problem keeping one step ahead of the students. Alternatively, it may be that the word processor was not used to work on writing quality because the learning goals for these students relate mainly to the mechanics, rather than the process of writing, and that teachers have less training in how to teach about the writing process.

3.Other Applications of Learner Centered Software

With the exception of word processing, very little learner centered software was used: 15% of the teachers who were surveyed reported using problem-solving or simulation software, 12% used the Logo language, and 9% made use of other applications (construction tools, data bases). It is interesting to note that all of the teachers in the category of "other applications" used a total of only seven different pieces of software. Given the huge number of titles available, it is surprising that use was limited to so few pieces.

a) Construction tools and data bases

Most of the teachers used this software primarily for rewarding or motivating children and found construction tools where students created their own drawings or graphics (e.g., Koala Pad or Facemaker) to be "great motivators." One aspect of these tools that particularly attracted teachers was that they did not require any reading skills, and learning disabled students had no problem using them. One teacher said that these tools had been particularly beneficial in building the self esteem of nonreaders who have some artistic skills.

Only one teacher used data base software. His junior high students used a data base to gather information on the population, products, and economy of various countries. This teacher indicated that he wanted to demonstrate to students that the computer is a powerful storage and retrieval device, which can manipulate information in many ways in order to meet the needs of users. For children with perceptual difficulties, particularly those who cannot organize and retrieve data, he found the data base to be an extremely useful tool in teaching social studies.

It is surprising that we found only one example of a teacher using a data base. In many ways, a data base is a flexible tool like a word processor, which can be easily incorporated into many subject areas. Yet with one exception, teachers seemed completely unfamiliar with this tool.

Programming

All of the teachers who worked with a programming language used Logo, and often these teachers served as tutors who helped children with Logo assignments for their regular classes. (Through the course of our interviews we discovered that many learning disabled children were learning Logo in their mainstreamed classes.) Interestingly, only one teacher--the same one who used the data base--discussed cognitive goals and benefits of using Logo. This teacher talked about the power of Logo in helping children truly understand geometry and improving their math skills more generally.

Problem-solving and simulation software

Most of those who used problem-solving software had started using it very recently--within the current academic year. Those who used the software often did it on an enrichment or optional basis--perhaps because using this software was often time consuming and did not readily fit into a class period.

While a fair number of teachers said that students enjoyed the "games" (Oregon Trail, Gertrude's Secrets, and The Pond were the only ones mentioned), few of the teachers articulated learning goals or outcomes associated with this software. Sometimes, the software was used to encourage "brain development", or to "get kids to use their minds"--rather vague curriculum goals when compared with the very specific objectives that teachers articulated when discussing word processing software. When asked about the benefits of using this software, student motivation was again seen as the key benefit. Teachers reason that if students like a particular piece of software they will stay

with it and experience success, which will in turn lead to a greater willingness to engage in learning activities.

Discussion

The applications of learner centered software described above appear quite different from the use of word processing. With word processing, teachers had articulated the new software with their writing and language arts curricula. On the other hand, teachers probably did not perceive the other tools as meshing with existing curricula or Individualized Education Plans. Instead of trying to make the software fit with existing programs--or modifying existing programs to incorporate the use of the new software--most teachers simply made the new software into an "extra" that students could work on when they finished their regular assignments. The exception to this was Logo, where resource room teachers became acquainted with Logo in order to support mainstreamed students in the use of this popular program.

Simulations, problem-solving software, and tools other than word processors were very underutilized. The fact that only one teacher made use of a data base, and no teachers used spreadsheets is noteworthy. One could argue, as did the articulate teacher who used a data base, that these tools are particularly beneficial for students with learning disabilities because the tools allow for smooth, structured handling of information and lower the chance of mechanical errors. The tools offer support to those who have difficulty in organizing and processing information and may even help students develop more sophisticated cognitive structures for handling information, simply because users must set up their files in a logical and efficient manner.

What staff development had teachers received?

Perhaps the answer to many of our questions about the uses (and non-uses) of learner centered software lies in the process through which special education teachers learned about the educational applications of computers.

In questioning the administrators who supervised the work of these teachers, we found that few had a concrete notion of what the teachers were learning in the inservice courses that were offered. Several administrators gave general answers such as "we offer training to anyone who wants it." Of the few administrators who talked specifically about the nature of the training, most mentioned that teachers learned how to operate the computer (e.g., "how to turn it on.") It was clear, however, that

most special educators were not getting training that differed in any way from the training offered to other teachers. Only 11% of administrators reported offering special workshops for SPED teachers, often workshops which dealt with IEP management software.

Our teacher survey revealed that most teachers (19 of 33) had learned about computers through inservice workshops and courses offered by colleges, local schools, the state department of education, or commercial organizations. The others learned on their own, informally from colleagues, or through relevant work history.

The content of the courses taken by teachers focused on programming. Thirteen of the 19 teachers who had formal training had learned to program--usually in BASIC or Logo. In interviewing teachers, we found that many seemed to be proud of their programming expertise. As stated above, however, few teachers taught programming. There was little resemblance between what the teachers learned and what they were doing with their own students.

Other skills that teachers had acquired through formal training included basic computer literacy (labeled "get your feet wet" courses by one teacher), and operational skills. A few special education teachers indicated that they had learned how to use a computer for IEP management.

Again, what is absent from the training experiences is telling: Only 4 of the 19 teachers who received formal training learned anything about educational software other than programming languages. In other words, less than 25% had learned about what could be done with computers in an educational setting besides programming. Even fewer received any instruction on uses of computers with special needs children, with this instruction focused on how to "adapt" software for children who have learning problems. Not one teacher reported receiving training on how to integrate educational software into the regular curriculum.

Despite the obvious limitations of the training that teachers received, few thought of it as being a problem. Only 2 of the teachers who were interviewed stated that they had received insufficient training. (One of these teachers had received no training whatsoever.) Their expectation may be, "Now that I've had a programming course, I should be able to use computers with my students."

Did the teachers find their training experiences useful? Many of the teachers valued the inservice training opportunities they had received, but few could point out how

it had been useful to them in their teaching. However, some teachers who had taken inservice workshops indicated that they hadn't really understood the content of these workshops until they had the opportunity to sit down and use the computer. What was truly useful to teachers was the assistance of other teachers and the time and administrative support to learn informally on their own and from peers. The opportunity for plentiful hands on experience--especially when it meant having a computer in one's own classroom--was a particularly valuable learning experience for teachers. Having ready access to a computer meant that teachers were able to try things out on their own before using them with students.

What factors made it difficult or easy for teachers to use computers?

1. Problems

We asked teachers to identify the major problems they had encountered, if any, in using computers with their students who have learning disabilities and learning handicaps. Interestingly, about one quarter of the teachers (and a similar proportion of administrators) said they had encountered no problems at all.

Many of the reported problems centered on inappropriate or limited software (one third of the teachers). Many of the educators found existing software "unimpressive", and they were concerned about the lack of good selection in a given subject area or for the computer that they owned. Reading level was a problem mentioned by several teachers. They noted that much of the software specifically designed for special needs students is at a reading level that is too difficult.

Other major barriers confronted by teachers were lack of computers, lack of software, and insufficient access to computers (identified by about one third of the teachers). A typical problem was a very limited budget for software, accompanied by the inability to give each child sufficient time on the one or two computers that were available. In some cases, teachers were vying with other teachers for limited computer time. We did not get the sense that special needs teachers were low on the totem pole, only that the teacher demand for computers was becoming far greater than the limited supply.

A few teachers (10%) indicated that while they had sufficient access to computers, there simply was not enough time in a day to cover the regular curriculum and use computers. These teachers saw "computers" as a distinctly

separate curriculum strand, not one that could be integrated into other subject areas.

Only a few teachers (10%) indicated that they had encountered resistance to using computers from parents, school board members, or other teachers. It was surprising to us that only <u>one</u> individual said that this took the form of resistance to special needs children using computers. The notion that only the brightest children should use computers was not prevalent in this sample, except perhaps by implication: Learner centered software was not being used very extensively with these students.

Finally, nearly 20% of the teachers indicated that there were student-related problems that interfered with the effective use of computers. Most often, teachers had a hard time "convincing kids that the computer is not just for games." Another teacher added that "Kids really like to use the penny arcade stuff", and that "if rockets don't go off, they're disappointed." Although this expectation may be partly attributed to students' familiarity with vide games, one might also wonder whether the children's game orientation is partly a result of school use of arcade-style drill and practice software.

<u>2. Facilitators</u>

About one-third of the teachers could identify nothing which had made their work with computers any easier. Of those who identified facilitators, most mentioned student support, support of the community, good teacher training, or access to computers.

Given the fact that several teachers reported students' attitudes as being a problem, it is surprising that 23% of the teachers identified students' attitudes as making their work easier. These teachers talked about the student's keen interest and excitement in using computers: "Now that we have computers, kids are beating on the door to get into the resource room." One teacher pointed out that children like to use computers because everyone gets a lot of attention from peers, as well as teachers, when working on computers. There is a great deal of collaboration and peer learning. Many teachers indicated that the excitement of the students made it possible for <u>teachers</u> to get through an initial resistance to using computers.

Support from the school and community--from administrators, fellow teachers, parents, and school boards--was another factor which made it easier for 18% of these teachers to use computers. Most talked about "support"

very generally, giving few details as to how administrators or the community had been of assistance.

While 23% of the teachers mentioned that good training had been a facilitator, most of them discussed the length or complexity of their training, rather than its usefulness in the classroom. Most teachers genuinely appreciate their district's effort to provide inservice workshops and opportunities to attend courses at local colleges.

Finally, 15% of the teachers mentioned that having access to computers, especially in their own classroom, is an important facilitator. When a teacher had a computer in her class or in her home, she was much more able to plan and prepare for classes.

Will teachers use learner-centered software?

We asked teachers who currently do not make use of learner centered software whether they would consider using one of these applications. It was difficult for many teachers to answer this question, because of their limited familiarity with the software. Most of the teachers in this survey were aware of word processing or programming applications, and expressed a willingness to try these. About a third of the nonusers said that they would be interested in using this software, if they had the appropriate software and some training on how to use it. "I'd try anything," was a typical comment offered by teachers in this group. Another third of the non-users said that they have definite plans to use either word processing or programming as soon as the proper equipment and software arrives.

The final group of teachers--again about one third of the nonusers--said they would not consider using learner-centered software, or would use it only after basic skills had been thoroughly mastered. A few teachers in this group thought that programming and word processing were too difficult for learning disabled children to master, and that these skills were basically for enrichment. Others felt that these computer uses, even word processing, did not fit with their students' learning objectives.

