DOCUMENT RESUME

ED 325 105 IR 014 708

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| AUTHOR | Franklin, Sharon, Ed.; Strudler, Neal, Ed. |
| TITLE | Computer Integrated Instruction Inservice Notebook: Elementary School. |
| INSTITUTION | International Society for Technology in Education, Eugene, OR. |
| SPONS AGENCY | National Science Foundation, Washington, D.C. |
| REPORT NO | ISBN-0-924667-57-5 |
| PUB DATE | Jan 89 |
| CONTRACT | TEI-8550588 |
| NOTE | 231p.; For related documents, see IR 014 709-711. The accompanying 800K Macintosh diskette is not included in this document. |
| AVAILABLE FROM | International Society for Technology in Education, 1787 Agate Street, Eugene, OR 97403 (1-4 copies, $40.00 each prepaid). |
| PUB TYPE | Guides - Classroom Use - Guides (For Teachers) (052) -- Guides - Non-Classroom Use (055) |
| EDRS PRICE | MF01 Plus Postage. PC Not Available from EDRS. |
| DESCRIPTORS | *Computer Assisted Instruction; *Computer Literacy; Educational Change; Elementary Education; *Elementary School Teachers; *Inservice Teacher Education; Instructional Innovation; Postsecondary Education; *Teaching Methods; Word Processing |

ABSTRACT

The purpose of this notebook is to assist educators who are designing and implementing inservice education programs to facilitate the effective use of computer integrated instruction (CII) in schools. It is divided into the following five sections: (1) Effective Inservice (a brief summary of inservice literature focused on inservice dimensions and design principles); (2) Background Information (an overview of computers in education and a discussion of the roles of computers in problem solving); (3) Initiating/Planning an Inservice (suggestions for preliminary planning and activities and a sample timeline for those activities); (4) An Eight-Session Elementary School Inservice (2-hour sessions on interpreting data with graphs, integrating graphing software with existing materials, unstructured and structured data, structuring and analyzing data, database and word processing, prewriting activities with word processing, process writing conferences and Formula Vision, and revising and editing with a word processor); and (5) Instruments and Evaluation (a variety of instruments for needs assessment, formative evaluation, and summative evaluation). Each 2-hour elementary school inservice session contains some or all of the following: narrative overview, script (topics, objectives, materials, activities), timeline, handouts, and readings. Also included are appropriate articles from issues of "The Computing Teacher," and a Macintosh diskette. References are listed in the first three sections. (DB)

# COMPUTER INTEGRATED INSTRUCTION INSERVICE NOTEBOOK:

## ELEMENTARY SCHOOL

INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION
ISTE Publications

## About the Project Director

David Moursund has been teaching and writing in the field of computers in education since 1963. He is a professor at the University of Oregon in the College of Education. He is the director of both a master's degree and doctorate programs in computers in education.

Some of Dr. Moursund's major accomplishments include:

- Author, co-author, or editor of more than twenty books and numerous articles.
- Chairman of the Department of Computer Science, University of Oregon, 1969-1975.
- Chairman of the Association for Computing Machinery's Elementary and Secondary School Subcommittee, 1978-1982.
- Founder, International Council for Computers in Education, 1979.
- Chief Executive Officer, ICCE, 1979.
- Executive Officer, ISTE, 1989-present.

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ISBN 0-924667-57-5

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* The research and development for this Notebook was funded during 1985 - 1989 by the National Science Foundation grant TE[illegible] 8550588. The ideas and opinions expressed however are those of the authors, and do not necessarily reflect the views of the National Science Foundation.

** Not all staff members worked specifically on the mathematics inservices. A number of volunteers also contributed to this project.

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# PREFACE

The purpose of this Notebook is to assist educators who are designing and implementing inservice education programs to facilitate the effective use of Computer-Integrated Instruction (CII) in schools. CII involves the use of the computer as a problem solving tool. CII includes the use of applications such as databases, graphics, spreadsheets, telecommunications, and word processors, these are generic applications in the sense that they can be used in many different subject areas and grade levels. CII also includes use of special purpose software designed to help solve the problems occurring in specific courses or disciplines.

This Notebook was prepared by the staff of NSF Project TEI 8550588, which received three years of funding beginning September 1985. It is one of four notebooks to be prepared that include:

CI$^3$ Notebook for Elementary School
CI$^3$ Notebook for Secondary School Mathematics
CI$^3$ Notebook for Secondary School Science
CI$^3$ Notebook for Secondary School Social Science

The problem addressed by this NSF Research and Development Project is the disparity between the overall capabilities and potentials of CII and the current implementation levels of CII in our schools. There is strong support from computer-knowledgeable educational leaders for increased use of CII.

Growth in appropriate use of CII depends on schools having:

- Access to appropriate hardware;
- Access to appropriate software;
- Access to appropriate curriculum and instructional support materials; and
- Appropriately trained teachers and school administrators who support increased use of CII.

The cost of computer hardware continues to decline even as its capabilities continue to increase. The amount of computer hardware available for instructional purposes is now sufficient to have a significant impact on schools. Moreover, hardware availability is continues to grow very rapidly. This project assumes that the problem of hardware access will gradually diminish; thus, this project does not focus on the hardware problem.

The quantity of educational software is continuing to grow, while the average quality continues to improve. A 1986 estimate suggested that there were about 10,000 educationally oriented, software programs for microcomputers commercially available. *The Educational Software Selector*, published by EPIE, lists nearly 8,000 titles. The amount and quality of CII software now available is adequate to support extensive use of CII in schools and to have a major impact on school curriculum. The educational market is large enough to support a viable, competitive industry with many companies participating.

This project does not focus on the overall problem of educational software. However, each Notebook contains information about a number of pieces of educational software. To the extent possible, the focus is on currently available generic CII software. In cases where more specific pieces of CII software are discussed, they were selected because they are readily available, and are apt to remain so for some years to come, and because they fit the specific instructional needs of the authors of these notebooks.

Instructional support materials include textbooks, workbooks, and reference materials; films, filmstrips, and video tapes; and course goals, course outlines, and teacher support materials. Although there is a substantial amount of instructional support material for learning/teaching about computers (teaching computer literacy, computer programming, and computer science), the amount of instructional support materials for CII is still quite limited. This project includes the development of a modest amount of CII teacher support materials, a number of sample lesson plans have been developed and are included in the Notebooks, for example. It is not, however, a major goal of this project to develop CII instructional support materials.

The NSF Research and Development project focuses on the development of effective methods for the inservice education of educators interested in CII. The materials contained in the Notebooks are intended for computer education leaders who are designing and implementing CII inservice education workshops and courses. Each Notebook contains a detailed outline of an eight-session workshop along with support materials. A number of "Copy Me" pages are included for dissemination in an inservice workshop or course.

It is recognized that designers and deliverers of inservice education vary widely in their experience, computer background, and academic area of specialization. With this in mind, two general methods are envisioned for using the materials in these Notebooks. First, an inservice provider might rely heavily on a particular Notebook, following it closely in giving a sequence of workshops or a course. Second, an inservice provider might use these Notebook materials to get ideas and to serve as resources in designing and presenting CII instruction to educators. In either case it is expected that the inservice provider will benefit from use of the Notebook materials and will learn some new ideas about effective inservice and CII.

This Notebook presents a particular philosophy of inservice education. It is a process-oriented philosophy, as distinguished from a content oriented philosophy. Thus, an inservice education program based on this Notebook will look quite different from the traditional computer-oriented inservices that have been widely presented in recent years. The resulting inservices are fun to lead and fun to participate in. They are an effective way to encourage the increased and appropriate use of computer-integrated instruction in schools.

# How to Read and Use This Notebook

The purchaser of a single copy of this Notebook receives a print copy and a copy in *MacWrite* format on 800K Macintosh disks, and a single user site license.

**The single user site license gives the one person who is designated as the "Primary User" of the site license the right to make copies of all of the materials in this book for classes he or she teaches. If the single user site license is purchased by a school or school district, the intent is that one person be designated as the "Primary User." If several people are to teach using this book, a multiuser site license should be purchased. The right to copy materials from the book does not transfer to participants in classes taught by the "Primary User."**

Information about purchasing a multiuser site license can be obtained from the publisher, the International Society for Technology in Education, 1787 Agate Street, Eugene, Oregon 97403.

The disk copy is organized into folders, sub folders, and individual files in a systematic and relatively logical fashion. At the bottom of each page of the print copy there is information that will help you locate the appropriate file on disk. The typical footer consists of three parts:

*Brief title of the book*: CI$^3$ Notebook
*File name*: This is explained in more detail below.
*Page number within the specific file*: Each file is numbered sequentially starting at Page 1.

The name of an individual file is two or three digits, separated by periods, and a brief title. You will notice that the name of the file you are currently reading is 0.4 Read and Use. The first digit of the sequence is a folder number. This file is in folder number 0. The second digit refers to a particular file within the folder unless there is a third digit. If there is a third digit, the second digit refers to a subfolder number, and the third digit to a file within that subfolder.

This Notebook contains a great deal of information to aid you in conducting an effective inservice for integrating computers into the curriculum. Most readers will want to skip around in the material, rather than reading it from cover to cover. This section is a guide to help such readers by presenting a brief summary of each section and how and when to use it.

## Section 1: Effective Inservice

Substantial literature exists on effective inservice. This section of the Notebook contains a brief summary of the effective inservice literature followed by a discussion of the CI$^3$ model for the inservices designed for this NSF project. We recommend that you read all of this section.

## Section 2: Background Information

The first part of this section is a general overview of computers in education. It might be used as a handout at an inservice for educators who have not had previous coursework or extended workshops on computer uses in schools.

The second part of this section discusses the roles of computers in problem solving. This is essential background information for all inservice presenters. It can also be used as a handout for workshop participants.

## Section 3: Initiating/Planning an Inservice

This section offers a few suggestions to consider when beginning to plan an inservice. Novice inservice organizers will want to read this section.

## Section 4: An Eight-Session Elementary School Inservice

The inservice described in this Notebook is eight sessions of two hours each. Although the basic information included can be presented in eight session, there is enough material for additional sessions if desired. We suggest that you carefully read through the materials for all of the sessions to get the general idea of the information presented.

### *Session 1: Interpreting Data with Graphs.*

We begin the inservice series by learning to use graphics software to represent data. Such visual representation of data is a considerable aid to solving problems involving a large quantity of data. The specific software we use is *MECC Graph*, but any relatively simple graphics package suffices. The main emphasis is on beginning to understand some roles of computers in problem solving and how use of the computer as a tool in the everyday curriculum leads to changes of emphasis and approach on a variety of topics.

### *Session 2: Integrating Graphing Software with Existing Materials.*

This session focuses on integrating use of computer graphics into the existing curriculum. Participants will look at curriculum materials they might currently be using in their schools, and find instances in which computer graphing applications might be appropriate. The focus is on use of the computer as a tool for students, as a tool for teacher-presented demonstrations, and as an aid for preparing student handout materials.

### *Session 3: Unstructured and Structured Data.*

This is the first session on using the computer to store, organize, and retrieve data as an aid to problem solving. Participants will be introduced to the use of database software from MECC and will begin to explore capabilities and limitations of such software.

### *Session 4: Structuring and Analyzing Data.*

We continue to learn about database software and the types of problems that can be solved by use of databases. In this session participants will gather, organize, and analyze data. This session also includes an introduction to *AppleWorks*, which is an integrated package with database, spreadsheet, and word processing components.

### *Session 5: Database and Word Processing.*

In this session we end our database studies and begin working with word processing. Participants practice creating a database and learn to think about what questions a database might be designed to help answer, or what problems a database might be designed to help solve. The major focus of the remainder of the inservice sessions is on process writing in a word processing environment. We introduce word processing through use of *FrEdWriter*, which is freeware designed for use on the Apple II series of microcomputers. Even in this initial introduction, the emphasis is on the writing process rather than on learning the key strokes and other details of a particular word processor.

### *Session 6: Prewriting Activities with Word Processing.*

Process writing begins with prewriting. This session focuses on the use clustering techniques and on "prompts" as part of the prewriting process. *FrEdWriter* contains good facilities to aid teachers in doing prompted writing with their students.

### *Session 7: Process Writing Conferences and* Formula Vision.

After students have completed a draft of a piece of writing, they are ready to receive feedback. Feedback can come from themselves, their peers, or their teachers. This session focuses on peer and teacher conferencing techniques. However, about half of this session is spent on a piece of software that has little to do with writing. *Formula Vision* is a one screen spreadsheet-like piece of software useful in math and science beginning at about the fifth grade. It is an excellent tool for introducing students to the ideas underlying spreadsheet software.

### *Session 8: Revision and Editing with a Word Processor.*

The final session focuses on use of a word processor to revise and edit one's writing. Time is also provided for participants to plan how they will continue to use computers with their students. The final activity is an evaluation of the inservice series.

## Section 5: Instruments and Evaluation

The NSF project used a variety of instruments for needs assessment, formative evaluation, and summative evaluation. Copies of these instruments and a discussion of some of the results are included in Section 5. The NSF project inservices placed considerable emphasis on formative evaluation, and we recommend that workshop leaders do likewise. Such an emphasis will help workshop leaders adjust their presentations to meet the needs of participants.

Readers are also encouraged to study Seymour Hanfling's doctorate dissertation, which was completed in the fall of 1987. Hanfling's work focused on formative evaluation of the NSF project. His dissertation was directed by Dick Rankin (the project evaluator) and Robert Sylwester. It provides substantial information about the effectiveness of the project during its first year. Additional detailed information on the long term effects of the project are discussed in Vivian Johnson's doctorate dissertation completed in summer 1988 under the direction of Dick Rankin and Dave Moursund.

# EFFECTIVE INSERVICE

## 1.1

## What the Research Literature Says

Change is difficult. It is difficult to imagine, difficult to plan for, difficult to implement, difficult to manage, and difficult to measure. Fullan (1982) states that, in the educational context, "change involves 'change in practice'" (p. 30) and he demonstrates several difficulties. For one, change is multidimensional; new materials, new teaching approaches, and alteration of beliefs must be considered.

Inservice training is a major tool in the implementation of educational change. In reporting a research-based model for such training, (Gall & Renchler 1985), the authors state, "No one yet pretends to have discovered all the elements that make staff development programs completely successful" (p. 1). One reason for this is the difficulty in designing studies that can "tease out" the effective practices from the background noise of incidental and uncontrolled effects. The most reliable measure of effectiveness—change in student behavior—is several steps removed from the major actions of most staff development programs. Joyce and Showers (1983) describe a model involving classroom-level coaching that promises to take the training all the way to the level of observation of actual classroom practice, but such designs are rarely implemented due to limitations of time and funding.

Because change takes time and is best viewed as an ongoing process, the internal state of the learners—in this case, teachers themselves—is an important consideration. Hall (1982) showed that it is desirable to match inservice to current levels of concern of the individual participants. Furthermore, continued tracking of the evolution of their level of concern can function as a diagnostic tool for modifying the content of training "on the fly," should modifications be necessary.

The literature on inservice designs that are specific to computer education is sparse. Gabel (1984) reviews the work of Isaacson (1980), Winner (1982), and Ferres (1983), and finds, that their essentially descriptive studies do not speak to the issue of effectiveness, but instead concentrate on the mechanics of developing and presenting special purpose inservice training. Gabel's own work concluded that the model suggested by Gall and Renchler (1985) was a valid and useful framework for organizing computer education inservice.

In this section, the categories for the dimensions of inservice follow those outlined by Gall and Renchler (1985) and are divided into five categories. content and organization, delivery system, organizational context, governance, and evaluation.

### Inservice Dimensions

*Content and Organization.* The realm of the planning, development, delivery, and follow-up of actual training sessions is below the level of more global concerns such as the environment in which inservice is provided, the goals and standards of the institution whose teachers are being educated, or the measures by which the inservice program is to be evaluated. Of course, these global issues have great impact on the training to be delivered. For example, the environment may determine the resources, timing, extent and depth of the program. The goals and standards of the institution (e.g., a school district) should strongly influence (if not actually determine) the content of the program. The measures of evaluation may direct the attention of the trainers to emphasize more closely monitored elements of the program at the expense of other elements less emphasized by the evaluation instruments.

Nevertheless, the actual conduct of an inservice may be separated from these other concerns and a large body of literature (accompanied by a much smaller body of research) is available for inspection. The predominant feature of the literature is that it is generally based upon common practice, rather than upon actual research. In fact, the *management* and *evaluation* of inservice training is more thoroughly researched than the *conduct* of inservice.

Gall and Renchler (1985) identified the dimensions of methods of delivering an inservice

1. Readiness activities. What actions are taken prior to the conduct of training to raise teacher awareness of the importance of the inservice program? How are school leaders prepared for their roles in the training? What participant information is gathered before the program begins?

2. Instructional process. What training methods will be used to help teachers acquire the target knowledge and skills?

3. Maintenance and monitoring. What provisions are made to observe and measure the actual level of application of the content of the training to classroom practice?

4. Training site. Is the training best carried out at the school site, or is another location more appropriate?

5. Trainers. What trainer characteristics may impact the effectiveness of the training program?

6. Scheduling. What duration, spacing, and timing should the training program have?

Competently designed inservice training programs will address each of these dimensions. The usual practice of trainers is to give great attention to the instructional process, scheduling and their own preparation.

An additional question to be addressed might consider any practical distinctions that exist among different types of learners. Are adults in general (and teachers in particular) sufficiently different from other learners that exceptions or refinements must be made to the well researched principles of learning? (see Gagné, 1977) Although the most general of these learning principles remain intact, researchers such as Knowles (1978) have determined that adult learners are sufficiently different from children as to merit distinct consideration. Among the important features of adult learners cited in Knowles' work are that:

1. Adults learn by doing, they want to be involved. Mere demonstration is usually insufficient. Practice and even coaching are highly desirable.

2. Problems and examples must be realistic and relevant to them *as adults*.

3. Adults relate their learning very strongly to what they already know. They tend to have a lower tolerance for ambiguity than children, so explicit attachment of new knowledge to their existing base is a paramount necessity.

4. Adults tend to prefer informal learning environments, which are less likely to produce tension and anxiety.

5. Changes in pace and instructional method tend to keep the interest of the adult learner high.

6. Unless the conditions of training absolutely require it, a grading system should be avoided. Checklists of criteria met in the course of training, for example, are less intimidating than the assignment of grades.

7. The instructor should frame his or her role as that of a facilitator of learning rather than as a font of knowledge or expertise. This guarantees that participants will find the trainer approachable, an absolute precondition of communication between adult learner and teacher.

It is obvious that these adult learner characteristics are of great concern to the teaching of adults and they should govern several aspects of the preparation, delivery, and follow-up. The impact of these elements of training is discussed below in summary with lessons learned from other sources.

In a study of the impact of inservice on basic skills instruction, Gall et al (1982) identified a number of deficiencies in the ordinary conduct of inservice:

1. Programs tended to be focused on the professional goals of individual teachers rather than on the improvement of the school instructional program. Teachers' goals and school needs are not always in consonance.

2. One-shot training or short sessions failed to show impact on the school's instructional program.

3. Although the inservice programs were sponsored and financed by districts or schools, the general plan and learning activities of the training were based on goals and objectives that had little or no demonstrable connection to those of the school or district.

4. Programs were very rarely assessed on the basis of actual improvement of student performance.

5. Most inservice programs lacked several of the following desirable features: readiness activities, a meeting, follow-up activities, and in-classroom observations to identify changes in teacher behavior that might be attributed to the inservice training.

These researchers judged that programs exhibiting such deficiencies will have little impact on teacher practice or student performance.

Much of the work of Joyce and Showers (1983) centers on governance issues, but they also have critical points to make concerning the conduct of inservice:

1. Training may be considered to be composed of levels of involvement: lecture, demonstration, practice in the training environment, practice in the target environment, and coaching in the target environment.

2. Generally, lecture and demonstration have little impact in terms of changing teacher behavior.

3. Practice (following lecture and demonstration) contributes greatly to change in teacher behavior.

4. Coaching (following lecture, demonstration, and practice) not only contributes further to change, but also creates opportunities for dissemination of an innovation or desired practice throughout the unit (e.g., department, school, or school district) in which change is desired. One of the most promising of these opportunities is peer coaching.

Echoing elements of both Knowles (1978) and Joyce and Showers (1983) are some of the findings of the Florida State Department of Education (1974):

1. Inservice programs that place the teacher in an active role are more likely to accomplish their objectives than those which place the teacher in a receptive role.

2. Programs that emphasize demonstration, supervised trials and feedback are more successful than those that simply present new ideas or materials to teachers without opportunities for practice.

3. Programs in which teachers share and provide mutual assistance to each another are more likely to succeed than those that fail to encourage interaction during and after training.

4. Self-initiated and self-directed training activities (although seldom used in inservice education programs) are associated with successful accomplishment of program goals.

The literature offers many similar indicators of success or effectiveness in inservice conduct. They are briefly summarized as follows:

1. The content of inservice education programs should be directly and immediately linked to the goals of the agency sponsoring the training.

2. The characteristics of teachers as adult learners should be taken into account when inservice education activities are designed. In particular, the activities should be relevant to them as adults, new knowledge should be explicitly connected to previous knowledge, an air of informality should predominate, grading systems should be avoided, and the trainer should act as a facilitator.

3. Designs that feature multisession contact and development of an ongoing relationship between trainer and teacher is preferred over one-shot designs.

4. If possible, the training should include not only presentation of information and demonstration of new methods and skills, but also supervised practice and coaching.

*Organizational Context.* When referring to the organizational context in which inservice education occurs, Gall and Renchler (1985) echo the "modal systems" of Joyce and Showers (1983). While Gall and Renchler recognize the five modes identified by Joyce and his colleagues, they prefer to think of these modes as representing different functions of inservice education and go on to identify four such purposes: (a) inservice for personal professional development; (b) inservice for credentialling; (c) inservice for the purpose of induction into the profession; and (d) inservice for school improvement.

"Inservice for school improvement" speaks directly to the school as an organization. Operationally, one can define the organizational context as those organizational elements of the school that directly influence the success of inservice education. But organizational context also implies a series of interrelated components that work in relative harmony. To divorce any one component from the whole distorts our perception of and reaction to that element. Just as our perception of our environment is continuous, so the school must be viewed holistically as a continuous, dynamic collection of interlacing and interactive parts.

A meta-analysis done by Lawrence and Harrison (1980) concludes that the most effective inservice programs address the school as a unit. Their research supports the contention that inservice is most effective when the emphasis is on global goals rather than personal development.

These findings are consistent with the observation of noted anthropologist Edward T. Hall (1981) about the essential nature of the context of expression and action. He states that context determines everything about the nature of the communication and predicates further behavior. A focus on school improvement places the "situational dialect" of the teacher professional life of the teacher within the larger frame of the school as a complete unit. This broad focus of shared goals gives a context of discussion in harmony with the larger organizational context. A somewhat different but complementary observation is made by Pitken (1972) when she examines the question of social membership. She notes that with respect to learned or cultural norms, the wholeness and uniformity of our society is determined by the acquisition of like patterns by people exposed to them. These views lead again to the conclusion that the more consonant the goals are with the school, the more consistent will be the patterns of compatibility between the behavior elicited and those expressed by the administration and support staff. In essence, the new behaviors or activities must mirror the intentionality of the school as a unit.

If we place the goals of the inservice within the larger framework of the school environment and provide a collegial support structure, chances of institutionalizing any changes are improved. In a fundamental sense, the organizational context provides the ecological gestalt of action and interaction. Compatibility between the objectives of the inservice and those of the school is essential if changes are to be made a part of the taken-for-granted background of the teacher, administrators, and support staff in their daily activities.

Holly (cited in Gall & Renchler, 1985) surveyed 110 teachers and found a general preference for activities that allowed them to work with other teachers. Ngaiyaye (cited in Gall & Renchler, 1985) found that teachers preferred to work with teachers who had similar educational duties. Domain-specific knowledge as defined by Doyle (1983) consists of an explicit semantic network of relevant information and identified methods or strategies for applying that information. Although Doyle was addressing academic content, it seems clear that the same theme can be applied effectively in inservice education. Thus, not only does educational research support the need for teachers to work with teachers, but it supports a more specific domain of discourse in which they share their goals and concerns with teachers in their own or similar subject areas. In a collegial environment made up of their peers, teachers can relate common concerns and share methods or strategies central to their needs as educators (U.S. Department of Education, 1986). Furthermore, teachers with similar instructional assignments can share materials, tools, and new methods of instruction.

Unfortunately, there appears to be no research examining the relative effectiveness of variations in teacher inservice groupings as defined by Gall and Renchler (1985). Wade (1985), however, does indicate in her meta-analysis that participation by both secondary and primary school teachers is more effective than either group working alone.

In an organizational context, the school principal as an instructional leader plays a major influential role. Research by Louchs and Pratt (cited in Gall & Renchler 1985) indicates that the role taken by the principal in the implementation efforts of a program is essential to the success of the project. Leithwood and Montgomery (cited in Gall & Renchler 1985) have shown that an effective principal will participate in at least part of the inservice workshops attended by the staff. Finally, the Rand study (cited in Gall & Renchler 1985) suggests that without the approval of the principal, teachers generally will not implement a new curriculum or process.

As noted above, the school is a dynamic but loosely coupled organization. This loose coupling requires a mediating force that lends a coherence to its structure. Thus, the principal seems to act as a lens to keep school goals clearly in focus and as a guide to keep teachers on track with district objectives (U.S. Department of Education, 1986).

*Governance.* The issue of governance frames the larger context of school as a functioning unit. Operationally we can define governance as that organizational process of decision making that determines school policy and directs school resources. The governance of inservice education specifically addresses concerns about the way an inservice will be designed and offered to the district staff. The study by Mertens (1982) clearly shows that the view of the teacher as a professional must pervade the district; when teachers are viewed as professionals, inservice projects are more successful than when teachers are viewed merely as functionaries. All projects and or policy decisions need to be approached in this light.

There appears to be no research on the most effective infrastructure for carrying out the process of governance at the district level. However, there is ample research to indicate that this process must take into account teacher concerns and expectations. Many researchers indicate that the teacher must be given the opportunity to be part of the planning. If teachers are not consulted the results can be disastrous. Wolcott (1977) documented a carefully planned effort for educational change in a school district in Oregon. This mammoth seven year plan involving several hundred thousand dollars, vast district resources, and uncounted hundreds of hours for both planners and teachers failed. Its primary failure was that it did not take into account the needs of the educator. It was conceived as a "top-down" approach and implemented as such.

Wolcott reaffirms the importance of teacher participation in the planning process. What is not clear is how much control teachers should have over the inservice content. On one side is the work of Schurr (cited in Gall & Renchler, 1985), where it is shown that teachers desire input into the planning process; on the other side is the work of Wade (1985) that indicates inservice sessions were gauged as "less successful" if participants were regarded as the major contributors to the process. Indeed, her meta-analysis shows that inservice sessions are more effective if the leader assumes the role of "giver of information" and teachers as "receivers of information." Clearly, a balance seems necessary. It is important to ascertain the needs of teachers so that inservice sessions can be directed specifically to their needs. On the other hand, the integrity of the inservice content must be maintained with policy and planning decisions attempting to strike a balance between teacher input and district needs.

Another issue of governance is the recruitment of participants. Motivation to attend inservices can be subtly but definitely enhanced if the research outlined in this section is taken into account. A feeling of personal connection with the concerns of the inservice is also important. Moursund (1988) suggests that ownership in a problem-solving process is critical. Inservice by definition is a form of problem solving. If participants can feel a sense of ownership of the content of the inservice, they will want to attend and take seriously the purposes of the project.

Wade (1985) confirms the need to have a sense of ownership, pointing out that inservice is more successful when the teachers are given special recognition for their involvement. But she further reports that projects are more successful if teachers are either designated to attend or selected on a competitive basis. Clearly, the research confirms the need of teachers to be a willing part of the process, but it also indicates that directing teachers to attend is not predictive of failure. Obviously, this is a complex issue. *How* teachers are directed to attend is important; the content and relevance of the inservice is important; the organizational context is important; and the way the issue of governance has been handled in the school is historically important.

Other incentives for attending inservices described by Betz (cited in Gall & Renchler, 1985) are release time, expenses, and college credit. Administrators, however, can take heart in Wade's (1985) finding that almost any inservice can make a difference. She reports that inservice of any kind, on the average, resulted in half a standard deviation greater positive change than control groups. This is a clear indication that inservice education can influence the quality of the education.

In summary, effective inservice must take into account the school organizational context and its governance policies. It appears that the more the inservice speaks to the unifying goals of the school, the more effective will be the results.

***Evaluation.*** As stated in Gall and Renchler (1985): "The evaluation of inservice programs is not a well-developed field," and "... systematic evaluation of inservice programs is the exception rather than the rule" (p. 30). In an effort to bring some order to the field, Gall and his colleagues (1976) attempted to define the different levels at which inservice training might have effects. They defined four levels:

Level I: Implementation of the inservice program. (Measures of the quality of the training itself.)

Level II: Teacher improvement. (Measures of actual change in teacner behavior in the classroom.)

Level III: Change in student performance. (Measures of the degree to which improvements in teacher performance lead to improvements in student achievement.)

Level IV. Changes in the environment. (Measures of changes in the school that may be indirect [or even unintended] results of the inservice program.)

The further away we get from measuring the direct delivery of training, the less certain we can be that changes in Levels II, III, and IV are actually attributable to the training program. Other factors, unpredicted and unmeasured, may have greater impact than training.

At Level I, the elements mentioned previously in the Content and Delivery System section (readiness activities, instructional process, maintenance and monitoring, training site, trainers, and scheduling) should be measured directly. In addition, some quantification of the degree of relevance of the program to teachers' perceived and actual needs should be attempted.

At Level II, the best measures are those of increased teacher competence. If the program is of novel content (as a computer inservice might well be), conventional measurements might have to be supplemented with new ones that reflect the content of the training. Observational measures of actual classroom practice are the preferred instruments.

At Level III, measures of student achievement are appropriate. Because this level is rather far removed from the training, it may be difficult to attribute changes in student behavior directly to actual inservice practices.

At Level IV, we hesitate to suggest methods of measurement. Although instruments can be created to measure school climate and levels of intercommunication among the staff (Joyce, Hersch, & McKibbin, 1983), it is perilous to presume explicit connections between an inservice program and a change in the school environment.

## Conclusion

To narrow the scope of the literature on effective inservice, this review concentrates on literature dealing with the actual conduct of inservice.

The five dimensions of inservice (i.e., content, delivery system, organizational content, governance, and evaluation [Gall & Renchler, 1985]) were used to examine the literature. The predominant feature of the literature is its bases in common practice, rather than on actual research. Literature specifically related to implementing changes in educational computing is extremely limited. The literature that exists concentrates on the delivery system aspect of Gall's classification.

Currently, staff development is the major tool for implementing educational change. Reviewing the literature confirmed our intuitive belief that effective inservice is difficult to attain for the following reasons:

1. Change is multidimensional. (We are dealing with change in a school system, and a school system is a very complex entity.)
2. Change is a slow process. (It is the nature of a stable and functioning system to resist change. School systems seem to be exceptionally resistant to change, and change only slowly.)
3. Effective inservice is resource intensive. (In many settings the resources available for inservice education may not be adequate to produce a significant change.)
4. Learning styles of adults are complex. (A typical inservice will involve adults with widely varying interests, characteristics, and backgrounds.)
5. Global characteristics of school systems, many of which are outside the influence of the inservice provider, influence change.
6. Participation of teachers in the process of setting goals for inservice may enhance the learning of the participants, but it is difficult to properly achieve this participation in goal setting.
7. Mechanisms for evaluation of inservice programs are ill-defined and infrequently attempted.

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# 1.2
# THE CI$^3$ MODEL FOR EFFECTIVE INSERVICE

*(Note: This is a slightly modified version of a paper written by Seymour Hanfling, Judi Mathis, and Jim McCauley for presentation at the University of Oregon "Extensions of the Human Mind" conference in August 1986. These three authors were all members of the NSF CI$^3$ project staff when the paper was written.)*

The Computer-Integrated Instruction Inservice (CI$^3$) project directed by Dr. David Moursund began in September 1985. The purposes of the three-year project: were (a) to develop an inservice model for educating teachers in methods of integrating general computer software tools such as databases, spreadsheets, graphics programs, science tool kits, into their curriculum; and (b) to develop a method for training inservice trainers in the use of that CI$^3$ model.

During the first year the project team concentrated on developing the inservice model and materials in two areas: elementary schools and secondary school mathematics. The second year of the project continued this teacher inservice development and extended it to include secondary school science. It also developed an inservice to train trainers in the use of the CI$^3$ model. The third year will refined the materials from the second year, created materials for secondary school social studies, and began dissemination of the results of the project.

The ultimate goal of the CI$^3$ project is to bring about improvement in the classroom; this is a formidable task. The process of bringing about improvement through innovation in the classroom by staff development has been studied extensively ( Berman & McLaughlin, 1978; Dillon-Peterson, 1981; Fullan, 1982). Even though there is no agreement on the "one" best way to do staff development, there is agreement on the need for the support and involvement of the major components of an educational system: the teachers in a school or department, the building administration, the central administration, the school board, and the students' parents. The CI$^3$ project used this knowledge in formulating an inservice program.

First, we received the support of the central administration of the district within which the workshops took place. Second, we viewed the school (or department in the case of a high school) as the unit of change, not the entire district. We worked with groups of teachers from a building (or department). Finally, an administrator from each building was required to participate along with the teachers. As Wood, Thompson, and Russell (1981) point out:

> For staff development to have a lasting effect, the principal must be committed to the implementation of the inservice goals, participate in the inservice planning and activities, encourage other staff members to participate in training programs, and support and reinforce the implementation of new knowledge, skills, and strategies. (p. 63)

During the first year of the project we were quite successful in getting school administrator participation in the project. During the second and third years we were less successful. There is a substantial body of theory on how to organize and conduct an inservice to be as effective as possible. It usually turns out that there is a substantial difference between the theory and what one is actually able to accomplish. In this case, we were not able to secure school administrative participation at the level we would have liked during the second and third year.

During the first year, the CI$^3$ project worked with two groups of educators. One consisted of the principals and a number of elementary school teachers from three schools. The second consisted of mathematics teachers from a middle school and a high school and an administrator from each building. There were approximately 17 participants (all volunteers) per group.

Prior to the training, a needs assessment was conducted by interviewing all the participants. We acquired knowledge on a variety of topics, including the participants' current educational and personal computer usage; their access to computers, computer lab(s), and software; their views on educational uses of computers; and the areas in which they desired training.

Originally seven inservice sessions were scheduled. The sessions were conducted after school and usually at the computer lab sites of the participating schools. (Two sessions were conducted on the University of Oregon campus.) The introductory and closing sessions were originally scheduled to be five hours long (with dinner provided), and the five other sessions were to be two hours in length, held every other week. The teachers found the first five-hour session to be too long after teaching all day. We adjusted our schedule and shortened the last session to two and a half hours. As a result of this experience, we redesigned the second and third year inservices to consist of 16 hours of workshops in eight two-hour sessions.

## The Inservice Model

> The wise leader knows that the true nature of events
> cannot be captured in words. So why pretend?
> Confusing jargon is one sure sign of a leader who does
> not know how things happen.
>
> *The Tao cf Leadership* by John Heider

### Inservice Design Principles

The participants in our inservices reflected a wide range of backgrounds and teaching environments. Although this lack of homogeneity is a common difficulty in computer-related inservice education, it led to the development of a significant premise of these workshops.

Clearly, these workshops are *not* inservice *trainings* in the sense of teaching a specific teaching technique, computer management skill or even competence with a specific piece of software, but instead are *educational* workshops. They are meant to expand teacher knowledge and capabilities in the classroom, and they provide an environment for exploring and learning about the applications of computers and software tools in the curriculum.

The issue of training versus education is critical Computers will be part of education from now on. All teachers will eventually need to deal with computers in schools. Computer inservice for teachers needs to be an appropriate blend preparing them to make some immediate use of computers, but also laying a firm foundation for continued growth and learning in this field. It was our observation that many inservices on computers place too much emphasis on what keys to press and the specific details of particular pieces of software. Many inservices of this sort do not do a good job of developing computer-related foundational knowledge such as general roles of computers in problem solving, changes in education needed to prepare students for life in an Information Age society, etc.

The following design principles were used to create the balanced environment we deemed to be appropriate:

1. Each session should offer participants at least one idea that can be used immediately or in the short term future in their classrooms. This idea might be an activity, a piece of software, a teaching style, or a management aid. The sessions are rich learning environments in which participants discover and experience many ideas and applications of computer-related activities and software tools. These environments provid . many

opportunities for participants to find ideas that are appropriate and relevant to their instructional situations. The process of discovery also helps build ownership and increases the likelihood of classroom implementation.

2. Software should always be introduced in an instructional context. Rather than training participants in the details of a piece of software, the tool is introduced with classroom examples. Activities are designed so the participants can be successful even if they have only partial knowledge of the software. This allows teachers to see that they need not understand all of the nuances of a program before they use it in the classroom. There are two reasons for this approach: First, it helps teachers explore and gain an understanding of the instructional uses of a specific software tool. Second, it provides a model for teachers to experience an activity and begin to adapt the activity to their own classrooms.

3. Participants should experience activities on two levels. First, as "students" in an inservice, are the activities meeting the objectives? What is being learned? What is being experienced? Is it enjoyable? Second, they are asked to analyze the activities and the inservice itself: What activities have been chosen? Why have those activities been selected and not others? How can those activities be adapted to their classroom?

   Reflection and discussion of these questions occurs at different times. The participants are briefly reminded to note and reflect on the first questions while they are doing an activity. These questions are then repeated during the closure discussion for an activity. The second set of questions is also discussed during closure for an activity and at the closure for the entire session.

4. The participants should work in groups. There are four reasons for this. First, Cox and Berger (1985) have shown that working in groups on the computer is more effective in solving problems than working individually. Second, the participants become accustomed to discussing computer-related curriculum matters with each other. This helps build a school level and district-wide resource base, and it builds a spirit of mutual support among the inservice participants. Third, it allows the trainers to work with more of the participants. Finally, it allows the trainers to eavesdrop on participants' conversations and gain relevant information for conducting discussions and directing the remainder of the session.