Note that none of the teachers in this group had considered using problem-solving software or simulations, primarily because they were not at all familiar with this software. When we described it, a few indicated that it sounded interesting, but most were not in a position to evaluate the potential for use with their students.

Summary and Conclusions

The average teacher in our sample was just beginning to use beyond drill and practice software with her learning disabled or emotionally disturbed students, and was enthusiastic about doing so. This teacher had often been using drill software for some time and was pleased to find new applications. The first new application to be tried, typically, was word processing. Often, initial uses of the new software were almost in a "drill" mode, where students used the program primarily to correct the mechanics of sentences. The primary benefit the teacher saw in using the new software was in "motivating students," who were usually quite eager to use the computer.

The training received by the typical teacher, which often emphasized the development of programming skills, had been irrelevant to the daily applications she made with computers. Yet, she did not fault her training and often commended her district for providing this background. Perhaps because she had learned to program--a skill that was clearly valued--she felt that she should now be able to do anything and everything with computers.

Unfortunately, her training had almost never shown her any glimpses of educational software being used with learning disabled or emotionally disturbed children. In fact, her training did not show her much educational software at all. What she learned about software, she had to pick up from friends and colleagues, or from her purchasing mistakes. Software purchasing mistakes could be quite costly, becauses software budgets were extremely limited at most schools. The typical teacher was working in an "acquisition mode" in that she was just beginning to acquire the skills, software, and hardware that would ultimately be used to incorporate beyond drill and practice learning activities.

In contrast, a few of the techers in our sample had progressed to a "utilization mode". These teachers were familiar with a range of software, had used the software in conjunction with their regular curriculum, and had begun to identify specific benefits that they hoped would accrue to their students when using this software. These teachers also differed from the typical teacher in that they did not see the computer's primary benefit as motivational, but rather as instructional.

We suspect that the special education teachers who we surveyed are not unlike their "regular" education colleagues. Like their colleagues, these special educators

have often been eager to hop on the computer bandwagon, but they are just beginning to discover what using computers can mean for students' cognitive development. A few teachers talked about the normalizing influence of computers--how having access to the machine made learning disabled or emotionally impaired students feel part of the community. But in order to justify the extensive investment of time and energy we are putting into educational computing, there needs to be a demonstration that computers are having broader effects--not just on children's self image and motivation (although these are certainly important factors), but also on their thinking and learning. In order for this to happen, we need to see the following:

Recommendations

1) SPED and school administrators need to carefully plan for staff development opportunities that will meet the real needs of special education teachers. Programming skills should not be the ultimate goal of staff development.

2) Teachers need more time to learn about software--by trying it out on their own and by sharing their software evaluations with others. Collaborative learning with peers should replace much of the currently-offered didactic inservice workshops.

3) Teachers need to know that beyond drill and practice applications are useful for their students--not just for advanced students. They will discover this if they have opportunities to explore and test learner-centered software with their students.

4) Administrators and teachers need to plan ways of incorporating software into the existing curriculum, much as word processing has been incorporated into the language arts curriculum. If this does not happen, using computers will ultimately be seen as a "frill." The more powerful uses of the computer--for storing, retrieving, and organizing information, for generating and solving problems in the content areas, for simulating decision-making in complex interactional systems--need to find a place in the special education student's program.

5) IEPs need to be broadened to emphasize the important problem-solving and information processing skills that are facilitated through the use of beyond drill and practice software (especially data bases and spreadsheets.)

APPENDIX E

PUBLISHED REPORT OF SURVEY

LEARNER-CENTERED SOFTWARE: A SURVEY OF MICROCOMPUTER USE WITH SPECIAL NEEDS STUDENTS

Janice R. Mokros, PhD and
Susan Jo Russell, MS

This study reports the results of a survey of fifty school districts. It assesses the extent to which special educators are moving beyond drill and practice software with learning disabled and emotionally disturbed students. It also describes factors that are preventing or discouraging applications beyond drill and practice. It was briefly described in a previous Computers in the Schools article by Hummel (1985).—J.W.H., Associate Editor

What will widespread use of the computer mean for the special education student? Will computers be added to the current curriculum and submerged in it? Or will unique functions of the computer add to, or even change, the way we devise curriculum for the student with learning or emotional problems? We know from recent surveys (Crowner, 1984; Hanley, 1984) that drill-and-practice software is by far the most widely used application of the computer in special education. In this guise, the computer operates as a sort of robot classroom aide—tireless and with an eidetic memory mimicking familiar methods and materials. The computer's ability to branch (IF STUDENTANSWER = CORRECTANSWER THEN PRINT 'CORRECT') and to store data (PATSY GAVE 3 CORRECT ANSWERS OUT OF 8 AT LEVEL 2) make it appealing as an additional mechanism for drill and practice.

But what can the computer offer beyond the world of drill and practice? In addition to branching and data storage, non-drill software makes use of additional functions of the computer, which are highly developed in the non-education world. These functions include data manipulation (e.g., spreadsheets, data bases), system dynamics (e.g., simulation), and translation or transformation (e.g., programming).

In addition, this software has particular pedagogical characteristics which place more cognitive control in the hands of the user. For this reason, we have chosen to call it "learner-centered software." Learner-centered software:

1) offers students choice in selecting the goal of the activity, the strategies to reach the goal, or both;
2) provides feedback that is informational, not judgmental, feedback that students can use to expand their understanding of the content area; and
3) allows, emphasizes or encourages estimation and approximation.

Beyond these three characteristics, learner-centered software is often versatile enough to be incorporated into different subject areas and used for a variety of purposes by students who approach learning in different ways.

There are several categories of learner-centered software (see also Foster, Mokros, & Russell, in press) which can be used effectively with students who have learning problems. These include educational games; tool programs such as word processors, data bases, and spreadsheets; problem-solving software, including simulations and programming in languages like LOGO. Some of these applications have been studied very little; for others, both anecdotal and more formal research evidence (Carmichael *et al.*, 1985; Clements & Gullo, 1984; Fick, Fitzgerald, & Milich, 1984; Morocco & Neuman, 1985; Neuman & Morocco, 1985; Russell, 1983; Weir, Russell, & Valente, 1982) is beginning to show how learner-centered software can be an effective vehicle for closing the gap between the potential and the achievement of special needs students.

How are special needs teachers using learner-centered software with students who have learning problems? The survey reported in this paper provides a systematic description of special needs teachers' familiarity with and use of learner-centered software with K-8 students.

METHOD

A nationwide survey on the use of microcomputers with special needs students was conducted from December, 1984, through early March, 1985. The target population was teachers of learning disabled and emotionally handicapped students in grades K-8. We briefly interviewed, by telephone, a random sample of 50 special education administrators selected from all computer-using school districts at the

elementary level for instructional purposes. These schools were selected from a current list provided by Market Data Retrieval. In all school districts in which computers were being used for instructional purposes with special needs students (a total of 44 schools), the special education administrator identified a teacher who was knowledgeable about computer use in the classroom. A total of 35 teachers were identified in this manner, and 33 of them were interviewed by phone.

Interviews generally lasted from 10 to 15 minutes, and most teachers were eager to provide information. The interviews focused on (a) uses of learner-centered software with children who are learning disabled and emotionally handicapped; (b) teacher training; and (c) factors which facilitate or impede the use of microcomputers with this population.

Characteristics of Respondents

Because administrators were often unable to provide detailed information about the uses of computers for instructional purposes, the results which follow are based primarily upon information provided by teachers. Most of the teachers in the sample (58%) worked with learning disabled students, usually in a resource room. A substantial proportion of the teachers (36%) worked with children who had other types of handicaps, such as emotional disturbances or mild mental retardation. Most of the teachers had in-classroom access to one computer, usually an Apple; for at least a small percentage of time during the school week. Eighty five percent of the teachers who were interviewed were women.

RESULTS

1. What learner-centered software was being used by special education teachers?

First, we found that slightly more than half of the teachers had at some time used learner-centered software with their students. Word processing was by far the most widespread use of this software. About a quarter of the teachers (27%) were using a word processor, usually *Bank Street Writer*. Other uses included LOGO (12%) and problem-solving software (15%). In addition, we found two examples of tool use other than the word processor: one teacher was using a data base and one used the *Koala Pad*. Of all the available software, a total of only eight different non-drill titles were mentioned by this sample of teachers.

2. How was learner-centered software being used?

Actual use did not always reflect the potential of this software. In incorporating new software into existing instructional practices, teachers commonly used learner-centered software either for drill and practice or for reward and motivation. For example, several teachers had students use word processors primarily to list spelling and vocabulary words or to correct mistake-laden sentences written by the teacher. Others gave students access to a collection of software (both drill and learner-centered) when they finished their regular assignments. Thus, while these children had opportunities to use learner-centered software, it was not part of their instructional program.

Teachers were aware of the benefits of learner-centered software in improving students' motivation or self-esteem. For instance, programs which allowed students to create their own graphics, such as the *Koala Pad* or *Facemaker*, were considered to be "great motivators" (which had the additional advantage of not requiring any reading skills). One teacher said that these tools had been particularly beneficial in building the self-esteem of nonreaders.

Only one teacher used data base software. His junior high students used a data base to gather information on the population, products, and economy of various countries. This teacher indicated that he wanted to demonstrate to students that the computer is a powerful storage and retrieval device, which can manipulate information in many ways in order to meet the needs of users. For children with difficulties in organizing and processing information, he found the data base to be an extremely useful tool in teaching social studies.

All of the teachers who worked with a programming language used LOGO, and often these teachers served as tutors who helped children with LOGO assignments for their regular classes. (Through the course of our interviews we discovered that many learning disabled children were learning LOGO in their mainstreamed classes.) Interestingly, only one teacher, the same one who used the data base, discussed cognitive goals and benefits of using LOGO. This teacher talked about using LOGO in helping children to understand concepts in geometry and to improve other mathematics skills.

Teachers' use of word processing differed, to some extent, from their other uses of the computer. Not only was word processing used by more teachers than any other computer application, but its use was more clearly integrated into ongoing instruction. It is worth examining this computer application in special education in detail.

3. How was word processing used with special education students?

About half of the teachers who used word processors had children work on the mechanics of writing by means of teacher-directed exercises in editing, vocabulary, spelling, and dictation. For example, one teacher typed sentences that included many mistakes in punctuation, grammar, and spelling. Students were instructed to find the mistakes and edit the teacher-generated sentences. Another teacher had children type in their vocabulary words and the dictionary definitions of these words. While these activities could be accomplished without the aid of the computer, teachers indicated that there was particular value in having the child *type* these assignments. Some teachers emphasized perceptual-motor skills, while others thought that it was easier for students to see their mistakes when the words were typed. One teacher said that the word processor helped slow down impulsive students "by making writing more deliberate and forcing them to look at the screen."