   In recent years the effectiveness of cooperative learning has become clear. Many people fear that computers will be used to isolate students and work against against the cooperative learning environment. But this need not be the case. Many computer activities can be done in a cooperative learning environment, and research supports this approach as being good.

5. Each session should be structured to allow participants to discover methods and models of instruction. The participants demonstrate or gain an understanding of these methods during the debriefing of each activity or at the session closure. This approach differs from many prevailing inservice formats by avoiding an explicit statement of inservice objectives at the outset of each session. Our goal is to avoid creating a specific mind-set in participants that may deter them from making their own original observations or restrict them from making additional observations. It also allows them to experience the activities as their students might, thus providing valuable insights that can be gained in no other way.

   Imagine, for a moment, a scale which is labeled "Pure Discovery" on one and "Pure Directed Instruction" on the other end. Most of the instruction in our schools is conducted using a style that is much closer to the Pure Directed Instruction end than to the pure Discovery end. But it is essential that both teachers and students learn to use computers in a discovery-based mode, so that they feel comfortable in working with new software applications and learning on their own. Thus, in designing the inservices, we made a decision to place major emphasis on discovery-based learning about computers. We reasoned that if teachers learned about computers in this type of mode, they would then use it with their students as they introduce computers into their classrooms.

This method requires the development of mutual trust. Through the activities the participants discover, learn and gain insights across many pedagogical domains. During the debriefings the trainers can aid the participants in understanding and adapting their insights. This discovery and debriefing-oriented model is stimulating, interesting, and successful.

A key aspect of discovery-based learning is the debriefing periods at the end of discovery sessions. The course instructor (the facilitator) must have a clear picture of the key elements that are to be discovered. (Of course, it usually happens that many additional important elements are discovered.) The debriefing sessions allow participants to bring up and discuss the ideas that they have been working on and discovering. The facilitator must ensure that all key elements are brought up and that they receive appropriate emphasis.

6. The sessions should be *enjoyable!!!* There has been substantial research on the relationship between attitude and learning. We know that if participants are enjoying the learning experience, they will learn more and better.

## Material Selection and Development of Activities

The main reasons that computers are so heavily used in business, government, and industry is that they are a powerful aid to problem solving and productivity. Computers can solve or help to solve a wide range of problems. The focus of this CI$^3$ project is to improve student problem solving by integrating of software tools (e.g.,graphics, databases, spreadsheets, science kits, etc.) into the curriculum. Thus, the theme of problem solving is interwoven throughout the design of the inservices. Inservice participants can explore and experience the use of these tools by solving problems presented in the inservices. These experiences also encourage participants to discover new ways to pose problems and even new types of problems to be solved.

Problem posing and problem solving are higher-order skills, essentially corresponding to the Analysis, Systhesis, Evaluation end of Bloom's taxonomy of cognitive skills. There is a strong and growing movement in our school system to place increased emphasis on such higher-order skills. Computers are a vehicle that can help in this endeavor.

Problem posing and problem solving are interdisciplinary skills. They are not, as many teachers think, just mathematics. All teachers should have their students pose and solve problems. All teachers should teach problem posing and problem solving as part of their overall curriculum

Due to the wide range of backgrounds and experiences of the participants, as well as gender difference careful selection of materials and activities is important. However, selection of software is also limited by practical constraints. Our selections are based upon availability, quality, utility in the particular inservice situation, appropriateness to the grade and concept level, and effective cost. The last item refers to software that is under district license, in the public domain or allows multiple loading. (Some software companies give special permission for multiple loading to educators conducting teacher training.)

After the design of activities and selection of software, performance aids and learning aids (worksheets) are developed. *Performance aids* contain the basic information necessary to use a piece of software; keystroke commands, data retrieval and printer commands, for example. Many participants find that they can use unfamiliar software with a minimum of instruction if supplied with an appropriate performance aid. Participants can also learn to use some software through on-line tutorials.

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*Learning aids* contain problems that increase in complexity and software knowledge, therefore, they may contain software comments where appropriate (e.g., how to print a graph). These worksheets range from very specific instructional sequences to open-ended explorations.

Along with performance and learning aids, sample lesson plans are provided, which can be adapted, extended, and used as models. They are important in assisting participants to transfer inservice concepts to their classrooms, and reduce the amount of effort required to develop and transfer new activities to the classroom.

## Organization and Development of an Inservice Script

In organizing the sessions we tried various inservice methods and activity sequences. The ones we found successful were those that embodied our assumption that instruction is a dynamic process by nature. Decisions are made continually through the interactions of the trainers, the participants, and the content being presented. Thus, the framework of these sessions must be flexible. The same session presented with different groups of participants might begin in the same way, but then, based upon their responses and needs, proceed along different paths. Many times the participants are offered a choice of options or they are allowed to offer their own suggestions on the next step in the inservice. This dynamic process is difficult to capture in words. In the following discussion it is important for the reader to keep in mind that these inservices embody a process that is designed to be flexible.

*Sequencing of Activities.* The sequencing of all activities enhances concept attainment and assists in the transfer of these concepts to the classroom. The sequencing of activities begins with the most concrete activities and progresses to the more abstract.

The typical sequence for an activity is:

1. *Explore.* Allow participants time to "play," so that they may develop an intuitive understanding of the software or activity. Participants make use of a Performance Aid.

2. *Experience.* Work on the software or activities in an instructional format that models classroom presentations. Participants make use of a Learning Aid.

3. *Discuss.* Debrief the activity, paying particular attention to participants' feelings, experiences, attitudes, and ideas for instructional applications. The facilitator makes sure that key ideas that the lesson was designed to cover were indeed covered and get discussed during the debriefing. But keep in mind that the debriefing is to be conducted in a discovery based mode. The facilitator should avoid, as much as possible, switching into a directed instruction mode during the debriefing.

4. *Closure.* The facilitator gives a brief summary statement. Relate this activity to the objectives of the session or previous sessions. Integrate previous participant comments as frequently as possible during closure.

*Sequencing within a session.* We begin each session with a hands on activity or an off-machine problem solving activity that is approximately 5-15 minutes long. (We strongly encouraged participants to work in pairs on the computers. Sometimes a person would decide to work alone, and sometimes three people would work together.) This instant involvement is very useful in setting the tone for the day's session. It allows participants to begin participating as soon as they arrive, and it handles the situation of some participants showing up a little late. The debriefing of this opening activity provides an opportunity to discuss the focus and general goals of the session. (A general goal might be to explore uses of computers to store and retrieve information as an aid to solving problem.)

The next 30-40 minutes is spent exploring activities on the computer with participants working in groups, generally in pairs. This exploratory period might be directed by the trainer or through performance and learning aids, with a focus on the specific objectives of the activity. Participants may become involved in trying to "solve the puzzle" or "beat the computer," and it is sometimes necessary for the trainers to draw the participants' attention to the instructional aspects of the activities. The participants may finish an activity at a later time and at their own pace.

The debriefing of all activities is extremely important. As described above, explanation and debriefing of all activities follows rather than precedes the activities. This allows participants to experience an activity in a situation without a trainer-induced "mindset" and places them in a similar position to that of their students. Encouraging participants to generate ideas cc ibutes to the transfer of ideas from the inservice to their teaching situations. It is more likely that teachers will try new classroom practices if they have experienced these new practices in the workshops and then analyzed and reflected upon them.

The remainder of the session is spent intermixing off-computer and computer based activities. The participants enjoy the integration of off-computer activities into the sessions. The concrete nature of these activities provides a bridge to the abstract nature of the computer.

Final closure for an entire session provides a transition from the inservice setting to the classroom. Our experience indicates that the integration of software tool activities into classes seems to take place if the integration (a) allows students to learn better, faster or in more exciting ways; (b) allows students to work with more important concepts than they are now learning; and (c) is not appreciably more difficult for the teacher than present instructional practice. Discussions during final closure are useful in generating ideas that illustrate these points.

Once the above ideas have been used in planning a session or series of sessions, it is important to review the entire set of activities. Are the transitions smooth? Are the activities building upon each other? Are the original objectives still being met? (The last question can sometimes be overlooked as "exciting" activities and software hide or even change the original objectives.) Finally, is this still a inservice that is interesting and enjoyable to lead and experience?

*Inservice techniques.* Like any teachers, we use a variety of techniques during the sessions. The following are those we find useful and consider the most important:

1. Model classroom activities and appropriate teacher behaviors. We generally teach the way we have been taught. The importance of modeling appropriate teacher behaviors cannot be overstated in helping participants to integrate new ideas into their classes. Merely "discussing" how activities can be done in the classroom is insufficient; they must be *experienced* in order to be understood. (Note that there is some research that suggests that elementary school teachers like to be in inservices that model appropriate behavior, and that secondary school teachers are less supportive of such an approach to inservice education.)

2. Identify and utilize participants with knowledge of the inservice contents. (No matter how carefully one states the prerequisites and describes the intent of an inservice, the participants will have widely varying backgrounds. Frequently there will be one or more participants who are quite qualified to be facilitating the inservice.) Forming groups where at least one of the participants has experience with a piece of software can help make workshops go more smoothly. Establish peer support by publicly validating participants' knowledge and encouraging peers to consult each other for answers. Remind participants that they are experienced educators who bring a multitude of skills to the inservices. (An analogous situation for teachers is using students in their class who are experienced with software to act as helpers or teachers to other students.)

3. In the debriefings and discussions, encourage participants to analyze the activities from two perspectives. that of a student (their experiences while using the software) and that of a teacher.

4. Obtain feedback from the participants at each step of the inservice. Be responsive to their needs and, when appropriate, modify the inservice plan. When necessary, help the participants reevaluate their expectations in order to gain the most from the inservice. For example, because a wide range of teacher backgrounds is present at a inservice, a specific piece of software may not fit everyone's teaching assignment. Shift the focus of those teachers toward examining the software for its strengths and weaknesses: Is it easy to use? Is the feedback appropriate? Does it allow for exploration?

5. Do not be disturbed if the time schedule that you have set occasionally requires you to interrupt participants in the middle of an activity. Research suggests that this can actually contribute significantly to learning. The interruption provides a time for participants to reflect upon their experiences during an activity.

6. Use open-ended questions that encourage teachers to reflect on the session's activities. Convergent questions can cover the content and analysis, as well as pacing and sequencing. Divergent discussions can cover transfer of the activities to the classroom and possible impact on the curriculum and individual classes. These types of questions are important and cannot be hurried. A time for reflection and analysis helps participants gain the ownership necessary to integrate new ideas into their own educational setting.

7. When the trainer does not have an answer to a question, the best response is "I don't know, let's see what all of together know about this question." There may be participants that can provide information, just as the teachers may have students in their class who can help them with a piece of software or activity.

## Reference Materials, Handouts, and Log Sheets

Each participant receives a set of materials at the first session, including relevant journal articles, software reference lists, classroom ideas and public domain software. Refer participants to elements of this collection whenever related activities or discussions take place.

The participants are asked to keep a log of their computer-related activities, including: classroom lessons, work with individual students, personal use, readings and discussions with colleagues. This log form also can be used to ask trainers for information or help. The trainers respond to questions, suggest software the participants might wish to preview, and return the logs. These forms are an important feedback mechanism. It is an efficient way for participants to communicate with the trainers to have a record of their computer-related activities.

## School Visits

Based on the experience from this project, classroom visits should be included as part of the inservice program. This can be done in a variety of ways: A trainer may model a lesson in a participant's classroom; both the participant and trainer may teach a class together; or the trainer may observe the participant teaching a lesson. Many teachers feel that this type of interaction is helpful.

## Closing Comments

We have spent many hundreds of hours working on the CI$^3$ project. It has been difficult to summarize what we have learned, primarily because, as stated earlier, education is a dynamic process. The only way to learn a process is to do it. What we have presented here is a framework that has been effective. However, this is not the end of the development of an effective inservice model. Both formative and summative evaluations have taken place or are in progress, some of the results are given in Part 5 of this Notebook. As you practice using the inservice materials in this Notebook, and as you continue to practice and study the field of inservice education, you will get to be a better facilitator of inservices. One of the joys and frustrations of education is that it is constantly evolving and that educators need to be lifelong learners.

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# BACKGROUND INFORMATION

## 2.1

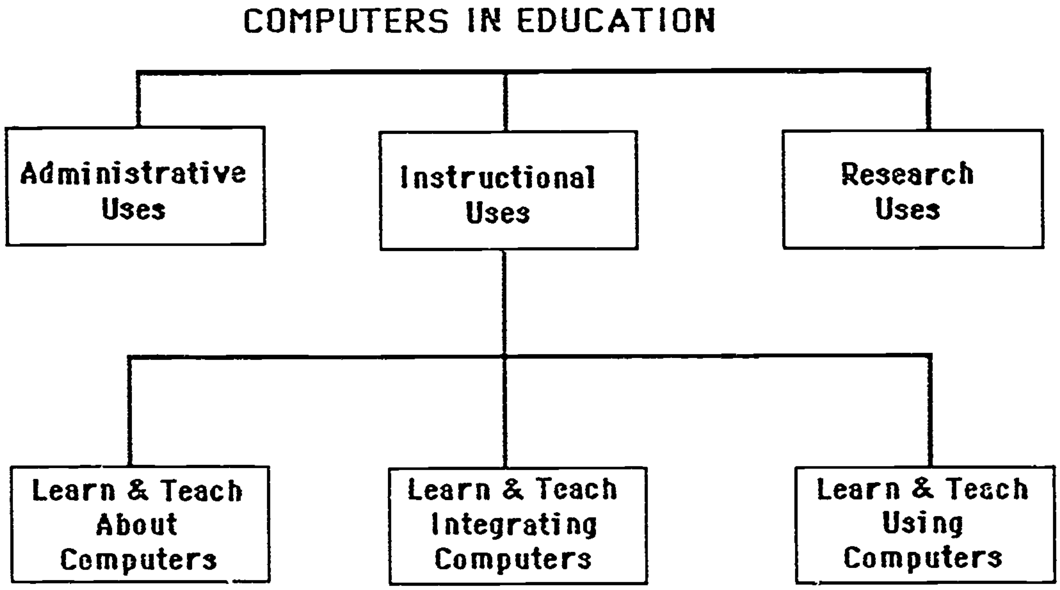
## OVERVIEW OF COMPUTERS IN EDUCATION

Computers are important and widely used in our society because they are cost effective aids to problem solving in business, government, industry, education, and other areas. The primary focus of this Notebook is on the use of computers as an aid to problem solving.

This chapter of the Notebook provides an overview of computers in education, with primary emphasis on Computer-Integrated Instruction (CII). The underlying assumption is that we want to increase students' ability to make use of the computer as a tool in problem solving throughout the curriculum. This chapter might be given to inservice participants as general background reading.

### Computers in Education

The diagram below presents a structure of the overall field of computers in education. As indicated in the diagram, the field of can be divided into three main parts. Although each part will be discussed briefly, the main focus is on *instructional uses* of computers. As the diagram illustrates, instructional uses of computers also may be divided into three parts. After briefly discussing each part, we will focus on *learning & teaching integrating computers*. We call this part Computer-Integrated Instruction (CII).



## Administrative Uses

Many aspects of running a school system are similar to running a business. A school system has income and expenses. It has facilities and inventories. It has employees who must be paid and employee records that must be maintained. And, of course, a school system has students who must be taught. Detailed records must be kept on student performance, progress, and attendance.

Computers can be cost effective aids to accomplishing all of the administrative-oriented tasks listed above. Thus, it is not surprising that computers are extensively used for administrative purposes in most school districts in this country. In some school districts this use goes back more than 25 years. Overall, the administrative use of computers in schools is growing steadily.

At the current time there are two major approaches to administrative use of computers in schools. One approach is based on centralization. A large, centrally located computer system is used to serve a number of schools, as well as central school district office needs. There may be terminals to individual schools. Thus, some input and output operations may occur at the school sites. Other operations especially those involving large amounts of input and output, occur at the central facility.

An alternate approach that has gained considerable support in recent years is to place administratively oriented microcomputer systems into individual schools. Initially these were self-contained microcomputers, but there is a growing tendency to network them. It has become clear that microcomputers can make a substantial contribution to the functioning of a school office.

It seems evident that there will be a continuing need for a central, powerful computer system in most school districts. Also, it seems evident that on-site microcomputers will become increasingly popular. What is not so clear is how and to what extent the central facility and the on-site microcomputers should be networked together, nor is it always evident which computer applications are best accomplished at the school site and which are best accomplished at the central facility.

The design and implementation of a school district administrative computer system is a task for computer professionals. It takes years of computer education and experience to become well qualified at dealing with this type of task. It is important to realize the level of training and experience needed, since few computer-using teachers have this type of training and experience. In most school districts the instructional computing coordinator does not attempt to also be the administrative computing coordinator, since these positions require such different types of training and experience.

## Research Uses

Educational research has benefited immensely from computers. Many educational research projects involve collecting large amounts of data and subjecting that data to careful statistical analysis. If a research project has a control group and a treatment group, students in the two groups may be tested extensively during various phases of the experiment, resulting in a substantial collection of data. Large libraries of statistical programs have been available for more than 25 years. Now such program libraries are even available on microcomputers. Thus, it is relatively easy for a researcher who is knowledgeable in the use of statistical packages to carry out a number of statistical analyses on the data collected.

Computers are making it easier to conduct longitudinal studies. Detailed records can be kept over a period of years. These records can then be analyzed, looking for patterns or trends that might not be evident under casual scrutiny. This type of research is common in medicine, and some of it has been done in education.

Computer-Assisted Learning (which will be discussed later in this chapter) provides an exciting vehicle for research. As students interact with computers while studying a particular subject, the computers can collect and maintain detailed records. These records can be analyzed to help determine which aspects of the instructional program seem to be most effective, and which need modification. Such formative evaluation can provide the foundation to improve instructional materials.

If a school district is large enough to have an evaluator on its staff, the evaluator is apt to be quite knowledgeable in research uses of computers. It is important to understand that administrative, research, and instructional uses of computers are relatively distinct fields of study. A person may be an expert in administrative uses of computers, yet have little knowledge of the statistical packages and statistical techniques of a researcher. Similarly, a person may be an expert in instructional uses of computers but have little knowledge of the hardware and software needed in an administratively oriented computer system.

## Instructional Uses

Our diagram of computers in education divides instructional uses into three categories. The categories overlap to a certain extent, but it is helpful to look at each individually. The first one we will examine is **Learn & Teach About Computers.** Learn & Teach About Computers focuses on the discipline of computer science. (A very broad definition of computer science is used, which includes information science, data processing, computer engineering, etc.) This is a well established discipline; many colleges and universities have had bachelor's degrees and/or graduate degrees in these areas for more than 20 years. There are hundreds of journals and magazines that publish the rapidly growing body of computer-related research.

A few high schools began to experiment with teaching computer programming in the late 1950s. This early use of computers in schools provided solid evidence that high school students could learn to program in assembly language or Fortran. However, computers were quite expensive and not particularly accessible for use in high schools.

The development of timeshared computer systems and the language BASIC in the early 1960s opened up the possibility of large number of students learning to write computer programs. As timeshared computers decreased in price, more and more schools began to offer a course in BASIC programming.

By the early 1970s it was becoming clear that computers were beginning to transform our society. The Industrial Age had ended, and the Information Age had begun. Many educators argued that all students should become "computer literate," and that this could be best accomplished through specific computer-oriented coursework. Often the courses were in introductory BASIC programming. The trend toward students taking computer programming-oriented courses increased rapidly as microcomputers became available to schools beginning in the late 1970s.

Now a counter trend has emerged as people realize that it is not necessary to learn to write computer programs in order to make effective use of a computer. Many introductory courses have reduced their emphasis on computer programming and increased their emphasis on using applications software that use the computer as a tool. Computer literacy courses have been developed that contain little or no computer programming. Secondary school enrollments in computer programming and computer science courses have dropped markedly.

The rapid growth of applications-oriented computer literacy courses have caused a number of educational leaders to ask why such instruction must be limited to a specific course. Would it be better for students if computer applications were taught throughout the curriculum? The idea is that students should make use of the computer as a tool in all courses where appropriate. That is exactly what Computer-Integrated Instruction is about, and it is the main focus of this Notebook. CII will be discussed further later in this chapter.

The teaching of computer programming and computer science courses at the precollege level is slowly beginning to mature. A Pascal-based Advanced Placement course has been developed and is now widely taught. This has tended to lend structure to the high school computer science curriculum. However, it is evident that this type of course appeals to only a small percentage of high school students. Enrollment in introductory programming courses that use BASIC, Logo, or other non-Pascal-like languages remains high. On a nationwide basis, however, such enrollment peaked several years ago and has declined substantially since then.

Logo has developed a wide following, especially at the elementary school level. Some teachers view the learning of Logo as an end in itself. However, most Logo-oriented teachers recognize the potentials of Logo as a vehicle for illustrating and teaching various problem-solving strategies. The turtle geometry part of Logo also can be used effectively to help students learn a number of important geometric ideas. The *Logo Exchange*, a nine times per year periodical published by the

International Council for Computers in Education, is specifically designed for educators interested in using Logo in schools.

**Learn & Teach Using Computers.** A computer may be used as an instructional delivery device. This type of computer use is often called computer-assisted instruction, computer-based instruction, or computer-assisted learning. In this Notebook it is referred to as Computer-Assisted Learning (CAL).

CAL is sometimes divided into categories such as drill and practice, tutorials, and simulations or microworlds. Most CAL systems include a recordkeeping system, and some include an extensive diagnostic testing and management system. Thus, computer managed instruction is sometimes considered to be a part of CAL.

Initially, most CAL material was designed to supplement conventional classroom instruction. For example, elementary school students might use drill and practice mathematics materials for 10 minutes a day. But as computer hardware costs have declined and more CAL materials have been developed, there is some trend toward implementing substantial units of study and/or entire courses. Declining hardware costs make such CAL use economically feasible. For example, suppose that a small high school has only a half dozen students per year that want to take particular courses such as physics, chemistry, or advanced mathematics. It may be much more cost effective to make such courses available through CAL than through a conventional, teacher taught, mode.

CAL has been heavily researched over the past 30 years. The evidence strongly supports the educational value of using CAL in a wide variety of settings. The success of CAL may be explained by three factors. First, students using CAL on the average spend more time on task. Because learning correlates well with time on task, students on the average learn faster using CAL. Second, CAL materials allow students to work at their own levels and at their own rates. This individualization is a considerable aid to some students. Third, CAL materials can incorporate good practices of instructional and learning theory. Formative evaluation can provide a basis for improving CAL materials under development. Through this approach, the quality of commercially available CAL materials is gradually being improved.

**Learn & Teach Integrating Computers.** The third category of instructional use of computers is Computer-Integrated Instruction (CII). CII focuses on the computer as a productivity tool, an aid to problem solving. One orientation focuses on general purpose or generic application packages such as database, graphics, spreadsheet, word processor, and telecommunications. Each of these application packages is widely used in business, industry, and government. In education, each can be used at a variety of grade levels and in a variety of courses.

A second orientation focuses on the development of applications software for a specific discipline. For example, there is now a substantial amount of software that can help a person compose music. Such software makes possible the teaching of musical composition to elementary school students. There is a substantial amount of Computer-Assisted Design (CAD) and other graphics artists software. Such software tools are often now centrally used in high school courses that used to focus on drafting or engineering drawing.

It has long been recognized that precollege students could learn to use computers as an aid to problem solving. The initial approach, now dating back more than 25 years, was to have students learn to write computer programs to solve specific categories of problems. For example, it was suggested that if a math student could write a computer program to solve quadratic equations, this indicated real understanding of that mathematical topic. Over the years there have been a number of research studies on whether this is indeed correct. While the results have been mixed, it seems clear that having students write computer programs to solve math problems is not a magical solution to the problems of mathematics education that our schools face.

Initially, such an approach to CII made little progress because both the programming languages and the computer hardware were not suited to the needs of most precollege students. But the advent of timeshared computing and BASIC have helped to change that. And then, beginning in the late 1970s, microcomputers, with built-in BASIC, made it feasible for millions of students to learn to write simple programs to solve specific categories of problems.

It takes considerable time, as well as a specific type of talent, however, to become a competent computer programmer. It was soon recognized that the time was being taken away from the study of conventional subject matter. The movement toward integrating computer programming into various high school courses has long since peaked and has been replaced by a trend toward using applications packages. This new trend has accelerated as better applications packages have become available for microcomputers used in schools. An increasing percentage of this software is specifically designed for use in education.

Word processing can be used to illustrate both the general idea of CII and some inherent associated difficulties. Word processing is a generic computer application tool in the sense that it is applicable across the entire curriculum at all grade levels. Clearly, a word processor is a cost effective productivity tool for secretaries and for many people who do a lot of writing. Moreover, word processors make it easier to do process writing (prewrite, compose, conference, revise, and publish). For these reasons, many schools have decided to have all their students learn to do process writing in a word processing environment.

But it takes quite a bit of instruction to learn to make effective use of a word processor. To learn proper keyboarding techniques and to keyboard faster than one can handwrite takes a typical fourth grade student about 30 minutes a day for eight weeks or more. To learn to compose at a keyboard and make effective use of a word processor takes additional instruction and practice.

There are several additional difficulties. First, teachers have to learn to provide the initial instruction and to work with students who do process writing in a word processing environment. Even if the initial instruction is provided by a specialist rather than the regular classroom teacher, the classroom teacher must work with students after the initial instruction. All of the students' subsequent teachers face the same problem. This suggests that large numbers of teachers will need to learn to work with the idea of process writing in a word processing environment.

Second, there is the matter of access to appropriate computer systems. Once a student becomes adept at this mode of writing, the student will want to continue its regular use. This can easily require providing each student with 30 minutes of computer time per day. It also raises the issue of needing to provide computer access for students to use at home, after school, and on weekends.

Third, there is the problem of testing--especially standardized testing. Suppose a student has had several years' experience in using a word processor to do process writing. The student has learned to approach writing projects using this productivity tool. There is a good chance the student can write better and faster using a word processor than using pencil and paper. An appropriate assessment of this student's writing skills requires giving the student access to a computer during the test.

Fourth, once one has a word processor, it is quite helpful to have a spell checker, a grammar/style checker, and an outliner. Such aids to writing may have a significant impact on the nature of the writing curriculum. They may require changes in textbooks, lesson plans, and the way class time is structured. And once again the issue of testing arises. Should a student be allowed to use spelling and grammar checkers when doing writing for an essay test?

These four types of difficulty occur for all CII applications. The problem of teacher training is addressed specifically by the materials in this notebook. The problem of access to appropriate hardware and software will be with us for many years to come. It can be overcome through appropriate allocations of money. The testing problem is being addressed by a number of agencies involved in widespread assessment. For example, some states and provinces now allow use of calculators on certain tests. However, it seems clear that this will be a long term problem. Textbook companies are slowly beginning to address the issue of integrating the computer as a tool into the books they publish. School districts and individual teachers interested in making more rapid progress are developing their own curriculum materials.

## The Potential of CII

Many work environments now provide a computer or computer terminal for every employee. It is clear that this will become more and more common, since computers are such useful aids to solving certain types of problems and increasing human productivity. Thus, it seems appropriate to assume that increasing numbers of today's students will use computers when they go to work.

Research on transfer of learning strongly supports the position that instruction and training should closely parallel the final desired behaviors. Thus, if we need workers who are adept at using computers to aid in solving problems, we should integrate computer use as students develop their basic problem-solving skills and strategies. For these and other reasons, it seems clear that CII will grow rapidly for many years to come.

As CII increases, both teachers and students will begin to question the content of many of their courses. If a computer can solve or help solve a particular type of problem, what should students learn about the problem? Is it necessary and appropriate to learn to solve each type of problem using only conventional aids such as books, and pencil and paper? Or, should schools focus more on underlying concepts and help students gain an overall understanding of problems that computers can solve?

In some cases an answer will be forced on schools. For example, libraries are being computerized. Card catalogues are being replaced by computerized information retrieval systems. Important publications are available only in computer databases. Since learning to access information is an essential component of education, students will have to learn to use databases and computerized information retrieval systems.

In other cases schools will have wide options. For example, consider the impact that handheld calculators have had on the upper elementary school and middle school mathematics curriculum. While the potential for calculator-integrated instruction is large, the actual impact on the curriculum has been minimal. This is true in spite of many years of strong support from the National Council of Teachers of Mathematics for integration of calculators into the curriculum. In April 1986, the NCTM issued still another strong statement recommending calculator use at all grade levels. A few states and provinces are now beginning to allow use of calculators in certain testing situations. We may be seeing the beginnings of a trend toward allowing calculators (and, eventually, computers) in standardized testing situations. During the academic year 1987-88, for example, the Chicago public schools purchased approximately a hundred thousand calculators for use by their students.

Much of the short term potential for CII depends on how well our educational system addresses the issue of inservice education. All current teachers can learn to make effective use of CII. Given appropriate inservice educational opportunities, many will do so.

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# 2.2
# ROLES OF COMPUTERS IN PROBLEM SOLVING

Each academic discipline focuses on certain types of problems. Each discipline has vocabulary and notation, methodology, and tools to aid in describing and solving its problems. Problem solving is a unifying theme throughout all of education. In this chapter we use the term problem solving in a very general sense, so that ideas such as higher order skills and thinking skills are also included.

Undoubtedly the single most important idea in problem solving is that of building on the previous experiences of oneself and others. For example, consider the importance of language in problem solving. The language(s) you speak and read have been developing over many years, beginning long before you were born. You learned to speak and read many years ago, so that now when you speak or read you are using learning work that you did long ago as well as building on new meanings words have taken on for you.

Paper and pencil provides another type of example of building on the previous work of oneself and others. It is evident that paper and pencil are useful aids to problem solving in every discipline. Paper and pencils artifacts developed and produced by people. When you use these artifacts, you are building on the work of the inventors, producers, and distributors of these artifacts. Paper and pencils are tools that you spent many hours learning to use when you were young. You now use them readily and with little conscious thought of your earlier learning efforts.

## The Computer Tool

Now we have a new, general purpose aid to problem solving. (Actually, the electronic digital computer was invented in the 1940s, so it really isn't very "new" anymore. Commercial mass production of computers began in 1951 with the introduction of the UNIVAC I. Most people who talk about the computer being a new tool are people who have been introduced to computers relatively recently. The computer is new to them, so they assume it is new to others.) The advent of the microcomputer beginning in the mid-1970s has made computers readily available to very large numbers of students and workers. However, it is only recently that enough computers have been made available to precollege students to begin making an impact on their education. In that sense, computers are still a new tool in education.

One of the most important ideas in problem solving is that the aids available for solving a problem shape the thinking processes used. You have grown up with books and pencil and paper. When you were a young student, you received many years of instruction in their use. Now, when working on a problem, you automatically consider possible uses of these aids.

For example, suppose that you needed to prepare lesson plans for a course. Perhaps you would first do some brainstorming, writing notes to yourself on the major ideas to be covered, sources of information, time lines, and so forth. Next, you might go to your files and pull out materials you have collected and/or used in the past. Then you might begin to organize, writing new materials and adding to old materials. Perhaps a trip to your bookshelf or the library might be necessary. Finally, you might put it all together in a notebook or in file folders.

This description represents a problem-solving process. It involves careful thinking, drawing on one's knowledge of students, one's own teaching skills, the teaching/learning process, school schedules, etc. It involves creating new materials and reorganizing old materials. It involves information retrieval, organization, processing, and storage. In this problem-solving process you automatically and with little conscious thought make use of reading and writing. The reading/writing tools, which are actually essential to solving the problem, are essentially transparent in the problem solving process. That is, you don't even think about them. Eventually it will be this way with computers, and that is a major goal for computers in education.

A computer can be a useful aid in accomplishing much of the work in solving the lesson planning problem discussed above. However, relatively few people have worked with computers long enough for computer use to be second nature. Indeed, it could well be that most adults today will never achieve this level of comfort or ease in using computers. But students who have the ability to learn reading and writing can also learn how to use the computer as a problem solving tool. This can be done through computer-integrated instruction which focuses heavily on the computer as an aid to problem solving.

Because computers are still rather scarce in elementary schools, the idea that students may grow up accustomed to the idea of using the computer as a tool may seem rather "far out" to you. But on a national scale we are now in a period of very rapid growth in availability of computers in schools. The value of learning to use a computer with a word processor, spelling checker, and grammar checker is now widely accepted by educational leaders. Many school districts have made the decision that all their students should have such an educational opportunity. Often these school districts are also teaching their students to make use of databases and computer graphics. Eventually these types of problem solving tools will be a routine part of the elementary school environment as well.

## A Definition of a Formal Problem

Every person encounters and copes with a large number of problems every day. Many of these problems are routine and solving them becomes almost automatic. But think for a moment about the variety of problems you deal with in a typical day on the job. For example, as a classroom teacher, you routinely solve problems such as deciding what materials to teach, how to present them to students, how to measure student performance, and how to work with students who are not performing up to your expectations. You attend staff meetings and work on problems faced by the whole school. You handle your personal budget, solving problems on how these funds should be used. It is easy to extend the list, and you should find little difficulty in building your own list. This exercise should convince you that you are an accomplished problem solver and know a great deal about problem solving.

Problem solving has been carefully studied by many great thinkers. There are a number of books that define the concept we call *problem* and explore a variety of problem-solving techniques. (see the references listed at the end of this chapter). We will use the following four components as a definition of problem:

1. **Givens.** There is a given initial situation. This is a description of what things are known or how things are at the beginning.

2. **Goal.** There is a desired final situation (or more than one). This is a description of how one wants things to be; it is a description of the desired outcome.

3. **Guidelines.** This is a listing or description of the general types of steps, operations, or activities that may be used in moving from the Givens to the Goal. Guidelines are the resources and facilities -- that is, the powers of the problem solver. (The Guidelines *do not* tell one how to solve the problem.)

4. **Ownership.** In order for something to be a problem for you, you must accept some ownership. You must be interested in solving the problem or agree to work on the problem.

The choice of vocabulary (Givens, Goal, Guidelines) is for the mnemonic value of the three G's Other writers may use different terms. When we say that a problem is *well defined*, we mean that the three G's are clearly and carefully specified. A well-defined problem can be worked on by people throughout the world over a period of time. Progress toward solving the problem can be shared, and cumulative progress is possible. This idea of sharing progress toward solving a problem or category of problems is absolutely fundamental to the human race making intellectual progress.

We frequently encounter problem-like situations that have some, but not all, of the four defining characteristics of a formal problem. We will call these *problem situations*. Often the most important step in solving a so-called "problem" is to recognize that it is actually a problem situation and then do the work necessary to obtain a carefully defined problem. This requires careful thinking, drawing on whatever knowledge one has that might pertain to the problem situation. Often a group of people will have a brainstorming session to get relevant ideas. See especially the works by Torrance. His research and development group has produced instructional material designed to help students gain improved problem-solving skills. See also de Bono (1971, 1973).

Each of the four components may require further explanation in order to become clear to you. We begin with the last one: Ownership. Some experts on problem solving exclude this component, while others give it considerable weight. If coping with a particular situation is essential to your survival, you are apt to have considerable ownership of this situation. But if the situation is a hypothetical (school book) exercise of little intrinsic interest, you may have little or no ownership. Ownership is a mental state, so it can quickly change.

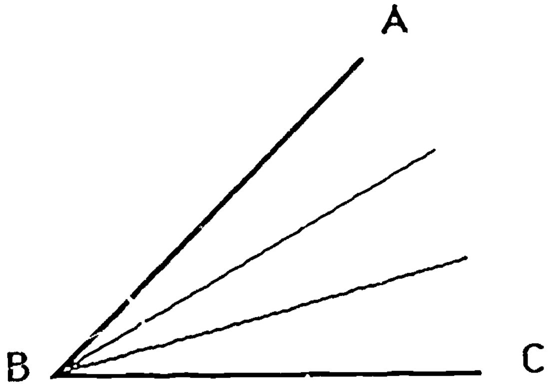
The issue of ownership is particularly perplexing to educators. They recognize that ownership -- that is, a deep interest and involvement with a situation -- often contributes to deep and lasting learning and intellectual growth. Thus, teachers often expend considerable effort creating situations in which their students will feel ownership.

Some alternatives to ownership are apathy and/or coercion. Keep in mind that problem solving is a higher order mental activity. Most people do not perform higher order mental activities well under coercion or while in a "I couldn't care less." mood.

As an aside, you may know some students who have spent literally dozens or even hundreds of hours working on a particular computer program or mastering a computer system. You may have said to yourself, "If only I could get all of my students that deeply involved." It is clear that such ownership of a computer-related problem has changed the lives of a number of very bright and talented students.

Many people are puzzled at first, by the Guidelines component of the definition of problem. Suppose that you were giving your students a spelling test. From the student viewpoint, the task of correctly spelling a word is a problem to be solved. The student would be successful if allowed to use crib notes or a dictionary. What makes the problem a challenge is that these aids, and other aids such as the use of a neighboring student's paper, are not allowed. The Guidelines specify that students are to do their own work, without the use of crib notes or a dictionary.

For the mathematically oriented reader, another excellent example is provided by the problem situation of trisecting an arbitrary angle. In the figure below, angle ABC is an arbitrary angle (i.e., it is of unspecified size). The goal is to do a geometric construction that divides angle ABC into three equal angles.



Given angle ABC

Sometimes the Guidelines specify that one is only allowed to use a straight edge, compass, and pencil. In that case it can be proven mathematically that the problem cannot be solved. In other cases one is allowed to use a protractor in addition to the other implements. Then the problem is easily solved by measuring the angle, dividing the number of degrees by three, and constructing new angles of the resulting number of degrees. Note that in the latter case the compass is not used, even though it is available. Solving real world problems is sometimes difficult because many resources are available, and often it is not clear which ones to use to solve a particular problem.

For a third example, consider this problem: Teachers in a particular school seem to be using substantial amounts of pirated software. You can investigate the problem situation to clarify the given situation (that pirated software is being used by teachers). You can set a goal, such as reducing the use of pirated software by two-thirds in the first year and decreasing it still more the second year. As a responsible and ethical educational leader, you may have considerable ownership of the problem situation. But what are the guidelines? What types of things can you do that might help achieve the goals?

Brainstorming, individually or in groups, is often used to develop a list of resources (guidelines) or potential activities you might carry out to solve a problem. For example, teacher software piracy might be reduced by an informational program, providing money to buy enough software, threats of dismissal, and so forth. Further exploration would be needed to determine if these options were actually available to the problem solver.

## Steps in Problem Solving

In this section we list a sequence of steps that may be followed in attempting to resolve a problem situation. Often we carry out some of the steps quite automatically with little conscious thought. But it can be quite helpful to consciously think about each step in problem situations that seem to be giving us trouble. (Here we are assuming the Ownership condition is satisfied; that is, you are interested in resolving the problem situation.)

1 Work with the problem situation until you have converted it into a well-defined problem, that is, until you have identified and understood the Givens, Goal, and Guidelines. This first step is a creative, higher order thinking process, which often involve considerable knowledge as well as a good sense of values. Two different people, when faced by the same problem situation, may come up with quite different well-defined problems.

2. Select and/or develop a procedure that is designed to solve the problem you have defined. This is an information retrieval and/or creative thinking step. Usually it involves both; computers may be useful in retrieving needed information. (We will discuss the idea of *procedure* more in the next section of this Chapter.)

3 Execute or cause to be executed the steps of the procedure. Sometimes this will be a mechanical, nonthinking activity, where speed and accuracy are desired and computers may be quite useful. (The executions of many mathematical procedures falls into this category.) At other times the execution of a procedure will require the best of truly human skills. (The work of a good psychotherapist falls into this category.)

4. Examine the results produced in Step 3, to determine if the problem you defined in Step 1 has been solved. If it has been solved, go on to Step 5. Otherwise, do one of the following:

   a. Return to Step 3 and recheck your work. People and machines sometimes make mistakes.

   b. Return to Step 2 and determine another approach to solving the problem you have defined.

c. Return to Step 1 and determine another problem to be solved.

d. Give up, or seek help from others. The problem might not be solvable, or it might be beyond your abilities, or it might be beyond the efforts you are willing to make at this time.

5. Examine the results produced in Step 3 to determine if the original problem situation has been satisfactorily resolved. If it has, you are done. If it hasn't, do one of the following:

   a. Go to Step 1 and determine another problem to be solved.

   b. Give up, or seek help from others.

Problem solving research suggests that students benefit from learning and practicing the above five-step approach to problem solving. It is applicable over a wide range of disciplines and problem-solving situations. Notice that success is not guaranteed, but that persistence increases the likelihood of success. Note also the personal nature of the five-step approach. Problem solving is a personal thing, and personal values are often central to a problem situation.

## What is an Effective Procedure?

When you are able to solve a particular type of problem routinely or automatically, you have developed one or more procedures (algorithms, detailed sets of directions, recipes) for this type of problem. Computer scientists are deeply concerned with developing procedures that tell a computer how to solve a certain category of problem. We will use the phrase *effective procedure* in discussing the idea of a procedure that can be carried out in an automatic, nonthinking, computer-like mode.

More formally, an effective procedure is a detailed, step-by-step set of instructions having the two characteristics:

1. It is designed to solve a specific problem or category of problems.

2. It can be mechanically interpreted and carried out by a specified agent. Here the term "mechanically interpreted" means in a machine-like, nonthinking manner. Computer scientists are interested in situations where the agent is a computer or a computerized machine such as a robot.

Computers are important because they can rapidly, accurately, and inexpensively execute many different procedures. The number of such procedures continues to grow very rapidly through the work of researchers in all disciplines, computer scientists, and computer programmers. Thus, an understanding of the concept of effective procedure is generally considered to be an important part of computer literacy, and it certainly lies at the heart of having a general understanding of roles of computers in problem solving.

## Roles of Computers

In this section we briefly examine each of the five steps one might follow in resolving a problem situation. Our intent is to point out roles of computers in each step and to briefly discuss possible curricular implications.

The first step is to understand the problem situation and work toward having a well-defined problem. This is a thinking step , drawing on one's general knowledge as well as specific information about the problem situation. That is, both a broad general education and in-depth knowledge about the specific situation are useful. Many educational leaders argue that a broad liberal arts education is useful in understanding and critically examining the wide range of problem situations one encounters in our society. Values education plays an important role here, since the process of developing a well-defined problem from a problem situation often depends heavily on personal values and views.

Computer-Assisted Learning (CAL) is of growing importance in acquiring education for understanding problem situations. Research evidence strongly supports the contention that students generally learn faster in a CAL environment than they do in a conventional instructional environment. There is strong research evidence that CAL is a cost effective aid to students. The evidence is strongest in the acquisition of factual knowledge, or at the lower-order level of Bloom's taxonomy. Computerized drill and practice works!

The second step is to select and/or develop a solution procedure for the well-defined problem you have produced in the first step. You might select and retrieve a solution procedure from your head.

As an example, the problem might be to determine the number of cubic yards of concrete needed for a patio that is to be 12 feet wide, 15 feet long, and 4 inches thick. A procedure to solve this problem involves conversion of units, multiplication, and division.

S1: Convert 4 inches to feet (by dividing it by 12).

S2: Multiply the three dimensions (each given in feet) to find the number of cubic feet in the patio.

S3: Divide the answer produced in Step 2 by 27, to convert it to cubic yards.

It is important to realize that there can be many different procedures for solving a problem. Here is another approach to solve the patio problem:

S1. Convert all measurements to yards. This involves dividing the measurements given in feet by 3, and dividing the measurements given in inches by 36.

S2: Multiply the three dimensions (each given in yards) to get the number of cubic yards of concrete needed for the patio.

The mental selection and/or development of a solution procedure is a thinking process. One can gain skill in this thinking process through practice. Computers can be used to create practice situations. Many simulations or simulation/games are designed to provide practice in this problem solving step.

An alternative to retrieving a procedure from your head is to retrieve it from a library, which may contain books, periodicals, films, and so forth. Many libraries have replaced their card catalogs by computerized card catalogs. Moreover, much of the information needed is now stored in computers. One of the defining characteristics of the Information Era we are now in is the growing availability of information and the growing technology to aid in information retrieval. It is clear that computers are very important in retrieving procedures for solving problems. This strongly suggests that all students should learn to make use of these aids to information retrieval.

The third general step in resolving a problem situation is to execute or cause to be executed the procedure from the second step. As we have indicated, some procedures require a "human touch." Others can be executed mechanically, in a nonthinking fashion. A large and rapidly growing number of procedures can be executed by computers or computerized machinery.

If a computer can execute or help execute a procedure, what aspects of this procedure do we want people to learn to do mentally, assisted by pencil and paper, assisted by noncomputerized machinery, or assisted by computerized machinery? This is a very difficult question, and it will challenge our educational system for many years to come. The answer that seems likely to be widely accepted is that we want students to have a reasonable understanding of the problem being solved and the capabilities/limitations of the computerized procedure. We want students to remain in control, but we want them to work with computers rather than in competition with computers.

The fourth and fifth steps in resolving a problem situation require examining the results of your work to determine if you have succeeded. These steps require critical thinking, drawing on your understanding of the initial problem situation and the steps followed in resolving the situation. These are higher-order mental activities.

The research literature on problem solving strongly supports the idea that people get better at problem solving if they study the processes of problem solving, learn to use aids to problem solving, and practice problem solving. This suggests that students should learn to use computers as an aid to problem solving in disciplines for which computers are an useful aid. They should practice solving problems, making use of computers when their use is appropriate to the problems being solved.

## Software

In a broad sense, all computer software can be considered as problem solving software. But when we think of preparing teachers and/or students to deal with computers in schools, problem solving software tends to fall into three main categories:

1. Programming languages such as assembler, BASIC, C, COBOL, Logo, Pascal and Pilot.
2. Application packages, such as a graphics, spreadsheet, or database package. Some application packages are useful across many disciplines, so we call them "generic." Others are useful in quite limited contexts (such as software for writing music).
3. Simulations/games specifically designed to help students learn specific problem solving techniques.

There are hundreds of programming languages. In all cases the intent is to make it possible for a human to communicate with a computer. Usually a programming language is designed to meet the needs of a particular category of computer programmers. For example, BASIC was originally designed for college students, COBOL was designed for business data processing programmers, and Pilot was designed for writing Computer-Assisted Instruction materials.

In all cases one uses a programming language to specify procedures to solve certain categories of problems. This is a very important concept. The writing of a computer program to solve a problem requires both a knowledge of a specific programming language and skill in developing procedures to solve problems. The latter is called *procedural thinking* and is generally considered to be an important component of computer literacy. Skill in procedural thinking is independent of any particular programming language. Indeed, one can develop a high level of procedural thinking skill independently of whether computers are available or whether computer programming is used to represent the procedures.

Computer-in-education leaders have not reached consensus as to which students should receive instruction in computer programming, at what grade levels, or using which particular programming language(s). For example, many school systems have decided to provide instruction in Logo to all of their elementary school students. Other districts have decided to include some BASIC in a junior high or middle school computer literacy course required of all students. Still other school districts have decided that computer programming is best left as an elective course, perhaps mainly available to secondary school students who have had a reasonably strong mathematics preparation.

Applications software may be generic (useful over a wide range of disciplines or problem areas) or it may be quite specific to the problems in a particular discipline. A computer graphics package is useful over a wide range of disciplines, while music composition software has much more limited applicability. A trend has begun to emerge, and it seems likely to continue. Many school districts have decided that all students should learn to use a variety of generic applications software. The use of such software will be integrated into the total curriculum. Initial instruction may be in a variety of courses at a variety of grade levels, or it may be concentrated into a single computer literacy course.

At the same time there is growing realization that each discipline has its own applications software. Thus, as students study a discipline at a higher and higher level, they need to receive specific instruction in use of the applications software of the discipline. Thus, two types of computer literacy are emerging. A computer literate student uses generic computer applications software as appropriate in working with problems in every academic area. As a student progresses to higher levels or greater depths in any particular discipline, the student becomes more and more computer literate within that specific discipline.
For example, a student who takes college preparation courses in chemistry and physics should be learning quite a bit about applications software specific to the fields of chemistry and physics. Microcomputer-based laboratory (MBL) software falls into this category.

There are many general purpose problem-solving techniques. For example:

1. Plan ahead, anticipating the consequences of proposed actions.

2. A large, complex problem can often be solved by breaking it into several smaller, less complex problems.

3. It is often helpful to draw a picture or map, or in some other manner graphically represent the problem under consideration.

4. It is often helpful to write down the steps you take in an attempt to solve a problem.

Many different simulation/games software packages have been developed to give students practice in particular problem solving techniques. Research into the value of such software is sparse. The main difficulty seems to be the issue of transfer of learning. For a particular simulation/game, it is evident that students get better as they practice using the software. That is, they get better at applying particular techniques in the context of the simulation/game under consideration. But there appears to be relatively little transfer of the techniques to other problem solving situations. It seems likely that the teacher plays a very important role in helping to increase such transfer of learning. A teacher can provide a wide variety of examples, suitable to the academic level and interests of a particular student, where the techniques are applicable. A teacher can help encourage students to apply the problem solving techniques they have studied to the variety of problems they encounter throughout the school day.

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For more information on creative problem solving write to:
Georgia Studies of Creative Behavior
Dept. of Educational Psyhology
The University of Georgia
Athens, GA 30602

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# INITIATING/PLANNING AN INSERVICE

## 3.1

## Preliminary Planning and Activities

This section consists of some general ideas followed by the project staff in setting up the workshops. Although some of the ideas are useful primarily to people who are working in a relatively formal environment such as a funded project, others apply to any inservice activity.

Many inservices are open to all educators in a district or region, perhaps subject only to certain prerequisites. But research on effective inservice points to the value of peer support within a school or department. Thus, there is considerable merit in having a number of participants from a single school. The NSF project set guidelines of having at least 3 - 5 or more participants from each school, including a school administrator. While it was not always possible to adhere to these guidelines, they served as an aid in the participant screening process.

### Needs Assessment

The starting point for planning an inservice is to determine the need(s) that will be addressed by the inservice. (That is, what educational problem is being attacked through the inservice?) Chapter 1.1 discusses some of the needs that an inservice might address. The question is, how are needs determined?

Ideally, a school district would have a carefully developed long-range plan for instructional use of computers. Detailed information on the development of such a plan is given in Moursund and Ricketts (1988). The appropriate development of such a long-range plan involves participation by all of the stake holders. Thus, teachers, school administrators, parents, etc. all have ample opportunity to provide input.

A long-range plan calls for certain actions to be taken. Generally, these actions will include acquisition of computer facilities, acquisition or development of software, courseware, and curriculum materials, and *staff development*. That is, the process of developing a long-range plan can play a major role in doing a needs assessment for a computer inservice. One merely points to the long-range plan and says "We need to do this particular inservice because of the key role it plays in implementation of the plan."

There are, of course, other approaches to needs assessment. And even if one has a well done long-range plan, these other approaches are useful and should be followed. Generally speaking, a needs assessment should be done using both a bottom up and a top down approach. The bottom up approach is to obtain information from the people who are to be inserviced. The top down approach is to obtain information from the administrators of the people who are to be inserviced. Such information can be obtained by personal interviews, use of questionnaires, informal conversations, etc. Part 5 of this Notebook contains some needs assessment instrumentation.

The needs assessment will answer a variety of questions such as:

1. What are the demographics of the group of potential participants in the inservice?
2. What level of interest is displayed by the group of possible participants?
3. What are suitable meeting times, places, length of sessions, and number of sessions for the potential participants?
4. What incentives, such as college credit, release time, improved access to computers in their schools and classrooms, etc. are needed to secure there will be an appropriate number of participants?
5. What is the level of support from the administrators of the potential participants? Does this level of support include release time for teachers, appropriate materials, appropriate staff support to develop and conduct the inservice, etc? Does it include making appropriate computer facilities available to the participants in their schools and classrooms during and after the inservice? Does it include actually participating in some or all of the inservice sessions themselves?

## Staffing

Most people who organize and present inservices are trained and experienced teachers. But facilitating an inservice is quite a bit different from teaching a class of precollege or college students. Also, the inservice participants will all be educators themselves. Educators expect that the inservices they participate in will be models of excellence. They are not very tolerant of poor organization and teaching. Most teachers find that teaching teachers is much more difficult than teaching other groups of students.

We have two recommendations. First, don't attempt to do a hands-on inservice (such as discussed in this Notebook) without an assistant. Your assistant may be someone you are helping to train as an inservice facilitator or a computer coordinator from one of the schools participating in the inservice. Once participants get into a hands-on mode, there will be many more questions than a single facilitator can handle. Or course, having participants work in pairs will help some. Emphasize that participants are to work quite hard to discover the answers to their questions before they seek help from the workshop facilitator or assistant.

Second, plan to spend at least 8 - 12 hours preparing for each two-hour inservice. Many teachers are used to planning a whole day's teaching in an hour or so. But a staff development workshop is quite different. Here you will be working with your peers, and you want to do an excellent job. Here also you are doing something new -- you have not offered the workshop a number of times before. *It will take a lot of hard work to be adequately prepared to facilitate the workshop sessions.*

## Some Initial Ideas

Let's assume you have decided to conduct an inservice and that you have a general topic and audience in mind. You do a needs assessment and conclude both that you will be able to obtain appropriate participants and that you will have appropriate administrative support. You have a staff (it might be only a part-time secretary, a volunteer, or members of a district computer committee) who will be involved in the overall planning and implementation process. You have selected an assistant who will help during the inservice presentations. You have a good idea of how the inservice will contribute to accomplishing the district's overall plans for computers in education.

The following list of ideas may help you as you continue the planning and development of the inservice.

1. Meet with your staff early and often. Have them participate in the overall planning process as much as possible. This helps to keep them informed (so they can respond to telephone inquires when you are not available, for example) and increases their "ownership" in the overall task.

2. Establish guidelines for selecting the schools and individuals who will participate. Check these guidelines with the funding agency or group responsible for making the inservice possible. If you are not the computer coordinator for the region to receive inservice, check with the computer coordinator.

3. Communicate with the potential participating schools and individuals. This may be done via a combination of mail (regular and electronic), announcements in newsletters, phone calls, and direct contact. Indicate generally the desired nature of school and individual participants, and indicate where and when an information meeting will be held.

4. Prepare for and conduct the information meeting. You will want to have a handout containing key information that possible individual and school participants need to know, which may include appropriate application forms. Hold the informational meeting early, so that possible participants from each school will have time to have an in-school meeting to decide if they will participate.

5. If you are giving university credit to the participants, make sure you have everything coordinated with the university or college as well as the school district(s). This process can take some time, so begin early.

6. Your inservice will use of a variety of software. You will need multiple copies and/or permission from publishers to do multiple loading. Make sure that you begin the process of obtaining the software and/or permissions early enough so that this task is completed well before the inservice is scheduled to begin.

   The choice of software can be a major decision. Should you use software readily available to teachers, or should you use the "latest and greatest?" An inservice must be grounded in reality. Thus, much of the software used should be software to which teachers have easy access. But an inservice should also be forward looking. Thus, it is appropriate to use some software that may be new to teachers in your school or district.

   To a large extent, the NSF project used software from the Minnesota Educational Computing Consortium (MECC). This was done because such software is in wide use throughout North America and because it was available in the school district where the inservices were being conducted. However, we also obtained multiple copies of some software on loan from certain vendors, and we obtained permission to do multiple loading from certain other vendors. Our experience was that vendors are very supportive of staff development efforts.

7. Your inservice may make use of print materials that will need to be ordered from publishing companies or reproduced. It can easily take a month to obtain print materials from a publishing company, so begin this process well in advance of the starting date for your inservice.

8. Think about where and when the inservices are to be conducted. From the point of view of the inservice organizer, it is easiest to conduct all inservices at one central site, and to hold them at a time that "seems" convenient to the organizer. However, participants may gain more ownership and overall involvement if the inservices are conducted in their schools.

This involves holding inservices at a number of different sites with varying equipment facilities. It involves holding inservices at a time that the potential participants have indicated fits their needs.

## Miscellaneous Suggestions to Inservice Facilitators

1. At the first meeting of the inservice, be well organized. Have name tags available, appropriate refreshments, etc. Be efficient and business-like. If appropriate, provide each participant with a list of the names, addresses, and phone numbers of the participants and the facilitators.

2. At the first meeting of the inservice you will most likely want to have a number of things to hand out. These might include:

    a. A notebook for participants to keep materials in, with colored paper or dividers to separate the lessons.

    b. The types of materials illustrated in this Notebook. (Some inservice facilitators prefer to hand out all materials during the first session, while others prefer to hand out each session's materials at the start of that session.)

    c. Other print materials, such as books, that participants will need to read during the inservice.

    d. Some software, if it is appropriate. For example, there may be some excellent public domain software that is suitable for participants in the inservice. Participants like to receive free materials.

    e. A syllabus for the inservice.

3. Much of the material you hand out may be forms that you want participants to write on during the inservices. If so, make sure participants know that extra copies of these pages in the handout can be "ordered" from you so that they feel free to write on them during the sessions. Have a form available to them, so they can order copies as needed, or just provide them extra copies in an automatic fashion.

4. The computer is a powerful tool and a powerful change agent in education. Both the overall educational system and individual educators are (in general) resistant to change. The inservice facilitator should deal openly with change processes and resistance to change. This should be a reoccurring theme in the debriefing at the end of each activity. Spend some time thinking about educational change. How do you feel in your role as a facilitator of change?

Student / teacher modes. The style of inservice described in this Notebook has the participants sometimes play the role of "students" and other times play the role of "teachers." Make the participants aware that at times they will be students and at other times teachers during the inservice sessions, and why the inservice is designed in this way. This switching of modes can be confusing, so make it clear when you are having participants switch roles.

6 The style of inservice described in this Notebook is heavily oriented toward discovery sed learning. Be aware that relatively few teachers are comfortable with discovery based ning. Think about why discovery based learning is particularly appropriate in computer ion and in this inservice. Raise this as a topic for discussion quite early in the nd raise it several additional times during later inservice sessions.

7. Transfer of learning is a very important idea in computer inservices. The goal is that participants will take ideas from the inservice and implement them in their classrooms. Raise this as a topic for discussion during the first inservice session and bring it up again at subsequent sessions. It is quite appropriate to ask in the second and subsequent sessions "Would one of you please share with us some classroom uses you made this week of the ideas that we covered in the last session?" Do everything you can to encourage such immediate implementation and the sharing of successful implementations.

8. Keep in mind that problem solving is a central and unifying theme in the inservice and is the main reason why computers are coming into schools.

   a. The computer-as-a-tool is essentially the computer as an aid to problem solving. Problem solving should be a central theme in every activity and in every debriefing.

   b. Many of the changes that may occur as computers come into schools are changes that could/should occur even without computers. A typical example is increased emphasis on problem solving in math and decreased emphasis on rote computation. Another example is increased emphasis on the overall writing process (process writing) and less emphasis on the mechanics of writing, such as spelling and grammar.

9. Preparation time. (Here we are repeating some ideas given earlier in this chapter, because they are particularly important.) The novice inservice facilitator may wonder how much work is involved in preparing to facilitate a sequence of inservice sessions. Of course, a lot depends on the standards the person sets. Also, the time depends heavily on the overall knowledge of computers, computers in education, the subject discipline of the teachers to be trained, and the software to be used. The experiences of the NSF graduate assistants who did almost all of the presentations during this project have shown that even a highly qualified inservice facilitator can easily spend 8 - 12 hours preparing for a two-hour inservice. (*Note it doesn't take nearly this long to prepare for subsequent presentations of the same inservice.*) Access to materials such as those in this Notebook can decrease preparation time somewhat and can add to the overall quality of an inservice. But to a very large extent, the quality of an inservice depends on the quality, experience, and preparation of the facilitator.

## References

Moursund, D. and Ricketts, R. (1988). *Long-Range Planning for Computers in Schools.* Information Age Education, 1250 East 29th Place. Eugene, Oregon 97403.

# 3.2
## Sample Timeline Outline

The final format of the NSF inservice sessions discussed in this Notebook was a sequence of two hour sessions. The sessions were held immediately after school, typically from 3.30 - 5.30 or 4:00 - 6:00 in the afternoon, one day per week.

Through careful thought, trial and error, and experience, we gradually developed a Sample Timeline for the organization of a two hour session. In essence, this Sample Timeline consists of a model for a one hour session, and the model is followed twice for a two hour session. This way of building longer sessions from a one hour session can be further extended to still longer inservice sessions.

The outline given below suggests specific amounts of time for the various parts of an inservice session. However, flexibility is important. The actual time spent on any given activity will depend on the activity, the facilitator, and the participants.

| Minutes allotted | Activity |
|---|---|
| 10 Minutes | *Starting activity.* Have participants either work on an off machine activity or on the computers with software that is fairly self-explanatory. Make use of an appropriate Performance Aid. |
| 5 Minutes | Debriefing of the above activity. |
| 25-35 Minutes | *First major activity for the session.* This is time for the participants to be on the computer. It can be a more in-depth continuation of the starting activity, or it can be a new piece of software. |
| 10-15 Minutes | Debriefing of the above activity. |
| 10 Minutes | A short break for stretching, coffee, cookies, other refreshments, and informal conversations. Generally speaking, there is never enough time to accomplish the aims of an inservice program. Don't let the break time stretch too much! |
| 30-35 Minutes | *Second major activity.* Again, participants will be using the computer in most such activities. However, sometimes off machine activities are quite appropriate. |
| 10-15 Minutes | Debriefing of the second major activity. |
| 10 Minutes | *Closure.* Summarize what was accomplished during the day; any additional comments from the participants or yourself; details of the next meeting. |

This general outline is only meant to serve as a starting point for organizing a two-hour session. There may be certain sessions where the debriefing and discussion is of more importance than hands-on time. In those cases the facilitator should adjust the schedule as necessary. In other cases an off-machine activity may be more appropriate than a hands-on activity.

A key concept in the CI$^3$ model is a discovery-oriented approach. Most inservice facilitators are quite used to delivering lectures that cover a given body of material. But the amount of straight lecture time in a two-hour session such as outlined above should probably be less than ten minutes!

Rather than lecture, the inservice facilitator facilitates. Participants spend the bulk of their time in two modes. The first is a hands-on mode, usually working in groups of two at a machine. This is a learn-by-doing environment. Participants are encouraged to answer their own questions by a combination of trial and error, reading the Performance Aids and other handouts, and asking each other. When the inservice facilitator must intervene, it should be as a facilitator rather than as an answer provider.

The second major participant mode is group discussion, sometimes in small groups and sometimes in a whole-class group. Many teachers have had relatively little experience in facilitating small-group and large-group discussions. (A good way to gain experience is by working with a group of educators. This is because once a facilitator gets educators started talking, it is hard to get them to stop!) A good rule of thumb is that the facilitator should talk less than half of the time during a group discussion.

The group discussion debriefing sessions must lead to discovery or reiteration of the major points covered. Thus, the facilitator must have these points in mind. As participants make comments that relate to the major points, the facilitator must seize these opportunities to make sure that these points have been discovered and comprehended by all participants. Initially, many inservice facilitators find that this is harder to do than to just delivering a straight lecture. But, with practice, it becomes an enjoyable and relatively easy mode of instruction.

# EIGHT-SESSION ELEMENTARY SCHOOL INSERVICE

## 4.1
## SESSION 1: Interpreting Data with Graphs

### 4.1.1 Narrative Overview

The main reason computers are so important in education is that they are a powerful aid to problem solving. One way that computers can be used to help solve problems is in the organization and presentation of data. The human eye and mind are not particularly good at looking at a table of data and extracting key features and trends. But when the data is put into graphical form, the human does much better. This session focuses on using computer graphics to present data in a form that is a useful aid to problem solving.

The first session of an inservice sequence is particularly important, since it sets the tone for the whole sequence of inservice sessions. For example, suppose you really want participants to participate freely in discussions, and that an open atmosphere of discovery based learning is to prevail throughout the inservice sequence. Then you want to get this started immediately. Begin the first inservice session with an activity that has participants interacting, sharing their ideas, discovering new ideas, and actively participating.

There are several purposes embodied in this first training session:

1. The participants and facilitator will meet one another and learn one another's expectations.
2. Teachers will learn how to use a graphing program designed to help students learn to interpret data.
3. Important details about the conduct of the training (such as scheduling and location of subsequent sessions) will be settled if it has not been possible to make firm arrangements prior to the first session.

In general preparation for the training, the facilitator should make sure that the information on the handout, **A Day in the Life of Lucy Van Pelt**, is typed into *MECC Graph* and that an appropriate number of copies of *MECC Graphing Primer* and *MECC Graph* are made.

Also, the facilitator should prepare a wall chart on butcher paper. The purpose of the chart is to act as a data source for one of the activities to be done later in this first session. The facilitator provides column headers (fields) and participants fill in data. The subject of the chart depends to some extent on the trainer's strategy. During the development phase of this training, we experimented successfully with two different subjects: personal data from the participants, and characteristics of the participants' favorite restaurants. The chart is simple to make, all that is necessary is to place a few headers across the top and leave plenty of blank space below. Headers for personal data might be *Name, School, Grade Assignment,* and *Years Taught.* Headers for restaurant characteristics might be *Restaurant Name, Location, Cuisine Type,* and *Distance from Here.* A personal data chart can be helpful during introductions, while a restaurant chart might help out-of-towners find a place to eat.

Before the session begins, the facilitator should load all the computers with the first program to be used (*MECC Graphing Primer*). Also, the wall chart should be placed in an area of the room that is convenient to see and reach.

At the start of the training, as participants enter the training area, they should be greeted individually at the door, given name tags, and directed to fill-in their contributions to the wall chart. (Notice that this allows immediate involvement, even if some participants arrive a little early and some a little late.) Participants should also be given a copy of the training notebook, with their name on the outside front cover.

At approximately five minutes after the designated starting time, the facilitator should speak briefly about the purpose and organization of the training. It is important to start on time and to get participants used to the idea that the sessions will start on time. The use of individualized and somewhat open ended initial exercises (such as the butcher paper exercise) helps in this endeavor.

**Introductions** should be carried out swiftly. It is appropriate for the facilitator to suggest a format: for example, name, grade taught, and school.

Participants should move into the first activity (*MECC Graph Primer*) as quickly as possible. Distribute the instruction handout and encourage participants to begin immediately. When teachers/students are using materials like these, the facilitator should circulate around the classroom responding to questions and requests for assistance.

In the **Life with Lucy** activity described in the lesson sequence (Script, p. 2), participants are asked to examine a table of information and predict what a pie graph representation will look like. It might be useful to show students several illustrations of pie graphs, perhaps drawn from textbooks that they are using or from newspapers and magazines.

After the **break**, participants will put the information from tables they have filled out into the *MECC Graph* program, which will then draw a pie graph of their data. They can compare this to their prediction. Debrief the **Your Day on the Computer** activity by drawing out the differences in speed, convenience and accuracy between creating pie charts by hand and preparing them on a computer. If a printer is available, print several of the participants' graphs. Point out how the graphing program is also a *teacher tool*, in that the teacher can prepare graphs of any set of appropriate data for classroom use.

In the **Graphing Data from a Table** activity, the goal is to have participants look at a large amount of information (in this case, the data they themselves created) and extract from it some information to be represented graphically. First they find a column of the table that describes some "countable" information. If they have created a "personal data" table, it might be best to use *Years Taught*. The years could be grouped into ranges and graphed. Similar things can be done with other data. If teachers from three schools are in the same training group, a pie graph may be made of the distribution of participants.

The strategy during the **Debriefing** is to draw out from the participants as much information as possible about what they have learned. If the facilitator does all the recapitulation, the learning will not "stick" with the participants nearly as well as it will if they are put in the position of reflecting upon what they have learned. For more information about the concept of debriefing see the reading "Enhanced Learning Through Debriefing" in the **Handouts** section of this session.

After the training, make sure that the training area is left in good order. This will help to establish and preserve a good relationship with the person who controls your training site.

## 4.1.2 Script

This script contains more than enough materials for a two-hour inservice session. Thus the facilitator must select a subset of it to present in the time available, or adhere tightly to the time line suggestions. (Most facilitators will wish to add or substitute their own ideas and materials for some of those provided.) A sample timeline for a two-hour session is in the next section. It represents what was actually done by the NSF facilitators in one two-hour session.

The reader will note that this first script is a little more detailed than later scripts. It is important to be over-prepared for the first session.

**Theme**

Interpreting data with pie graphs.

**Objectives**

Participants use a piece of graphing software to create pie graphs for classroom use. Participants think and talk about impact on the curriculum of providing students with access to graphing software.

**Abbreviations**

Readers of this script and subsequent scripts should note that the following abbreviations are used.

LP – Lesson Plan
HO – Handout
PA – Performance Aid (a special set of notes describing how to use a piece of software or how to perform an activity)
OV – Overhead projector

**Materials**

*Software:* *MECC Graphing Primer, MECC Graph.*

*Handouts:* **MECC Graph Primer Instructions, A Day in the Life of Lucy Van Pelt, Empty *MECC Graph* Table (2 copies), MECC Graph Pie Graph Training Instructions.**

*Other:* Name tags, a large sheet of butcher paper, heavy felt-tip pens.

**Preparation**

Load the *MECC Graphing Primer* program into the computers. Put up the wall chart (see the *Narrative Description* for details).

**Start**
5 Minutes

As the participants enter, greet them individually, give them a name tag, and direct them to the wall chart to fill in the appropriate information. Hand out notebooks. Acquaint participants with the nature and purpose of the sequence of inservice sessions.

**Introductions**
5 Minutes

Have persons in the training team introduce themselves. Ask trainees to share appropriate information about themselves.

**Activity**

**MECC Graphing Primer Materials:** ***MECC Graphing Primer*** (one per 15 Minutes computer) and **MECC Graph Primer Instructions.**

- Discuss basic pairing rules for the following activities: principals pair with a teacher, teachers pair with another teacher not at own grade level.
- Use the **MECC Graph Primer Instructions** as a guide to the training activity.

**Activity**
20 Minutes

**Life with Lucy**
Materials: **A Day In The Life Of Lucy Van Pelt** and **Empty *MECC Graph* Table** handouts.
This can be done either on or off the computer. If on the computer, have a file labeled Lucy's Day ready to go in *MECC Graph*.. If used as an off-line activity, have copies of **A Day in the Life of Lucy Van Pelt** copied for every one or two participants.

- Discuss how the information shown on the form was organized and placed in its correct place. Have the trainees fill in the blank *MECC Graph* table and draw their estimate of the pie graph in the circle

**Debrief**
10 Minutes

Facilitate an open-ended discussion. Ask questions such as: "Can students learn to use the software?" and "What would be the impact on the curriculum if students were allowed to use such software?" Strive to have participants do more than half of the talking during debriefing times.

**Break**
10 Minutes

Load *MECC Graph* into computers. (Begin to train participants that breaks are indeed only ten minutes long!)

**Activity**
10 Minutes

**Your Day**
Materials: ***MECC Graph*** (one copy per computer) and **MECC Graph Pie Graph Training Instructions.**

- Teachers enter information on how they spend the day into *MECC Graph* and graph the data.

**Activity**
25 Minutes

**Graphing Data from a Table**
Materials: **Empty *MECC Graph* Table** handout.

- Working in pairs, participants study the data table that they created at the beginning of the session and discuss the relationships among the data items. After selecting a column as a source for data, they enter that data on the **Empty *MECC Graph* Table**; then each pair goes to a computer to graph the information selected.

| | |
|---|---|
| Debrief<br>10 min. | • Recap concepts covered in the previous activities.<br>• Draw out suggested uses in classroom by questioning teachers.<br>• Point forward to connections with future training. |
| Closure<br>10 Minutes | Discuss possible changes in starting time, the location of next training site, and any other needed changes in the conduct of training. Who will provide refreshments for the next session? Involve the participants in these decisions to the extent possible. |
| Post-training | Collect disks and any other training materials. Straighten up the training area, returning it to better condition than it was prior to the session. |

## 4.1.3 Timeline

| | |
|---|---|
| 0:00 — 0:05 | Start |
| 0:05 — 0:10 | Introductions |
| 0:10 — 0:25 | MECC Graphing Primer |
| 0:25 — 0:45 | Life with Lucy |
| 0:45 — 0:55 | Debrief |
| 0:55 — 1:05 | Break |
| 1:05 — 1:15 | Your Day on the Computer |
| 1:15 — 1:40 | Graphing Data from a Table |
| 1:40 — 1:50 | Debriefing |
| 1:50 — 2:00 | Closure |

## 4.1.4 Handouts

The pages of this section are handout materials needed by the participants during Session 1 of the *Elementary Education* inservice.

**Index to Handouts**

# Outline of Eight-Session Inservice Series

This handout contains a brief summary of the contents of each of the eight sessions of the inservice series.

## Session 1: Interpreting Data with Graphs

We begin the inservice series by learning to use graphics software to represent data. Such visual representation of data is a considerable aid to solving problems involving a large quantity of data. The specific software we use is *MECC Graph*, but any relatively simple graphics package suffices. The main emphasis is on beginning to understand some roles of computers in problem solving and how use of the computer as a tool in the everyday curriculum leads to changes of emphasis and approach on a variety of topics.

## Session 2: Integrating Graphing Software with Existing Materials

This session focuses on integrating use of computer graphics into the existing curriculum. Participants will look at curriculum materials they might currently be using in their schools, and find instances in which computer graphing applications might be appropriate. The focus is on use of the computer as a tool for students, as a tool for teacher-presented demonstrations, and as an aid for preparing student handout materials.

## Session 3: Unstructured and Structured Data

This is the first session on using the computer to store, organize, and retrieve data as an aid to problem solving. Participants will be introduced to the use of database software from MECC and will begin to explore capabilities and limitations of such software.

## Session 4: Structuring and Analyzing Data

We continue to learn about database software and the types of problems that can be solved by use of databases. In this session participants will gather, organize, and analyze data. This session also includes an introduction to *AppleWorks*, which is an integrated package with database, spreadsheet, and word processing components.

## Session 5: Database and Word Processing

In this session we end our database studies and begin working with word processing. Participants practice creating a database and learn to think about what questions a database might be designed to help answer, or what problems a database might be designed to help solve. The major focus of the remainder of the inservice sessions is on process writing in a word processing environment. We introduce word processing through use of *FrEdWriter*, which is freeware designed for use on the Apple *II* series of microcomputers. Even in this initial introduction, the emphasis is on the writing process rather than on learning the key strokes and other details of a particular word processor.

## Session 6: Prewriting Activities with Word Processing

Process writing begins with prewriting. This session focuses on the use clustering techniques and on "prompts" as part of the prewriting process. *FrEdWriter* contains good facilities to aid teachers in doing prompted writing with their students.

## Session 7: Process Writing Conferences and *Formula Vision*

After students have completed a draft of a piece of writing, they are ready to receive feedback. Feedback can come from themselves, their peers, or their teachers. This session focuses on peer and teacher conferencing techniques. However, about half of this session is spent on a piece of software that has little to do with writing. *Formula Vision* is a one screen spreadsheet-like piece of software useful in math and science beginning at about the fifth grade. It is an excellent tool for introducing students to the ideas underlying spreadsheet software.

## Session 8: Revision and Editing with a Word Processor

The final session focuses on use of a word processor to revise and edit one's writing. Time is also provided for participants to plan how they will continue to use computers with their students. The final activity is an evaluation of the inservice series.

# MECC Graph: Lucy Van Pelt

This is a Performance Aid. It is a detailed set of directions for accomplishing a specific task with a particular piece of software.

1. Insert the *MECC Graph* disk in the drive. Close the drive door.

2. If the computer is off, turn it on. If the computer is already on, hold down the **Open-Apple** and **Control** keys, and press the **Reset** key (this is called a *warm start*). When you release these keys, the disk drive should start and the program will load. (If it doesn't work, repeat this step.)

3. When the disk drive goes off, press the **Space Bar** and read the description of the program on the screen. Then press the **Space Bar** again, and read the menu (a set of options) on the screen.

4. Choose item 1 (Graph Name/Number Data) by pressing **1**; then press the **Return** key.

5. The screen now displays samples of bar, line, and pie graphs, and a menu that allows you to specify what type of graph you want to have the computer do for you. Select Pie Graph by pushing the 3 key and then the **Return** key.

6. The LEGEND screen now asks, "Do you want to use data stored on the diskette?" Type **Y** (for yes) and then the **Return** key.

7. The next screen begins with the directions "Select a data name." There will be one or more files named, and one of them will be LUCY VAN PELT. If it is already highlighted (black on white instead of white on black) then press the **Right Arrow** key and then the **Return** key. If it is not already highlighted, press the D (for down) or the U (for up) key an appropriate number of times to highlight the LUCY VAN PELT file name. Then press the **Right Arrow** and then the **Return** keys.