However, almost all teachers who used word processing did so at least some of the time to have students *produce* a piece of writing (stories,

assignments, and products such as cookbooks). When discussing the benefits of using word processors, motivation was again a common theme. Several teachers indicated that they had seen an impressive increase in children's willingness to write. Students were not as resistant to writing when they were able to use the word processor. While no teachers were ready to claim that word processing had yet influenced the quality of student writing, many expected to see writing improvement once students used the tool for a longer period of time. A few teachers had seen an increase in the *quantity* of writing.

What the teachers did *not* say about word processing is also important. None of the respondents spoke about students using the editing potential of the machine to improve the pieces they had written. When they talked about the revision process, they referred to correcting spelling, punctuation, and grammar, *not* to improving content and style. Often, the computer was not used for drafts at all, only the corrected final copy was typed into the computer.

Why was there such a lack of emphasis on using the computer as part of the writing process? Perhaps because many teachers did not have enough computers to make it feasible for students to compose and revise at the machine. It is also possible that teachers simply did not know enough about word processors in order to use them in a flexible manner to improve writing. Many of the teachers in the sample indicated that they were just learning to use these tools and that it was a problem keeping one step ahead of the students. Alternatively, it may be that the word processor was not used to work on writing quality because the learning goals for these students relate mainly to the mechanics, rather than the process of writing, and that teachers have less training in how to teach these skills.

4. What staff development had teachers received?

In questioning the administrators who supervised the work of these teachers, we found that few had a concrete understanding of what teachers were learning in the inservice courses that were offered. Of the few administrators who talked specifically about the nature of the training, most mentioned that teachers learned the mechanics of operating a computer. The administrators also told us that special educators were getting training that was identical to that offered to other teachers. Only 11% of administrators reported offering special workshops for special education teachers; these often focused on IEP management software.

Teachers were asked a series of questions about their training. The survey revealed that most teachers (about two-thirds) had learned about computers through inservice workshops and courses ofered by colleges, local schools, the state department of education, or commercial organizations. The others learned on their own, informally from colleagues, or through relevant work history.

The content of the courses taken by teachers focused on *programming*. Thirteen of the 19 teachers who had formal training had learned to program usually in BASIC or LOGO. Teachers who were interviewed exhibited a sense of pride in their programming expertise. However, few of these teachers *taught* programming to their students. Other skills that teachers had acquired through formal training included basic computer literacy (labeled "get your feet wet" courses by one teacher), and operational skills ("how to turn the computer on and off").

Again, what is *absent* from the training experiences is telling: only 4 of the 19 teachers who received formal training learned anything about educational software other than programming languages. Even fewer received any instruction on uses of computers with special needs children. *Not one teacher reported receiving training on how to integrate educational software into the curriculum.* What teachers learned about software was gleaned from friends and colleagues or from ill-informed purchases. There was little resemblance between what the teachers learned in their inservice training and what they were doing with their own students.

Despite the obvious limitations of the training that teachers received, few listed lack of training as a problem. Only two of the teachers who were interviewed stated that they had received insufficient training, and one of these teachers had received no training whatsoever. However, many teachers talked about the lack of *time* they had to use new software themselves, read the manuals, and think about how to use it with their students. For instance, several teachers had access to word processing software and wanted to begin to use it but had no time to learn about it.

5. What factors made it difficult or easy for teachers to use computers?

When asked to identify the major problems they had encountered in using computers, about one quarter of the respondents said they had encountered no major problems. Problems mentioned by at least 10% of the sample included the following:

1. Inappropriate or limited software, particularly software that is either age-inappropriate or of an inappropriate reading level.
2. Lack of computers and software.
3. Not enough class time to use computers.
4. Student attitudes, particularly the attitude that software should have many arcade features. "If rockets don't go off, they're disappointed."

Given the fact that 20% of the teachers reported students' attitudes as being a problem, it is surprising that another group of teachers (23% of the sample) said that students' enthusiasm about computers made their work *easier*. Other factors which facilitated the use of computers for at least 10% of the sample included: (a) support from school and community (from administrators, parents, fellow teachers, school boards); (b) good background or training; and (c) having access to computers in one's own classroom.

SUMMARY AND CONCLUSIONS

The geographic and socioeconomic composition of the sample was extremely diverse. Our sample included districts of 300 and 20,000 students, rural and urban, transient and stable, minority, bilingual, wealthy and low income. Given this diversity, the con-

sistency of the experience of special education students in using computers is striking. Most students use computers primarily for drill, often as a motivational experience after other work is completed. About a quarter of the students also use word processing, with some of this time devoted to skill practice and some devoted to writing original compositions. A few students have been exposed to one or two other programs such as LOGO or problem-solving software.

The average teacher in our sample was just beginning to use learner-centered software (most often, word processing) and was enthusiastic about doing so. This teacher had often been using drill software for some time and was pleased to find new applications. This typical teacher was working in an "acquisition mode," just beginning to acquire the skills, software, and hardware that would ultimately be used to incorporate learner-centered software. In contrast, a few of the teachers had progressed to a "utilization mode." These teachers were familiar with a range of software, had used the software in conjunction with their regular curriculum, and had begun to identify specific benefits that they hoped would accrue to their students as a result of using this software. These teachers also differed from the typical teacher in that they did not see the computer's primary benefit as motivational but as instructional.

The training received by the typical teacher, which often emphasized the development of programming skills, had been irrelevant to the daily applications she made with computers. Yet, she did not fault her training and often commended her district for providing this background. Perhaps because she had learned something about programming, a skill that was clearly valued, she felt that she should now be able to use computers effectively in the classroom.

The results of this survey suggest that improvement in the field of educational computing for the special needs student be concentrated in three areas: improved staff development, more curriculum options, and expansion of the research base.

1. Staff Development

Teachers need knowledge and models. They need experience of their own with a selection of computer applications before they can choose knowledgeably among them. Few of our teachers knew about problem-solving software, simulations, telecommunications, data bases, or spreadsheets, much less how they might be used with special education students. These applications cannot be learned in an overview course or a two session after school workshop. This suggests that training in computer education is a long-term endeavor, that the most significant computer applications must be introduced slowly, and that enough time must be spent on each so that teachers can develop a clear sense of how it is used and why.

Models of effective practice allow teachers to relate their newly acquired knowledge to work with students. Unfortunately, few models of how to use most of the applications mentioned above are yet available. Listings of software "for special education," which are usually limited to drill software, can be obtained, but these do not provide a sense of the actual classroom experience, how to begin, how to define appropriate problems or projects, what difficulties students are likely to encounter, how to manage computer time, and how to evaluate student work. Most inservice courses simply do not cover these important areas.

Many of the teachers who used learner-centered software, both in this sample and in an ongoing follow-up survey of effective uses of learner-centered software, did not attribute their own learning to inservice courses. Rather, they pointed to a peer, a student teacher, a colleague, or a friend who had shared knowledge and enthusiasm and then *had continued to provide support*. Continued support and time are key factors in enabling teachers to try something new. The availability of *a person* appears to be more important than time spent in courses, and, of course, it does no good for a person to be available if there is no time and opportunity to seek her out.

The critical steps necessary for effective training appear to be: (a) input from a knowledgeable person on how to use a particular application; (b) considerable time spent at the computer exploring this application; some of this time might be spent with and some without the peer teacher available; and (c) work with students using this application, interspersed with consulting time with the peer teacher.

Should special education teachers complete these steps in isolation from other teachers? We do not necessarily advocate a separation of regular and special education teachers for training. In fact, one approach would be for *all* teachers to spend time exploring computer use with special needs students. Some of the teachers we spoke with talked about the normalizing influence of the computer, how having access to the machine made learning disabled or emotionally impaired students feel part of the community, and sometimes even placed them in a leadership role. However, in most systems, "regular" and special education are clearly separated in staffing, budget, and administration. It may be difficult to get regular classroom teachers to spend a considerable amount of time focusing on students' special needs, when they are also subject to their own myriad pressures and demands of regular classroom teaching. Yet, as the computer has provided a tool for mainstreaming students, perhaps it can also be used as a way to bring teachers together.

2. Curriculum Options

The computer can offer access to new curriculum to special needs students or it can enhance the already established curriculum. From the survey results, it is clear that teachers first look for computer applications which fit what they are already doing with their students. For this reason, the workbook style drill and practice software, which adheres to well established content and methods in special education, is quickly adopted. And word processing, which relates directly to standard writing objectives, is the next computer use to be tried. But use of learner-centered software offers the opportunity to expand learning goals and content for the special needs student. New goals can arise in two ways, through addition of entirely new categories of

goals and through a change of emphasis within old categories.

Word processing is a good example of a computer application which leads to changed emphasis within an existing curriculum category. As noted in an earlier section, the editing capability of the word processor is being used primarily for correcting spelling, grammar, and punctuation. However, as both teachers and students become more fluent in using the word processor, attention begins to turn toward improving the quality of writing. While real editing (as opposed to proofreading) once seemed too laborious and time consuming, especially for children with learning problems, the mere availability of the word processor makes it more possible to concentrate on better writing. Then, of course, the question arises: what do we mean by "better"? How do we teach students to *improve* their writing, beyond the correction of mistakes? This questions should begin to lead us to alterations in two areas: 1) the framing of learning objectives for our students and 2) teacher training. If the learning goals for these students relate mainly to the mechanics rather than the process of writing, then teachers will spend their time primarily stressing those mechanics. But even more important, teachers have less training in *how* to teach about the writing process. Teachers must be better prepared to take advantage of the possibilities the new tools offer. Word processing is the only current example of a new tool which may lead to changes in curriculum emphasis. But, other tools such as spreadsheets and data bases can also provide the opportunity for rethinking the relative importance of various language, mathematical, and thinking skills.

However, while some learner-centered software does relate to many of our usual learning objectives, the fact remains that much of this software simply does not fit with the usual curriculum. Software that encourages use of more general problem-solving skills, e.g., simulations; games which involve classification, sequencing, spatial visualization; programming, does not clearly fall within any of the traditional curriculum areas. The survey showed that instead of trying to make this software fit with existing programs, or modifying existing programs to incorporate the use of the new software, most teachers simply made the new software into an "extra" that students could work on when they finished their regular assignments. Although some teachers saw general benefits in the use of this software with their students (e.g., "to get kids to use their minds"), they had not yet articulated clearer objectives.

Teachers we have contacted in our ongoing survey of promising practices, who are convinced of the value of using learner-centered software, are creating new IEP goals reflecting the aims of the innovative software. Some of these goals relate specifically to problem-solving skills (such as defining a goal, formulating a hypothesis, trying a new strategy when one has failed, gleaning information from errors), while others relate to more general learning objectives (such as time on task, cooperation with peers, and oral communication skills). In any case, better articulation of such objectives as well as the means for monitoring students' progress towards accomplishing them is a critical task for the special education community (Russell, in press).

3. Research

A final recommendation emerging from the results of this survey is that we must seek better answers to the inter-related questions: What new learning options are possible via learner-centered software and how can special educators equip themselves to deal with these new possibilities? Most of the outcomes research to date has examined aspects of drill-and-practice activities, either comparing computer to non-computer treatments or examining the characteristics of student-computer-teacher interactions while using the computer for this purpose. While these studies have yielded useful information, they have not begun to scratch the surface of what is possible in educational computing with special needs students.

Now that we have a good sense of how special educators are using software for instructional purposes, researchers should identify the developmental paths followed by teachers who *have* implemented learner-centered software. What differentiates these teachers, their departments and schools, and their training from teachers who do *not* use this software? We are beginning to address these questions by collecting case study reports from special educators who are using learner-centered software in innovative ways.

Once these teachers have been identified, the next step is to study their classrooms to 1) describe patterns of effective implementation, and 2) determine student outcomes associated with the software. Model sites must be identified or created in order to develop appropriate curriculum and teacher training and to address these research issues. In order to justify the extensive investment of time and energy we are putting into educational computing and to maximize its effectiveness, there needs to be a demonstration of how computers can have broader effects, not just on the self image and motivation of special needs children (although these are certainly important factors), not simply as an extension of the drill-and-practice activities we already know how to do well, but also on significant aspects of *thinking and learning*.

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APPENDIX F

HANDBOOK OUTLINE

Beyond Drill and Practice:
Using Learner-Centered Software in Special Education

by Susan Jo Russell, Janice Mokros, Rebecca Corwin, and Peggy Kaprisovsky

Contributing Teachers:
Betty Church, Massachusetts
Donna Simone, Massachusetts
Steve Spencer, California
Linda Ware, Texas
---etc.

OUTLINE

Chapter I: Charting a New Course: Drill, Practice, and Beyond

A. Special Education: The Computer Moves In
   1. The beginnings: drill, practice, and motivation
   2. The next kid on the block: word processing
   3. Moving outwards: Teachers' choices beyond drill and practice
   4. The need for learner-centered software

B. Characteristics of Learner-Centered Software
   1. .Learner control of goals and strategies
   2. Informational, neutral feedback
   3. Support of prediction and successive approximation
   4. Meaningful contexts which emphasize intrinsic motivation

C. A Map of This Handbook: Structure and Landmarks
   1. How this book came about
   2. The role of contributing teachers
   3. The structure and content of this book

Chapter II: Using the Computer to Support Skill Development

A. New Approaches to Familiar Content
   1. Cognitive control for passive learners
   2. A Meaningful context for learning new skills
   3. Flexible uses and design
   4. Useable feedback for the learner

B. Reading and Language Arts: Meaning from Written Language
   1. Software which uses the cloze technique to develop vocabulary and comprehension
   2. Software which provides motivating contexts for writing
   3. Software which focuses on word meaning and structural relationships in language

C. Mathematics: Making Sense out of Numbers
   1. Software which helps students to develop visual models for mathematical ideas
   2. Software which helps students develop estimation skills

D. What Difference Does Skill Development Software Make?
   1. Advantages for students' learning
   2. Advantages for teachers' teaching

***Chapter III: Using the Computer to Teach Writing**

A. The Practical advantages of word Processors for Handicapped Students

B. Learning Objectives: Balancing Content and Mechanics in the Teaching of Writing

C. Some Simple Prerequisites: How Much Keyboarding Skill is Enough?

D. First Steps in Using the Word Processor

E. Teacher-tested Word Processing Activities

F. Juggling Computers, Classrooms, and Students' Needs
   1. Managing scarce resources
   2. Using peer collaboration in the teaching of writing
   3. Effective teacher interventions during the writing process

G. Does Word Processing Really Make a Difference?: Evidence from Research and Practice

***Chapter IV: Using the Computer to Develop Problem-solving and Critical Thinking Skills**

A. "But my students could never do that!": Why Use Problem-solving Software?

B. Three Programs Which Worked
   1. Snooper Troops: Learning to reason deductively
   2. Agent U.S.A.: Sticking to a long-term problem
   3. Gertrude's Secrets: Sorting and classifying throughout the curriculum

* chapters enclosed

C. Learning Objectives for Problem-solving Software

1. Teachers' reasons for choosing problem-solving software
2. A sampling of problem-solving goals

D Selecting Problem-solving Software

Chapter V. Learning to be a Learner: Using the Computer to Improve Motivation, Responsibility, and Metacognition

A. Goals for Special Needs Students

1. Motivation: The desire to learn
2. Engagement: Knowledge about the learning process
3. Insight: Knowledge about oneself as a learner
4. Responsibility: Monitoring one's own learning

B. Learning How to Learn, Learning Not to Learn

1. Software features which affect interest and engagement: Intrinsic and extrinsic motivation
2. Software features which affect students' interaction with the learning task: Enough guidance, enough choice
3. Software features which affect students' sense of how they are doing: Feedback and rewards

C. The Difficult Job of Choosing Software for the Special Needs Learner: Guidelines

Chapter VI. The Teacher's Role

A. Introducer: Getting Students Started

B. Technical Advisor: Helping Students over Mechanical Hurdles

C. Arranger: Building Peer Collaboration and Cooperation

D. Visitor: Checking in and Hanging around

E. Booster: Dealing with Students' Frustration

F. Mentor: Getting Students to Consider, Reflect, and Analyze

G. Observer: Supporting Student Independence

H. Bridger: Facilitating Generalization and Transfer

Audience: Appreciating Student Work

J. Learner: Modeling the Joys and Difficulties of Learning Something New

VII. Integrating Technology into the Special Education Curriculum: The Learner-centered Classroom

A. Characteristics of the Learner-centered Classroom

1. Student independence and empowerment
2. Peer collaboration
3. Emphasis on applications
4. Moving into the mainstream
5. The shifting roles of teacher and learner

B. Getting Started Beyond Drill and Practice

1. Tips from practitioners
2. Resources: Sources of information and support
3. A startlist of software (several alternative selections)
4. An annotated listing of software (including software mentioned throughout the book and related software)

APPENDIX G

TWO SAMPLE CHAPTERS FROM HANDBOOK

USING THE COMPUTER TO TEACH WRITING

Janice R. Mokros and Susan Jo Russell

[Excerpted from the forthcoming book, *Beyond Drill and Practice: Using Learner-Centered Software in Special Education* by Susan Jo Russell, Janice Mokros, Rebecca Corwin, and Peggy Kapisovsky]

Many special needs students have problems with writing—problems which surface at different levels. At the mechanical level, students have trouble with spelling, punctuation, and handwriting. They may be unable to construct grammatically correct sentences. On another level, perhaps because of their problems with the mechanics of writing, special needs students have difficulty focusing on the flow of ideas in their writing. The stories they write are typically shorter and more barren of detail than the stories written by their classmates. Because of their lack of writing skills, many of these students appear disinterested in writing, and lack self-confidence in their writing ability.

For students with these problems, in the words of one teacher, "the word processor is the equivalent of a ramp for physically handicapped individuals." It helps students get around their writing problems and gives them access to written expression. Teachers have found that the word processor helps students focus on their strengths as writers, and allows them to find ways of communicating more effectively. Like other children, special needs students have a variety of interests and ideas, as well as the desire to communicate about these. The word processor allows children to demonstrate their expertise by writing fluently about meaningful topics without stumbling over mechanical obstacles. At the same time, the word processor allows teachers to spend time thinking about how to facilitate writing, rather than simply serving as proofreaders.

While it is no panacea, the word processor can help special needs students gradually begin to tackle problems with writing. Ultimately, it can help students be more confident writers who enjoy using their writing skills to communicate with others. By giving them a vehicle for writing frequently and writing about things they care about, word processors help students learn not only writing skills, but also grammatical and spelling skills. Some teachers find that the simple fact that students are able to read their own writing when it appears on the word processor, helps them focus on how the words should look and be spelled

Research has demonstrated that children learn more about the mechanics of writing by writing than by doing workbook exercises on grammar, punctuation, or spelling. A series of studies has shown that formal instruction in grammar has no lasting effect on the quality of students' writing. By giving students more opportunities to write and rewrite, we help them improve both their composition skills and their use of standard writing conventions.

Some educators think that the greatest potential of word processing is with students who have an aversion to writing or severe problems with the mechanics of writing. These students stand to gain the most from a tool that will simplify the writing and revision process. As one parent (herself a school principal) commented about her learning disabled seventh grader: "He had never written a paragraph before this year. Then, when a teacher showed him how to use the word processor, his writing just took off. He's writing stories now. He doesn't think he's dumb anymore."

The Practical Advantages

In addition to its great potential to improve the writing and self-confidence of special needs students, word processing software has great practical advantages. One major advantage is that it meshes well with existing writing curricula. It is easy for teachers to

transfer writing, editing, and grammar exercises to the computer, using the same instructional methods that they have used all along. It is easy to type, save, and print assignments on the computer, and the resulting product is pleasing to the eye of both student and teacher. Here is an instance where the transfer of existing learning activities to the computer is straightforward and effective.

A second practical advantage of word processing software is that it can be easily integrated with the learning objectives that appear on students' Individualized Educational Plans. When a teacher introduces word processing, few changes need to be incorporated into existing IEP's. The word processor is simply a better tool for accomplishing the writing goals that have already been established for individual students who have problems with writing.

In the classroom, it is difficult for teachers to encourage students to work systematically on planning, writing, and rewriting. In the time allotted to writing, most students have time only to create an initial draft, make minor corrections, and then copy onto white paper a cleaner version of the same draft. A major advantage of the word processor is that it buys more time: Once a piece has been entered, it can be reworked and embellished very efficiently. Because new work can be added without recopying the entire piece, the possibility of making new errors is largely eliminated. Freed from the burden of recopying papers to make them look good, students have more time to play with ideas, sequences, images, and language.