8. Now the screen display will show some data about A DAY IN THE LIFE OF LUCY VAN PELT. Answer N (for no) and press the **Return** key in response to the question, "Do you want help entering labels for your graph?"

9. Notice the menu at the bottom of the screen. Select the graph option by pushing the G key.

10. Notice that the computer now draws a pie graph of the LUCY VAN PELT data. The graph shows the percent of the data that is spent in each of several different activities. At the bottom of the display is a menu.

11. Now feel free to experiment. For example, you might want to start over at Step 2 of these instructions, but try different options. You might want to see what the LUCY VAN PELT data looks like when presented in the form of a bar or line graph.

# (Alternate) MECC Graph: Lucy Van Pelt

*Note 1.* This is an alternative format for the MECC Graph Pie Graph Training Instruction Performance Aid. It has been designed to better fit the needs of younger students. Notice that the reading level has been lowered and the key strokes to be performed have been more clearly identified. This PA contains more detail than the PA designed for teachers. This PA would be even better if it contained pictures showing what the screen is supposed to look like after each major step.

*Note 2.* Writing really good Performance Aids is quite difficult. Usually it involves a trial and error process. One writes the best PA they can, and then tries it out with the intended audience. Some users will not be able to follow the instructions. This would likely suggest that some revisions are necessary. This cycle of writing, testing, and rewriting may need to be repeated a number of times before a satisfactory PA is produced.

1. Take the *MECC Graph* disk out of the disk jacket.

2. Keep your thumb on the label.
   Insert the *MECC Graph* disk in the disk drive with the label up.

3. Close the disk drive door.

4. If the computer is off, turn it on.

   - Turn on the monitor. The switch is usually on the front or the top.
   - Turn on the computer. The switch is on *your* left on the back of the computer.

   If the computer is already on,

   - Hold down the Open-Apple and Control keys *at the same time.*
   - Continue to hold down these two keys.
   - Press the Reset key.

   Release these keys. The disk drive should start . If nothing happens, repeat this step.

5. When the red light on the disk drive goes off, the program is loaded.
   You see a screen that identifies the program.
   You see the instruction "Press the Space Bar to continue."

   **Press the Space Bar now.**

6. Read the description of the program on the screen.
   You see an instruction to press the Space Bar again.

   **Press the Space Bar now.**

7. You see a *menu* on the screen. (A *menu* is a set of choices.)

8. You are to begin with choice number 1, Graph Name/Number Data

   **Press the number 1.**
   **Press the Return key.**

9. Your screen show samples of bar, line, and pie graphs.
   There is a menu at the bottom of the screen.

You are to start with choice Number 3. Pie Graph.

**Press the number 3.**
**Press the Return key.**

10. Your screen now contains four columns of horizontal lines.
The word LEGEND appears at the top on the left.
At the bottom, you see "Do you want to use data stored on the diskette?"

**Press the Y key.**
**Press the Return key.**

11. You see a screen that begins with "Select a data name."
You see a list of one or more files.
One of the files is called LUCY VAN PELT.
(If LUCY VAN PELT is not on your list, ask for help.)

12. You can use the U (for Up) and D (for Down keys) to highlight the names in the list.

**Press U and D several times.**

Notice that the names are highlighted as you move your cursor.

13. Now you are to choose LUCY VAN PELT.

**Highlight LUCY VAN PELT (use U and/or D)**
**Press the Right Arrow key.**

This selects the LUCY VAN PELT file.

**Press the Return key.**

This gets the LUCY VAN PELT file.

14. The screen contains some data entitled A DAY IN THE LIFE OF LUCY VAN PELT.
You see the question "Do you want help entering labels for your graph?"

**Press the N key.**
**Press the Return key.**

15. You see a menu at the bottom of the page.
You are going to graph the data you see on the screen.

**Press the G key.**

The computer now draws a pie graph of the LUCY VAN PELT data.
The graph shows the percent of the data that is spent in each of several different activities.

16. You see a menu at the bottom of the screen.
Now you should experiment. Here are some ideas:

- Start over at Step 9 of the above instructions, but try different options.
- Find out what the LUCY VAN PELT data looks like when presented in the form of a bar or line graph.

*Note*: You may choose any local hero, heroine, or popular star you wish for this exercise. If you choose to duplicate this sheet or create an overhead we suggest you decorate it with appropriate cartoons.

# A Day in the Life of Lucy Van Pelt

| | |
|---|---|
| eating | 2 hours |
| sleeping | 9 hours |
| beauty | 7 hours |
| watch t.v. | 2 hours |
| baseball practice | 4 hours |

# Empty MECC Graph Table

_______________________________________________

| LEGEND | ________ | ________ | ________ |
|---|---|---|---|
| ________ | ________ | ________ | ________ |
| ________ | ________ | ________ | ________ |
| ________ | ________ | ________ | ________ |
| ________ | ________ | ________ | ________ |
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| ________ | ________ | ________ | ________ |

_______________________________________________

| LEGEND | ________ | ________ | ________ |
|---|---|---|---|
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| ________ | ________ | ________ | ________ |
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| ________ | ________ | ________ | ________ |

# MECC Graphing Primer:
# Pie Graph Training Instructions

This is an example of a Performance Aid. It is a detailed set of directions on how to accomplish a specific task with a specific piece of software. Carefully follow the directions, stopping after each one to think a bit about what it should/does accomplish and whether it seems to have worked correctly. (It is easy for something to go wrong. For example, you may press a wrong key, press a key twice when you only intended to press it once, or you may have a version of the software that is slightly different from the one used to create the Performance Aid.)

1. Insert the **MECC Graphing Primer** disk in the drive. Close the drive door.

2. If the computer is off, turn it on. If the computer is already on, simultaneously press the **Control, Open-Apple** and **Reset** keys. That is, hold down the **Control** and **Open-Apple** keys, and then press the **Reset** key. When you release the keys, the drive will start and the program will load.

3. When the drive goes off, press the **Space Bar** twice.

4. You should see a screen titled **MECC Graphing Primer**. Choose Item 3 (Exploring Pie Graphs) by pressing 3; then press the **Return** key

5. When the disk stops spinning, read the information on the screen and then press **Return**.

6. Select item 2 (Quick Review) from the **Pie Graphs** menu. This is a sequence of "screen pages" that gives some information about pie graphs. Press the **Space Bar** to "turn" each page. Unless you wish to read the screens again, enter "n" at the review prompt on the last page.

7. From the **Pie Graphs** menu, select Item 3 (Pie Games). There are two informational pages. Then you have your choice of games. Choose either. Enter data into the table when instructed to do so. Any data will do - you can just make it up. Unless one of the trainers asks you to do otherwise, please answer "n" to the question, "Would you like to print this graph?" Create another graph if you wish. or play the other game by choosing **Pie Games** again.

8. *Optional.* If you have time, select Item 4 (Tell the Story) from the **Pie Graphs** menu. In this activity, you must make up a story to explain a graph. The story can only be as long as the space between the [brackets]. You don't have to press **Return** at the end of each line; the computer takes care of that.

9. When you finish, please select Item 5 (Return to main menu) from the **Pie Graphs** menu. From the **MECC Graphing Primer** menu, select Item 5 (End). Please remove the **MECC Graphing Primer** disk from the drive and leave the computer on.

# MECC Graph: Create Your Own Pie Graph

This is an example of a Performance Aid. It is a detailed set of directions on how to accomplish a specific task with a specific piece of software. Carefully follow the directions, stopping after each one to think a bit about what it should/does accomplish and whether it seems to have worked correctly. (It is easy for something to go wrong–for example, you may press a wrong key, or press a key twice when you only intended to press it once. You may have a version of the software that is slightly different from the one used to create the Performance Aid.)

1. Insert the **MECC Graph** disk in the drive. Close the drive door.
2. If the computer is off, turn it on. If the computer is already on, press the **Control**, **Open-Apple** and **Reset** keys and hold them down together. When you release them together, the drive will start and the program will load.
3. When the drive goes off, press the **Space Bar** twice.
4. You should see a screen titled **MECC Graph**. Choose Item 1 (Graph Name/Number Data) by pressing **1**; then press the **Return** key.
5. When the disk stops spinning, select item 3 (Pie Graph) from the main menu. When you see the screen with the word **LEGEND** at the top, answer "N" to the question, "Do you want to use data stored on the diskette?" Remember to press **Return** after you type "N".
6. Answer "Y" to the question, "Do you want help entering the labels for your graph?"
7. Now the computer draws a "blank" pie graph. When the drawing is complete, respond to the question, "What is the name of your graph?", by typing in the name of the graph you wish to create.
8. You can store data for up to three pie charts on one form. When the program asks, "Type names of up to three pie charts:", type a convenient name for your chart into the set of brackets and press **Return**. Simply press **Return** when the other two sets of brackets appear.
9. Answer "N" to the question, "Do you want to change any labels?"
10. Now the table appears with your titles written in. Note the square brackets beneath the word **LEGEND**. This means that the computer is ready for you to give names for the "slices" of the pie graph you are about to create. Enter these names from the paper form you have already filled in, pressing **Return** after each name. Notice that these names can be only eight letters long. When you have entered the last name, press **Return** repeatedly until the square brackets are at the bottom of the **LEGEND** column.
11. Press **Return** once more. Now the square brackets are in the next column. Here you will enter the numbers you have already written on the paper form. Type them in now, pressing **Return** after each one.

12. When you have typed in the last number and pressed **Return**, press "G". The computer will draw a pie graph of your data. Compare the graph on the screen with the graph you drew by hand. In what ways are they similar? How do they differ? Notice that this graphing program calculates the percentage that each "slice" represents of the whole. Will this be useful in your classroom?

13. Press "C" to change data. This will erase the pie graph and replace it with the table you recently filled in. Use the Arrow keys on the computer to move the square brackets around one of the numbers you entered. Change this number by typing in a new one and pressing **Return**. Press "G" and examine the new graph. How has it changed?

14. When you finish, please select the menu option (Q). From the graph menu, select item 4 (Return to main menu). Please answer "N" to the question, "Do you want to store this information for further use?" From the MECC Graph menu, select item 6 (End) Please remove the MECC Graph Disk from the drive and leave the computer on.

# Enhancing Learning Through Debriefing

by
Bob Gray

*Jamie sat at her desk with a far-away look in her eyes. She was thinking about the software simulation she had just finished. Jamie saved her tribe from starvation—even though her leg was wounded—and in her mind she was still stalking through the African jungles, carrying a spear. She was eager to talk about it, dying to be asked a question. Would the teacher encourage her to express her excitement? Or would the class simply move on to the next activity?*

In this scenario the student's interest and involvement is at an all-time high She still feels like a native hunting for food in central Africa. If the teacher neglects to wrap up the new knowledge, allowing the student to discuss her successes and failures, the teachable moment may be lost.

## Why Debrief?

The successful integration of computers into the curriculum involves many steps, even after choosing good software that meets curricular goals and objectives (see Figure 1) Raths (1987) defines debriefing as the process that gives students relatively free rein to organize, evaluate, summarize, or analyze a learning experience Debriefing and integrating learning activities with the goals and objectives of a unit is a step often omitted or only touched upon But debriefing can be one of the most important steps in curriculum integration of computers, resulting in highly personal and often very meaningful learning outcomes.

When you provide ample opportunity for students to build bridges from old learning to new material, students can reflect on the nature of the concepts, analyze their impact, and relate to past learning in a manner that amplifies and clarifies both old and new knowledge. Some outcomes of debriefing are:

- Increased understanding of content;
- Improved problem solving strategies;
- Exposure of misunderstandings and personal theories;
- Increased ability to recall content; and
- Increased motivation.

The result of a comprehensive debriefing experience is the meaningful integration of subject matter and increased motivation for the next learning experience.

## Debriefing Strategies

To follow up lessons that have taken advantage of the computer, talented teachers can select debriefing strategies from a large number of possibilities. Here are some tested techniques.

Role-playing is an effective way to capitalize upon the interest generated by a lesson and channel it into a more focused, reflective thinking mode. First of all role-playing allows students to express the feelings they experienced while using the program. Sometimes students need help returning to reality after participating in a complex, engaging microcomputer simulation Some continue to carry a spear around the class long after the program ends. Role-playing should allow learners to express their feelings in a positive, supportive environment. After expressing their feelings, students can more objectively reflect upon the decisions made in the simulation.

Role-playing also enhances decision making. In acting out the decisions made in the simulation with their classmates, students experience their own decisions again in a different environment from the computer, and they also see what decisions their classmates made. After the emotional release of the physical activity and looking at the situation from different perspectives, students can more objectively analyze their decision making processes—by themselves or in class discussion.

The revised edition of *Oregon Trail* (MECC) is a good example of a simulation that can be followed by an exciting role-playing activity. Students can imagine themselves in a covered wagon, battling the elements to reach Oregon Choose a scene, for example, where students approach a stream and try to decide whether to ford it Have students pretend they are part of a wagon train so that all groups can participate

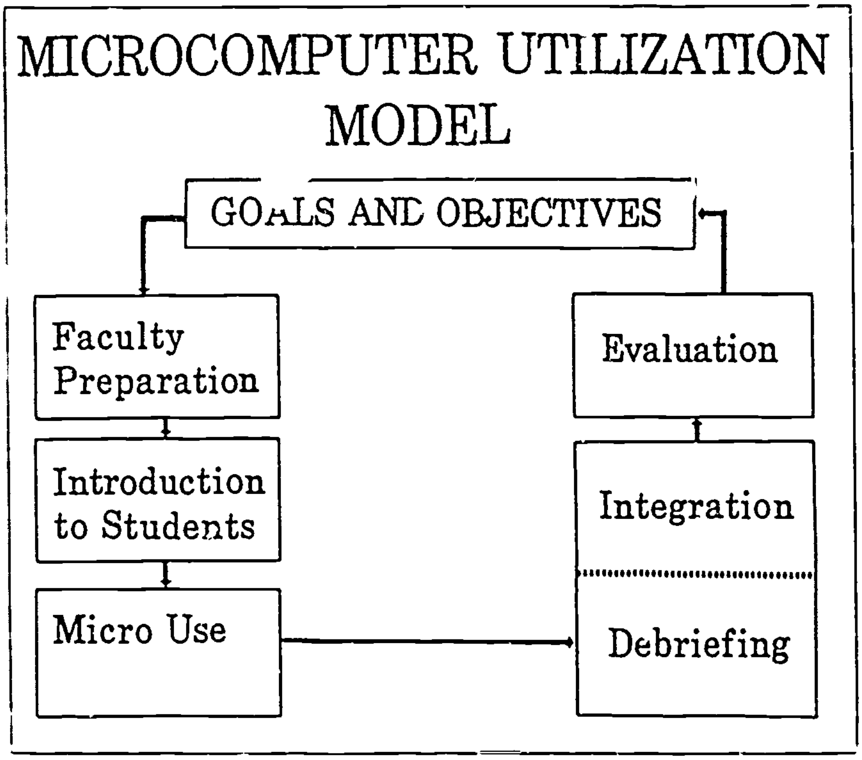


*Figure 1.*

Each group will have a chance to hear prior experiences of the other groups based on how they played the computer simulation. Afterward, they will be better able to evaluate their own decisions and decision making processes.

Writing a reaction paper helps students summarize the content and analyze major concepts in a software program. This exercise requires students to relate their new knowledge to past learning.

*Where in the World is Carmen Sandiego?* (Broderbund) is an excellent simulation in which students learn facts about geography in a problem solving environment. As a rookie detective assigned to catch Carmen Sandiego and her band of thieves, a student travels through the program to different countries. Descriptors of the countries through which Carmen has passed serve as clues, thus guiding the student detective's search.

As part of the computer activity, have students trace the paths of Carmen and themselves on a map you've provided. Also have students list the major characteristics of each country visited. Then, as a debriefing activity, have students write a paper on what they have learned about world geography as a result of playing *Where in the World is Carmen Sandiego?* Emphasize that the paper is not a listing of the facts recorded on their maps. They should think about general statements they can now make. For example, "I now know that people in different countries speak different languages and use different types of money." Or, "I know something about distances in the world because I know how long it takes to fly from London to Cairo."

This type of reaction paper helps students synthesize geographical facts into concepts. Another type of reaction paper can be used for debriefing the problem solving strategies used in playing the game. During the computer activity, have students keep a log of the clues and places in the cities they visited and why. As a debriefing activity have students write down and critique the investigative methods they used as the detective. Students should gain some idea of the benefit of prior experience and knowledge in the problem solving process. (One note of caution. Don't have students record too much information before they see its value in playing the game or in debriefing. At first, let students discover their own approaches.)

Comparing and contrasting two concepts helps intensify a student's learning experience by building bridges between old and new knowledge. This can be a paper assignment or the focus of a discussion. In either case, develop some type of chart that lists similarities and differences.

*Green Globs and Graphing Equations* (Sunburst) consists of three activities and an equation plotting utility. The activities motivate students to determine graphs from equations and vice versa without tedious point plotting. By trial and error, students modify and refine equations to find the graph or graphs that will intercept the 13 green globs scattered randomly on a grid.

As a follow-up discussion, generate a table as students compare and contrast different types of equations and the graphs they produce. Attributes to look for in graphs include slope, intercept, critical points, and so forth. Attributes of equations include coefficients, exponents, trig functions, and so forth.

Logo is often used to introduce and explore geometric concepts such as polygons. After students have generated a number of four-sided, closed ploygons with right angles, have them classify the figures as squares or rectangles.

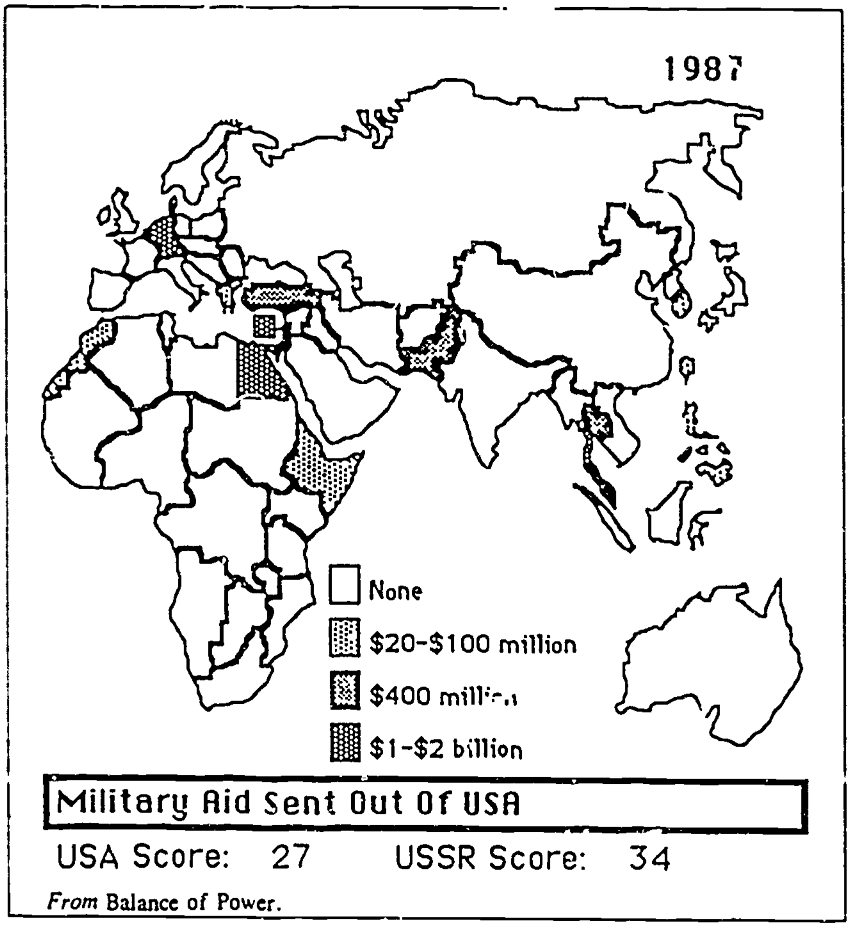
Comparing and contrasting activities helps students fully explore a concept and helps them generalize from their computer activity. In the process student misunderstandings and incorrect models are often exposed and can be corrected.

Drawing a visual summary after a computer activity enhances newly attained concepts by providing a concrete, highly personalized experience. Make transparencies of student drawings and have students describe their development as part of a follow-up discussion.

*Botanical Gardens* (Sunburst) helps students learn the importance of controlling plant growth variables. After using the program, have students draw a series of pictures depicting the growth of plants under a specified variety of physical conditions, or showing various stages of growth, conditions needed for growth, or parts of a plant.

*Protein Synthesis* (Helix) describes the process of protein production from basic genetic controls. Making pictures that summarize this rather complex program would help students organize the new knowledge.

Conducting a panel discussion based upon a software program produces a lively exchange to dispel misconceptions and reinforce learning. *Balance of Power* (Mindscape) is a complex, sophisticated game. As a leader of one of the superpowers, the user's object is to survive from 1986 to 1994 without blowing up the world. A panel discussion concerning specific strategies the real super



*From* Balance of Power.

powers use produces an exciting, motivating debriefing activity. Individual students or teams represent the superpowers and analyze specific actions (e.g., trade embargoes and military actions, in relation to international problems. Each leader will have six or seven advisors to assist in developing policies. Have one class member serve as secretary to compile the data and indicate findings on the chalkboard for all class members to see. At the end of this panel discussion, students will have greater insight regarding major world problems.

Evaluating the program by using standard software evaluation criteria can help improve students' understanding of the content and provide valuable input to the teacher on how much the students have learned. In the process of filling out a software evaluation form, students will be thinking about the objectives of the software (after finding them in the documentation), how well they have been met, and how much the software has contributed to their overall understanding of the subject matter. They are in the best position to evaluate how well certain features of the software such as color and sound use or feedback on incorrect answers aided in their learning. Make sure the form is not too much of a checklist or too laden with educational jargon. Adapt the form so that students tell what contribution the use of color made, not just whether it helped in understanding the content. This activity has an added plus. It helps students become more critical software consumers.

*Odell Lake* (MECC) is a simulation designed to teach young students about predator/prey relationships and the food chain. Teachers can have students evaluate the effectiveness of the two modes—simulation and game. What did they learn from each? Was one more effective than the other?

Simulating a particular computer environment or scene from a program may improve overall learning and increase motivation. Simulating a scene by acting it out is not as open ended as role-playing. But it can be just as fun and requires synthesizing knowledge of the event as well as attention to detail. Adding stage props and costumes or actually creating a physical model of some environment challenges students' creativity and ensures retention of what they're learning.

*Interviews with History* (Educational Publishing Concepts) is a program in which students act as reporters interviewing famous historical figures. An in-class simulation of an interview with a famous historical figure (a member of the class, a parent, or another teacher) provides for a more interesting experience. An interview with honest Abe Lincoln right in the classroom gives students a chance to ask their own questions, gives the teacher a chance to hear what students are interested in, and lets everyone have some fun.

## The Teacher's Role

These debriefing activities are all different, but they all provide additional learning experiences, develop analysis skills, and allow for closure. To provide even more motivation, give students some freedom in the choice and development of these activities.

Plan the debriefing activities very carefully. Secure the needed resources, allow ample time, collaborate with students, and select the most appropriate strategy based upon the software used, the characteristics of the learners, and available resources.

Feedback from the teacher and other students is an important part of the debriefing and integration process. Look for ways to make the debriefing activity as interactive as possible. Follow debriefing activities that are individual in nature (for example, writing a reaction paper or creating a series of drawings) with discussions in which students share their strategies, conclusions, or results.

The debriefing phase can be *the most important* aspect of curriculum integration of computers. It represents an exciting opportunity for teachers and students to use their creativity. Well designed follow-up activities will motivate students, expand their learning horizons, and lead to more positive and substantive learning outcomes. Like the student at the beginning of this article, students on the whole often require the debriefing step. Help students learn when and where to leave the spear behind. Capitalize on their motivation. This is a major opportunity that teachers cannot afford to miss.

*[Dr. Bob Gray, Kutztown University, Kutztown, PA 19530.]*

## Reference

Raths, J. (1987). Enhancing learning through debriefing. *Educational Leadership*, 45, 24-27.

# Software REVIEWS

Judi Mathis

## Turning Data into Pictures: Part I

*This month's column is devoted to software programs that produce pictographs, bar graphs, line graphs, and pie charts. Because so many programs were reviewed, not all of them fit on these pages. Next month look for a continuation of these reviews along with a tabular summary of all the programs and their features.*

Graphing programs can be used to represent information in a concise, clear, interesting manner in various subject areas. Many graphing programs exist that produce bar graphs, pie charts, and line graphs, and each contains various extra features. (See "Computers in the Math Classroom," p 34, for a discussion of function plotters.) There is a tremendous range of flexibility, ease of use, and grade level applicability among the various packages.

Graphing is no longer just a concern of secondary mathematics teachers. Many primary students are being introduced to graphs using activities from *Math Their Way*, a popular mathematics text from Addison-Wesley. Current textbooks contain graphs in various subject areas throughout elementary, middle, and secondary school. Graphs are commonplace outside of school, too. *USA Today*, a successful, fast growing, news daily presents a number of informative graphs in each issue. One usually appears on the cover. But graphs can be more or less than informative; they can easily be scaled to bias the presentation. So today's citizens must be able to read, interpret, analyze, and draw clear conclusions from graphs, to put graphs in their proper perspective, and to gain necessary information.

Certain preliminary steps are critical when planning to use any graphing utility in the classroom. Students need to understand the power of representing data in a graph. They need to spend time gathering data, organizing it, and determining appropriate labels for the graph. Students should clearly understand which measurements are being taken, which questions are being answered, and how to interpret the results. I strongly suggest the use of manipulatives for the first few graphs at any grade level. My favorite beginning activity came from an NCTM workshop. Have students compare the taste of red, green and yellow apples. Each student selects one Unifix cube that matches his or her preference. These cubes can then be combined in a pictograph or a bar graph before being represented in a graph on paper. This activity works well at all grade levels. Comparing three items is optimum for younger students. Four or more becomes confusing, and two is too few.

Many upper grade students, going through a transition from curricula with no graphing to textbooks that assume graphing skills, may need extra time to develop concepts and practice graphing. Fortunately, many computer programs contain tutorials that can assist beginners. Some programs are extremely simple and versatile and work with many different grade levels. A few programs are integrated with word processors so that graphs may be easily included in reports.

A recent article, *When is a Graph Worth Ten Thousand Words?* (Stone, 1988), establishes a well thought-out set of criteria for examining graphing software. I concur with Stone's decisions that a graphing utility should:

1. Provide a choice among a variety of graphing formats and enable alternate representations of a given data set.
2. Provide for simple, straightforward data entry and editing of information.
3. Maximize student control of labeling, range and number of entries, scaling and format.
4. Make relevant on-screen help readily available.
5. Produce clear, easily understandable printouts.
6. Allow disk storage of both data set and graph.
7. Execute graphs accurately.

Keeping these criteria in mind, I analyzed the following programs using data students had gathered for various graphing projects from many different age groups. In general, students preferred graphing programs that easily transferred data from one type of graph to another and had easy-to-use editing functions. Teachers demonstrated more concern with how long it took to produce a graph and the accuracy of the final representations. Each review in this month's column and next month's continuation describes briefly how the program works and gives some classroom suggestions. Additional information is contained in a table to appear next month where programs are compared side-by-side in approximate grade level and complexity progression.

### EASY GRAPH II

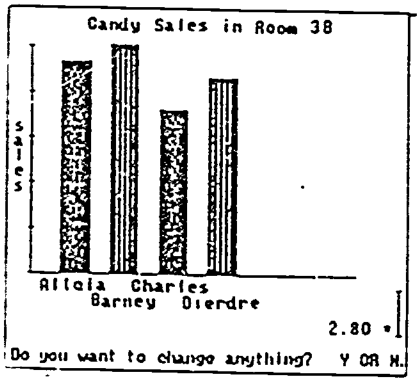
**Publisher:** Houghton-Mifflin
**Cost:** $60
**Grade Level:** K-4
**Contents:** Two-sided disk (tutorial on side one, tool on side two) and backup disk.

*Easy Graph II* can produce pictographs, vertical bar graphs, pie charts, and line graphs. In addition to the graphing tool it contains a well-written tutorial covering pictographs, bar graphs, and pie charts. Within the tutorial students use word problems to gather data, which are then used in creating each type of graph. In this way students can see similarities and differences between the various graphs.

Using *Easy Graph II* to create a pictograph and print it on screen takes only a minute or two. The only hurdle is the initial screen, which requires that labels be supplied in a rigid format. With young students this can be simplified by preparing a handout. The handout should include the same sentence they would see on the screen: (Using a PICTOGRAPH I want to compare the ______ of several ______.), a place to enter one to six items of data, and the set of 20 pictograph symbols. Once this information is entered into the program, the pictograph quickly appears in completed form on the screen.

Students then have the option of changing anything on the graph, printing it, saving it, or transferring the data to a bar graph. Pressing Escape returns the user to the main menu. Everything requires short answers and simple keystrokes.

Designing a bar graph follows the same steps as above, but there is an important difference in the representation: The bar graph is automatically scaled to maximize height. The scale in the lower right-hand corner is often presented in decimal notation and the scale cannot be adjusted. I made one graph using simple data and it calculated a scale of 2 80 (see Figure 1). I do not recommend using this bar graph in Grades K-4 for anything other than comparisons.



```
Do you want to change anything?   Y OR N.
```

*Figure 1*

I found a couple of drawbacks using the line graph It has automatic scaling that cannot be adjusted, and the line drawn always begins at the origin, even if that is not a data point These problems limit the usefulness of the line graph option in the primary classroom

The pie chart is excellent It is simple and well labeled, and it includes the total on the graph The wedges are labeled and entered in the same order as the data is entered, not rearranged according to size

It is quicker (less than one minute) to print the graph using a screen capture utility than to print the same graph using the program's print utility (more than four minutes), but the program's print quality is slightly better.

### Recommendation

*Easy Graph II*'s tutorial is a valuable teaching tool. The pictograph and pie chart utilities are excellent for primary grades. All four graphs could be used in higher grades, but the restriction of the number of data entries limits the complexity of the graphs being generated. The large, clear screen presentation makes this a useful demonstration tool for whole-class projects.

### Publisher's Reply

We're glad you reviewed *Easy Graph II*. As you noted in the review, *Easy Graph II* saves files to disk and contains a line graph option, unlike the original *Easy Graph*. Those schools that have *Easy Graph* can trade it in, along with $36, and receive a 64K version of *Easy Graph II*.

## EXPLORING TABLES AND GRAPHS I AND EXPLORING TABLES AND GRAPHS II

**Publisher:** Optimum Resources
**Cost:** $34.95
**Grade Level:** Grades 3 & 4 for I and Grades 5 & 6 for II
**Contents:** Two-sided disk (Tutorial on side one, Tool on side two), backup disk, and user's guide.

*Exploring Tables and Graphs I* enables students to create tables, picture graphs, vertical and horizontal bar graphs, and area graphs (pie charts). In addition to the above, *Exploring Tables and Graphs II* will generate line graphs.

In Learn About Tables, the tutorial, students can choose to play a game After playing the game a number of times, students have data to graph—data they generated This is fine in principle, but not in execution The first game I examined practiced discrimination between right and left Unfortunately it required a color screen, was noisy, and could be played for much longer than the clocked 30 seconds if the user constantly pressed keys This was not an anomaly; all of the games had educational drawbacks. I suggest the publisher redesign this section.

When students use Make Your Own, the tool side of the disk, they can fill in their own data tables and easily select various graph types. Entering data in the table requires a Return to select the location, typing in the data, and pressing Return once again to secure the data. Students I worked with found the extra keystrokes frustrating.

Up to 16 rows and six columns of data can be entered, but not all are graphed clearly. Students must Pick which items will be graphed. I recommend no more than 10 horizontal bars or 10 rows of pictures be selected. The line graph is restricted to four or fewer lines per graph and it cannot be scaled. The symbols for picture graphs are limited, and fractional pictures are inconsistent. But once a manageable number of data are entered, it is easy to move from one graph type to another using the icon selection line at the bottom of the screen (see Figure 2). This feature should be emulated by other programs for young children.

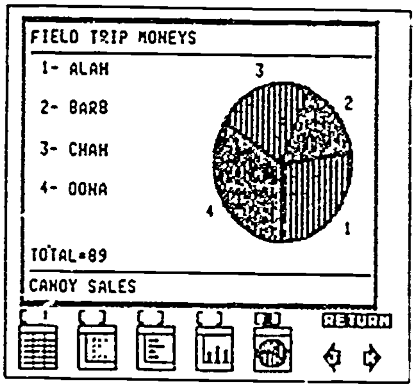


*Figure 2.*

*Exploring Tables and Graphs* is a great teaching tool for discussing which graph is most appropriate for each set of data, because it is easy to quickly present the same data using a variety of formats. During a classroom demonstration data can be quickly added or edited and then viewed to see any dramatic changes Some questions for discussion are. Is it easier to understand these data in a pictograph or bar graph? Do the data represent parts of a whole? Should we use an area (pie) chart? Another asset for the teacher is the documentation, the user's guide has blackline masters for the classroom and some excellent suggestions for data gathering

The programs need to be updated to fully accommodate the Apple IIe, IIc, and IIgs

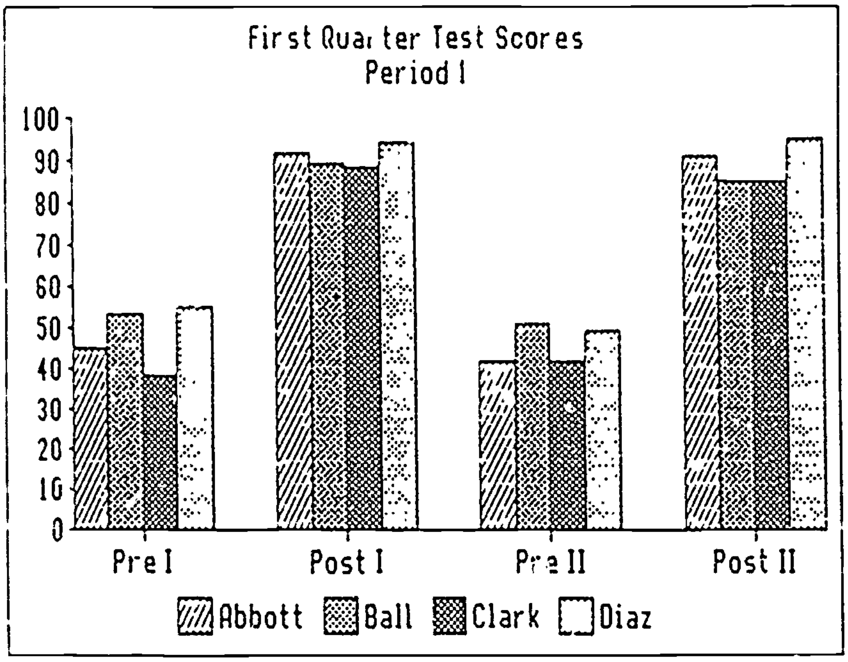


*Figure 4. A stacked-bar graph generated by* TimeOut ———

*TimeOut Graph* is a delightful accessory for *AppleWorks*. When you install *Graph* and the new Paint accessory that comes with it, *AppleWorks* becomes an even more powerful integrated program. After loading *AppleWorks* these applications are easily accessable.

In order to generate a graph, you first use the *AppleWorks* spreadsheet to create a data table. When you access *Graph*, the command line appears at the bottom of the spreadsheet screen. To design a graph you select a graph type, enter the data by highlighting the appropriate rows and columns in the spreadsheet, and type in the headings and labels. You enter up to six data ranges (columns or rows) and the labels on the x-axis directly from the spreadsheet. Everything else is entered via the keyboard. Next you view the graph to see if any modifications are necessary. Then the graph can be saved as a picture file or printed.

Graphs can be printed in three sizes. Size 1 (approximately one-sixth of a page), Size 2 (one-half), or Size 3 (full page, printed sideways). The number of sizes and the actual size of each final graph varies with each make of printer Experiment with your printer and keep a copy of each size with the software for reference

The graph types include Bar, Line, Pie, XY, Stacked-Bar, Area, and Hi-Lo Two additional graphs can be easily generated by modifying the spreadsheet data tables a pie graph becomes an exploded pie, and two sets of data on an XY graph depict linear regression. Instructions for designing these are found in the clearly written, very usable documentation.

What if a graph is completely designed and one or more data points need to be changed? You simply exit *Graph*, make the changes in the spreadsheet, reaccess *Graph*, and view the graph. *TimeOut Graph* retains the graph design and accesses the edited data to construct the new graph. It's that simple.

Students can use *AppleWorks* with *TimeOut Graph* for writing reports in Social Studies and Science. Many different graphical representations of the same set of analyzed data can offer insights in a mathematics class. Administrators can use the clean, clear graphs to emphasize a presentation. Anytime data are best organized using a spreadsheet, a graph should be generated from them. It provides a picture, and that picture is worth 10,000 words.

The Paint accessory is new. It is now available as a part of *TimeOut Graph* without an increase in price. As opposed to the rest of the program, the paint environment on the IIgs feels like a Macintosh, complete with pull-down menus and rapid response. I could not find the print option in the version I was able to preview I can only hope it is as easy and logical as the rest of the program

### Recommendation

Anyone who uses *AppleWorks* and wants to generate graphs should consider *TimeOut Graph*. It meets most classroom and administrative needs.

### Publisher's Reply

We feel that *Timeout Graph* is an excellent graphing program. With the addition of Paint there is no comparison with what can be done with *AppleWorks*. FYI—To print a Paint document, save it to the clipboard or on disk and print using *Superfonts* or *Graph*. The Paint option is also keyboard driven, using the Arrow and Option keys. We want to thank *The Computing Teacher* for running this interesting and informative review—as they always do.

## GRAPH-IN-THE-BOX

**Publisher:** New England Software
**Cost:** $139 95
**Grade Level:** Grades 8-12
**Contents:** Program disk, documentation.