Learning Objectives

> "<My goal> is to help the children reflect on themselves and their world and to help them express their thoughts and ideas in a coherent manner, where they're able to pay attention to some rules for punctuation, capitalization, and spelling. But I think it's more helping them understand who they are and be able to express that."

Betty Church, the teacher quoted above, has been using the word processor with her

5-10 year old resource room students. Through activities such as writing poems about food, creating books about dinosaurs, and authoring autobiographies ("The Maze of My Life," as one student titled his essay), students are developing a sense that "the writing process is a very thoughtful, reflective, and personal process."

Word processors are most valuable when used to focus on what the child wants to say, rather than on the mechanics of writing or of using the word processor. Above all, the teacher must keep in mind that a central learning objective is to help students take ownership of their writing. Students who feel that they have something important to say to a particular audience are often more invested in saying it correctly. On the other hand, when the piece belongs to the teacher who has structured the assignment around a topic she has selected, students often do not care enough to put much thought into the writing assignment.

While it is tempting to plan several introductory sessions to master word processing commands, students are often bored by such sessions. Many teachers prefer to have students master the correct procedures as the need arises within the context of their own writing. In this context of working on meaningful writing, students often swap word processing commands that they have mastered with each other. They learn to turn to peers for help when encountering trouble with deleting, moving, or other editing tasks. Teachers who encourage this exchange find that everyone benefits. On the other hand, teachers who insist that each word processing command be mastered before proceeding with real writing find that students lose interest before they ever get a chance to write.

Should editing and proofreading skills be stressed as a major learning objective? Certainly the word processor facilitates skill development in these areas. The problem is that for children who are not yet confident writers, editing gets in the way of composing.

Children begin to focus on getting it "right", rather than on the process of writing. They begin making safe choices—for example, using the word "bird" for "downy woodpecker"—because they fear that potential spelling mistakes matter more than careful selection of words.

Children become quickly discouraged and easily lose their trains of thought when their thoughts are interrupted by a teacher's requests to go back and fix punctuation or spelling i n a sentence that was just written. A major strength of the word processor—the ability to make instantaneous revisions—can become a drawback if teachers focus on corrections without attending to the content.

The issues are timing and emphasis. Word processors are best used for composing, without calling attention to the student's mistakes until drafting and refining have been finished. At a later stage, when students are proud of the content of their product, they are more than willing to polish a piece for publication. Keep in mind that simply in rereading their piece to see if it suits them, students will identify and fix many mechanical errors.

Students certainly can be encouraged to use spelling checker software (such as the Bank Street Speller) to correct mistakes in spelling. For example, when they have finished writing, students use the Speller to identify words that have been spelled incorrectly. The Speller gives the student a list of words which it does not recognize, and the student takes responsibility for correcting the spelling mistakes. Note that many spelling programs include a dictionary to which students can add proper names and idiosyncratic words they use in their writing. Keep in mind that seeing and using the correct version of a word in a variety of contexts is the most effective way to learn its spelling. One student used the Find and Replace functions of the word processor to help him with his difficulty in spelling "Prometheus". Every place where he needed to write "Prometheus", he simply wrote "P"

temporarily. Then he went back and instructed the word processing program to substitute "Prometheus" for each "I". In this process and in rereading his work, he saw the correct spelling again and again. The more children write, the better their spelling skills will be.

Some Simple Prerequisites

What skills do students need to master before they begin using word processors? Although students need reasonably sound letter recognition skills before they can start typing text into the computer, many students enjoy dictating stories to a teacher or aide, who types the story on the computer. Primary grade teachers, and even some preschool teachers use the word processor to publish children's stories. Beginning writers and readers—even those who cannot yet recognize letters on the typewriter—get a great deal of satisfaction from the fact that someone values their thoughts enough to type and publish them. Reading and rereading these class books leads to the building of sight-word vocabulary as well as the development of a feel for linguistic sequence and syntax.

When children use the word processor themselves, they are both writers and typists. This dual focus can be a problem for students who have special needs. What level of typing skills do children need in order to effectively use word processors? Educators vary in their answers to this question. Children as young as six years old can learn the positions of keys and how to use them in a hunt and peck fashion. In fact, finding and pressing a letter on the machine may be less difficult than "producing" the letter by hand, especially for children who have difficulty with fine motor skills. Typing ability clearly varies from child to child, and students who have a difficult time with it should not feel like they have to become touch typists before they can even start writing. But it is clear that children who have mastered some basic keyboarding skills are more able to focus on their writing, with less interference from the mechanics of typing.

When children are left to their own devices at the keyboard, they typically create their own idiosyncratic methods for typing. One educator reports observations of four- and five-year-olds who had designed a quite ingenious system: They divided the keyboard into quadrants, moved their dominant hand to the appropriate quadrant, then searched for the appropriate letter within the quadrant. The only problem with this system is that children might develop habits which would later interfere with learning touch typing. Rather than leaving students on their own to figure out how to type, many teachers suggest that time be set aside for separate practice sessions devoted to familiarizing children with the keyboard. Keyboarding practice can be an ongoing part of computer education beginning in the early grades, but mastery of keyboarding skills does not need to be a prerequisite for using the word processor.

Sound keyboarding skills for beginners can be developed through the following methods which have been suggested and tried by teachers.

- provide students with a cardboard template of a keyboard, which they can refer to and practice with during free time.
- at first, encourage students to keep both hands on the keyboard, using their right hand for keys on the right side of the keyboard, the left hand for keys on the left.
- later, have students keep their index fingers on the "home keys" ("f" for the left hand, "j" for the right), which are marked by a raised bump on many computers or can be marked with colored labels.
- have students practice typing skills by using one of the "typing tutor" software programs for a few minutes before they begin writing. Be aware that students can become very adept at arcade-style typing games without using appropriate keyboard positions. Software which mirrors traditional, systematic techniques for teaching typing appears to be the most effective.

First Steps

How do teachers begin to use word processors with their special needs students? The first step, of course is to become personally familiar with the software. This means trying it out for your own writing, experimenting with its capabilities, and going through the

minor frustrations that students are sure to encounter. Most teachers do not find it helpful to begin by reading the instructional manual from cover to cover. Use the manual as a reference book, rather than a step-by-step guide.

It is often a good idea to work through the tutorial software that accompanies many word processing programs. Well-structured tutorials can give the new user an immediate feel for the software and what it can do. But even tutorials are no substitute for actually using the software to do some writing of your own—a letter, weekly plans, or notes about one of your students.

The best way to learn and remember the editing conventions is through a great deal of hands-on practice. Finding someone who can answer questions—another teacher, a friend, a student—has been critical for many teachers learning to use word processors. There is nothing more frustrating than getting completely stuck and feeling like you are totally inept at using computers. There is probably a simple way of getting "unstuck", and someone with a little more experience can often help you find your way out quickly. And it's much easier to ask a friend than to find the solution in the manual! Like learning the rules of a board game, learning a word processor's features is best done by "playing the game", and having others help you learn it.

After two or three practice sessions, most teachers feel comfortable enough with a word processor to introduce it to students. Thorough mastery of the software's features is not a prerequisite for student or teacher use. A few basic functions—how to enter text, how to delete text, how to insert text into what you have already written, how to save your writing to a disk, how to retrieve your writing from the disk—are needed to begin; additional mechanics, such as moving a paragraph or centering a heading, are best learned as the need arises. Many teachers find that students themselves become a valuable source of expertise,

and are quite willing to share their expertise with others. In one classroom, two learning disabled junior high students learned how to use Appleworks on their own, although their peers were using the less complex Bank Street Writer. Their teacher commented, "It's wonderful. They're teaching me now—I don't even now how to access their files!"

Teacher-tested Word Processing Activities

Teachers suggest starting with relatively simple activities that involve the entire class. For example, a good initial activity is writing a group story. Each student takes a turn writing one line of a story. The finished story is then read aloud, and students critique it. Which parts lack clarity or detail? Which sentences don't "sound right"? This kind of discussion gets students used to thinking about writing as communication to an audience, with the focus first on sense, style, and vocabulary, and later on spelling and punctuation. Yet because the story is not the work of one author, the risk in hearing criticism is not so great. Once the group story is completed, it can be revised, expanded, or continued by individual students as a hands-on introduction to word processing.

Once students have had some practice with the word processor, they will want to work on their own pieces. It's important to give them access to the word processor for planning and initial drafts, as well as for revising. When the word processor is used simply as a typewriter, with students writing out the first draft by hand, the mechanical advantages of word processing are minimized. In all cases, the teaching goal should be to have children focus more on their writing and less on mechanical obstacles.

Below are some successful, teacher-tested writing activities that can be introduced to children who have used the word processor a few times:

- Have each student write a "book" to contribute to the class library. With younger students, use software that has extra large print (such as Magic Slate) so that there will be many pages in the book. Students can make special covers, illustrate each page, laminate the pages, then share their contributions with others through the

library. Children can "check out" these books to bring home and share with parents. Unmotivated students who "don't have anything to write about" have often become interested when they begin to see the published ideas of their classmates.

- Write a class cookbook. Each student contributes a recipe, along with a paragraph about the dish (why s/he selected it, what's special about the dish, etc.) Once the recipes have been collected, the class needs to organize the cookbook and decide how recipes should be grouped. This is a good activity for helping students master word processing features like setting margins and tabs, moving text, and formatting. It also provides a context in which students can develop good organizational and classification skills.

- Write journals. Give each student his/her own disk and set aside some time for ungraded personal writing. Many teachers say that this is an extremely effective way of helping students with low self-esteem to begin thinking about themselves as writers. Journal writing has the additional benefit of encouraging students to articulate issues that are of personal concern.

- Use a word processor in conjunction with a graphics program to have chilldren write illustrated stories or reports. For example, one teacher's class wrote and illustrated reports on silkworms using a combination of a word processor and a graphics program. Students who cannot do their own writing can use software which combines text and graphics in many ways. For instance, they can dictate sentences to an adult or more skilled student, then go back and illustrate their story. This procedure encourages students to read and reread their own text.

Publication is a critical part of writing. When finished writing disappears into a student folder, the student's desk, or the wastebasket, the student has little sense that writing is for communication, not just for a grade. To enhance intrinsic motivation to write and write well, publication in some form—a class book, a newspaper, distribution to friends or parents, a periodic collection of writing for which each student selects his best work—is essential. Teachers stress that much of the excitement of a word processor comes from showing a professional-looking printed product to peers, parents, and even the principal. If the final product is enhanced with graphics and illustrations (either hand-made or computer generated), students are especially proud of their accomplishments.

Therefore, access to a printer is one of the key elements to successful word processing. Special education teachers may find themselves in the position of fighting for a share in the limited access to the school's printers. However, the professional look of a printed piece of writing that has been carefully edited and published using the word processor is a

powerful motivator for reluctant writers. As one special educator put it, "My students are learning that their work can be more than just adequate; it can be excellent."

Juggling Computers, Classrooms, and Students' Needs

It is important to give students as much access as possible to the word processor. Many students lack confidence in their writing skills, and they need to explore the new writing tool without major distractions or time pressure. Because computers are a scarce resource in many schools, teachers need to find creative ways of allocating computer time. Teachers working in a resource room, who typically work with only a few students at a time, may want to give each student some time with the computer during a class period. If this strategy results in insufficient time for a student to work on a piece, it may be a better idea to schedule each student on the computer for one substantial chunk of time during the week. Giving students the opportunity to work on their own can have unexpected benefits, according to one resource room teacher. She sent individual students into the computer lab to work while she remained in the classroom with other students. She found that the students became quite independent and were proud of their ability to work on their own.

Teachers working with larger classes, including those working with special needs students in a mainstreamed classroom, face problems in giving each student a turn at the computer. One solution is to have students take turns throughout the day working at the classroom computer, while other students engage in regular classroom activities. Research has shown that this approach is better than taking students to a computer lab, where they feel pressured to finish a writing task during a class period. Teachers who work in mainstream classrooms should be sure to give special needs students plenty of time on the computer. In fact, some teachers advocate giving these students more time than their classmates. For students who have poor fine motor control, for instance, this tool is more than just a welcome change; it may be critical to the development of their literacy skills.

Students with learning disabilities often need the extra time, as well as extra encouragement, to translate their ideas to the screen.

Should students work alone, in pairs, or in larger groups? Although collaboration often initially comes about as a matter of necessity—too few computers for too many students—teachers find that there are unexpected advantages in having students collaborate. As students learn to use the word processor, they can share their frustrations and successes with a partner. By working with peers who have particular strengths, students may develop new competencies, and the student "expert" feels accomplished in sharing his or her expertise. Pairing students with different strengths in generating interesting ideas, illustrating, and editing may also help students make best use of their talents.

Teachers have noticed that students who collaborate become less dependent on the teacher and at the same time more able to critique their own and each other's writing (Russell, 1986). As a result, they take more responsibility for their writing. As Betty Church explained,

> Now I've started having the kids read to each other; when they've finished a piece of writing they read it to the group. . . the responsibility of the listener is to listen and respond to something they particularly like in the story. That's been great. I want the kids to interact a little more with each other rather than interacting with me on the writing. It's beginning to happen.

Donna Simone noticed changes in her students' proofreading skills as they began to collaborate:

> We have an activity once a week where the kids take one piece of their writing and they have to read it to their peer. In reading their work to one another they're picking up more of their errors and going back and doing the proofreading. . . Somehow with the computers, we find that the reading part of it really helps. And it's not me saying, "look, there's something wrong here." Another kid is reading, and they hear, "That's not what I meant when I wrote it."

Students seem to enjoy reading each others' stories. Teachers find that they are much more interested in editing stories written by their friends than editing "canned" stories from a disk or a textbook.

Important as collaboration is, keep in mind that some students feel protective of their writing and are not yet willing to take the risk of sharing writing with another student or with the class. Students who view themselves as writing failures may need privacy in the beginning, and the word processor certainly can support this need for privacy. If at all possible, give each student his or her own disk for saving writing assignments. Encourage the class to respect these disks as personal property. While students should be encouraged to share their writing and to collaborate with others, at the same time their right to privacy must be respected. Teachers often make agreements with their students about which writing is private and which is to be published. For example, one group of students wrote lively and heartfelt essays about how they would change their school, but they agreed in advance that these would be published and shared only within their class, where they felt they could risk saying what they really thought about school rules, requirements, and activities.

Strategies to Promote Writing

As the student is working on the word processor, the teacher's role is critical in helping the child expand on his or her writing, and to provide suggestions for doing so. Some teachers circulate throughout the room, acting as an unobtrusive assistant. Other teachers set a regular conference time to meet with each student to discuss the writing. This ensures that everyone gets a chance to get assistance, and students can learn to save their questions

and comments for the assigned meeting time. Teachers report that successful word-processing interactions between student and teacher involve strategies like the following (Morocco & Neuman, 1986):

- Read what the student has written and react to it on a personal level. ("After reading that paragraph, I feel like I can almost taste that horrible meal you describe.")
- Help the child clarify or expand his writing by asking questions which directly relate to what the child has written. ("What is it about the room that makes it feel cheery?")
- Help the child plan what she is going to say, and review the plan with her while she is writing. ("You said you were going to concentrate on that nasty bee sting you got. How does this part about the picnic fit in?")
- Suggest strategies for expanding or clarifying what the child has written. ("Think back to when you went through the doors into the emergency room. Write about what was going through your mind.")
- Listen to what the child is saying, and ask her to write down just what she said. The child may also need help in remembering exactly what she said. ("That part about how you fooled your neighbor sounds very funny. Write down what you just said.")
- Type what the child is saying. The teacher is most likely to type for a student when ideas are flowing and the student is unable to type fast enough to get her ideas down, or when the student is stuck. Teachers can type short phrases on the computer, based on what the child says aloud, which the student can then expand into complete sentences. This technique helps bridge the gap we so often see between the richness of a student's verbal account and the barrenness of the same account when it is written down.
- When the child encounters difficulties with the word processor, help her focus on the writing itself by assisting with particularly difficult commands or steps.
- Build the child's self-image as a writer by commenting on the strengths she has in common with real authors, and by assuring her that authors share some of her same frustrations.
- When you are working with a pair of children, demonstrate the skills described above, and encourage students to use the same strategies you are using when they are reading each other's work.

In sum, the teacher serves as audience, guide, and collaborator. The word processor helps the teacher by making the writing process more public and explicit and helps the

student by providing clear and easily modifiable text, but teaching strategies which support and extend the child's writing are still the key to helping students become better writers.

Does Word Processing Really Make a Difference?

When teachers use word processors, they notice many changes in their students' approach to writing. The changes are not always easy to articulate, because they can occur in many different ways for different students and may include changes in attitude and self-confidence which are difficult to measure. As Donna Simone explains,

> There are just so many things [the word processor] attacks; you can't say one is more important than the other. I used to think that this improved writing was really important, but I have to remind myself about the kid who wouldn't do the writing because he had such a lousy feeling,<and now> he's sitting right down when he comes in to do the writing. Also what's improving is the thinking going with the writing. . . So it's like a whole spectrum of things that improve, and you can't say that one is more important than the other.

Teachers notice that special needs students write more when they use word processors, that the quality of their word choice and sentences improves, and that students have improved images of themselves as writers. By keeping writing folders of students' work over the course of a year, teachers are able to document changes in writing skills that would not be apparent from examining only one or two assignments. Furthermore, writing folders enable teachers to show parents, principals, and the students themselves what has happened to the quality of writing over time. Teachers state that it is far easier to evaluate changes in students' writing when they have printed pieces from the word processor than when they have to struggle with a sheaf of handwritten pieces.

One researcher (Rosegrant, 1985) showed that when learning-disabled students used a word processor along with a speech synthesizer, their writing improved in length, vocabulary, use of punctuation, and use of more complex writing structures. Other researchers have found that when children write on the computer, the product is often a more natural, speech-like composition that has special meaning for the child. However,

one thing is clear from what we are learning about word processing from teachers and researchers: The power of word processing software is quite dependent on the pedagogical skills of the teacher (Neuman & Morocco, 1985). Word processing software is a tool that can facilitate writing, if used by a skilled and sensitive teacher. Providing students with a tool does not provide them with instruction nor an appropriate learning environment. It is up to the teacher to do this. It is gratifying to see that as teachers become more involved with word processors, the questions they ask start to focus more and more on teaching writing rather than on how to use the word processor. This is a good sign. It means that the tool is, as it is intended to be, an unobtrusive aid to the writing process. It means that we are correctly focusing our attention on helping special needs students learn writing, rather than teaching them how to use the computer. As one teacher said after using the word processor for nearly a year, "I've shifted gears from focusing on disabilities to focusing on real writing."

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USING THE COMPUTER FOR DEVELOPING PROBLEM-SOLVING AND CRITICAL THINKING SKILLS

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[Excerpted from the forthcoming book, *Beyond Drill and Practice: Using Learner-Centered Software in Special Education* by Susan Jo Russell, Janice Mokros, Rebecca Corwin, and Peggy Kapisovsky]

The computer offers new approaches, activities, and tools for special education students in the familiar curriculum areas of reading, writing, mathematics, science, and social studies. But some of what the computer has to offer neither relates to the development of familiar skills nor fits neatly into traditional subject matter categories.

In this chapter we take a look at computer software designed to help students develop and use the ability to cope with unfamiliar problem situations, situations which more nearly approach the complexity and unpredictability of real life than do most textbook problems. This software is not always easily categorized in terms of the usual sort of learning objectives and, at least at first glance, may appear difficult to justify in a tightly scheduled, highly accountable regular or special education setting. However, software which helps students learn how to solve problems offers learning opportunities which can be of great benefit to them—opportunities to develop confidence and skill in making decisions and thinking critically, processes which we know are of great importance to their survival beyond school.

The software we will be discussing in this chapter covers a broad range of content and complexity. At one end of the spectrum, some of this software offers straightforward problem-solving games which involve the student in discovering a secret pattern, sequence, or relationship, usually by trying something, seeing the result, then trying again. For instance, in The Pond, students try to find a pattern of moves (e.g., down 5, left 2, up 3) which, when repeated a number

of times, will enable the frog to jump successfully through a maze of lily pads from one end of the pond to the other. Such a game may require only a few minutes for completion of one puzzle.

Other problem-solving software is much more elaborate and time-consuming. In using a simulation, for example, the student may participate in a story which has a setting, a goal, perhaps other characters, objects to use, events which occur, and rules which may be stated or which may be left to the user to uncover. By making decisions and accumulating information, the student can gradually reach the goal, which may be to solve a mystery, to find something, to get to a particular place, or to prevent a disaster. For instance, in Snooper Troops, the student is a detective who must find clues and interview people in an attempt to solve a mystery. This problem may take many sessions and may require the cooperation of several students to complete.