When using any graphics program on an IBM, there is an initial installation It takes only a few moments with the *Graph-in-the-Box* Setup utility. The user designates the graphics board/card, printer, and plotter (if available), then *Graph-in-the-Box* is ready to be used as a stand-alone graphing program or kept in residence while other programs are running. Always load *Graph-in-the Box* before any other program. Be careful, do not remove *Graph-in-the-Box* without first removing any programs loaded after it, or your other applications could crash

At any time a simple keystroke awakens *Graph in-the-Box* A title line appears at the top of the screen and an unobtrusive main menu is visible along the bottom The main menu lists the options Capture, Data, Layout, Show, Printout, Files, Erase, and Quit Capture allows the user to select data from another program Whatever text was on the screen before calling *Graph-in the Box* is still visible, so data can be easily captured

Entering data in this program is straight forward *Graph-in the-Box* will accept up to 200 rows with 15 columns in a layout similar to a spreadsheet, but without any calculation capabilities The data can be entered from scratch, or from captured data I recommend using a spreadsheet to set up a data table, as the flexibility and mathematical

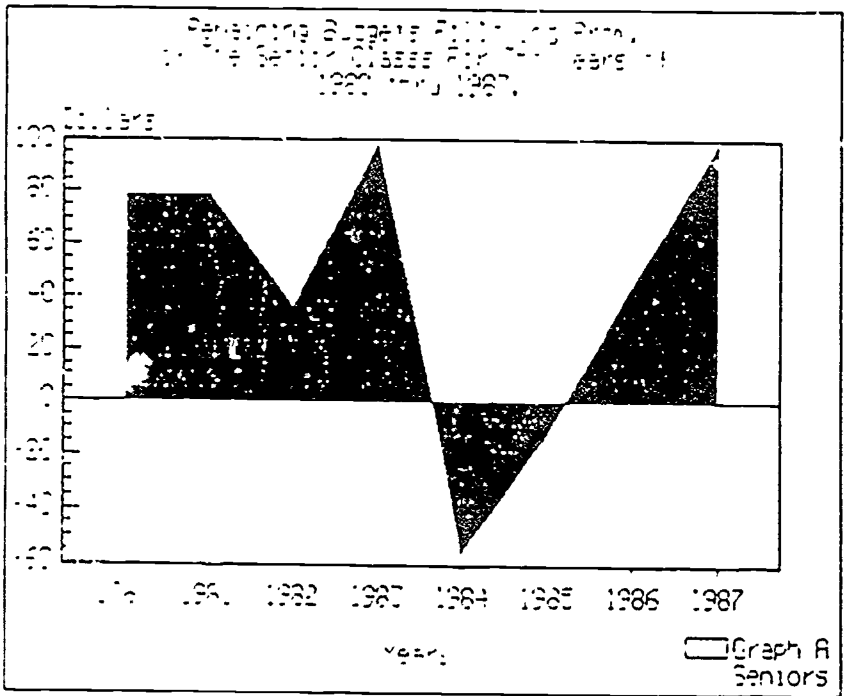


*Figure 5 An area-filled line graph generated by* Graph-in-the-Box.

features of a spreadsheet are desirable. I was delighted to find it just as easy to capture data from a word processor. At the top of the data columns, fill in each column heading, select one of 10 line patterns, and choose the colors. This data table can be easily edited, saved, and re-accessed.

Use the Layout screen to select the graph type, decide on figures and guidelines, determine automatic or manual scaling, and supply the labels. The 11 possible graphs include vertical and horizontal bar and stacked bar graphs, line, step, area-filled line, and area-filled step graphs, scatter plots, mixed line and bar graphs, and pie charts. Labels include a four-line centered title, y-axis, and x-axis.

When you choose Show from the main menu, the border and titles are presented and the graph is dynamically plotted. Both plotters and printers can be used through the Print option. Graphs can be printed in three sizes: small, medium, or large. I initially examined the first version of *Graph-in-the-Box* and was disappointed with the time-consuming printouts. Fortunately, version two has been improved. A small graph takes about half a minute, a medium one takes a couple of minutes, and a large graph even longer. However, the quality is worth it.

With a program this easy to use, I was surprized and pleased to see the comprehensive documentation. The 182-page book is tabbed, well-organized, full of examples, and well-written. It also explains procedures for producing charts on transparencies for overhead projection and, with the proper accessories, color charts on 35mm transparency film (color slides).

### Recommendation

*Graph-in-the-Box* is an easy-to-use graphing program for the IBM PC, Tandy 1000, or IBM compatible. It can be used alone or in resident with other programs. Using the default values, data can be captured from another program and a graph can be generated in any of the 11 different graphing layouts very quickly. This menu-driven program is appropriate for student reports, business classes, and administrative applications.

### Publisher's Reply

We are pleased you liked *Graph-in-the-Box* and look forward to your reactions to our two new IBM products, which deal with data analysis and representation.

## MICROSOFT WORKS

**Publisher:** Microsoft
**Cost:** $295
**Grade Level:** Grades 8-12
**Contents:** Integrated Package

*Microsoft Works* is an integrated productivity software program containing a word processor, database manager, spreadsheet generator, and telecommunications interface. Lurking within the spreadsheet options under Draw Chart are the choices of New Series Chart and New Pie Chart. The pie chart is self-explanatory. The series chart is a layout which includes line, bar, side-by-side bar, stacked bar, combo graphs (bar and trend line), and layout options. The pie chart uses two columns of the spreadsheet for its table: one column for labels and one for values. The series chart graphs up to four rows by 12 columns of spreadsheet data, using additional rows and columns for labels.

Although limited by number of data entries, the graphs can be generated quickly,

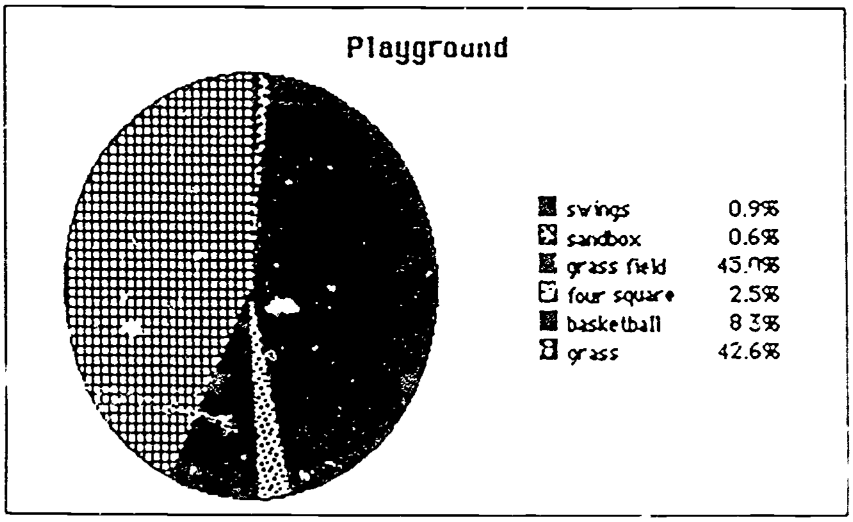


*Figure 6 A pie chart generated by* Microsoft Works

are clean and simple, and are easily inserted into a document. Using the spreadsheet as a data table is a real strength. This provides for easy editing and allows the user to make additional calculations and manipulations. The quickness of generating a chart allows for many different renderings of the same data in order to find the most appropriate representation. These graphs would enhance any student's report in science or social studies.

Recommendation

High school and some middle school students could use *Microsoft Works* effectively to write exciting and incisive reports containing graphs.

Publisher's Reply

With version 2.0, shipping this October, we have added a complete drawing tool to Microsoft *Works*. The Drawing tool has a wide variety of uses, for example, newsletters, logos, and so on. More specifically, it is particularly effective in regards to enhancing charts developed by both students and administrators.

## GRAPHIC EDGE

Publisher: Pinp Publishing
Cost: $89
Grade Level: 9-12
Contents: 5.25" and 3.5" program disks, documentation.

*Graphic Edge* is a tool for developing presentation materials that may contain graphs. It includes eight different graph types: point, line, bar, stacked bar, area, and hi-lo graphs; pie charts; and scatter plots. Data tables for the graphs are designed using the spreadsheet in *AppleWorks*. A drawing environment is provided to create drawings, design text charts, and embellish graphs. Pictures predesigned with *Print Shop* and *Dazzle Draw* can be combined with graphs and drawings to create a final picture that can be saved, printed, or included in a slide show

When I first examined *Graphic Edge*, I took a double-take It looks and feels like *AppleWorks* That gave me the confidence to dive in without checking the manual. Because the menus are well-designed and appropriately labeled, I quickly learned how

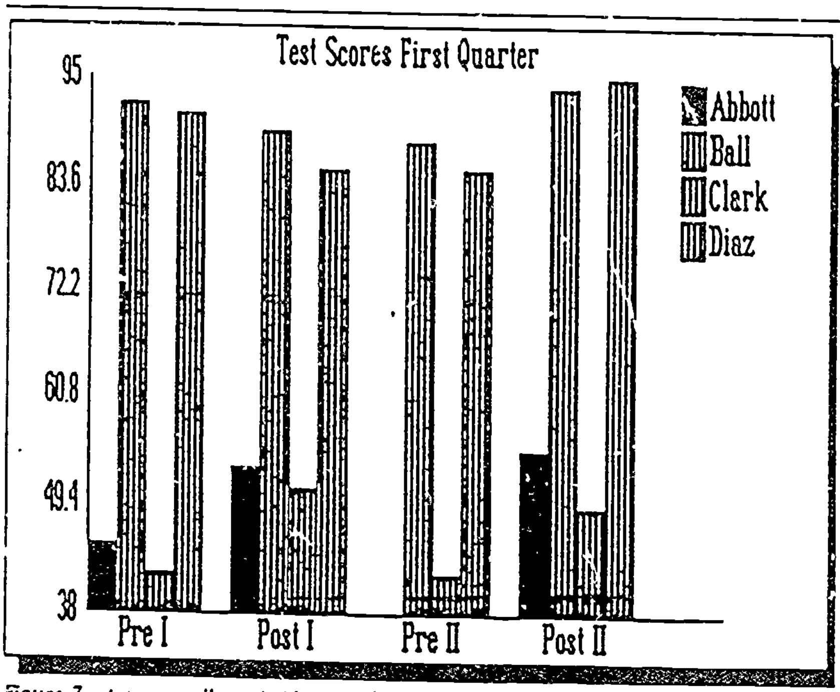


*Figure 7 Automatically scaled bar graph generated by* Graphic Edge.

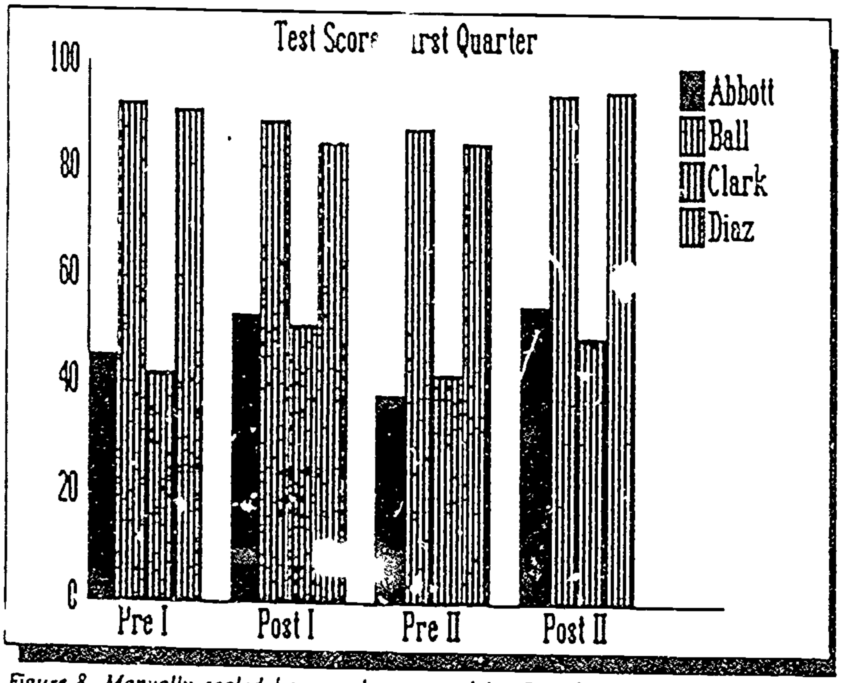


*Figure 8. Manually scaled bar graph generated by* Graphic Edge.

to use the graphing option and explored the drawing environment

In order to generate quality graphs, the *AppleWorks* spreadsheet file must be carefully designed, complete with titles and labels, and saved on a data disk. Because the contents of the spreadsheet file cannot be edited using *Graphic Edge*, you should always check one last time to make sure all the data, headings, titles, and scaling options are correct before leaving *AppleWorks*. Two features I rarely include on spreadsheets are a must for proper scaling using *Graphic Edge* the maximal and minimal y-axis values.

Next you load *Graphic Edge*, call up the spreadsheet file, and design the graph. The data are entered by highlighting the appropriate information in the spreadsheet The graph is now ready to be generated

The graphs are automatically scaled unless otherwise specified. The program chooses the least and greatest y-values for the minimum and maximum, respectively. This is visually misleading (see Figure 7). In order to put a graph in proper perspective, it is necessary to choose manual sizing and select the maximum and minimum values recorded in the spreadsheet file (see Figure 8).

The graph can be viewed before printing. At first I used an Apple IIGS with a color RGB monitor, and the commands at the bottom of the drawing environment, where the graphs are viewed, were unclear. I assumed it was the monitor. Next I used a fresh-from-the-factory monochrome monitor and found the words were only slightly clearer. The solution lies with a special utility for the IIGS that allows the graph screen to be viewed in super hi-res instead of the less clear Apple IIe emulation mode.

Up to 10 different graphs can be designed and saved using each speadsheet. They can be saved as screen maps or object files. Only the object files retain the data on each object and can therefore be altered. By designing a piece of data on the graph as an object, it can be altered without returning to *AppleWorks* to edit the data entries. It is easy to print a graph, edit data, add text or clip art, or select a different graph type, and print another version.

I found two drawbacks while using *Graphic Edge* in the classroom. One obvious problem is the inability to edit data within the program. This will force students to design their data tables carefully and thoroughly, but can cause more frustration than desirable. The other problem occurs when an empty spreadsheet cell is selected. It is treated as though it contains the number zero and this creates inaccuracy in the final graph.

The extra features, such as various fonts, are fun to use. The Font Editor allows students to demonstrate some creativity with lettering In fact, the extra features can overpower the graphing component of the program. Students may spend more time enhancing a graph using clip art from *Print Shop* or *Dazzle Draw* than focusing on the accuracy of the graph. These features will delight students and encourage the creation of graphs for presenting ideas, but teachers may find the students more focused on the final picture, rather than the graphic information

## Recommendation

If you use *AppleWorks*, *Graphic Edge* may meet your needs as a graphing tool in the classroom As always, I suggest previewing it before purchasing

**Publisher's Reply**

The beauty of *Graphic Edge* is that it is an object-oriented program that allows you to add art.

## ALPHACHART!, CURVE-PLOTTER!, AND 3D CHART!

**Publisher:** Spectral Graphics Software
**Cost:** $49.95 for all three, or $29.95 each
**Grade Level:** Grades 9-12
**Contains:** Program disks and short guide.

These are three separate programs, but because of their similarities in style I reviewed them together. *AlphaChart!* graphs vertical bar, vertically stacked bar, and pie charts. *CurvePlotter!* includes line and area graphs, trend charts, and function plots. *3DChart!* accepts data in a grid of up to 12 by 12 and then prints a three-dimensional bar graph using squares or rectangles. The programs were designed for the Apple II, so remember to keep the Caps Lock key down at all times.

*AlphaChart!* accepts up to 24 items, with three pieces of data for each item, for a bar graph. But the resultant chart may be too crowded for clear interpretation. I recommend keeping the graphs simple and uncomplicated. The pie charts can have from one to six slices, with one exploded piece. These can be presented as two-dimensional circles or in varying degrees of three-dimensional perspective. The program will label the pie chart with the entered values or percents, or leave it blank. With a built-in editing feature, this last option allows users to add their own labels and any additional text after the graph has been generated.

When I first examined *CurvePlotter!* I noticed an error on the line chart option menu: Select Bar Graph. There are no bar graphs in this program; that is what you choose to get a *line* graph. Each line graph can contain up to six lines with 24 divisions along the horizontal axis. An area graph can also contain up to six lines. The area under each line is filled with a different pattern. In order to see the comparison of all the areas, this graph is drawn in a three-dimensional perspective. This graph takes the longest to draw on the screen.

The sequence for using each program is the same. The user enters data and legend labels, which then can (and should) be saved on a separate disk. The chart can then be viewed on screen for a few moments. Both the data and charts can be saved on disk.

The print utility is on the back side of the program disk. The printer interface supports many different cards and printers. It is easiest to enter and save numerous files before printing. There are a lot of printing options, and I found myself printing a number of versions until I found the right combination for each graph.

I found the programs fairly straightforward. Directions are clear and data entry can be done quickly. Figuring exactly where the labels will appear on the graph, or which labels you ought to be entering, takes some practice. The program constantly gives helpful on-screen hints for the first-time user. It is wise to save often, and fortunately the programs remind the user to save both data and charts.

A special feature of these three programs can also complicate data entry As many of the graphs are three-dimensional, don't be

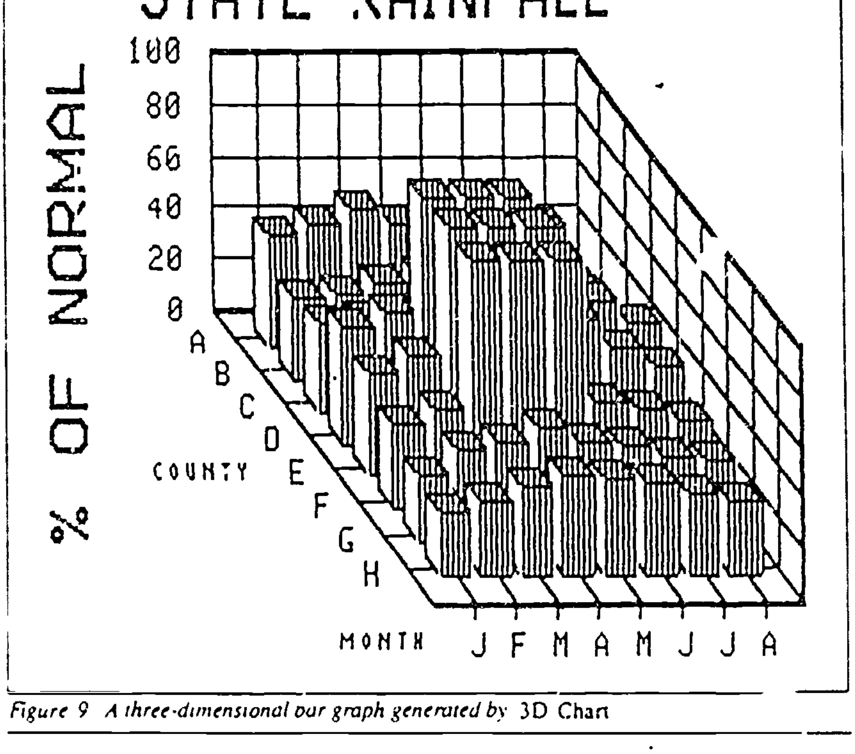


*Figure 9 A three-dimensional bar graph generated by* 3D Chart

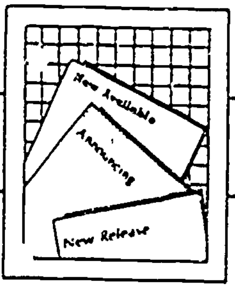
discouraged if their use requires some trial and error in order to enter the data in the correct order with the best possible labeling. Give some practice with simple data sets if you plan to use any of these programs.

These programs have some drawbacks for use in the classroom. At times the maze of directions is confusing. There is no support documentation for students or teachers to consult. It is possible to accidently throw away your data or print atrocious graphs, so practice is essential. Student worksheets would be a great help before using this program. A word of caution: Be careful when adding text or diagrams to your chart. While adding text, I covered part of the graph. I could erase the text, but not recover the lost graph. I do find the advertisement contained in the introduction intrusive.

### Recommendation

These are inexpensive programs for printing three-dimensional graphs on an Apple II, and they can be useful to high school students as well as people in business

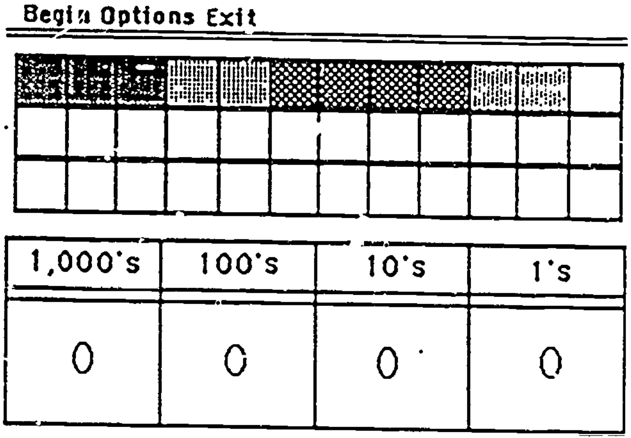
## New Software Releases



• Thunderware Inc. has released *ThunderView*, a low-cost program for creating personalized slide shows. The $39.95 program allows users to create slide shows from images created with most popular painting programs or scanned images created with ThunderScan. *ThunderView* allows a user to advance through images manually or automatically. Both 3.5-inch and 5.25-inch formats include Volume 1 of Thunderware's *Image Library* and run under Apple's ProDOS operating system. (*Image Library* is a collection of clip art that can be used in most painting and desktop publishing programs.) For further information, contact Thunderware Inc., 21 Orinda Way, Orinda, CA 94563; ph. 415/254-6581.

• *Geometry*, developed by Sensei Software and published by Broderbund, is now available for the Apple IIGS. *Geometry* is compatible with major textbooks and can serve as an extension of classroom work, a refresher, or a private tutor. It takes full advantage of the IIGS's graphic capabilities; for example, users can demonstrate that the sum of angles in a triangle is 180° by creating and moving angles on the screen. The program covers a full year's coursework and includes more than 350 problems. The school edition comes with a backup disk and a teacher's guide for $89.95; the lab pack includes the teacher's guide and a total of five disks for $179.95. Contact Broderbund Software Inc., 17 Paul Drive, San Rafael, CA 94903-2101; ph. 415/492-3200.

• Ventura Educational Systems is bridging the gap between the use of manipulatives in the math classroom and the representation of manipulatives in computer software. *Hands-On Math: Volume 1* simulates the use of six manipulative devices: colored rods, tiles, counters, trading chips, geoboards, and tangrams. *Hands-On Math: Volume 2* simulates the use of five manipulative devices: two-color counters, color tiles, mirrors, attribute blocks, and base-ten blocks. For each device a program called *Playground* provides students with an opportunity to freely explore and discover important mathematical concepts by moving objects on the screen. Teachers can use *Playground* with reproducible activity pages to present mathematical ideas in a structured way The examples in the teacher's guide show the many ways *Hands-On Math* can be integrated into the curriculum The package, available for the Apple IIe, IIc, or IIGS, includes a program disk, a data disk, a teacher's guide, and an activity book. Each one-volume package costs $49.95; a 5-pack costs $89.95, a 10-pack costs $139.95. From Ventura Educational Systems, 3440 Brokenhill St., Newbury Park, CA 91320; ph. 805/499-1407.



| 1,000's | 100's | 10's | 1's |
|---|---|---|---|
| 0 | 0 | 0 | 0 |

• *Gradebook Plus* is a total gradebook management system from Mindscape. It gives teachers a grading system so complete that it maintains records and provides a myriad of statistical analyses through simple commands. *Gradebook Plus* accommodates eight classes per disk, 45 students per class, and 60 entries per student The program uses a built-in or instructor-selected grading scale, and grades are automatically assigned once scores have been entered. Students may be listed by their identification numbers, thus keeping scores confidential when grades are posted Numerous editing options are available. The reports that can be generated for an individual student or an entire class are scores on a given student, gradebook of an entire class, student or class statistical data, deficiency list; missing assignments; weighted averages, standardized or customized; and progress reports in letter form to parents Apple and MS-DOS versions cost $49 95, the Apple Macintosh version is $59.95. Backup disks for all formats are available for $10

# 4.2
# SESSION 2: Integrating Graphing Software with Existing Materials

## 4.2.1 Narrative Overview

This session will require the most preparation of any in this series. The materials presented here are an example of curriculum-specific computer integration. The materials are probably not suitable for direct use since they are based upon a textbook that is unique to the state of Oregon. Trainers should examine this lesson as an example of textbook integration and then create a similar training lesson based upon materials used by teachers participating in the training.

Teachers need to see models of software use integrated into their existing course of instruction before they are ready to develop their own integrative lessons. It is possible for an inservice trainer to develop several examples of materials and lesson plans for integrating software into a specific curriculum.

However, usually an inservice will contain quite a mix of participants. It will not be possible to provide sample lesson plans that meet the specific needs of each participant. This creates a dilemma for the inservice provider. Sometimes classroom teachers assume that the task of preparing "integrative" materials like those created for this session are the responsibility of the inservice facilitator, a school's resource teacher, or the district's resource teacher. While some resource teachers may actually wish to take on that burden, and it is a heavy one, often this is neither possible nor appropriate.

At the current time computers have not been fully integrated into the curriculum, and we do not have commercially produced materials that cover the wide range of possible software and ideas for integration. If computers are to be integrated into the curriculum, the classroom teacher doing the integration will likely have to do quite a bit of the work of preparing the necessary materials. This session presents an opportunity for trainers/resource teachers to clarify their curriculum development roles with respect to integration.

The script presented here features two activities to promote integration. The first — **Pie Charts: Be a Piece of the Action** — is an off-computer activity that teachers really enjoy. The idea of the activity is to get teachers thinking like students and involving them in physical action that demonstrates the creation of pie charts. The actual sequence is described in detail in the script. The activity itself is readily adaptable to a wide range of source materials, so it is easily integrated into any lesson on pie charting from any source.

The second activity calls for careful attention and substantial preparation. The idea is to find a textbook, text series, or set of supplementary materials that are being used by the participants and show how a particular piece of software may be used with it. The details of the script and the materials provided should prove a useful guide for creating an example suited to any appropriate materials.

There are rich hunting grounds for source materials. Some suggestions. supplementary materials for social studies and science (especially if they have a skill strand for graphs and charts) and so-called "eclectic" reading series (which often have a study-skills strand). While many math series feature *coordinate plotting* as a skill, few offer graph and chart interpretation. Since *MECC Graph* and similar programs offer facilities for creating bar, line, and pie graphs, it is best to find source materials that show illustrations of all three types.

The lesson illustrated in the script follows this sequence:

1. Participants work in pairs to examine a particular instance of how a graph-interpretation skill is presented and taught in a textbook.
2. Participants examine the same graph presented by computer software and interact with the graph, modifying the information and viewing the results.
3. Participants are requested to draw conclusions concerning the difference between the textbook presentation and the computer presentation.
4. Participants use the software to transform the data representation by changing graph types (while leaving the data unchanged). Then they discuss the educational utility of that characteristic of the software.
5. Returning to the text, participants note the features of a text that make it particularly appropriate for use with this type of software.

The final activity of the day involves working with *Safari Search,* a piece of problem-solving software from Sunburst Communications, Inc. Detailed directions for the activity are found on the handout "Safari Search" in the Handouts section of this chapter. The object of the activity is to acquaint the participants with this type of software and encourage them to consider its place in the curriculum. It would be appropriate to have participants read Chapter 2.2, Roles of Computers in Problem Solving, to gain a general overview to guide them as they begin to place increased emphasis on use of computers in problem solving in the curriculum.

## 4.2.2 Script

As pointed out in the *Narrative Overview*, this is likely to be the most difficult session to prepare, since it will involve extensive work with a textbook used by at least some of the participants. Allow yourself plenty of time to complete this preparation.

The main idea is that students in elementary school are introduced to the use of graphs to represent data. The graphs are in books and they are static. Students do not yet have the math background and skills to graph data. But, a computer can easily graph data. Thus, we can think about using a computer in three ways in this situation:

1. As a tool for students so they can do a hands-on activity.
2. As a tool for the teacher to use to demonstrate graphing.
3. As a teacher tool to print out examples of graphs to use with students.

The first two are particularly important. The roles of the teacher and the students change as both are empowered to produce professional quality graphs.

Computers bring a new dimension to the use of graphs to represent data. It takes years for a student to learn enough mathematics and to develop good enough drawing skills so the student can readily graph data. Moreover, it takes quite a while to draw a single graph. All of this is changed by having computers available. (It is changed even more as Hypertext becomes available. Think of Hypertext as a computerized book, with the student being able to change the displays. Thus, if a student is looking at a bar graph in the book, and would rather see the data presented as a pie graph, the student can request the book to change its display.)

The Script shown here is a particular instance of how this was done with a textbook of local interest in the area where the training was developed. It is not intended to be used "as is."

In this session, the participants will be cued specifically to "think like students." In the script, this is indicated by requests that they act in *student mode*. At other times, they will "think like teachers" in *teacher mode*.

The closing activity in this session is a change of pace: participants will work with a piece of problem-solving software.

| | |
|---|---|
| Themes | Integrating software with existing materials.<br>Interpreting data from pie, line, and bar graphs.<br>Learning problem-solving strategies through interaction with software. |
| Objectives | Participants will work with materials developed to use a piece of graphing software with existing text materials.<br>Participants will list principles of integrating software with existing materials.<br>Participants will explore the uses of ~~problem-solving software. |

| | | |
|---|---|---|
| Materials | *Software:* | *MECC Graph*<br>*Safari Search* by Sunburst |
| | *Handouts:* | *Our Oregon* graph-skills pages<br>(Not included in handouts)<br>*Safari Search* Lesson Plan |

*Other:* Cards with participant data, crepe paper streamers, sheets of colored paper (eight colors) with a yarn loop attached, masking tape.

**Preparation**

- Load *MECC Graph* into the computers and load the ORAG EIGHTY- THREE table (a table of data taken from the Our Oregon textbook).
- Set up the Apple //e with the large-screen monitor and load it in the same way.
- Set up a table with cards containing participants' data from last week's wall chart (personal data or restaurant data).

**Activity**
**20 Minutes**

Pie Charts: Be a Piece of the Action
Materials: cards with participant data, crepe paper streamers, sheets of colored paper (eight colors) with a yarn loop attached, masking tape.

- The activity is to make a pie chart using the crepe paper streamers and the participant's bodies. You will need a large open space for this.
- Make participants aware that they are in *student mode*.

*Instructions to participants:*

1. Locate your own cards.
2. As a whole group, decide which category of information will make the most interesting chart.
3. Decide what the "slices" of the pie represent.
4. Sort yourselves into groups for each "slice."
5. Get a colored sheet that identifies you with the "slice" to which you belong.
6. Arrange yourselves into a circle that is the perimeter of a pie chart.
7. Those who are at the left side of each "slice" will get a crepe streamer.
8. Tape one end of the streamer to the floor and pull all the loose streamer-ends to the middle of the chart, taping them to the floor.

**Debrief**
**5 Minutes**

Change to *teacher mode*.
Discuss the merits of the activity.
Discuss extensions to the activity.

**Activity**
**45 Minutes**

Graphs: Extensions of a table
Materials: One copy of *MECC Graph* for each computer, copies of pages 56, 174-5, 181, 211, 234-5 from *Our Oregon* textbook.

- Intro: Tell the teachers that this will be a time of sharing extension activities from an existing textbook.
- Teachers pair up and go to a computer, turn the monitor on, read the handout sheet, and answer the questions at the end of the reading.
- Direct the participants' attention to p. 56 from the text "Our Oregon."
- Pose this question: Why teach this with a computer when the same material is presented in our textbook?

- Ask the participants to go into *student mode.*
- Direct the participants to select GRAPH OPTIONS from the *MECC Graph* menu and choose the bar graph option.
- Point out the new additions to the table: x and y axes.
- Graph the data using a bar graph.
- Discuss briefly the following question: What data is best represented by a pie graph? What is best represented by a bar graph?
- Direct the participants to turn away from the computers and get their notebooks.
- Direct the participants' attention to pp.174 and 175 of *Our Oregon.* Have the participants read and answer the questions on p. 175.
- Ask the participants to go into *teacher mode.*
- Discuss the level of questioning found in the textbook.
- Discuss horizontal versus vertical graphs and the appropriateness of a teacher-led activity in a classroom versus a hands-on activity in a lab.

- Ask the participants to go into *student mode.*
- Direct them to turn back to the computer and follow these directions: "Press ESCAPE twice. Load a new file of information called *Oregon Population Graph* ."
- Direct participants' attention to p.181.
- Describe the purpose of the activity as: to determine what line graphs are used for.
- Direct the participants to read and answer the questions on p.181.

- Ask the participants to go into *teacher mode.*
- Direct them to select the CHANGE DATA option and extend the line graph by adding data to the table. Graph the new information
- Discuss the ability of the computer to extend graphs.

- Ask the participants to enter *student mode.*
- Issue these directions: "Press ESCAPE twice. Load a new data file called ORAG83. Choose the pie graph option and graph all three pie graphs."
- Circulate around the room to answer questions as they occur.
- Pose this question: "Is it easy to see the changes from year to year using a pie graph?"
- Issue this direction: "Go to the graphing option menu and choose bar graph." A triple bar graph will appear on the participant's screens.
- Direct the participants' attention to pp. 211, 234, 235, and remaining prepared sheets of tables and graphs from the *Our Oregon* textbook.
- Question: "What crops are growing and/or diminishing in value over time?"

- Ask participants to go into *teacher mode.*
- Questions: "Is the total amount of information presented in the text sufficient for students to learn enough about line, pie, and bar graphs?"
- Note that the computer can help in three ways:

  1. As a tool to interact with the students - a hands-on activity.
  2. As a tool for the teacher to use to demonstrate graphing.
  3. As a teacher tool to print out examples of graphs to use with students.

| | |
|---|---|
| Break<br>10 Minutes | Load the computers with *Safari Search.* Make sure that there are at least three levels of difficulty available on different computers. |
| Activity<br>25 Minutes | **Safari Search Activity**<br>• Demonstrate *Safari Search* briefly, using a large screen monitor or PC Viewer. Then have participants follow the directions on the Handout **Safari Search.** Teachers use a particular level of difficulty for a few minutes and then move to another computer with a more difficult level. |
| Debrief<br>15 Minutes | Ask the participants to review the concepts covered today. Place special emphasis on the idea of matching characteristics of software to characteristics of existing materials. Pose this question: "What kind of textbook (or other educational material) might be a successful 'partner' for a program like *MECC Graph* ?" Write down the characteristics on butcher paper or an overhead as the participants suggest them. |

## 4.2.3 Timeline

| | |
|---|---|
| 0:00 — 0:20 | Pie Charts: Be a Part of the Action. |
| 0:20 — 0:25 | Debrief pie charting activity. |
| 0:25 — 1:10 | Graphs: Extensions of a Table. |
| 1:10 — 1:20 | Break. |
| 1:20 — 1:45 | *Safari Search* Activity. |
| 1:45 — 2:00 | Debriefing of *Safari Search* activity and the whole day's activities. |

## 4.2.4 Handouts

The pages of this section are handouts needed by participants during Session 2 of the *Elementary Education* inservice.

# Safari Search Lesson

**Time:** 25 Minutes
**Materials:** Disks with Sunburst Communication's *Safari Search*
**Note:** This is a brief lesson plan intended to be used jointly by the workshop facilitator and the participants.

## Pre-Prep

We will be looking at four different games. Load the different games on different computers. The idea will be that each pair of participants will move from computer to computer and will have the time to try out at least three different games, spending about five minutes per game.

One Animal Games:
  #2 Find the Flamingo
  #4 Locate the Loon
  #6 Detect the Donkey

Two Animal Game:
  #3 Sight the snails

*While the participants are still at their seats:*

- Explain that this activity will be done entirely in "Teacher Mode." We want participants to have an opportunity to see this software and think about how they might use it in their teaching situations.
- State which games are on which computers (use the chalkboard or large signs on the computers).

*Instructions for participants:*

- Spend about 5 minutes per game.
- When finished, set your computer so that it is ready for someone else to play the game.
- Move to a computer with another game on it.
- Think about how you might use the game with students. What kinds of pre-information might you give them? Are activities like this worthwhile?

If there is extra time, participants can play other levels of *Safari Search*.

## Debrief

- Facilitate a discussion about problem solving.
- Have participants explain their strategies for different levels of the game. What makes a game easy or more difficult? What general ideas about problem solving are being illustrated?

# Creating a Graph Table

A lot of data "naturally" falls into table format. But the human mind and visual system are not particularly good at dealing with long tables of data. Thus, we have developed a variety of graphical-picture methods of representing tables of data. Pie, bar, and line graphs are examples of the types of representational systems that have been developed. Consider the following when creating or looking for a table from which graphs will be made:

- What can be counted?
- What can be grouped or categorized?
- Are there "yes/no" or "is/isn't" pairs?
- What are the names of the categories (in a pie chart, the names of the "slices")?
- What might the graph look like?
- What would be a good title for this graph?
- What are the capabilities and limitations of the the available graphics software?

There are other, deeper questions. Presumably the data is gathered for purposes of answering some type of question or solving some type of problem. (Often the data is used to answer additional unforeseen questions or solve unforeseen problems.) Sometimes a question is best answered by studying a table of data. But often a question is more quickly and easily solved by making use of a graph of the data. Each form of graph has certain advantages over other forms of graphs. Questions for discussion and study include:

- When is a bar graph best?
- When is line graph best?
- When is a pie graph best?

# Pie Charting Lesson for *Our Oregon*

## Description

Topic: Creating pie charts with software.
Grade Level: 4-10
Time: Varies (15-45 Minutes)

## Materials

Software: *MECC Graph.*
Equipment: One Apple // per two students.

**Grouping** Students work in pairs. On occasion, two pairs of students will need to be able to view one another's computer screens.

## Objectives

- Students will create pie charts from data in the *Our Oregon* textbook, then modify the data and report the effects on the charts.
- Students will create new data sets and use them to create new pie charts.