While you are reading through this chapter, keep in mind the following thoughts:

- problem-solving software includes a very broad range of content and complexity
- any particular piece of problem-solving software can be appropriate for a variety of ages and abilities
- student cooperation can allow students with a range of strengths and needs to work together in using this software
- special needs students' ability to cope with this software has often surprised their teachers
- watching special needs students work in these less familiar contexts has helped teachers understand more about their learning styles and strategies

This chapter includes examples of how special needs teachers have used problem-solving software in different ways, the learning objectives they have developed, and how they see their own role in supporting students' use of this software.

"But my students could never do that!": Why Use Problem-Solving Software?

In addition to the four general characteristics of learner-centered software described in Chapter 1 (user control over the goal or strategy or both; informational feedback; the use of prediction and successive approximation; meaningful context), problem-solving software has all or most of the following characteristics:

1. It presents unfamiliar problems in unfamiliar contexts.
2. While students may need to draw on some skills that fall into conventional subject matter areas (e.g., estimation, map-reading), much of what is required crosses subject area boundaries (e.g., sequencing, testing hypotheses, revising strategies).
3. It requires (and encourages) risk-taking and initiation.
4. Errors are necessary and unavoidable.
5. Information is often given in more than one mode. Information is offered visually as well as through text or symbols.
6. In order to solve problems, many facets of the situation must be considered and coordinated. Depending on the particular problem, synthesizing a very large amount of information and paying attention to many variables may be necessary.
7. Directions are of limited usefulness. Students find out most about the problem situation by trying something and seeing what happens.

You may already be starting to say, "No directions? Many variables? Risk-taking? Complex problems? My students could never do that!" Many of us reacted this way when we first encountered problem-solving software. It intrigued us as a potentially interesting and useful learning experience, and we wished we could make more such experiences available to our students, but we were all too aware of the difficulty many of our students seem to have with material that is not presented carefully, slowly, sequentially. However, as teachers began to try software such as that mentioned in this and the next chapter, they found that many students functioned differently in this new context than in their regular school work. Teachers learned new things about their students' strengths and learning styles, while the students themselves found new ways of working on their learning problems. In some cases, teachers found that working with students in the computer problem-solving environment led to a much improved student-teacher

relationship in other aspects of classroom work. You will encounter some of these first-hand experiences later in the chapter.

Some of the characteristics of problem-solving software are actually advantageous for some special needs students. Students with different language, visual, and reasoning strengths can often be successfully paired to work on these activities because of the range of modes in which information is presented. A child who is a poor reader, but is quick to see visual patterns, may excel in a problem-solving game which emphasizes classification of graphic images. Lack of directions may encourage children who have always failed at following written directions; the necessity to try something and see what happens brings about a certain amount of equality among students—nobody knows, at first, what to do!

There are also practical, educational reasons for beginning to include problem-solving computer activities in our curriculum. Lack of directions, complexity, and the inevitability of making errors—these are the conditions of solving problems in daily life. Looking for a job, planning a trip, buying a used car, or managing a budget are activities for which there are no directions and no quick solutions. In fact, many of these problems are never really "solved" at all; they require continual reevaluation and planning.

Providing "real life" problem-solving experiences in an educational setting, without watering them down so far that they lose exactly those characteristics of reality that we are after, has always been a difficult task. Many teachers have attempted to involve their students in the kinds of complex projects which are optimal for the development of thinking, reasoning, and organizational skills. Such projects—running a school store, planning and cooking a meal, publishing a newspaper, writing and presenting a play—allow students with many different kinds of learning problems and learning strengths to participate successfully. Often these activities are exactly the ones in which special needs students find a role that is different from their usual one of failure.

But such projects happen rarely for most students. Problem-solving software gives us a new way to offer students a greater variety of experiences with unfamiliar problems and more opportunities to develop the skills necessary to solve them.

Three Programs Which Worked

The best way to give you a sense of how problem-solving software can be used with special needs students is to share the accounts of several teachers who, each in her or his own way, developed objectives, approaches, and activities which worked with a particular student population. These classroom stories are not intended as prescriptions. The teachers themselves would be the last people to offer their experiences as the only way—or even the right way—to use this software. All of them are continuing to develop and modify their approaches. These stories simply provide glimpses of the possibilities, and we hope you will find flashes of the familiar in encountering these classrooms.

1. Snooper Troops

Snooper Troops is a simulated mystery story in which the user plays the role of detective. Students must travel around the town and collect clues by interviewing various characters in the story. Jan Schraith chose Snooper Troops to use with her class of twelve seventh-grade learning disabled students in order to focus on student improvement in six areas: map skills, organizational skills (such as note taking), deductive reasoning, communication skills, cooperation with peers, and the ability to work on a project not completed within one class period. The students were at least two grade levels behind in reading as well as two to three grade levels behind in written expression skills. The class was in the computer lab two days a week to use the word processor and on one of these days, students used Snooper Troops, on a rotating basis. (They had three copies available, so this limited the number of students who could work on it, since the disk must remain in the disk drive during use).

Jan introduced the whole class to the mechanics of operating the program, then chose partners based on particular objectives she had for work on interpersonal skills. Students began by practicing the mechanics of the program, such as driving the Snoopmobile. Students at first had

difficulty thinking ahead in order to press the command to stop in time. To a chorus of "oops" and "oh, no, not again", students gradually learned to control the car. At first, Jan gave no directions for proceeding to solve the case, but as students worked, it became clear, both to her and to the students, that further direction was needed. She devised a worksheet to help students organize information from the booklet which accompanies the program and an outline map on which students could fill in the places they located as they investigated. She met with each group at "frustration times", directing the students, through questioning, in order to guide them in determining next steps. At intervals, three pairs would meet as a group to compare notes and learn from each other.

In working with this game, students learned—from necessity—to keep good notes, to read information in the booklet, and to use their maps. Students also learned that they could not solve the case simply by guessing. While this was frustrating at times, they learned that they had to gather facts to back up their suspicions. Students loved this game, and those who solved the mystery were secretive and amused by others' guesses. Jan saw particular improvement in organization, communication, and cooperation among her students in the course of working with this software.

2. Agent U.S.A.

Agent U.S.A. challenges students to locate and neutralize the "fuzz-bomb". In order to do so successfully, students travel on trains around the United States searching for the fuzz-bomb, a search which requires attention to both time and geography. Steve Spencer used this program with a self-contained class of ten students, grades four to six, with reading or language problems and behavior problems directly related to their learning difficulties. Steve's goals included organizational skills, helping students to expand their strategies beyond a trial-and-error approach, reducing antisocial behavior, and improving students' self-images as learners.

Steve began with a short introduction to Agent, and almost immediately began playing the game and having students join in. Because his students have difficulty listening to a long stream of information, he felt that the best approach was to involve them in trying the game immediately, then gradually add information through discussion. When the students were initially unsuccessful, he helped the group discuss possible strategies.

Steve found that a group of three students at the computer was the most effective grouping One student studied the map, one typed, and the third helped out with strategies. He often included in the group one student with severe reading problems, but average conceptual skills, and one student who was a better reader with poorer cognitive skills.

One group of three 12-year-old boys became particularly involved with Agent. They saw it as different from the usual school tasks and were surprised that Steve allowed them to play it frequently. As they worked with the game, the group began discussing and trying new strategies and establishing long-term goals. Steve noticed increased skills, concentration, and cooperation. One boy in particular, Allen, with a severe reading disability and visual perceptual, auditory, and memory problems, had refused to try anything and was becoming a troublemaker. He was turned off to everything, and, as Steve says, "if you can't solve that problem, you can't teach." But like many learning disabled students, Allen was smart and was able to develop effective strategies in this context, one which appealed to him and in which he felt more in control. The experience boosted his view of himself, improved his attitude, and helped him develop and use some important organizing strategies.

Steve felt that this activity required a lot of teacher supervision. He checked in with his students often while they used the game, helping them to consider new ideas and strategies. In the future, he thinks a group discussion after each session to review what occured and develop strategies for the next round would be useful. An interesting footnote to Steve's experience is that

none of his students actually solved the game. Howeve , Steve's students found immense satisfaction and success in getting better and better at a challenging, demanding activity. We often protect our special needs students from frustration and failure by insuring that they gain immediate succes, yet frustration is a necessary component of the learning process. In real life, success is often measured in years rather than minutes. This kind of experience with a long-term problem may help students develop the kind of concentration and involvement they will need when tasks do not begin and end within a 45-minute period.

3. Gertrude's Secrets and Gertrude's Puzzles

Gertrude's Secrets and Gertrude's Puzzles each contain a series of games which require sorting and classification by shape and color. For example, in one of the puzzles, the user must arrange puzzle pieces in three rows and three columns so that no piece is in the same row or column asa another piece of the same shape or color. Many special education teachers have used these programs with a range of populations. Linda Ware uses both Secrets (the easier of the two programs) and Puzzles with her junior high resource class of students with learning and emotional problems. Her objectives in using this software are to promote her students' ability to: discriminate between color and shape, order and classify by pattern and by sequence, categorize and infer patterns and rules, recognize similarities and differences, use deductive reasoning, and use critical thinking.

She finds that her students are eager to use the computer, considering it "play" rather than "work", but that their responses clearly indicate that they are thinking not only about selecting an answer but about why they are selecting a particular response. She organizes her class into groups of three, introduces the computer work to one group, then appoints a Computer Tutor (CT) from the first group to help the next group of three get started. This kind of organization enables her to work with students not involved with the computer.

Linda has been particularly interested in developing off-computer activities to give students the chance to use and extend the learning she sees going on while her students are using the computer. She creates worksheets which guide students to use the same kinds of comparison and categorization skills with which they have been engaged on the computer in other areas of the curriculum. In one activity, students worked on the similarities and differences among animal, plant, and human cells from their science notes; in another, they classified bodies of water in their state. Huge arguments arose from their work on classifying rock musicians. Linda reports that their classification scheme was complex and entirely student-directed: "Throughout their work, they immersed themselves in the data in a manner which rarely occurs in the classroom; they were thinking about the data rather than merely memorizing it without meaning-making." With her support, she felt that there was an obvious transfer of skills learned while using Gertrude to other content areas.

Steve Voiles has used Gertrude's Secrets with everyone from his own five-year-old to his sixth grade special education students. He finds that these learning activities seem to stimulate the same intense interest and perseverance throughout this broad age range. Like Linda, he is interested in learning objectives that include hypothesis and prediction, pattern recognition, and using deductive reasoning, and he also modifies his approach to fit the emotional and social needs of his students. Here are Steve's accounts of two students' experiences with Gertrude.