## Before you start

- Obtain sufficient copies of MECC Graph.
- Prepare sample data files based on content similar to that of *Reading a Pie Graph* (p. 56) and *Skills Practice* (pp. 80-81) in *Our Oregon.* (Note: The *MECC Graph* disk prepared for CI$^3$ training has a data set that is related to the content of page 56.)
- You may wish to use the handout **MECC Graph: Pie Graph Training Instruction** (Session 1, Handouts Section) as an activity guide for this lesson. If so, prepare sufficient copies.

## Lesson (Sequence of instructional activities)

1. Have students load *MECC Graph* and the sample data file for page 56. Guide students through menu choices for creating a pie graph of the data. Review questions 1-4 on page 56.

2. Have students create a data table for the 1993 crop year. Instruct them to make changes in the balance of farm product values that reflect current trends; for example, the fact that Americans are eating less red meat and more poultry and vegetables.

3 Use the students' projected charts to discuss the following issues:
If the price of a particular kind of food drops, what actions might farmers take?

4. Can some crops simply be substituted for others? If farmers decide to grow different crops, what must they do to change crops? How far ahead must they plan?

5. Suppose that exactly the same *amount* of each crop was grown in 1993 as was grown in 1983. Might the charts look the same or different? Why?

## Post:

Using a different data set, a similar lesson can be conducted for the *Skills Practice* on pp. 80-81.

## 4.2.5 Readings

This section is designed to supplement the materials presented during Session 2. It is appropriate to assign materials from this section as homework readings for inservice participants.

# Statistical Sampling of Fish Populations

by Judi Mathis

*[Reproduced with permission from ISTE. This article first appeared in The Computing Teacher, June 1986.]*

Students growing up in the information age need to understand sampling, statistics, predictions, and interpreting graphs. They see samples and opinion polls in newspapers and magazines and ought to know what they mean. A well-designed sample, accounting for proper representation of each stratification of the population, can poll less than one percent of a total population and predict fairly accurately the opinions or needs of the entire population through mathematical formulas developed to do this.

The following activity helps students develop a basis for understanding elementary statistics. The activity is outlined for third grade, and elaborations are given for grades 4 through 12. The emphasis in the activities, especially in the lower grades, is on experiencing the sampling procedure, gathering and organizing data, feeling comfortable with making estimations, and developing an intuitive sense of range of accuracy. Students need to experience situations where an exact answer is not necessary.

The computer is used to record gathered data, organize and report compilations of data, perform calculations, and present information graphically. The teachers doing this activity used *MECC Graph*. Other titles suitable at the elementary level include *Easy Graph* by Grolier, *Exploring Graphs and Tables* by Field Publications, and *MECC Graph Primer* by MECC. Any good software that transfers information from the database to the graphing tool is desirable for middle school and above. Spreadsheets can offer help in organizing and recording data and in the subsequent calculations.

This activity and its elaborations were used in training workshops for the CI$^4$ (Computer Innovations Integrated Into Instruction). [*Editor's Note*: The project is now called CI$^3$, Computer-Integrated Instruction Inservice] research project at the University of Oregon and subsequently by several participants in their classrooms. For more information on the project, see "Effective Inservice for Use of Computers as Tools," by David Moursund in the February 1986 issue of *The Computing Teacher*.

## Let's Go Fishing

### Description

Topic: Statistical Sampling of Fish Populations
Grade Level: 3
Time: 10 Minutes at desk + 20 Minutes on computer
Grouping: Students in groups of 2, 3, or 4

## Objectives

- Learn sampling methods: gathering, recording, and sorting data;
- Practice measurement (for activities at some grade levels);
- Graph sampling results using the computer; and
- Make predictions and "guesstimations" and determine range of acceptable error.

## Materials

Software: *MECC Graph*
Equipment: Apple *II*
Other materials: Fish patterns and colored paper, and brown paper bags.

(*Editor's Note*: The original article contained a large number of pictures of fish that could be cut out and used to create the fish population. In this copy of the original article, we have provided you with just one picture of a fish, plus two variations on it. The original fish was created in *MacPaint*. In *MacWrite* format, it can be stretched into a variety of shapes to produce a variety of fish. This is illustrated at the end of this article.)

## Before You Start

Students should have prior experience using *MECC Graph*. Photocopy the fish patterns onto different colored paper, or color the fish a variety of colors. Cut into rectangles and group samples in brown paper bags with the name of a lake, or location of a lake, on each bag. For example, using three colors of fish, bag 1 contains three blue, three green, and six orange; and bag 2 contains six blue, three green, and three orange. Prepare one bag per group. (Keep the number and type of fish in each bag recorded in a safe place.)

## Lesson (Sequence of Instructional Activities)

1. Each student catches a fish from the lake (the brown paper bag);
2. Records the color of the fish; and
3. Replaces it in the lake (the bag) and stirs up the lake.
4. After repeating the above steps a specified number of times, students graph their results.
5. Each group makes a guesstimate as to the total number of fish and number of each color.
6. Combine and present all of the group's results. Compare the small samples, the whole group sample, and the original sums in the fish bowl. Which was the best predictor, small or whole group?

## Post Activities

1. Do a statistical sampling of a new lake. Have students predict the total in the lake and the number of each color. The group with the best estimate gets a reward.
2. Within the school, students can take statistical samples of eye color, categories of favorite books, kinds of pets, etc.
3. Within the community, students can take statistical samples of number of video machines or gum machines per building, number of trees in the park, etc.
4. Students can poll their parents on some condition when they were in third grade (e.g., distance from school, coldest or warmest temperature during a school day, etc.).
5. Vary the available fish ponds, have students do the lesson again, then post the contents of each bag without naming them. Students can match the "real" data with their predictions to guess which bag is theirs.
6. Have students bring articles from newspapers and magazines based on samples.

Comments

1. Sampling activities can be done in a piecemeal fashion as an ongoing project, rather than allocating a single block of regular class time.
2. Concrete materials are appropriate at all levels to deepen the understanding of the concepts.
3. Have students create their own survey to answer questions they pose.
4. Relate the sampling process students have experienced to real-world examples such as presidential polling, location of blue whales, gypsy moth populations, etc.

Examples for Other Grade Levels

*Fourth grade*: Using fish of varying length; for each sample, determine the maximum, minimum, and range.
*Fifth grade*: Measure, record, and determine the average length of the fish sampled. Take a second sample and determine the average. Do they agree?
*Sixth grade*: Record fish color of a sample and predict ratios of certain-colored fish to the total number of fish (using fractions). Empty the lake and count the fish and determine the exact fractions. How close were the predictions?
*Seventh grade*: Record samples from different locations on a lake and match up the sample with the location (e.g., stream runoff, near a boat dock, middle of the lake, close to the dam, etc.) Predict environmental impacts on populations.
*Eighth grade*: Gather fish information on local lakes or rivers by contacting your fish and game board or consulting your local newspaper or a textbook about your state. Each group makes a sample bag representing their lake. Other students sample the bags, predict the breakdown, and compare their results.
*Ninth grade*: Sample, record vital information, and determine probabilities for each length of fish, type of fish, or color of fish.
*Tenth grade*: Determine the mean, median, mode, and standard deviation of a normal population.
*Eleventh grade*: Sample, measure, and record on Day 1. Student or teacher then changes the sample by adding fish or replacing with longer fish. Sample, measure, and record for Day 2, which represents one week's or one month's growth. Students continue for four or five samples and predict growth rates. Compare with actual populations. What kind of a curve is this?
*Twelfth grade*: Catch a fish, measure, record, and repeat while keeping a running average. What percentage of a sample must be taken until the error (difference between sampling average and real average) is within a certain value? Now change the value: How does the sampling percentage change? (*A spreadsheet would be most effective for this activity.*)

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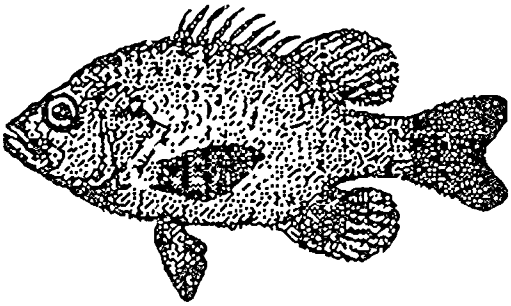
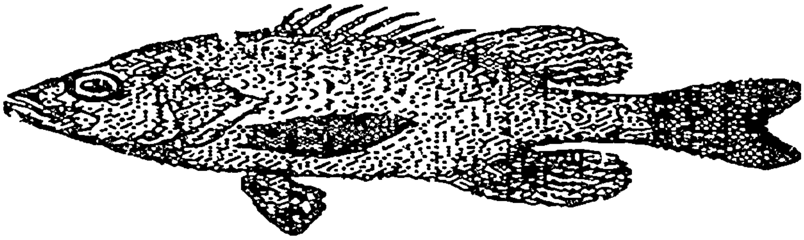
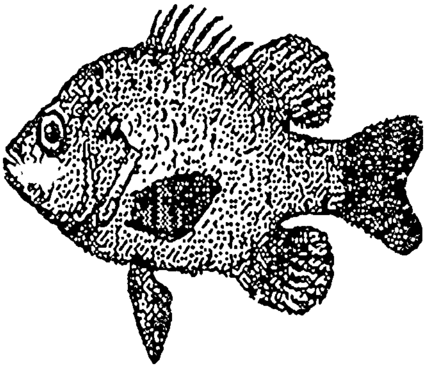
[*Note*: The original article contained a number of pictures of fish that could be duplicated and then cut out and colored. One of the fish is pictured below. All of the fish came from one "original" such as this.]



Next we give two more pictures of the same fish. All we have done is to do some stretching and/or shrinking in the horizontal and vertical dimensions. Such is the "magic" of having a picture (created in *MacPaint*) in a *MacWrite* file.





# Fishing for Statistics
## Student Data Recording Form

Record your "fishy data" here:

| Classes or Characteristics | Counts |
|---|---|
| ____________________ | __________ |
| ____________________ | __________ |
| ____________________ | __________ |
| ____________________ | __________ |
| ____________________ | __________ |
| ____________________ | __________ |

## 4.3

## SESSION 3: Unstructured and Structured Data

### 4.3.1 Narrative Overview

Now we shift the focus of training shifts away from *presentation* of data to the methods of *collecting, selecting,* and *organizing* data. The focus of today's session is on the merits and costs of putting data into structures.

Let's begin with a simple example. Suppose we have the data that Pat Smith weighs 92 pounds and is 4 feet 10 inches tall. A seemingly "natural" way to organize this data is:

| | | |
|---|---|---|
| Pat Smith | 92 pounds | 4 feet 10 inches |

However, we might organize it as:

| | | |
|---|---|---|
| 4 feet 10 inches | 92 pounds | Pat Smith |

In the first case the emphasis is on the person's name. In the second case the emphasis is on the height and weight.

Now suppose that we have records on several people, and we have organized these records as follows:

| Name | Weight (lbs) | Height (inches) |
|---|---|---|
| John Adams | 85 | 56 |
| Terry Davis | 95 | 59 |
| Pat Smith | 92 | 58 |
| Sue Taylor | 88 | 56 |

This data structure is convenient to use if one wants to find the weight and height of a particular student, since the data is arranged alphabetically by name. But suppose we were interested in making and testing a hypothesis about how weight and height are related. The following reorganization of the data might be useful.

| Weight (lbs) | Height (inches) | Name |
|---|---|---|
| 85 | 56 | John Adams |
| 88 | 56 | Sue Taylor |
| 92 | 58 | Pat Smith |
| 95 | 59 | Terry Davis |

But now suppose we conjecture that the height/weight pattern we are looking for may be different for boys and girls. Then we would find that we lack the data about which of the children in our database are boys and which are girls, and the database is not easily organized into a form that would allow us to proceed with our research.

It might seem obvious that data is easier to handle if it is put into a convenient structure. This is not always the case. For one thing, if data is structured, there are usually some assumptions made about how it is to be retrieved and analyzed. It is necessary to make these assumptions in designing the data structure because there are many ways to organize and store data. Professional database managers and data processing personnel have a common saying: "Choose a data structure that works today, and you can be sure that an application will come along that will not fit that structure tomorrow!"

Fortunately, it isn't necessary for teachers and students to work with the kind of complexity faced daily by data processing professionals. However, some of the same questions do arise. For example, it may be convenient to break information up into *records* (collections of data about a particular thing) and to further break the records up into *fields* or *categories* (individual data items within records). This makes the entire data collection (the *database* ) easy to rearrange through *sorting* (reordering records by numerical or alphabetical information in given fields), or *reporting* (selecting particular records and fields to be printed out for convenient perusal). The *MECC Classification* program that will be used in this session operates on these principles, as does the *AppleWorks* program that will be used in subsequent sessions.

However, quite a lot of time has to be devoted to ordering the information and designing the methods by which the users of the database will retrieve information. In some circumstances, it may be more desirable to keep the information in a simpler form. For example, the *MECC Stuff 'n' Fetch* program stores information by records, but the information on each "record-card" need not be organized by fields. Also, it's possible to "ask" *Stuff 'n' Fetch* to search for a number, word, or phrase on any portion of any card, while *Classification* can only match numbers, words, or phrases that appear in the same field in different records. This can make for much greater flexibility, and some data-management tasks may require it.

More advanced database systems allow both kinds of searching. In the *AppleWorks* program, the **Find** command searches across the whole database. The *HyperCard* program (which runs on the Macintosh computer series) has an even more powerful **Find** that can search practically the entire contents of the computer.

The simple database tools presented here are designed to acquaint participants with different ways of storing and retrieving information. There are also differences in the *user interfaces* (the way the computer program presents to the user the different tasks it is capable of performing) of these two programs. If you have time, it is worthwhile discussing the issue of user interfaces with participants. The Apple Macintosh computers and the newer IBM (and compatible) computers equipped with "window-oriented" user interfaces are changing the expectations of computer users, since these newer systems are often easier to use than older types.

Finally, as a break from the heavy emphasis on computer tools, participants get a chance to learn a game strategy from the computer. The game of *Taxman* is a simple and interesting introduction to the automation of game-playing. It is a piece of problem-solving software and can be used with a wide range of students. See how long it takes the participants to develop a successful strategy.

*Taxman* is an interesting piece of software in that it is representative of many problem-solving game-types of software. One could approach this game from the point of view that the goal is to learn to play the game well. The simplest way to do this is to have someone teach you the strategy. The strategy is simple enough so it is possible for many students to master it. After mastering the strategy, one plays well.

But who cares? What good does it do to play this simple computer game well? The much larger goal is to learn to learn, to learn to develop strategies by oneself, to get better at attacking problem-solving tasks. Unless *Taxman* is presented in this mode, the school time could better be spent on other topics. The same statements hold for most of the problem-solving software.

## 4.3.2 Script

In these first database-related activities, participants will experiment with two very simple tools for storing and retrieving data. With the first, *MECC Stuff 'n' Fetch*, participants will learn the advantages and shortcomings of storing data in a relatively unstructured form, analogous to that of a library card catalog. Then, with *MECC Classification*, they will see both the order and restrictions that come with structure.

Topics

- Developing classification skills.
- Understanding the uses of free-form and categorized database management software.

Objectives

- Participants will browse an unstructured database and retrieve information from it.
- Participants will recover information in report form from a small structured database.
- Participants will generate a list of relative advantages and disadvantages of structured and unstructured data-storage systems.

Materials

*Software:* *MECC Stuff 'n' Fetch*, *MECC Classification*, *MECC Taxman.*

*Handouts:* ***MECC Stuff 'n' Fetch*** Reference Card (one per computer). ***MECC Classification*** work pages (pages 23, 25, 27, and 34-38).

*Note*: Except for the *MECC Stuff 'n' Fetch* Guide Sheet, all the handouts for this session are to be duplicated from the documentation that accompanies *MECC Stuff 'n' Fetch* and *MECC Classification*. We are assuming, of course, that you have appropriate legal access to the MECC materials.

*Other:* Pad of yellow paper and extra pens and pencils

Preparation

- Collect logs from participants.
- Pre-load the computers with *MECC Stuff 'n' Fetch.*
- Place one folded copy of the *MECC Stuff 'n' Fetch* reference card on or by each computer.

Activity
30 Minutes

Free-Form Database
Materials:

- One MECC *Stuff 'n' Fetch* disk containing the "Student Book Notes" file per computer.
- One copy of the reference card per computer.
- Sheets of writing paper and extra pens and pencils.

- Ask participants to write the following information about one of their favorite books:
  1. Title
  2. Author
  3. Short paragraph description

- Inform participants that the information will be used later in the training.
- Briefly explain the idea behind a free-form data base.

- We will show:
  1. How students might use a free-form database.
  2. How a free-form database can be used as a teacher tool.

**Activity**

**Demonstration of student activity**

Materials: One copy of *MECC Stuff 'n' Fetch* **Guide Sheet** per teacher

- A common goal of teachers is to build student enthusiasm about reading and sharing books. This activity promotes reading and sharing information about library books while giving practice using the skill of summarization (also reinforces correct spelling).
- Teachers will be manipulating a pre-created data set made up of comments extracted from book reports written by elementary-grade students.
- Participants work in pairs.

  ***Pairing rule*** - Pair up participants who have had experience with word processing with those who have not. (*Note*: Word processing and process writing are emphasized in the later sessions of this inservice series. The facilitator should be aware that many participants have had some experience with word processors.)

- Follow instructions given on the *Stuff 'n' Fetch* Guide Sheet.

**Debrief**
5 Minutes

*Prompting question*: How else might one use *MECC Stuff 'n' Fetch* with students?

- Suggest other uses for a tool like *MECC Stuff 'n' Fetch*. For example, it might be used by the teacher to keep track of student incident reports, since it would be easy to search for all occurrences of the student's name, and this could readily be printed out at parent conference time.

**Discussion**
10 Minutes

Paper-based free-form data storage systems

Take this opportunity to tie in the previous computer-based activity with other paper-based activities with which the participants may already be familiar. Examples: card files, indices, book reports, activity lists and so on.

**Break**
10 Minutes

- Load the *MECC Classification* program into all the computers.
- Arrange seating for two participants per computer.
- Turn monitors off.
- Place one set of animal cards (from the *MECC Classification* work pages) at each workstation.

Activity
45 Minutes

**Classification**

*MECC Classification* activity.

Handouts Needed: #1 (page 23), #2 (pages 23, 25, and 27), #3 (pages 34-37 and 38).

**Introduction to structured databases**

Materials: Handout #1, "An Animal Database"

- Introduction: Classifying animals and using the computer to help with analysis of data.
- Define term of database and give some examples.
- Give students Handout #1 and discuss new vocabulary words (and the concepts they embody) like *database, element, field*, and *record* .
- Go over Handout #1 and identify element, field, record, and database.
- Discuss limited space in a database and use the perch record as an example of limiting information.

Activity
15 Minutes

*MECC Taxman*

Participants are introduced to the game of *Taxman* through a brief demonstration of the game with the trainer interacting with the computer program. Participants then work with *Taxman* software in pairs. Then they challenge one another to *Taxman* off the computer to test their understanding of strategies. During debriefing, participants make explicit the methods by which they came to understand the strategies they used.

Debrief
5 Minutes

- Summary of day's activities
- Have participants generate a list of relative advantages and disadvantages of *MECC Stuff 'n' Fetch* and *MECC Classification* for different kinds of instructional activities.

### 4.3.3 Timeline

| | |
|---|---|
| **0:00 — 0:30** | Free-Form Database activity using *MECC Stuff & Fetch* |
| **0:30 — 0:35** | Debrief |
| **0:35 — 0:45** | Discussion of paper-based free-form data storage systems |
| **0:45 — 0:55** | Break |
| **0:55 — 1:40** | Classification activity using *MECC Classification* |
| **1:40 — 1:55** | *MECC Taxman* activity |
| **1:55 — 2:00** | Debriefing the day |

## 4.3.4 Handouts

# STUFF 'N' FETCH Guide Sheet

**NOTE:** <esc> <esc> (pressing the **Escape** key twice) will always return you to the main menu.

1. You should be looking at the main MECC *Stuff 'n' Fetch* menu. Press **1** and **<return>** to select:

   Program:
   1. *Stuff 'n' Fetch*

2. You should now see the "File Choices" menu. Press **1** and **<return>** to "Use a File."

3. Press **1** and **<return>** one more time to select "Use the file space on the program diskette" from the "Use an Existing File" menu.

4. You are now ready to move around in *Stuff 'n' Fetch*. Your choices are to:

   Stuff
   Fetch
   Print All Cards
   Quit

   Use the Arrow key to highlight **Fetch** and press **<return>**. We want to fetch cards (pull them out of the database) to look at them.

5. Within the "Fetch" menu we can select from the options:

   Find Cards
   Scan Cards
   Done

   To find a card implies we know what is in our database and we want to find a specific card (or cards) or type of information. We want to scan the cards just to see what we have. Using the Arrow key highlight "Scan Cards" and press **<return>**

6. In the "Scan Cards" menu move **forward** and **backward** through the cards to see what we have. How many cards are there in this database? What kinds of information do the cards contain?

7. Now that you have looked through the cards to see what is there, let's find cards with some specific information.

8. Highlight **Done** from the "Scan Cards" menu and press **<return>** to get back to the "Fetch" menu. (You can "wrap around" from **forward** to **Done** by pressing the left Arrow key.)

9. From within the **Fetch Menu** select (highlight and press **<return>**) **Find Cards.**

10. You are now ready to enter the phrase for which you would like to search.

11. Type "leprechauns" (no caps) and press **<return>** to find if there are any story descriptions containing that word.

12. Voila! You probably are looking at the entry by Gloria Conner about the book "The Little People." Nice going.

13. Press **<control>-D** to make a new selection. (Hold the keys marked **control** and **D** down at the same time.) Select **Find Next Card** from the file menu to see if there is another story about leprechauns.

14. As we have run out of books about leprechauns, select **New Phrase** from the "File" menu and try the phrase "elephants." Notice what happens when a phrase is not found.

15. Once again select **New Phrase**. This time type the word "funny." To see if there is more than one card that a student deemed funny, press **<control>-D** and **<return>** to find the next card(s).

16. Now that you have moved around in the set of cards and scanned them to see what is there, we are ready to do some editing. Select **Done** from the "Find Card" menu, and **Scan Cards** from the "Fetch" menu.

17. Once you have Jerry's write-up of *The Big Orange Splot* select **edit** from the "Scan Cards" menu. The cursor (blinking rectangle) should be over the "t" in the word "the".

18. Using the reference card by your computer make the following changes to Jerry's write-up (for practice, we won't save them):

    - Add capitals to the title;
    - Change "rilly" to "really, " and "naybors" to "neighbors"; and
    - Between the words "they and "paint" in the second line *add* the words "change their minds and".

19. When you are through making changes press **<control>-D** to put the card back.

20. It is finally time for you to enter the information you have written about a favorite book of your own. Select **Done** from the "Scan Cards" menu and then select **Done** from the "Fetch" menu.

21. You should now be back at the "Stuff & Fetch" menu. We will be "stuffing" a new card into the database so select **Stuff** and then **Type on a Card** from the "Stuff" menu.

22. Using the format that the students used enter the information about your special book. Press **<control>-D** when you have finished.

23. Even though you have written on your card, you need to **Put Card in Box.** Do so now. **Great!** Give your partner a chance to enter his/her card and you'll be finished with the exercise.

24. Feel free, if you have some extra time, to try moving around in the database without looking at the directions. See if you can "feel your way around." When you are all finished and have selected **done** or **quit** from the menu you are in, you should see the questions, "Do you want to save your cards?" and "Do you want to leave this database?" Please answer "no" to the first question (we don't want to alter Jerry's work) and "yes" to the second.

Hope you enjoyed yourself and came up with some creative, useful ways to use *MECC Stuff 'n' Fetch* with your students!

# Brontosaurus Meets the Computer

*by*
*Shirley Krueger, SNJM*

"I weighed more than 3,000 boys and girls put together. I also could have looked over a three-story building without stretching. My front legs were longer than my back legs. My nostrils were on top of my head, which made some scientists think that I lived in the water. Now, though, it is thought that the pressure of the water would have crushed my lungs. I was the 'giant of the giants.' Who was I?"

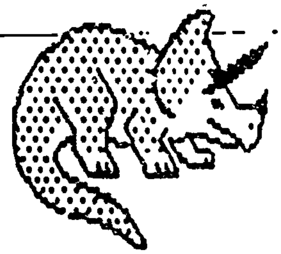
If you are one of the people from the ages of three to 93 who are fascinated with dinosaurs, you might know the answer to that question. However, it is not the answer to the question that is important. What is important is the thinking process students go through to reach the answer.

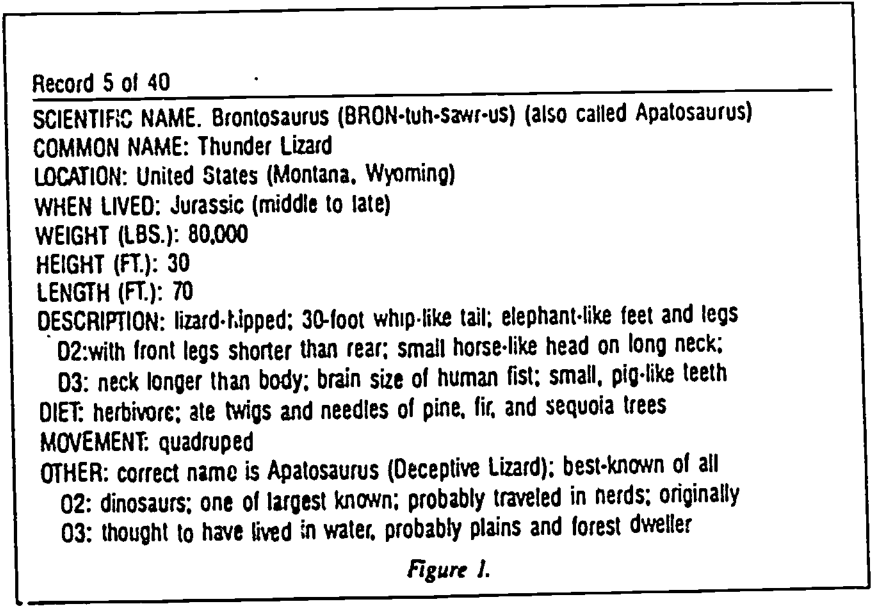
Developing critical or higher-level thinking skills should be one of our top priorities in education today. Using a unit on dinosaurs as a vehicle to teach these skills gives the students a subject they are so interested in that they are willing to put extra effort into the learning process. "Datasaurs—An Experience with Dinosaurs" is a computer unit that grew from a group project started by the Math Learning Center's "Try Them and Apply Them. Fifth Grade" class during the summer of 1985. The complete unit was fieldtested by the fourth, fifth and sixth grade students at All Saints School in Portland, Oregon, and was very successful. The students enjoyed studying dinosaurs and got a chance to learn and practice thinking skills throughout the unit—both on and off the computer.

Some of the first computer activities in the unit are designed to get students familiar with the program and involve just the knowledge and comprehension levels of thinking. For example, the students concentrate on doing keyword searches using just a "find" command, searching the entire data base of 40 dinosaurs. A typical question would be, "What dinosaur had three great horns and a short, thick nose horn?" Next, the students have to think a little harder to decide which category will have the answer, using a "search" command to search in just one category (see figure 1). Then students are given two categories to search in, and finally three categories. A sample question would be, "What dinosaur lived in the Triassic period, was lizard-hipped, and had a small head on a long neck?"

Moving beyond the knowledge and comprehension level, students are asked to find answers to questions such as, "If Polacanthus and Ornithomimus ran in a marathon, which one would finish first?" In this type of question, students have to decide how to find the answers they need, and then apply that knowledge to distinguish which answer is the correct one.

These questions still have not moved into the higher-level thinking skills of analysis, synthesis and evaluation, so more provoking questions, such as the one at the beginning of this article, are introduced. Here students must sort through the information given in the questions, determine what is pertinent, decide how to use that information, and then find answers to specific parts of the question. If resource books are used in addition to the data base, studen[illegible] will find that not all scientists agree on t[illegible] answers, so the students have to select criteria for accepting or rejecting answers.





```
Record 5 of 40
SCIENTIFIC NAME. Brontosaurus (BRON-tuh-sawr-us) (also called Apatosaurus)
COMMON NAME: Thunder Lizard
LOCATION: United States (Montana, Wyoming)
WHEN LIVED: Jurassic (middle to late)
WEIGHT (LBS.): 80,000
HEIGHT (FT.): 30
LENGTH (FT.): 70
DESCRIPTION: lizard-hipped; 30-foot whip-like tail; elephant-like feet and legs
  D2:with front legs shorter than rear; small horse-like head on long neck;
  D3: neck longer than body; brain size of human fist; small, pig-like teeth
DIET: herbivore; ate twigs and needles of pine, fir, and sequoia trees
MOVEMENT: quadruped
OTHER: correct name is Apatosaurus (Deceptive Lizard); best-known of all
  02: dinosaurs; one of largest known; probably traveled in nerds; originally
  03: thought to have lived in water, probably plains and forest dweller
```

*Figure 1.*

*A sample record from the dinosaurs data base.*

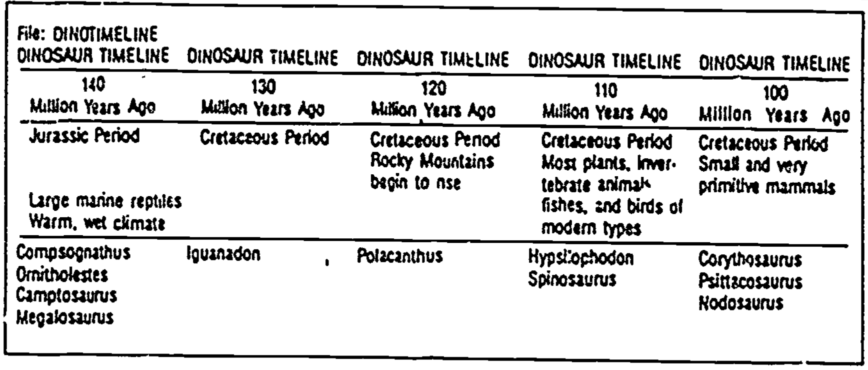
Finally, they have to put all the parts together to decide on the correct dinosaur. (Did *you* come up with the correct answer of Brachiosaurus?)

Another important thinking skill for students to develop is classification of data into categories. Classification skills are important for many subject areas and can be taught effectively with this unit. The students first learn the attributes used to place dinosaurs into orders and suborders. For example, the order Saurischia is distinguished by the attributes "lizard-like hips and clawed feet, some biped, some quadruped, some carnivore, some herbivore, some omnivores." Once they understand the attributes associated with the orders and suborders, the students are divided into groups and each group is assigned a suborder. Searching the data base, each group must find all of the dinosaurs included in its suborder and list them on a large wall chart. Much to the students' dismay, they find some of the same dinosaurs listed under different suborders. The groups then tell why they included particular dinosaurs in their suborders and try to resolve any double listings. Of course, scientists can't agree on the suborders and neither do the students. This seems to enhance the importance of the activity as a thinking skill.

Maureen Barnhart, the fifth and sixth grade teacher who taught the dinosaur unit at All Saints, states, "The subject of dinosaurs lends itself to the higher-level thinking skills. It is a subject about which we can only gather evidence to speculate on what the world was really like. Students see the scientists coming to different theories based on the facts and realize that they also may evaluate the evidence and come to different, but valid, theories."

By now the students are ready to synthesize their dinosaur knowledge and create their own dinosaurs. In this activity students are told that they have found a dinosaur bone in their back yard. A handout includes a picture of the bone. They must decide what the dinosaur looked like, how big it was, when it lived, what order and suborder it belonged to (or they can create a new order or suborder), give the dinosaur a name, and then draw a picture of it, placing their fossil anywhere in the dinosaur. Although the outcomes must be consistent with the information they have about dinosaurs, creativity is encouraged and some weird dinosaurs are to be expected!

Another activity that encourages creative thinking also has students using word processing, data base and spreadsheet skills. One of the spreadsheets in the unit is a timeline that lists each of the 40 dinosaurs and places



File: DINOTIMELINE

| DINOSAUR TIMELINE | DINOSAUR TIMELINE | DINOSAUR TIMELINE | DINOSAUR TIMELINE | DINOSAUR TIMELINE |
|---|---|---|---|---|
| 140<br>Million Years Ago | 130<br>Million Years Ago | 120<br>Million Years Ago | 110<br>Million Years Ago | 100<br>Million Years Ago |
| Jurassic Period<br>Large marine reptiles<br>Warm, wet climate | Cretaceous Period | Cretaceous Period<br>Rocky Mountains begin to rise | Cretaceous Period<br>Most plants, invertebrate animals fishes, and birds of modern types | Cretaceous Period<br>Small and very primitive mammals |
| Compsognathus<br>Ornitholestes<br>Camptosaurus<br>Megalosaurus | Iguanadon | Polacanthus | Hypsilophodon<br>Spinosaurus | Corythosaurus<br>Psittacosaurus<br>Nodosaurus |

Figure 2.

them in their time periods (see figure 2). The timeline also includes information about what other animals, climate, plants, etc., existed during that period. The students use this spreadsheet, along with the data base, to answer questions for a dinosaur that they have chosen. In the word processor, the answers are inserted into a story about a space traveler who is transported back into the dinosaur age. The students must also write an original ending to the story and then print it out.

Creative thinking and writing are also stressed in an activity that requires the students to use evaluation thinking skills. The students are given 13 reasons why dinosaurs may have become extinct. They then research them to defend one of these reasons or come up with a reason of their own. Next, they are asked to write a story on the word processor, using their research to back up their theory. Since this is a creative endeavor, any theory, as long as it is substantiated by some evidence, is acceptable.

Because it is unlikely that all the students can be using a computer at the same time, computer work can be supplemented with desk work that also encourages higher-level thinking. For example, math and logic, fossil research, graphing and interpreting graphs, Greek translations, and statistics are a few of the desk activities that encourage students to exercise their thinking skills. Figure 3 shows a sample of these worksheets.

Dinosaurs is just one subject area that is well suited for use with computer application programs. Although the objectives in this unit include learning about dinosaurs, developing computer and research skills, and much more, the top priority for the unit is the development of the students' higher-level thinking abilities.

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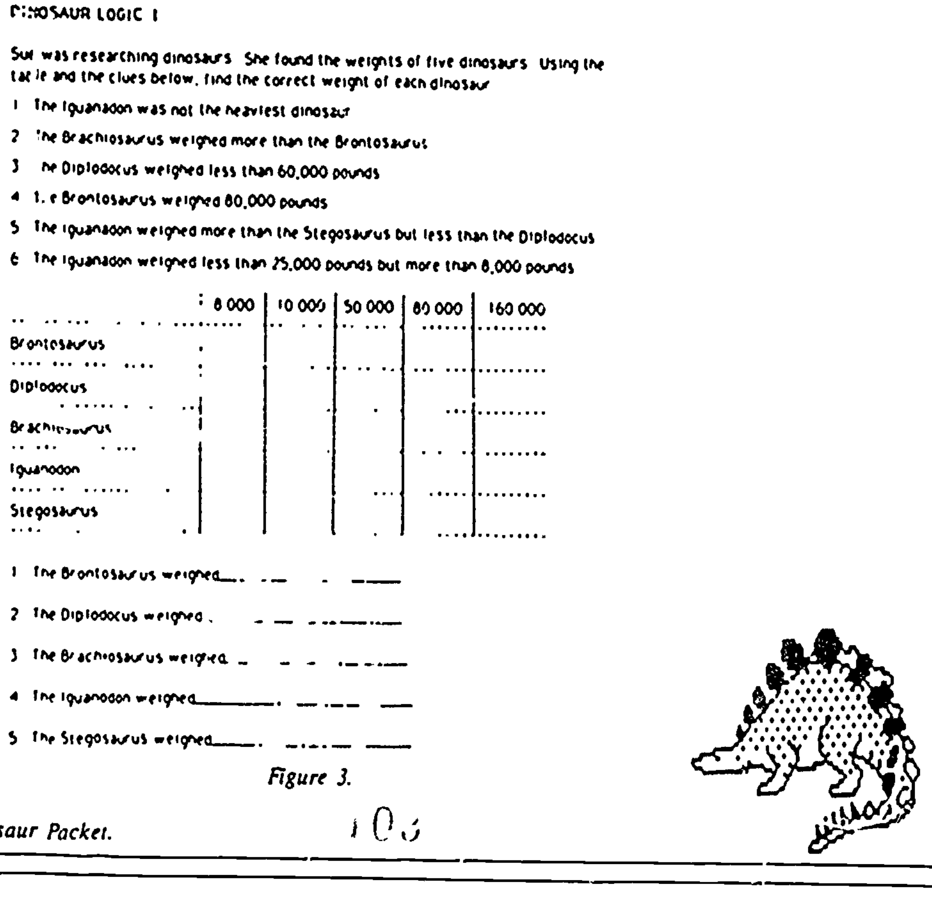
## Software

*The Dinosaur Packet* (96 pages of written activities and a data disk) using *AppleWorks* is available for $25 from the Math Learning Center, P.O. Box 3226, Salem, OR 97302; ph. 503/229-3041. A MECC *Dataquest Composer* version is available. Write for information.



DINOSAUR LOGIC I

Sue was researching dinosaurs She found the weights of five dinosaurs Using the table and the clues below, find the correct weight of each dinosaur

1 The Iguanadon was not the heaviest dinosaur

2 The Brachiosaurus weighed more than the Brontosaurus

3 The Diplodocus weighed less than 60,000 pounds

4 The Brontosaurus weighed 80,000 pounds

5 The Iguanadon weighed more than the Stegosaurus but less than the Diplodocus

6 The Iguanadon weighed less than 25,000 pounds but more than 8,000 pounds

| | 8 000 | 10 000 | 50 000 | 80 000 | 160 000 |
|---|---|---|---|---|---|
| Brontosaurus | | | | | |
| Diplodocus | | | | | |
| Brachiosaurus | | | | | |
| Iguanodon | | | | | |
| Stegosaurus | | | | | |

1 The Brontosaurus weighed________

2 The Diplodocus weighed________

3 The Brachiosaurus weighed________

4 The Iguanodon weighed________

5 The Stegosaurus weighed________

Figure 3.

Student worksheet from The Dinosaur Packet.