> Jeffrey was extremely defensive with teachers, especially special education teachers, because he had been teased about being a "dummy." Part of him was valiantly trying to prove that he was not dumb, but his emotions were so overwrought that he would make quick, poorly thought-out decisions based on only partial information. It was extremely hard to instruct him because he was forever trying to prove that he didn't need any help, and his rejection of assistance placed him in an even deeper morass of partial understanding and poorly concealed self-doubt. The attractive format of Gertrude, however, momentarily disarmed him. When I allowed him to "play," he faced a computer, not a teacher; his defensiveness slowly began to fall away. After some preliminary success, I began to offer observations about the choices he was making. I was a commentator more than a teacher, so I was tolerated. After a couple of sessions, Jeff began to be willing to speculate, hypothesize, and then test his ideas to see if he was right. He was thinking carefully instead of reacting emotionally and impulsively. His intelligence began to show through and our whole teacher-student relationship began to improve.

Kevin, however, baffled me with his hyperactive approach to the activities. He was bright, but impulsive. The keying caused him no problem and the maze was a breeze for him. When he got to an activity, his fingers would fly over the keys as he systematically inserted piece after piece into the puzzle until a solution was reached. He knew that trial and error would eventually solve the puzzle, and he was in a hurry to pile up prizes. I was disappointed to see him settle for a primitive strategy when he was so clearly capable of higher levels of thinking. Yet, when I tried to engage him in hypothesis and prediction, he just saw it as slowing him down and "making things harder." I put the disk away for a while, not wanting to help him overdevelop such a low level skill while ultimately more satisfying approaches lay untapped. Finally I realized that I could exploit his competitiveness as a means to get him to pay more attention to details and options. I had Kevin work with a partner, taking turns at the keyboard. While Kevin solved a puzzle, his partner would count the number of guesses that he needed to solve it. Then they would switch positions and Kevin would count the number of guesses required for his partner to solve the same puzzle. Very quickly, they began to compete. I innocently pointed out that, if they were competing, the winner would be the person who could solve the puzzle in the fewest possible guesses. Suddenly Kevin was willing to listen to suggestions and explore approaches that might lower his score.

For all of these teachers, effective use of problem-solving software required extra time, effort, and thought. All of them had to make the activities work for their particular group of students by designing support materials, deciding on grouping, or choosing how and when to intervene and when to hold back from intervening. For these teachers, the computer was not viewed as a way to save time or to make learning more efficient. Rather, it offered them and their students a flexible new approach for achieving important learning objectives. We consider these objectives further in the next section.

Learning Objectives for Problem-Solving Software

What are appropriate learning goals and objectives for problem-solving software which does not fit neatly into a content-area category such as mathematics or language arts? Teachers using this software have had to grapple with this issue, partly to explain to others—parents, administrators, next year's teacher—how and why this software is used, but also to help themselves clarify objectives and plan for individual students.

Here, for example, is what two teachers say about their objectives in using such software. Steve Voiles describes the use of Gertrude's Secrets this way:

> I don't believe Gertrude directly fits a standard curriculum area, but I value it as pure "cognitive exercise". You have to think to explore the maze and the activities. If students are encouraged to develop strategies and to state their ideas about why one possibility works and another does not, then several additional layers of mental exercise accumulate. Depending upon the student and his particular level of ability and experience, you might choose to focus on deductive reasoning, hypothesis and prediction, sets and subsets, shape and color recognition, the process of elimination, trial and error, pattern recognition, etc.

Steve Spencer explains the reasons for using Agent U.S.A. in his classroom:

> There are so many things my kids don't know. Their basic problem is a lack of organizational ability. They can't get organized to attack a problem. Instead they use trial and error only, get frustrated, and give up. I work on this in all areas, and Agent was one fun way to do it. The kids need help in a tremendously wide area—both academic and social. How do you teach concentration? You can't. You can't teach it explicitly. You try to help kids begin to ask themselves questions, develop strategies, and look at things in different ways.

From these statements, you can see that teachers' goals for their students' use of problem-solving software can cover a broad range of objectives. Many teachers have begun by trying out problem-solving software with their students without preconceived ideas about goals and objectives to see what the potential uses are for their particular group of students. Teachers find they can't always predict how their students are going to interact with problem-solving situations. However, after some experience with a piece of software, teachers usually devise more specific goals. They translate the general objectives they started out with, objectives such as concentration, organization, or "cognitive exercise" into more specific, more manageable goals which can be included in children's educational plans and which lend themselves to monitoring and documentation. Depending on the constraints or flexibilty in their particular setting, their own teaching styles, the strengths and needs of their students, and the curriculum for which they are responsible, teachers may choose to concentrate on social skills, general learning skills, or specific content area skills. More and more schools are including objectives in critical thinking or problem solving in their curriculum for all students; teachers' uses of problem-solving software with their special education students often match such objectives extremely well.

What follows is a selection of objectives based on those used by our contributing teachers. We offer this list as a beginning which we encourage you to examine, select from, expand, and alter appropriately for your particular group of students. Since some of these objectives were suggested by teachers at many grade levels, and since strengths and needs of students can vary so widely at each grade level, we have categorized them by type of objective only, not by age or grade.

A Sampling of Problem-Solving Goals

(Remember! This is a sampling of goals used by special education teachers, not a complete or definitive listing.)

Organizational skills

- Note taking
- Gathering facts
- Categorizing
- Comparing and contrasting
- Creating and using organized lists
- Identifying patterns
- Sorting necessary and unnecessary information

Reasoning skills

- Deductive reasoning
- Finding multiple solutions
- Constructing a sequence of events
- Modifying a sequence of events
- Reasoning backwards from a result to the sequence which led to it
- Using trial and error effectively
- Moving from sole use of trial and error to a range of other strategies
- Using a process of elimination to isolate the solution
- Solving problems with minimal clues
- Varying one aspect of a situation at a time to isolate critical attributes
- Evaluating partial solutions
- Testing solutions
- Making sense out of contradictory or ambiguous information
- Evaluating relative importance of different elements in a situation

Learning to learn
(See Chapter VI for more about this topic.)

- Working on a project not completed in one class period
- Responding to situations flexibly
- Concentrating on a task
- Learning to tolerate errors
- Controlling impulsive answers
- Using errors as information to guide next steps
- Sticking to a goal

Social skills

- Cooperating with a peer or small group
- Communicating with peers about content and strategy
- Taking turns
- Becoming a "student expert" or "computer tutor"
- Taking a leadership role

Content area skills

- Map skills
- Language development skills
- Recognizing shapes and colors

Starting Out with Problem-Solving Software

While we cannot imagine a checklist or set of rules which would adequately guide the selection of problem-solving software, much less appropriately match it to students, we have identified four guidelines which are important to consider when selecting and using software for work on critical thinking skills.

First, most teachers advocate beginning with one piece of problem-solving software and exploring it thoroughly with students. Problem-solving software is typically time-consuming and complex. Students need enough time to familiarize themselves with both the mechanics and the ideas of the software before they can focus on the problems themselves. As indicated by the accounts in this chapter, a good piece of problem-solving software can provide many sessions of productive work at the computer as well as class discussions and non-computer activities. Teachers, too, need time to make connections between the computer experiences and other parts of their curriculum. Extended, thorough use of a single piece of software appears to lead to a more productive, integrated, and coherent experience.

Second, select problem-solving software which offers the student a small world consisting of a setting and (usually) characters which create a believable context for the problem. The story context need not be complicated and detailed to be effective in engaging students in solving problems. Much simpler worlds, such as the frog-pond context of The Pond are intriguing and attractive, even for older students. By "believable" we do not mean realistic; rather, we mean that the problem emerges naturally and is clearly related to the context which is developed in the software. For example, there are many pieces of software in which the user travels through a maze of interconnected rooms, encountering hazards and acquiring treasures. If in order to enter the treasure room in a magician's castle, you have to use clues you have gathered to identify the magic words which open the door, this activity is perfectly consistent and natural, given the premise of

the situation. However, if you are asked to solve an arithmetic problem each time you want to move to a new room, the situation is contrived to lure you into mathematics practice, and any student can tell the difference. Settings and characters which are purely decorative, but do not have a function in the problem situation, appear to be of much less interest to students over time.

Third, problem-solving software in which trial and error is a possible strategy, but not the only or the best strategy, seems to work well with many different students. The opportunity to begin by using trial and error offers a low-risk entrance into problem-solving software. No one can solve problems such as these without some experience Trying without succeeding, then trying again and again until some success is achieved, is a skill—and requires an attitude—which many students must learn in an environment which appears to them a safe one in which to take such a risk. For many children, some success with trial and error lays the foundation for gradually moving toward more sophisticated reasoning strategies. For others, who are masters of trial and error, software in which trial and error is not sufficient to solve the problem may encourage them to adopt more sophisticated strategies. Software which allows trial and error but makes it worthwhile for students to devise more sophisticated strategies counteracts, on the one hand, too much initial frustration and, on the other hand, boredom resulting from lack of challenge.

Finally, match the complexity and duration of problem-solving activities with students' levels of experience with this kind of software. Students who lack confidence in their own intellectual ability, who are frightened by unfamiliar learning situations, or who have poor organizational and reasoning strategies will need to enter this new realm with appropriate support and structure. Software which limits the number of choices students must make, which has relatively few steps to reach a solution, which has a manageable amount of information for students to collect and organize, which offers on-screen prompts about next steps, and which can be completed in a single sitting is a good place to start. For example, Where in the World is Carmen Sandiego?, a detective

mystery which has all these features provides a straightforward, but still challenging, introduction to this whole genre of mystery simulations.

By choosing appropriate software we can help students gradually become more confident and independent in problem solving, but we should not expect to eliminate all the difficulties students may encounter. Teachers have found that they need to be wary of overprotecting their students. As one teacher of learning disabled teachers remarked, "I kept running over like a mother hen. I was more anxious than they were!" We don't want our students to fail, yet experiencing some degree of failure is a component of solving problems. If a student is ever going to be able to work on a problem which cannot be completed in one session, learn how to work cooperatively with a peer, or manage a period of frustration, s/he has to have these experiences.

The role of the teacher is a critical part of this process. What is clear from teachers' accounts of their use of problem-solving software with their special needs students is that successful incorporation of this software into the learning environment requires a triad: student, software, and teacher. It is just as unreasonable to expect students' critical thinking skills to blossom automatically when they use a piece of software which is designed to encourage problem solving as it is to assume students will learn how to read if given enough books. Books provide motivating and intriguing content—a reason for reading. Problem-solving software also provides motivating and intriguing content—a reason for thinking and planning. If students are to make the best use of this software, teachers are there to help students over mechanical hurdles, provide support during frustration, encourage productive failure as well as success, and extend new learning into other aspects of the students' work.