# 4.4
# SESSION 4: Structuring and Analyzing Data

## 4.4.1 Narrative Overview

Ours is a world consumed with attention to *data*-- raw facts and numbers. Data assails every person from every quarter: radio, television, newspapers, magazines, and conversation. Sometimes the data is simply factual, as in the measurements of temperature, humidity, and wind direction in a weather report. At other times the data is presented with an intention to sway the beliefs or actions of a particular audience, a common practice in advertising.

Raw data is just a pile of facts (or more abstract measures, such as opinions, for example). In order for data to be transformed into *information,* it is necessary to do four things:

1. *Organize* the data into a useful and usable form;
2. *Pose questions* about the conditions specified by the data;
3. *Analyze* the data to extract information; and
4. *Judge* whether the information has merit and worth.

Of course, the fourth step may pose further problems or questions which will result in the need to gather further data for organization and analysis. The rigorous form of this process is called the *scientific method.*

In this session, the participants will go through all of these steps in gathering, organizing, and analyzing data. In the interest of saving time and providing a broader range of data, the steps are broken up across two activities. In the first, the participants will generate a substantial amount of raw data. In this instance, the data will be about their favorite eating places. No attempt is made to impose any form on the data at the outset. The object of the activity is to make clear the notion that any reasonably well-related collection of data can be organized into a *table,* the simplest form of database. In the process, participants learn the notions of *instance* (a collection of facts about a particular restaurant) and *category* (common types of facts appearing in each instance). By organizing instances as the horizontal rows of a grid and maintaining common categories as the vertical rows, virtually any collection of data may be transformed into a database.

When this activity was run during the development phase of this National Science Foundation project, the facilitators discovered a number of interesting things about this activity. For one thing, it makes participants very much aware of how comparing different instance collections leads immediately to the formation of categories. Nearly every instance includes the name of the restaurant. On the other hand, participants found that there were categories for which they had provided no data (the theme of the restaurant's decor, perhaps, or the general level of expense of dining there), which led them to expand their own data or to address the matter of how to handle missing data. Finally, nearly all the participants had fun with this activity and appreciated it as a good addition to the "computer literacy" activities they could conduct whether they had access to computers or not.

The second activity allows the participants to work on a prepared database. Based on Beverly Hunter's activity in her book, *My Students Use Computers,* this activity presents a substantial body of facts about the planets of our solar system. After learning the basics of navigating through the database, participants form hypotheses about the data and use this database's two main tools of analysis--sorting and reporting--to confirm or deny the hypotheses.

Note that in this activity there is no emphasis on teaching students to become highly-skilled users of *AppleWorks*. That may be a worthy goal in a computer-literacy setting, but here the emphasis is on using the computer as an investigatory tool, so only the most rudimentary instruction in the use of the tool is provided. Instructors who plan to make extensive use of software like *AppleWorks* or other relatively sophisticated systems might well wish to invest more time in training students in the details and capabilities of the software. There are many fine books to assist the teacher in this effort.

*Editor's Note: Participants in these NSF inservice sessions were provided with copies of* FrEdWriter, *which is a word processor that can be used on an Apple IIe or IIc. It is an example of Freeware, so that teachers are free to make copies of it for their students. In the fall of 1988 another excellent piece of Freeware became available for the Apple IIe or IIc. It is called* FrEdBase, *and it is a database program suitable for use in schools.* FrEdBase *is quite suitable for use in this inservice session. You can obtain a copy of this software and its instruction manual from ISTE, 1787 Agate Street, Eugene, OR 97403-9905, USA.*

Time is provided in this session to allow the participants to do some cooperative planning. When the materials of these inservice sessions were being field tested, it was found that teachers wanted some time to get together with computer coordinators and principals (who were always part of the training group) to discuss how best to integrate what they were learning in these sessions into the schools where they taught Much of the discussion at these times usually centers on issues like resource allocation and scheduling of computer facilities.

We recommend that this time be spent organizing the points and issues for more detailed discussion at a later time outside of the training sessions. This focus helps to keep the discussion on a fairly high plane and avoids the risk of turning the training into an opportunity to air grievances.

This is the second of two sessions devoted to databases. The use of databases is a very important topic. In some sense, the collected print materials in a library constitute a database. That is, much of the accumulated knowledge of the human race can be considered as a database. Thus, helping students learn to access and use databases is one of the major goals of education. Very young students can learn to gather data, to organize it into categories, and to use it to answer questions. Equally important, students can practice formulating questions that can be answered by appropriate use of the databases they have available or are creating. The creation and use of databases are suitable topics even in the earliest grades. As students mature, they can learn to create more complex databases and they can learn to use more complex databases.

## 4.4.2 Script

In this session, participants will be performing a variety of tasks designed to acquaint them with the idea of a *structured database*. In the last session, they worked with a free-form database *(MECC Stuff 'n' Fetch)* and a very simple database manager *(MECC Classification).* Now they will have the opportunity to work with a more sophisticated program, the database management system in AppleWorks. (*Editor's Note: As indicated in the Narrative Overview,* FrEdBase *would be quite suitable for use in this session. It is quite a bit like the database portion of* AppleWorks, *but somewhat simpler to learn and to use.*)

Before participants use *AppleWorks* in the "hypothesis-formation" activity, though, they have an opportunity to learn about database structure by creating a database on a wall chart. At the close of the session, the participants work together to plan how the things they are learning in this training should be used in their school(s).

**Topics**

- Organizing information.
- Forming hypotheses and proving/disproving them through analysis of data.
- Cooperative planning.

**Objectives**

- Participants will collect free-form information and turn it into a database --that is, *an ordered collection of data.*
- Participants will examine data from a prepared database, form hypotheses concerning the phenomena described by the data and confirm or deny those hypotheses by manipulating and further examining the data.
- Participants will work together to develop, modify, or expand upon a computer-use plan for their school(s).

**Materials**

*Software:* *AppleWorks,* Sorting the Planets File.

*Handouts:* A Guide to "Sorting the Planets"

*Other:* Colored paper (lighter shades, at least 8 1/2" x 11"), butcher paper, scissors.

**Preparation** Collect logs. Hand out today's packets.

**Activity**
15 Minutes

**Restaurant Database**

Materials: Colored paper for each pair of participants, a large (at least 4'x6') sheet of butcher paper on the wall with lines for a dozen rows and the first two columns (about a foot wide) drawn in, scissors for each pair of participants.

- Hand out colored paper.
- Demonstrate how to put information about a favorite eating place on paper. (*Note*: If restaurant data was gathered during the first session and used during the second, likely you will want to select a different source of data. For example, you may want participants to provide data on their favorite grocery store.)
- Write on one side only, using large print or script that can be seen from a distance.

- Make sure that some of the information is in the form of numbers (highest/lowest entree prices, approximate seating capacity etc.).
- Deliberately exhibit different styles of recording information (use print, script, pictures).
- Using the demonstration as a model, participants work in pairs to record information about their favorite restaurants.
- Choose one participant to "enter" his/her "data" into the butcher-paper table by cutting or tearing out one item of information about their restaurant. Put that information in the first row.
- Ask another participant to bring up more information for entry on the next line of the table. Make sure to ask this person whether the information is similar to that already entered previously for another restaurant. If it is, put it in the same column. If not, make a new column for it.
- Repeat this process until the first time there are two items in the same column.
- The first time two pieces of information are in the same column, have the two people who entered those items decide what the name of the column should be. Enter the name at the top of the column.
- Continue until four or five rows have been named.
- Have everyone cut out their remaining information and come up to the paper and add it to the paper.

**Debrief**
5 Minutes

Use these questions as discussion guides:
- Does anyone have any left-over information? Why?
- What kind of name should be given to the whole chart?
- In debriefing, point out the instructional utility of gathering information first and then organizing it rather than trying to decide beforehand what kinds of things are going to be important and then gathering information to fit the predefined groups.

**Activity**
45 Minutes

**Sorting the Planets**

Materials: *AppleWorks* program disks and data disks with **PLANETS** data file (one per computer), **A Guide to Sorting the Planets** performance aid (one per participant).
- Participants will follow the directions on the **Guide to Sorting the Planets** performance aid (PA), working at the computers in pairs.
- Note that in this activity, the PA directs the pairs to work together for about 15 minutes while they explore the **PLANETS** database. Then they will break to discuss hypotheses that might be formed to be tested with this data. Then they will resume working in pairs.
- Be prepared to assist participants who lose track of the activity.

**Debrief**
5 Minutes

Debrief the activity by sharing participant comments made during the course of the activity, soliciting comments from the participants, and pointing out the *instructional* focus of the activity.

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| | |
|---|---|
| **Break**<br>10 Minutes | *Note*: You may want to have the break earlier, during the **Sorting the Planets** database activity. |
| **Cooperative Planning**<br>25 Minutes | Assist the participants in planning the use of computers in their school in such a way as to facilitate the use of the skills they are developing in these training sessions. Most likely you will want to group participants on the basis of the school in which they work. However, you may instead want to group by grade level taught. |
| **Mid-training Evaluation**<br>Minutes | Use this time to gather data on your training performance from the inservice participants. The last section of this Notebook contains samples of the 15 Formative Evaluation instruments used during the inservice sessions. A rather detailed instrument was used at the end of the fourth session. It was designed to require about 15-20 minutes to complete. |

**End of Session**

## 4.4.3 Timeline

| | |
|---|---|
| **0:00 — 0:15** | Restaurant Database activity |
| **0:15 — 0:20** | Debrief the Restaruant Database activity |
| **0:20 — 1:05** | Sorting the Planets activity |
| **1:05 — 1:10** | Debrief the Sorting the Planets activity |
| **1:10 — 1:20** | Break. (May want to do this before the debriefing of the Sorting the Planets activity.) |
| **1:20 — 1:45** | Cooperative planning |
| **1:45 — 2:00** | Mid-training evaluation |

## 4.4.4 Handouts

# A Guide to "Sorting the Planets"

*Note*. This is a Performance Aid. It is a detailed set of directions for using *AppleWorks* with the Planets Database. It is assumed that the Planets Database has been loaded onto an *AppleWorks* disk. The contents of that file are given later in this section of the Notebook. The instructions given here are for a one disk drive system. With two disk drives, the directions 3. and 4. will need slight modification to reflect use of drive two for the data files.

1. Load the *AppleWorks* program.

2 Item **1** (Add files to the desktop) is already highlighted, so press **Return**.

3. Item **1** (The current disk: Drive 1) is already highlighted, so press **Return**.

4. Look at the bottom line, which says **Place your DATA disk in drive 1 and press Return**. Remove the *AppleWorks* Program disk and place the disk marked **AW Data** in the drive. *Note:* From time to time the program may prompt you to exchange disks. Please do so when prompted by the program. No further mention will be made of disk exchanges in this guide.

5. The **Planets** file is already highlighted. Load it by pressing **Return**.

6. You now see part of the large table that makes up the **Planets** database. Each **line** across is a **record** containing information about one of the planets in our solar system. Each **record** holds information about the similarities and differences among planets, and the information is organized into **columns**. At the top of each **column** is a word or phrase that describes the information in that column. There are several more columns "off-screen" to the right. We will not be able to scan all fields of any one record using this type of "view." We can get an excellent view of the record for Mercury by "zooming in" on that record. The cursor (*a blinking underscore character*) should be on the letter **M** in **Mercury**. Hold down the **Open-Apple** key and press **Z**. Read the record for the planet **Mercury**. Notice that the words that were used as **column-headers** in the "zoomed-out" view (*multiple record layout*) we just left are now used as **field names** on this "zoomed-in" screen (*single record layout*), which is used as a data-entry form.

7. Return to the zoomed-out (*multiple record layout*) view by pressing **Open-Apple-Z**.

8. Notice the order of the planets. This is the order in which they were entered. Now examine the columns that you can see in this view. What was the order in which the planets were entered?

9. We will now change the order of the planets by sorting them according to the information in one of the columns. Move the cursor to the right by pressing the **Tab** key four times. The cursor should now be on the digit 4 in **4800**, the **Diameter** of **Mercury**.

10. Sort the database into a new arrangement (or order) by pressing **Open-Apple-A**. You will be given a choice of sorting-orders; choose Item **3** (From 0 to 9). This will sort the planets in order of ascending **Diameter**. Examine the sorted planets carefully. Has the order changed?

11. You can move the cursor to the left with **Open-Apple-Tab**. Using **Tab**, **Open-Apple-Tab** and **Open-Apple-A**, sort the planets back into their original order.

**Please indicate to the trainer when you have reached this point. Then spend a few minutes creating some hypotheses that could be confirmed or denied by use of the Planets Database. (The creation and testing of hypotheses is one of the key ideas of science. At a subconscious level we do it all the time. It is important that students learn to do it at a conscious level, and learn to do it in a careful and reasoned manner.) Record your hypotheses in the spaces below. The inservice facilitator will likely want to promote a whole class discussion at this point in the inservice.**

Hypothesis #1:

Hypothesis #2:

12. Even though we can zoom-in on any record to examine all of its data, it is slow and inconvenient to do so. It would be better if we had a smaller table (called a **report**) that contained only the information that is of interest to us in confirming or denying our hypotheses. There is already a report "format" on the disk (in another session, you'll learn how to make your own), and you can print a report onto the computer screen by calling up the **Print** function by pressing **Open-Apple-P**.

13. Item **1** (Get a report format) is already highlighted, so press **Return**.

14. Item **1** (Planet Table) is already highlighted, so press **Return**.

15. Notice (on the lower third of the screen) that only a few fields are available in this report format. Notice also that at the far right of the report the vertically-printed message **Len78**. This means that when the report is printed, it will take up 78 of the 80 columns on the screen. Finally, notice that it's possible to see only the first three records. Rest assured that *all* of the records will be printed.

16. Print the database to the screen by pressing **Open-Apple-P**. Select the print location option, **The screen** (it's usually Item 2) and press **Return**. No date is necessary on this report, so just press **Return** again. The finished report will appear on the screen in a few moments. Does this report help in confirming or denying one of the hypotheses?

17. These reports can be sorted before they are printed in a manner that is similar to the sorting function in the database. Return to the **REPORT FORMAT** screen by pressing the **space bar**. Use **Tab**, **Open-Apple-Tab** and **Open-Apple-A** to rearrange the planets in order of *ascending Mass*. Print the report onto the screen. Does this report help in confirming or denying one of the hypotheses?

18. Now rearrange the planets in order of *descending length of Planet year*. Does this report help in confirming or denying one of the hypotheses?

19. Leave *AppleWorks* in an orderly fashion by pressing the **Escape** key three times. Then select Item **6** (Quit) from the main menu. Respond to the question **Do you really want to do this?** by pressing **Y** (for Yes). Select Item **3** ( Throw out the changes to the file) and press **Y** once again.

20. When the disk stops spinning, remove it and return it to its sleeve. Please leave the computer on.

# Planets Database

| Planet | Solar Distance | Surface Temp (C) | Cloud Temp(C) | Diameter (km) | Mass (Earth = 1) |
|---|---|---|---|---|---|
| Mercury | .387 | +350 | | 4880 | .055 |
| Venus | .723 | +480 | -33 | 12104 | .815 |
| Earth | 1 | +22 | | 12756 | 1 |
| Mars | 1.524 | -23 | | 6787 | 5.5 |
| Jupiter | 5.203 | | -150 | 142800 | 317900 |
| Saturn | 9.539 | | -180 | 120000 | 95.2 |
| Uranus | 19.18 | | -210 | 51800 | 14.61.2 |
| Neptune | 30.06 | | -220 | 49500 | 17.2 |
| Pluto | 39.44 | | -230 | 6000 | .1 |

| Density (water=1) | Planet day (24hrs=1) | Planet year (24hrs=1) | # of known moons | Orbital speed (km/s) |
|---|---|---|---|---|
| 5.4 | 59 | 88 | 0 | 47.9 |
| 5.2 | 243 | 224.7 | 0 | 35 |
| 5.5 | 1 | 365.3 | 1 | 29.8 |
| 3.9 | 1.026 | 687 | 2 | 24.1 |
| 1.3 | .41 | 4347 | 13 | 13.1 |
| . 7 | .426 | 10776 | 10 | 9.5 |
| 1.2 | .458 | 30685 | 5 | 6.8 |
| 1.7 | .667 | 60201 | 2 | 5.4 |
| ? | 6.375 | 90485 | 1 | 4.7 |

## Gases

| CO2 | Nitrogen | Oxygen | Hydrogen | Helium | Methane | Other |
|---|---|---|---|---|---|---|
| N | N | N | N | N | N | |
| Y | N | N | N | N | N | Sulfur dioxide |
| N | Y | Y | N | N | N | |
| Y | N | N | N | N | N | |
| N | N | N | Y | Y | N | |
| N | N | N | Y | Y | N | |
| N | N | N | Y | Y | Y | |
| N | N | N | Y | Y | Y | |
| ? | ? | ? | ? | ? | ? | |

# DATABASING

## in the Elementary (and Secondary) Classroom

*by*
*Kathy Pon*

As a first-year teacher, I was given a third-fourth grade combination class full of curiosity. They all were excited to learn about Indians, and we spent many wonderful days studying them. I say "we" because I enjoyed the subject as much as the class. However, the following year, I faced the problem of what to teach my fourth graders, whom I had had the previous year as third graders. The majority of them wanted to study Indians again, but what details were left?

Fortunately, I've always had an interest in developing higher-level thinking skills in students. This prompted some research which resulted in the piloting (gulp) of an exciting tool that aids higher-level thinking in the classroom—use of database management as an inquiry tool.

The application of database management for inquiry is grounded in cognitive learning theory as it operates within Piaget's framework of the concrete, symbolic and abstract learners. Students gather data on a given academic topic in a number of concrete ways. For example, they examine different books, films, maps, museums, etc., for information. They then label and group their information in a meaningful, symbolic manner—that of the database form. Finally, with more analysis they are able to synthesize the pieces of data and combine them in new and different ways. Students can then make and test more abstract generalizations about the information.

Hilda Taba had teachers and students using this data retrieval method for learning, although she did it with paper and pencil. In one study she did using this method, she found that students who were given practice at making generalizations were able to make increasingly valid generalizations about their data, i.e., think more effectively. The students, therefore, were meeting multiple learning objectives with the same activity. They were increasing their knowledge and improving the quality of their thinking.

How does an elementary school teacher introduce the use of database management into the classroom? With enthusiasm, a critical examination of the many database programs available and careful management planning. Consider the educational possibilities of this tool as I describe my experience in using it in the classroom.

The first step was to have students gather data. Because they were studying California Indians, they found most of their information in our local library and Indian museum.

Sample of a Primary Data Chart on Maidu Tribe

| INFORMATION COLLECTED | LABEL OR ATTRIBUTE GIVEN LATER |
|---|---|
| Their houses were made of tules. They were round. They looked like bowls. | Home |
| They lived near or in the Buttes Mountains. The city nearby is called Yuba City. It is in Sutter County. They lived near the Feather River. | Location |
| They mostly ate acorns. They ate deer and small animals. They fished. Ate seeds. | Food |
| Men hunted and fished. Women gathered acorns and cooked. | Jobs |
| They danced and made musical instruments with reeds, especially at acorn harvest. They told stories. Had albino deer and acorn ceremonies. | Recreation,<br>Special Ceremonies |
| They used mortars and pestles to grind acorns with. They hunted with bows and arrows and fished with harpoons. | Tools |
| They wore hides and rabbit skins in winter. They used moccasins with high ankle covers for the mountains. | Clothing |

*Figure 1.*

Next, they designed a form on which to display this data, using a label to classify each piece of information such as FOOD or HOME. This form was entered on the computer database.

Completed Student Computer Database File

| | |
|---|---|
| TRIBE | MAIDU |
| LOC | N V BUTTE MTNS YUBA CITY |
| CLI | COOL WINTERS & HOT SUMMERS |
| HOME | BARK OR BRUSH, BOWL SHAPE TEMPORARY |
| FOOD MAJ | ACORN DEER FISH |
| FOOD MIN | NUTS SEEDS BULBS BERRIES |
| JOB M | HUNTING TRAPPING FISHING |
| JOB FM | GATHERING, FOOD PREP KIDS |
| CLO | SKINS IN WINTER MOCCASINS |
| SPEC TOOLS | DIGGING STICK MORTAR NETS |
| OUTSTD FEAT | ACORN & ALBINO DEER CERE. USED SWEATHOUSES |
| TRIBE | MIWOK—MOUNTAINS |
| LOC | C V CHAW-SE PARK NEAR YOSEMIT |
| CLI | MILD-COOL WINTERS & HOT SUMMERS |
| HOME | TULE BRUSH SHELTERS—TEMPORARY |
| FOOD MAJ | ACORNS FISH |
| FOOD MIN | ROOTS BULBS SM GAME |
| JOB M | HUNTING FISHING |
| JOB FM | GATHERING, FOOD PREP |
| CLO | LIGHT TO NONE—BAREFOOT |
| SPEC TOOLS | MORTAR & PESTLE |
| OUTSTD FEAT | SWEATING NECESSARY FOR UNT SOME AGRESSIVE |
| TRIBE | POMO—NORTHEASTERN |
| LOC | N V CLEAR LAKE & N COASTAL MTN |
| CLI | COOL WINTERS & HOT SUMMERS |
| HOME | BARK TIPILIKE OR BRUSH TEMP |
| FOOD MAJ | FISH ELK DEER SEA OTTERS |
| FOOD MIN | NUTS SEEDS BERRIES |
| JOB M | HUNTING FISHING TRAPPING |
| JOB FM | COOKING GATHERING KIDS |
| CLO | SKINS IN WINTER, LITTLE—MOCCA. |
| SPEC TOOLS | BALSA BOATS NETS HARPOONS |
| OUTSTD FEAT | MADE BEAUTIFUL TWINED AND COILED BASKETS CLAMS $$ |

*Figure 2.*

I conducted small-group sessions at the computer where students were then able to generalize about attributes that seemed to be related. We sometimes used Venn diagrams as in figure 3. I showed the students commands and procedures that enabled them to check their generalizations by making data searches for tribes that listed these criteria. Thus, their generalizations could be verified. For example, "Tribes that lived in the North seemed to wear skins and furs for clothing" was decided to be a relationship. By searching for tribes that met the stated generalization, students were able to check for tribes that listed the information SKINS under CLOTHING and NORTH under LOCATION.

Only a small group of my students discussed possible causes and effects. Most students were not cognitively ready to create hypotheses about causes and effects of the data and test them by making a database search. Instead, they concluded the study by discussing why they thought certain attributes were related.

Venn Diagram on Two Whole Tribe Comparisons

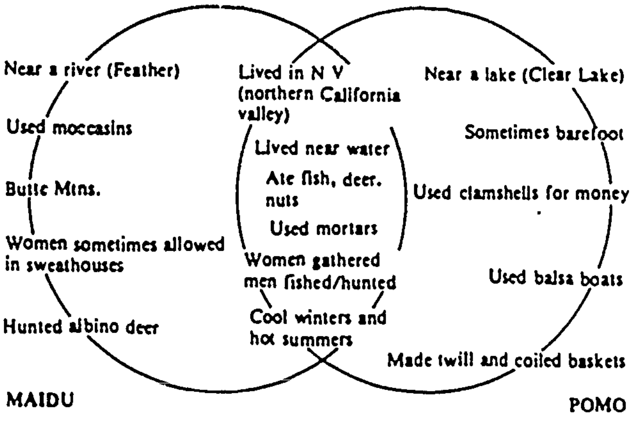

*Figure 3.*

However, one group continued the last part of the study before and after school. They took the generalizations made earlier at the computer and turned them into if/then statements. They then tested them for a cause-and-effect relationship by writing a null hypothesis statement and objectively testing it by locating the information in the database.

Students practiced the skill of making if/then statements and related null hypothesis statements on non-Indian subjects like this:

1) Practice with a generalization

> "It seems like rain and umbrellas go together."

2) became an if/then statement

> "If it rains, then the number of umbrellas on the street will increase."

3) and then was written as a null hypothesis statement:

> "On a rainy day the number of umbrellas will not increase on the streets."

Likewise, they developed this generalization from their study of California Indians,

> "Indians who ate acorns used mortars and pestles."

wrote it as an if/then statement

> "If Indians ate acorns, then they used mortars and pestles."

and then wrote the following null hypothesis statement.

> "Indians on the database who have acorns listed under FOOD will not list mortars and pestles under TOOLS."

The exciting part about working with the concepts at this level was the discussions about the validity of the data retrieved. Could it have been found with different wording? Even if the hypothesis was validated, did it really *prove* a cause and effect? Perhaps Indians who ate acorns used the mortar and pestle to wash clothes. The students became more critical than I would ever have expected them to be in examining their findings.

The most rewarding part of this study was at the end of the unit, two months later. I put together my own Indian database on tribes that my students had not studied. After students reviewed patterns they had observed, I planned to give an attribute of an unknown tribe (such as "these Indians wore little clothing) and have students make an inference about another related attribute or generalization based on the established patterns (such as "they must have lived in a warm climate"). I thought that if I required students to give reasons for their choice of attributes, that that would be a valid evaluation of their level of thinking. Imagine my surprise when I got more than that! Here's an example:

The pattern that "most tribes that ate shellfish had some sort of money system" was established. I then gave them the fact that "the Chumash tribe near Santa Barbara ate shellfish." I only expected the generalization that "they probably had a money system, because tribes who had access to shellfish usually used the shells in trading" in return. Instead, I heard statements like, "They must have used boats if they fished in the sea," or "They probably hunted in groups for sea lions," or "The boats must have been made of some sturdy wood (planks) to withstand the sea." The kids had used a great deal of imagination in their thinking!

Many powerful database management programs often used in businesses are not always as useful in an educational setting. They may be able to make as many as 20 different combinations of "and + or" searches, which is valuable when making generalizations about related attributes. However, these same database management programs may not be set up to retrieve data on a single attribute from every page in the file. (To show, for example, FOOD for every tribe in the database.) Most importantly, business programs can be very structured and be vague in their documentation, which limits their use with children.

Less-structured database management programs are being developed. Some don't have the power to make as many "and + or" combinations of searches as a business-oriented database, but they do an excellent job at finding one "and + or" statement at a time. They also locate and print isolated attributes from each page in the database. The forms are less structured, which is excellent for children. They also give "help menus," easily accessible instructions, for setting a form or making a search on the computer monitor. One program now out even comes with some ready-made forms for class lists and book reports.

At a time when many databases or spreadsheets are on the market, educators should consider their students' cognitive level and adopt one that is appropriate for their particular classroom use. Content areas like social studies or science that have topics with many attributes (countries, the plant or animal kingdom, cities, for example) work well for this kind of study. Not only are these tools giving students a way to manipulate the overwhelming amount of information in society today, they are providing students opportunities to create strategies for critical thinking, perhaps the most useful skill for the eighties and beyond. END ■

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A Comparison of Three Available Commercial Database Management Programs Based on Criteria Appropriate for the Classroom

| Criteria | Instant Recall | Quickfile | DB Master |
|---|---|---|---|
| Flexibility and loose structure in setting up a form | X | X | |
| Power to make "and" search | X | X | X |
| Power to make an "and" + "and + or" search | | X | X |
| Ability to add categories to a form already set up | X | X | |
| Overall ease of use | X | X | |
| Power to isolate one category or attribute from all pages in the database and display/PRINT it | | X | |
| Command to allow for spelling errors | X | X | X |
| "Help screens" | X | X | |

*Figure 4.*

# 4.5
# SESSION 5: Database and Word Processing

## 4.5.1 Narrative Overview

This session contains both database and word processing activities. We complete the database portion of the training (bringing our total to 2 1/2 sessions on this topic) by working through an activity from creation of a database through production of a report. We open a 3 1/2 session series on word processing with an activity designed to introduce word processing in the context of the process writing model.

The overall eight-session inservice series is broken into three major topics: graphics, databases, and word processing. In our opinion that these are the three most important computer tools that grade school students should currently be learning to use. If a student leaves grade school with a functional working knowledge of these three computer tools, the student has made a major step toward becoming computer literate. Middle school or junior high school curriculum can and should build on this level of computer knowledge.

It may seem curious that the word processing activity in this session *precedes* the database activity, but this is by design. In the fieldwork that led to the creation of these materials, we found that after two very solid sessions on databases, participants wanted a break. Since word processing activities tend to be great favorites of elementary teachers, we decided to begin this session with the opening activity in writing and close it with the database activity. This makes for a very full session; be prepared for weary participants at its end.

The word processing activities in this and subsequent sessions owe a great deal to the work of Donald Graves, perhaps the best-known figure in the process-writing movement. For additional information on process writing and use of word processors, here are two excellent resources:

Graves, Donald H. *Writing: Teachers & Children at Work.* Exeter NH: Heinemann Educational Books, 1983.

Daiute, Colette. *Writing and Computers.* Reading MA: Addison-Wesley, 1985.

The first activity in this session is intended to be a fast introduction to some of the capabilities of *FrEdWriter,* a public domain word-processing program. While it would be possible to use the word-processing capabilities of *AppleWorks* or any number of other equally fine programs, the fact that *FrEdWriter* is a free program has led to its wide adoption as the basic word processor in many schools in the western part of the United States and Canada. Therefore, the developers of this inservice series believed it was likely that the training would have better chances for impact if *FrEdWriter* was the word processor used.

If *FrEdWriter* is not available from a local educator, it can be obtained through CUE Softswap, PO Box 271704, Concord CA 94527-1704 for a cost of $20. (Orders from within California must include sale tax.) Once you obtain a copy, you can make additional copies.

This introductory activity's content relates directly to a central tenet of the process-writing model: that the author should feel some sense of ownership of the topic for composition. In this activity, participants are first shown a model for topic generation and then directed to generate topics in a similar fashion. During the generation of topics, they also get a chance to use the word processor for the first time. It may be that a number of the participants are already familiar with word processors in general and *FrEdWriter* in particular; no matter, for the focus of the activity is on *writing,* not in the mechanics of word processing. This is consistent with the entire CI$^3$ project. Learning the keystroke sequences to use particular pieces of software is a very small part of the overall learning that is necessary to integrate the computer as a tool into the curriculum. In the inservice sessions the focus is on use of the tool as an aid to accomplishing a particular task. In this case the task is writing (more properly, process writing). Once the trainer knows which participants are skillful in the use of word processors, it might be useful to reorganize the working pairs, taking care that the skilled participants don't do all of the on-computer work.

A small aside on process writing might be in order. In the mid 1970s a group of writing teachers got together in San Francisco and started the Bay Area Writers Project. Their goal was to improve the writing skills of students. The research literature up to that time had identified the concept of writing as a process, and that when writing was taught as a process (rather than a product) the results were better. The Bay Area Writers Project developed into a course by the same name. Typically the course is an all day long, four week course. That is, it seems to take about four weeks of intense training for a typical teacher to become reasonably comfortable with the ideas and practice of process writing.

In this inservice series we are devoting about seven hours of instruction to process writing and learning to use a word processor. That is about 1/20 of the time that the Bay Area Writers Project course spends on these topics. Thus, the inservice facilitator should not expect that participants will master these topics and immediately implement major changes in their classrooms. As indicated earlier in this Notebook, change is difficult. The amount of training, experience, and backup support needed for a teacher to make a major change is much larger than a typical inservice series can provide. A few "early adopters" will take the small amount of training being offered here, and will implement major changes in the classroom. Most participants will make more modest progress.

During the debriefing of the writing activity, it is important to maintain the focus of the discussion on the task of topic generation. One thing that can happen is a debate about the relative merits of the different word processors with which some of the participants may already be familiar. This is a worthy topic, but it can consume a lot of time. It might be worthwhile to schedule some time in a later session to have a discussion of the desirable features of word processors in educational settings.

Perhaps another aside is appropriate. There are many different word processors on the market. Each year new ones are introduced, along with updated versions of the more successful older ones. Schools often cannot afford to have the newest, latest, greatest versions of software. The key issue is having a word processor versus not having a word processor. *FrEdWriter* is quite adequate for introducing students to process writing in a word processing environment. Once a student has mastered the ideas of process writing and use of one word processor, the student can easily transfer this knowledge and skill to another word processor.

The pre-session preparation for the database activity involves some legwork. Databases are actually just large tables, and one of the best ways to acquaint teachers with the utility of database creation in the classroom is to start with some familiar (and fairly small) tables and turn them into databases by creating input forms using the table headers as field/category names and filling in the forms with the rows of information in the table. Starting with the familiar in this way builds some measure of connection between the teachers' existing bases of knowledge and the new and unfamiliar world of databases.

Finding appropriate source material that can be converted from its tabular form into a database is obviously critical to this exercise. This is where the legwork comes in. Good sources for tables include: many kinds of science texts, which often include tables; geography texts; newspapers (especially feature supplements on business or science, which often include tables and charts); and resource works like dictionaries and encyclopedias. Some things that don't look like tables can be converted to that use. For example, timelines in history texts can be converted to two-field tables (date and event) with ease, and these simple tables can be expanded by adding other fields (population growth, for example).

Once these are gathered the tables should be identified with bookmarks or photocopied. This will make the participants' tasks in selecting the resource they will use for creating their database easier. Even if the trainer photocopies the table, however, the resource itself should be brought to the training session, if possible. Teachers often get many good ideas about enriching the database activity if they have the whole context from which the table is drawn available for inspection.

The guide sheet for this activity (**Databases: Creating Forms and Reports**) is very detailed in its description of the steps needed to perform these activities using *AppleWorks*. It is a great deal to do in a short time. Do not be surprised if some of the participants cannot finish in the time allotted. It is very probable that anyone sufficiently interested in actually using databases in the classroom will complete the activities at a later time.

The debriefing of this activity should center on applications of database management systems in educational settings. A brainstorming session might be appropriate.

## 4.5.2 Script

In this session, the word processing strand begins with an introduction to the basic concepts of process writing, and the database strand is completed with an activity that involves creation of databases. Generally speaking, the creation of a database for purposes of attacking a particular type of problem is considered to be a higher order cognitive skill than merely using an existing database for attacking a particular type of problem.

**Themes**

- Using word processing in a process-writing context.
- Creating databases from academic material.

**Objectives**

- Participants will write a list of topics using a word-processing program.
- Participants will create a simple database from tabular information from textbooks and other academic materials.

**Materials**

*Software:* *FrEdWriter, AppleWorks*

*Handouts:*

**Good Writing Ideas - Promptly,**
**Databases: Creating Forms and Reports**
**Database Ideas**
**Tombstone City**

*Other:* Blank disks and labels; textbooks and other materials that contain tables from which small databases may be created.

**Preparation**

- Prepare a suitable number of copies of *FrEdWriter* (one per two participants).
- Bring three blank disks (with blank labels) per two participants. Place one copy of *FrEdWriter,* three blank disks and blank labels at each computer station. (One of the activities will be for participants to make copies of *FrEdWriter* to take back to their schools.)

**Activity**
15 Minutes

**Getting acquainted with *FrEdWriter***

- Using the self-copying utility in *FrEdWriter,* teachers work in pairs at the computers to make a copy of the *FrEdWriter* disk (so each has a copy to keep). They make the copy on the blank disk provided. They attach a label to the disk after it is copied.
- Teachers format disks to use for text-file storage. They attach labels to the disks after they are formatted.
- Teachers return to center tables for demonstration.

**Activity**
15 Minutes

**Topic selection (modeling)**

- Introduce the activity with this statement: "Topics should be memorable, even emotion-laden events."
- Model making topic-lists in *FrEdWriter* at one of the computers. Work with the pairs participants in turns as time permits. In working with a pair, have one person typing ideas for topics while the other provides prompts or enriches the range of ideas, then switch file disks and roles. Refer to the **Prompt Ideas** sheet for assistance in developing topics.

Refer to the *FrEdWriter* **Functions** sheet when moving the cursor, accessing the **<T>utor**, **<S>aving** text, clearing memory for <N>ew text, changing text-file disks while *FrEdWriter* is running and **<Q>uitting.**

Activity
20 Minutes

**Topic selection (computer activity)**

- Teachers move in pairs to the computers to prepare their own topic lists.
- Teachers work in pairs, typing their ideas into their own files in turn, as previously demonstrated.
- Circulate among the teachers as they work, stimulating ideas through mini-brainstorming, "I can remember" games and other methods, working from the **Prompt Ideas** and *FrEdWriter* **function sheets.**

**Debrief**
10 Minutes

- Pose questions like: "What happened?" "How was *FrEdWriter* to work with? Is it appropriate for use with the types of students you teach?"
- Develop the discussion on topic generation and point forward to the next lesson: "What can be done with these topic lists?" "Can you say why we asked you to think of topics that are memorable or have strong emotional content?"
- "Here's what happens next..." Introduce the next steps in the writing process. Indicate that the next three sessions of the inservice series will be devoted to process writing in a word processing environment.

**Break:**
10 Minutes

- Place a copy of *AppleWorks* and a data disk at each computer station.
- Place the textbooks and other data resources on a central table.

Activity
40 Minutes

**Creating databases**

- As the participants return from the break, direct their attention to the data resources displayed on the central table. Ask them to select one that is of interest to them.
- Ask the participants to pair up at the computer stations.
- Direct the participants' attention to the **Databases: Creating Forms and Reports** guide. Ask them to locate a table in their chosen resource and follow the directions in the guide to create a database entry form.
- Monitor their activity by circulating among them. Be prepared to answer mechanical questions about creation of entry forms in *AppleWorks.*
- As each pair finishes its entry form, direct them to begin entering the data from their chosen resource. They should enter at least five records.
- When they have entered a sufficient number of records, direct them to create a report by following the directions in the guide.

**Final debrief**
10 Minutes

- Ask participants to summarize what they have learned through the day's activities.
- Concentrate on eliciting potential applications of database management programs to social studies and science.
- You might point out that an integrated package such as *AppleWorks* contains both a database and a word processor. In an integrated package it is usually quite easy to bring files from one application into another. Thus, database files are easily incorporated into one's writings. If the application package contains graphics facilities, then it is easy to incorporate graphics into one's writings

## 4.5.3 Timeline

| | |
|---|---|
| **0:00 — 0:15** | Getting Acquainted with *FrEdWriter;* participants make copies to take back to their schools. |
| **0:15 — 0:30** | Topic Selection (modeling); an off machine activity. |
| **0:30 — 0:50** | Topic Selection (computer activity) |
| **0:50 — 1:00** | Debriefing |
| **1:00 — 1:10** | Break |
| **1:10 — 1:50** | Creating Databases |
| **1:50 — 2:00** | Final Debriefing; emphasize that participants should continue to experiment with use of databases in their classrooms, and that we will be spending the remainder of the inservice sessions on process writing in a word process environment. |

## 4.5.4 Handouts

**Index to Handouts** **Page**

# Good Writing Ideas – Promptly!

One of the concepts we want to develop is that students can write by responding to **prompts:** idea-sources that are either created by their teacher or by themselves. The idea of use of prompts, for prompted writing, is now quite common in schools.

Today, you will create some story-starting prompts for your own use. We suggest the following guidelines for selecting your personal story-starting prompt for use in today's activities:

**A personal memory:** Your story idea should be based on a memorable event. You may report it the way it actually occurred or as you would have *wished* it to occur.

**Strong emotional content:** Your idea should have strong emotional content. By investigating such topics, you are sure to find something that matters to you. This nearly always results in a story of higher quality than the alternative: writing on a topic you haven't chosen and may not care about.

We have no wish to invade your privacy, but we think you'll find that this is a valuable approach to unlocking creativity.

**Some general subject areas:**

A triumph
A tragedy
A meeting
A parting
An accident

A community event
A conversation
A confrontation
A disturbance
An agreement

## Good hunting!

# Databases: Creating Forms and Reports

*Note:* You will go through *two* cycles of the processes described in this document: once with the sample data we will help you generate and once with contents that you come up with on your own.

### Creating a form

1. Once you have decided on the field names for your database, you are ready to create an *input form.* Obtain a data disk and a copy of the *AppleWorks* program. (If the disk on which you wish to store the data is not yet formatted, you can format it within *AppleWorks* by choosing the **DISK FORMATTER** (option 5) function from the **OTHER ACTIVITIES** menu.) Start the *AppleWorks* program and move to the **MAIN MENU.** Select item **1** (Add files to the Desktop).

2. From the **ADD FILES** menu, select item **4** (Data Base). From the **DATA BASE** menu, select **1** (From scratch). Type in the name of your database at the prompt on the bottom line of the screen.

3. Now you see the **CHANGE NAME/CATEGORY** screen, which you will use to create and edit forms. It has two halves: a space for typing in field names (called Category names in *AppleWorks*) and a space containing a summary of commands (Options:) for creating forms. Note that in the **Category name** space, there is already a field name (Category 1). Erase this by pressing **Open-Apple-Y** or moving the cursor to the end of **Category 1** with the **Right-Arrow** key and then press the **Delete** key until the entry is erased. *Note:* In the upper right corner of the display, there is a note that if you press the **Escape** key, you can restore the entry you are deleting or changing.

4. Type in the field names one at a time, pressing **Return** after each entry. Note that the contents of the **Options** space change when you first press **Return.** When you have typed in the last field name and pressed **Return,** press the **Escape** key.

### Typing in records

5. You now see the **REVIEW/ADD/CHANGE** screen. Read the note in the center of the screen, which reminds you that this is a new database. Press the **Spacebar.**

6. Now you can fill in the form on the **INSERT NEW RECORDS** screen. Type in the entry after each field name and press **Return.** Note that when you type in the last entry and press **Return,** you will automatically move to the next empty record.

### Viewing individual records and the whole database

7. When you finish typing in the last record, press the **Open-Apple-Z** key. This will give you a zoomed-out (multiple record layout) view of the entire database (or at least the first part of each record). Experiment with moving the cursor to different parts of the database and zooming in and out with **Open-Apple-Z.** In *Sample Screens #1 and #2* (see the last pages of this guide), you see an example of zoomed-in (single record layout) and zoomed-out (multiple record layout) views. Note that all seven fields can be seen in the single record layout view, but the last two fields are not in view in the multiple record layout view. When you are finished, press the **Escape** key.

8. Now you have returned to the **MAIN MENU** screen. You could stop working with the database now if you wished; the database you have just created will remain on the Desktop while you work on another one or create another document with the word processor or the spreadsheet. We will continue with it, though. Note (in the upper-right corner of the screen) that if you press **Escape**, you will return to the database you created. Press **Escape** and return to the database.

## Adding records

*Note:* Initial the back of the paper forms which you have entered and pass them to the training group on your right. Accept the paper forms from the training group on your left. Use these forms to add records to your database.

9. Move the cursor to the end of the last record in your database and press **Return**. You will see a message in the center of the screen reminding you that you can add records to the database by selecting **Yes** as your response to the prompt on the bottom line.

10. Follow the sequence of Steps 6-8 until you have added all the records you want.

*Note:* Obtain other paper forms and pass yours on until you have 5-6 records in your database. Now take some time to consider what kinds of questions you might ask about this information. Can it be grouped or sorted in useful ways?

## Generating "table" reports

11. Press **Open-Apple-P**. This will take you to the **REPORT MENU**, which you will use to create report formats. A *format* is a way of laying out the information so that the printed report will be useful. There are several options on the screen:

    1. **Get a a report format:** This is not highlighted, since you haven't created any formats yet.
    2. **Create a new "tables" format:** You will use this in a moment to create a report in tabular form; that is, a report in which the information is laid out in rows and columns.
    3. **Create a new "labels" format:** You will use this later to create a report in which the information can be laid out in single record blocks. For example, you would use this function to prepare mailing labels.
    4. **Duplicate an existing format:** There are times when it is useful to create a report that is a variation on a format that already exists. You can save a lot of work and avoid making errors by duplicating an existing format and changing it to meet your needs.
    5. **Erase a format:** Use this function to eliminate report formats which you no longer need.

12. Select Item 2 (Create a new "tables" format) and press **Return**. Type in a name for the report at the prompt on the bottom line.

13. Now you see the **REPORT FORMAT** screen, which you will use to create a tabular report format for your database. Note the large block of "reminders" in the center of the screen. At the bottom, you can see the field names and the first three records of your database. If there are seven or more fields in your database, you will see only the first two letters of the seventh field, and any other fields will be "off-screen" to the right. See *Sample Screen #3*.

14. Use the **Right-Arrow** key to move the cursor to the rightmost column of your report. (If you had some columns off-screen, this will bring them into view.) Note that to the right of the last column there is an indication (under the vertically-printed letters **Len**) of how many columns wide the report would be if you were to print it out right now. Most printers can only print 80 columns unless special preparations are made. Press **Open-Apple-P.**

15. Now you see the **PRINT THE REPORT** screen, which you will use to select the device on which the report is to be printed. *AppleWorks* can be set up to send reports to many different kinds of printers. Many printers require special setups; if you are using *AppleWorks* on a system whose printer does not appear on the **PRINT THE REPORT** screen, you may have to go to the **OTHER ACTIVITIES** screen to select the **PRINTER INFORMATION** function to add your printer to the choices on this screen. If you must do that, all will be well, because your database and the format that you are preparing now will remain on the Desktop. For now, though, select **The screen** as the place to print the report and press **Return**. Type today's date (if you wish) at the prompt at the bottom of the screen and press **Return**. This will print the report onto the computer screen in exactly the same way that it would appear on a printer. This function is useful for checking what a report will look like without actually taking the time to physically print it out. See *Sample Screen #4*. Note that you may have some columns in which there is insufficient room to display the information, while there is too much room in others. Press the **Spacebar**.

16. You can change the width of any column by moving the cursor (by means of the **Right-Arrow** and **Left-Arrow** keys) to the column you wish to change. If you wish to widen the column, hold down the **Open-Apple** key and press the **Right-Arrow** key until the column is wide enough. You can narrow the column by pressing the **Open-Apple-Left-Arrow** key combination. Try printing the changed report to the screen by following the directions in Step 15.

17. You can also eliminate a whole column if you wish by moving the cursor to that column and pressing **Open-Apple-D**. If you wish to restore a column which you have deleted to its former position, move the cursor to the column which had formerly *followed* the deleted column, then press **Open-Apple-I**. You will then see the **INSERT A CATEGORY** screen which lists all the categories which have been deleted. Select the one you wish to restore by highlighting it and pressing **Return**. It will reappear in its former position.

    You can use a similar method to move a column to a new location in the report. Just delete it with **Open-Apple-D**, move the cursor to the new location, then restore the column with **Open-Apple-I**.

    Another way of moving columns is by switching adjacent columns with **Open-Apple->** and **Open-Apple-<**.

18. Experiment with other functions. Use **Open-Apple-A** to sort on particular columns. If you have numbers in any columns, right-justify them with **Open-Apple-J**. (Don't be disturbed when *AppleWorks* replaces all your numbers with **9999999.99**; that's just the program's way of telling you that something special is being done with the numbers.) Arrange for the report to add up any numeric columns by using **Open-Apple-T**. *Sample Screen #5* shows a format for a report listing debtors in decreasing order of indebtedness, with the amount owed by all totaled. *Sample Screen #6* shows what the report looks like when it's printed on the screen.

    When you have finished experimenting with tabular reports, press **Escape**.

### Generating "label" reports

19. You should now see the **REPORT MENU** screen. Select Item 3 (Create a new "labels" format). Type in the name of the label style report you intend to create and press **Return**.

20. This version of the **REPORT FORMAT** screen lets you create block-oriented reports like mailing labels. You can move the field names to different places on the screen by placing the cursor on the first letter of the field name, holding down the **Open-Apple** key and using the **Arrow** keys (any of them).

You can delete categories or blank lines with **Open-Apple-D**. You can insert blank lines and previously deleted fields with **Open-Apple-I**.

If you want to print mailing labels, you can put the city, state, and zip code neatly on the same line by using **Open-Apple-J**, which will left-justify the information so that it will print just one space to the right of the data which precedes it on the line.

Field names are often not included in label reports such as mailing labels. You can, however, arrange for both the field name and its data to be printed on the report by using **Open-Apple-V**. This can be useful if the information is not self-evident.

*Sample Screen #7* shows what the fields look like before they are formatted. *Sample Screen #8* shows a finished format. *Sample Screen #9* shows a "zoomed-in" view of one record (a handy way of getting an idea of what one "block" of the finished report will look like).

Experiment with some of the other functions in this formatter. You can view your options by pressing **Open-Apple-?**.

21. Print the report by pressing **Open-Apple-P** and selecting **The screen** from the **PRINT THE REPORT** screen. *Sample Screen #10* shows what the first three records in the sample file look like when they are printed on the screen.

# Database Ideas

This handout contains some possible sources of databases.

## Social Studies

Compare regions, cities, states, countries
Compare presidencies
Famous people, inventors, first-timers, ...
Compare different cultures - Indian tribes, religions

## Science

Planets, stars, our solar system, comets
Classifying animals (e.g. local lake fish, off-shore fish, cash catches, sport fish, tropical fish in homes, endangered species of fish)
Classifying plants (e.g. native trees, lumber trees, landscape trees, farming trees, poisonous trees)
Gases, liquids, crystalline solids
Robots

## Health

Vitamins, Minerals, Nutrients
Calories
Exercise

## Math

Number systems
Measurement Systems
Word Problems (use *Stuff 'n' Fetch*)

## Language Arts

Compare dialects
Common phrases from foreign languages
Proverbs - famous sayings
Poetry
Different book report titles, science fiction, autobiographies

## Physical Education

Hiking trails and rafting sites in your state
Olympic records
Favorite sports in different countries

## Personal

Pets
Hobbies
Vacation favorites
Rides at Disneyland

# Tombstone City

(Thanks to Jim Rae)

## Description:

Topic: Gathering Information, Posing Hypotheses
Grade Level: 5-9
Grouping: 3-4 students per group

## Materials:

Equipment: One computer
Software: A database manager
Other: One cemetery

### Objectives:

- Students will gather information from a cemetery.
- The info will be organized and stored in a database.
- The data will be analyzed and hypothesis posed.

### Before you start:

- Select one cemetery
- Assign student groups
- Determine with the students which data should be recorded from the tombstones - items could include: birth data, date of death, # years lived, first name, last name,sex, inscription, picture, shape of stone, and so on.
- Create a data gathering sheet with the field names that correspond to the database headers.

### Lesson Sequence:

1. Each student group gathers information from at least 5 headstones.
2. Students type the data into a database.
3. All the data is complied into one file.
4. Analyze the data and ask questions - Did many people die in a particular year? Did the average number of years lived vary according to sex? Was it more customary to have crosses before a certain year?
5. If any patterns or ideas emerge, follow them up by gathering more data and different data from sources such as encyclopedias, old newspapers, a different cemetery.

### Post:

- Create a story about one of the tombstones. Explain why the person with that tombstone died during that year, at that age, etc.
- What are some events that would affect the kind of data gathered from tombstones? Some possible examples include changes in the economy, world wars, influenza epidemic, opening a new cemetery, etc.
- Have students predict what types of things will be printed on tombstones 100 years from now.

### Comments:

This may not be a desirable subject for some students, but it can offer a wealth of material about the community in which they are living.

# Teaching Higher Order Thinking Skills with Databases

*by*
*Jim Watson and Neal Strudler*

### Introduction

While most educators agree that schools need to place increased emphasis on higher order thinking skills. there seems to be little agreement on how to do so. As Barry Beyer (March 1984, Phi Delta Kappan) stated. "The teaching of thinking skills is a lot like the weather. Almost everyone talks about it, but few educators seem able to do much to improve it."

Many educators have found that instructional database activities offer a wide range of opportunities for students to obtain thinking skills. The marriage of higher order thinking skills— analysis. synthesis. and evaluation (Bloom, 1956)—and instructional database activities appears to be a natural. As students use a database manager to store and organize information, they can generate and answer questions, formulate and test hypotheses. and critically evaluate the results of their inquiries. It should be stressed. however. that databases only provide the medium for such inquiry. The rest is dependent on the well-conceived implementation of solid teaching strategies that engage students in higher order thinking.

The following steps were excerpted from the final lesson of *Teaching Thinking Skills With Databases* (Watson, 1988). This is the culmination of an extensive database unit on the fifty U.S. states. The steps described are designed to be generic—applicable to any curriculum area. In prior lessons students learn basic database operations. arranging and selecting records, planning and printing reports, creating and building data files. and so forth. Students begin with pre-established data files about the states as they progress from lower order to higher order thinking skills. Earlier activities emphasize finding and retrieving information from the database. These learning tasks involve the lower order skills delineated by Bloom. knowledge (recalling information). comprehension (understanding literal messages) and application (using information in new situations). Subsequent activities focus on the higher order thinking skills of analysis (breaking down information to find relationships and connections). synthesis (putting together and organizing the information to clarify the big picture). and evaluation (making personal judgments to explain the meaning and importance of findings).

The concluding lesson in the unit was specifically designed to help students synthesize. evaluate. and extend what they have learned. The lesson is based on Hilda Taba's (1967) Inductive Thinking model of teaching. Taba's model fits especially well with computer database activities as it offers specific strategies that help students to organize, synthesize, and evaluate information. Students brainstorm on a topic, sort and interpret data. and apply principles that they've learned. Well-conceived questions and proven discussion strategies enhance the Inductive Thinking model and increase the likelihood that students will effectively achieve higher level learning objectives.

### Step 1: Generate a Series of Problems about the Topic

As students develop a database. they will likely formulate questions that relate to the topics being studied. Sometimes it might be appropriate for them to pursue the answers when the questions arise Often, however, it's desirable for students to continue to work on the prescribed task at hand. On such occasions, it's a good idea for the teacher to record these questions (and suggest others) for the class to consider later. Look for questions that have no definitive answers that suggest problems requiring higher order thinking skills to examine. The problem questions should be thought provoking and require students to speculate. Examples of such questions from the unit on U.S. States might include:

- What region of the U.S. is the "most important"?
- Will the U.S. ever elect a Black or other minority person as president?
- What could increase Mississippi's average annual income?
- How can the problem of minority unemployment be solved?
- What could be done to improve living conditions in high density urban areas?

### Step 2: Write Six (or so) Questions About Each Problem

The first question of each set written by the teacher should address a major concept involved in the problem During the *concept formation* stage of the Inductive Thinking model (see Figure 1), students brainstorm ideas pertaining to the first question They then organize their responses into groups and label each group.

The remaining questions posed by the teacher should involve students in judging the importance of various aspects of the topic. exploring relationships. making inferences. and applying principles to further questions (see Figures 1 & 2) Examples of question sets for each of the problems appear in Figure 3

### Step 3. Use One Problem and its Set of Questions to Guide a Class Discussion

As an example we might use the last question set described in Figure 3. The data file can serve as a valuable resource as students explore whether states with large urban populations do, in fact, have high crime rates, high costs of living, high suicide rates, and so on. Students can use the skills they have learned in prior lessons to arrange the file and select certain records to test some of their ideas. (See Figure 4 for suggested strategies to extend student thinking.)

**Question:** What are some of the problems of living in crowded cities?

**Possible Responses:** traffic jams, high cost of living, smog, tenements, crime, parking problems, gangs, drugs, neighbors too close, neighbors above and below and beside you, high unemployment, etc.

**Question:** What might be done to solve one group of problems of living in crowded cities?

**Possible Responses:** students might see groupings like: "safety" (crime, gangs, unemployment, drugs) or "quality of life" with items (noise, closeness of neighbors, alienation). Some solutions for the "safety" problem might include: put deadbolts and grates on the windows, everybody could have a gun, hire the unemployed to build new places to live, a neighborhood-watch program.

**Question:** Develop a plan based on the most promising solution you thought up for the last question.

**Possible Responses:** We plan to begin a neighborhood association to hire and train the unemployed to build new apartment buildings. The people who build the apartments will be among those who will live in them.

**Question.** What problems can you predict you might have with your plan?

## Hilda Taba's *Inductive Thinking*

(Taba 1967, page 109.)

**1. Concept Formation.** The teacher leads a "brainstorming" session in which the class responds to questions like:

"What do you know about . . . ?"

"What did you see in . . .?"

A recorder (often the teacher) writes the responses on a chalkboard, butcher paper or an overhead transparency. Ideas are usually accepted without comment or discussion (positive or negative).

When brainstorming is complete, the class then organizes ideas into groups and labels the groups.

"What belongs together? Why?"

"What should we call this group? Why?"

The Concept Formation strategy requires students to take information they have learned about a topic under study and organize it in a new way. In short, they practice synthesis.

**2. Interpretation of Data.** Students use the data they have organized to judge the importance of the various aspects of the topic, explore relationships, and make inferences (synthesis and evaluation skills).

"Which of the groups are most important?"

"Why are they the important ones?"

"Why is *this* data more important than *that* data?"

"What explains the apparent connection between these two aspects?"

"What does it mean?"

**3. Application of Principles.** Answering questions at this level draws students beyond the data, involving evaluation and increasing productive and creative thinking.

"What would happen if . . .?"

"Why do you think this would happen?"

"What would it take for this to be generally or probably true?"

*Figure 1*

## Question Templates from the Maryland State Department of Education

(McTighe and Lyman, 1988, page 21)

**Synthesis**

"What would you predict/infer from _______?"

"What ideas can you add to _______?"

"How would you create/design a new _______?"

"What might happen if you combined _______ with _______?"

"What solutions would you suggest for _______?"

**Evaluation**

"Do you agree _______?"

"What do you think about _______?"

"What is the most important _______?"

"Prioritize _______."

"How would you decide about _______?"

"What criteria would you use to asses _______?"

*Figure 2*

Question Set 1—What region of the U.S. is the "most important"?

1. Brainstorming: Name strengths and weaknesses of each region.
2. Prioritize the characteristics listed in your list of strengths and weaknesses according to how they rank in making a region "important."
3. Use your answers to numbers 1 and 2 to decide which two regions you think are the most important. Explain your choice.
4. Compare and contrast your top two regions.
5. Choose the one you think is *most* important. Explain your choice.
6. What priorities would have to change to move your number two region to the top?

Question Set 2—Will the U.S. ever elect a Black or other minority person as President?

1. Brainstorming: What factors might keep us from having a minority President?
2. What might happen to change those factors?
3. Describe some of the personal characteristics a minority person would need to have to get elected President.
4. Design a campaign for a minority candidate. What would be the issues to stress?
5. Predict what regions and segments of the country might support a minority candidate most strongly. Explain.
6. Do you think we will have a minority President in your lifetime? Explain your answer.

Question Set 3—What could increase Mississippi's average annual income?

1. Brainstorming: Why do Mississippians earn less on average than other Americans?
2. Compare and contrast Mississippi with a state with a high average annual income.
3. What do you think are the three most important reasons for Mississippi's low average annual income? Explain your choices.
4. What solutions would you suggest?
5. If you were Mississippi's governor, what would be the first thing you would do to solve this problem? Explain.
6. Governor, who would be helped by this action? Would it hurt anybody in your state? Anyone outside your state?

Question Set 4—In some of our major cities, almost half the young minority men and women do not have jobs. How can the problem of minority unemployment be solved?

1. Brainstorming: What factors keep minority youth from getting jobs?
2. Which factors are the same and which are different for white youth?
3. What are the three most important factors that keep minority youth unemployment high?
4. What solutions could you suggest?
5. If you were President of the U.S., what would be the first thing you would do to help solve the problem? Explain your answer.
6. Mr./Ms. President, predict who might oppose your idea and tell why they would.

Question Set 5—What could be done to improve living conditions in high density urban areas?

1. What are some of the problems of living in crowded cities?
2. What might be done to solve one group of problems of living in crowded cities?
3. Develop a plan based on the most promising solution you thought up in number 2.
4. What problems can you predict you might have with your plan?
5. Who might be hurt by your plan? How would it hurt them?
6. If your plan had been used for ten years, how would you test to see if it had worked?

*Figure 3*

Possible Responses: It would cost a lot of money to build new apartments and train the unemployed in construction. Unemployed drug addicts would have to learn to live without drugs before they could work for us. Would we have to tear something else down to build our apartments?

Question: Who might be hurt by your plan? How would it hurt them?
Possible Responses: Taxpayers, who would need to come up with a lot of money for the project, and people in neighborhoods where nothing is being done, who may feel they deserve similar programs.

Question. If your plan had been used for ten years, how would you test to see if it had worked?
Possible Responses. "The most important thing for me would be to see if the people were happier. I would just go around and ask them if they liked the apartments and whether life was better for them. The police could tell whether the crime rate and drug use had dropped and if traffic and smog were any better. One other thing I would look at would be to see if any other apartments like this had been built."

### Step 4: Discuss the Process

It's especially important to help students become aware of how to learn with databases and other information-based technologies. By examining the *process* involved, students gain a better understanding of how to explore and solve other problems. First begin by asking students, "How did we begin to think about the problem?" (Brainstorming.) How did we begin to organize the list of ideas? (Grouping similar items.) What were some of the other approaches used to explore the problem? (Prioritizing, exploring relationships, making predictions and judgments.) Was there one correct answer to the problem? Do complex problems ever have one correct answer? If there were a simple answer, wouldn't the problem have already been solved? Which is more important, the answer or the way you think about the problem?

### Step 5: Assign Individual or Small Group Assignments

Next, have students work individually or in small groups to explore

## Discussion Strategies from the Maryland State Department of Education

(McTighe and Lyman. 1988. pa )

- Provide at least three seconds of thinking time after a question and after a response.
- Allow individual thinking time, discussion with a partner, and then open up the class discussion.
- Ask follow-ups. "Why?" "Do you agree?" "Can you elaborate?" "Tell me more" "Can you give an example?"
- Withhold judgment. Respond to student answers in a non-evaluative fashion.
- Ask the class to summarize the point a student has made.
- Survey opinions "How many agree with the authors point of view?"
- Allow students to call on other students for responses.
- Require students to defend their reasoning against different points of view.
- Ask students to "unpack their thinking." "Describe how you arrived at your answer—think aloud."
- Call on students randomly—not just those with raised hands.
- Let students develop their own questions.

*Figure 4*

another problem. Ask them to follow the model used in the class discussion to generate answers to the questions. Answers can be presented in list or outline form, or as a more formal written assignment. Encourage students to use the computer database and other resource materials to gather information and test hypotheses and solutions. Your role as teacher is best served as a facilitator or process consultant. You should monitor students' progress and help them clarify their thinking and focus on how to best proceed. At the conclusion of the activity, discuss with students their solutions as well as the process involved. Help students to assimilate what they have learned and attempt to build upon this learning in future lessons on other topics.

### Conclusion

Leaders in all fields would agree that analysis, synthesis, and evaluation are critical skills for successful functioning in the information age. While computer databases offer an excellent medium for developing such skills, effective "off-line" teaching strategies are critical and often lacking. The lesson described in th s article, based on Taba's Inductive Thinking model, offers one set of strategies that enhances the teaching of higher order thinking skills with databases. Without such teaching strategies, instructional databases are unlikely to have a significant impact on students' abilities to organize information and solve problems.

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## COMPUTERS AND THE LANGUAGE ARTS

Edited by Lynne Anderson-Inman

# Writing with Word Processors for Remedial Students

*by*
*Susan B. Neuman and Catherine Cobb-Morocco*

> Student: I don't know what to write about. I hate school.
> Teacher: Why don't you write about why you hate school?
> Slowly the student writes: The reason I do not like school is because when I have to get to school early at 8:45 and get out at 2:45.
> Teacher: Why don't you like that?
> Student. I don't know. I just don't like school.
> Teacher. You must have a reason for not liking school. What's tough about getting to school early?
> Student: I have to wake up at 5:00 or 4:00.
> Teacher: Then tell me, "I have to wake up at. . . ."
> The student writes, "I have to get up at 4:00 or 5:30." That's all I want to write Mrs. F because that's all I can think of.

This dialogue illustrates the way many remedial students approach the writing process. They tend to regard writing as an unpleasant chore, a task to be completed as quickly as possible or not done at all. For remedial students who spend many hours per week in tutorial or resource room settings working on their reading and writing skills, the "out of ideas feeling" comes frequently (Johnston & Allington, 1985). By the time they reach fourth and fifth grade, most of these students are convinced they lack the ability to write and in many cases believe they have nothing to say.

An increasing number of teachers and researchers are exploring the use of word processors as writing tools for students with poor writing skills (Behrman, 1984; Daiute, 1985). The hope is that the computer will be a more engaging tool than the pencil, that it will cramp the hand less than conventional writing tools and make revision easier. Presumably, if students are more willing to write and are able to write and revise more easily, the overall quality of their written products will improve.

To learn more about how resource room teachers use word processing to improve the writing skills of remedial students, we have been conducting a two-year study of five elementary-level resource room teachers. Through observations and interviews, we have gathered data on the instructional interactions of these teachers with 14 remedial students: seven boys and seven girls. The students are from diverse socioeconomic and ethnic backgrounds and bring to the resource room varying degrees of difficulty with the writing process.

Analysis of the results from the first year of this study led to four conclusions about effective writing instruction for remedial students using the computer. These four conclusions are shared below, illustrated with examples and dialogue from participating classrooms.

### 1. Initial keyboarding and word processing skills should be taught separately from writing instruction.

Students need training in computer usage and word processing before being able to use the technology as a tool to write. The teachers in our study found this to be true in two areas. First, the students had to be familiar with the keyboard. Although it was not necessary that students learn to touch type, their skills in keyboarding needed to be sufficiently refined so that they no longer had to hunt and peck for letters—only peck. Five minutes of practice, two days a week using *Stickybear Type* helped students increase their typing speed to a rate more commensurate with the flow of their ideas (Neuman and Morocco, 1987). Second, the students needed some initial skills in word processing, such as use of the delete, insert, save, and print functions. Without these initial skills, attention tended to be drawn away from the writing task to matters related to the machine. Here is one example.

> Teacher: Last session you wrote about the foods you like to eat. I'd like you to finish that today.
> Kurt: I don't have to type this, do I?
> Teacher: Yes, you do.
> Kurt: This is going to take me years to do it. Can anyone type this for me?
> Teacher: No. You can type it for you.
> Kurt types "I cook turkey."
> Kurt: I'm through. Absolutely, totally.
> Teacher: Now you have to go to the transfer menu.
> Kurt: Oh, man.

We found that in settings where students had been given separate practice sessions to familiarize them with the keyboard, keyboarding fluency developed much more quickly than it did for students whose skills were simply allowed to evolve. Although some students were able to acquire keyboarding facility in the latter context, most were not. A few students who were still unable to locate keys quickly after several months evidenced some computer phobia—an extreme reluctance to write on the computer. One student would angrily call the computer "Stupid!" possibly attempting to project his own feelings of inadequacy onto the computer.

Word processing is not easy for elementary-level remedial students. It involves a number of operations that at first do not appear to make sense. For example, the dele function is difficult because it requires a student to position the cursor one letter beyond the actual letter he or she is trying to erase. Other functions, such as saving text, need to be taught explicitly so that students will develop confidence in their use of the machine. For instance, forgetting to save a file led one student to say: "I'm writing on the papers because I have to. . . . I put my things on that computer that day . . . I'm never going to touch that again."

The teacher's role as helper and troubleshooter is critical during this early stage. His or her ability to help students with some of the mechanics of word processing will allow young writers to continue to focus on the writing task. For example, when students become discouraged with the new writing tool, the sensitive teacher can help the writer perform the desired function, then acknowledge that the first stages of learning to write with a new tool are the most difficult.

### 2. Students should be taught strategies for generating and organizing their own ideas.

The most effective teachers in our study did not tell children what to write. Instead, they provided students with a context for discussion and helpful procedures or "hooks" for getting them started in the writing process. These procedures included both conversational approaches and cognitive strategies. Conversational approaches included such activities as joint brainstorming, having the student tell a story, or encouraging the student to recall personal experiences. Cognitive strategies provided students with new ways to gather and organize information. For example, when one student had difficulty describing the tea room in a story, "Tea at the Ritz," the teacher suggested that she draw a map of the room, showing what people would see as they walked in. The student then placed the map beside her at the computer and was able to compose the description.

The word processor was of assistance to remedial students in generating their own ideas for writing in several ways. For example, the computer encouraged students to take risks as they began to write. Because beginning attempts could be easily erased as the students thought of additional ideas, there was less hesitancy in getting started. In addition, use of word processing meant that students often began to compose sooner than before, i.e., prewriting and first draft attempts often merged during the writing sessions.

The teachers also developed a number of creative techniques to facilitate student planning on the computer, techniques which led to ideas for further writing. Using the computer for brainstorming was one of these techniques. In the following example the student was asked to brainstorm on the computer by writing whatever words came to mind. He slowly wrote two complete sentences, then apparently ran out of ideas.

Teacher: When you get stuck, just write "blank." The thing is, you can't stop writing.

Student: Yea, but I don't have nothing else to write about.

Teacher: Then you know what to do? (Stands over him and types "blank.") Tell me a word that you're thinking of in your head, any word.

Student: Autobiograpies (Teacher types this.)

Teacher: What does that make you think of?

Student: Working (Teacher types this.)

Teacher: Another word.

Student: Unnormal powers (When the student sees these words on the monitor, he comments:) I wish I could have unnormal powers.

Teacher: When you write, you can.

After several more minutes of discussion on "unnormal powers," the notes were printed out. On the next day, the student used these notes as the basis for writing about his own "unnormal powers."

The resource room teachers in this study found that there was a public quality about the computer's screen. Students' early ideas were accessible for teachers and other students to discuss because the writing was legible and available for all to see. The monitor also functioned as a neutral ground where students and teachers could brainstorm together, the resulting words and phrases all appearing as one activity. In addition, the teachers felt it was easier to interact with students about their writing when they were at the computer. The teachers were drawn to talking with the students as they wrote and provided encouragement to keep students thinking. Reading and rereading text on the screen became a primary way of maintaining the students' engagement in writing. It also enabled the teacher to praise the content of the text and to encourage expansion.

### 3. Students' attention should first be focused on composing their ideas, not editing their text.

Remedial students tend to be anxious

ut spelling and mechanics. They are often cerned about "saying it right." Unfortunately, paying so much attention to the mechanics of writing often makes it difficult for students to pay attention to what they want to say. The mechanical issues tend to draw these students away from what should be their major focus: generating and writing ideas. Here is a typical example:

Student: How do you spell "reason ?
Teacher: Think. REASON
Student: R-E-A-S-O-N?
Teacher: Good.
Student: I don't know what to write now.

The teachers who acknowledged spelling concerns but handled them quickly (usually by encouraging the students to use invented spelling) helped students maintain a high level of involvement in writing. This is not to suggest that these teachers ignored spelling accuracy. Rather, they assured students that spelling would be attended to at a later time. When students had completed their compositions, spelling checkers (*Bank Street Speller*, 1984) were used to help correct their work. In addition, students were encouraged to develop personal word files of frequently misspelled words to be used for later reference and study.

Too much emphasis on revision can also have negative effects on content. The word processor, with all its flexibility, makes editing and revising text particularly attractive. In fact, it may make the revision process too attractive. Our observations indicated that many students would begin to revise and edit their writing too early. This was unfortunate because it led some students to write short, technically correct pieces of writing which lacked spontaneity. For other students, the word processor's capacity for easy deletion resulted in a pattern of constantly generating and then erasing text.

Observations revealed that it was most effective for editing to be approached in two steps. After students had written their stories, they printed draft versions. The teachers and students then conferenced together, making corrections on their printed drafts. Following the conferences, students returned to the word processor to edit and publish final copies. In this way, mechanics and spelling issues were held in abeyance until students' ideas had been written down.

For example, an area in which this two-step approach to editing was found to be extremely helpful was in the teaching of sequencing. Remedial students often have difficulty sequencing their ideas into a logical order. Use of the move procedure on the word processor provided these teachers and students with a new remedial technique for this area of difficulty. First, students were encouraged to write down their ideas as the thoughts came to mind. While conferencing, the teacher would help each student specify which activities came first, second, third, etc. Students were then encouraged to organize the text sequentially by rearranging the sentences using the "move" procedure.

### 4. Students can be helped to manage their writing anxiety and lack of confidence.

The teachers who praised students' writing, verifying their role as authors, created a positive writing environment for those who might otherwise be anxious and insecure. Comments such as "That's so interesting" and "She is such a writer!" reflected the teachers' opinions that their students were capable of generating good writing. Students' willingness to engage in writing was very closely tied to having a warm and nonjudgmental person who responded with genuine interest to their ideas. This attitude enabled the students to feel that they had something of value to communicate to others.

This sense of achievement was also fostered by activities that allowed the students to "become like writers" (Smith, 1983). In one class, for example, the students each published a book of stories. These books were final versions of stories written on the computer. In addition to the stories, each book included an autobiography, a dedication, and a table of contents. The computer-written stories from another resource room were proudly hung on the bulletin board in the students' regular classroom. The word processor allowed students to produce work that was more professional looking and therefore more valued. One student, who was just beginning to feel successful as a writer, cheerfully exclaimed, "I wrote a great story. It is 57 lines long" While we know that sheer productivity does not indicate good writing, these comments reflect the student's positive attitude toward the writing task.

### Conclusions

This column has described four major

*Continued on page 61*

## From the Board

*Continued from page 5*

regarding the infusion of new technology, the better their chances will be of leading to successful use of that technology.

6. **Learn from business and industry.** As educators we should use computers to collect and analyze instructional data to enable us to make better decisions about future directions of educational process. In the area of testing alone, we can investigate the use of computer-adaptive testing and placement to better individualize instruction, or we can use microcomputer test analysis of criterion-referenced tests to help to determine the effectiveness of the course curriculum and instruction.

*[John Kline, ICCE Treasurer, Education Center Assistant Director, 203 E. Douglas, Ft. Wayne, IN 46802.]*

## Writing with Word Processors for Remedial Students

*Continued from page 47*

guidelines for helping remedial students learn to write with word processors. Our observations indicate that effective teachers were those who explicitly taught basic word processing and keyboarding skills, gave students strategies for generating their own ideas, encouraged students to focus their attention on composing rather than editing, and helped students manage their anxiety by encouraging and praising their ideas.

The word processor was used as a significant instructional resource by the five resource room teachers we observed. It allowed them to provide new opportunities for writing and to teach new strategies for revision. But the word processor's features alone did not facilitate improved writing. Rather, it was the teacher's approach that fostered effective use of the computer. Teachers who brought a working knowledge of the writing process to the instruction of their remedial students used the unique features of the word processor to enhance student learning and extend their repertoire of good writing skills.

*[Susan B. Neuman, College of Education, University of Lowell, One University Ave., Lowell, MA 01854; and Catherine Cobb-Morocco, Education Development Center, 55 Chapel St., Newton, MA 02160.]*

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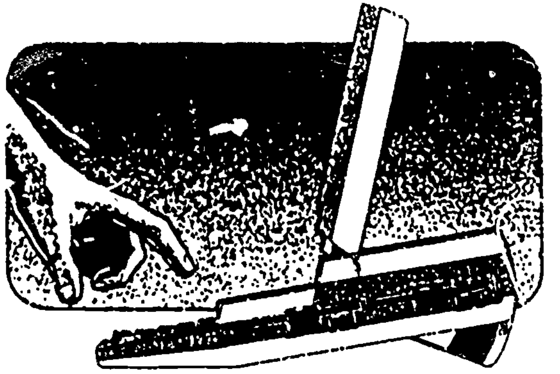
# The Computer As a Writing Tool

by
**Ellen Joslin**



*Ellen Joslin presents some excellent exercises for introducing the basic functions of word processors. To create a data disk of these exercises, use your word processor to type in each file and save it with the appropriate file name. You will need to make a copy of the data disk for each student.*

Computers are slowly but surely being integrated into the McCulloch Middle School language arts curriculum. All Highland Park seventh graders take a one-semester course in "Computer Literacy," where they are introduced to machine usage, word processors, spreadsheets, data bases, BASIC programming, etc. Our new language arts curriculum requires our eighth graders to use the computer as a tool, so they need to be especially proficient on the word processor.

Each fall the language arts teachers allow me two class periods to introduce word processing. In order to fit it all in, I've developed a set of exercises to present the "Seven Steps to Successful Word Processing." Each student buys a disk which contains the exercises for use with our word processor. As the school year passes, they store their compositions on their own disks.

On the old theory of:

1. Tell them what you are going to teach,
2. Teach it,
3. Tell them what they have learned,

we begin by loading a file called "Seven."

Seven Steps to Successful
Word Processing

1. Retrieve file
2. Delete text
3. Insert text
4. Save file
5. Print file
6. Move text
7. Composition and creation

*File name: "Seven"*

I run through this list, defining each of the terms briefly, then cover them thoroughly with the exercises.

Retrieval is the first and easiest skill to teach. After learning how to load a program, the class as a group loads the text file titled "Poem." The teacher explains that the students have on their disks a series of eight clues which, if correctly interpreted, will allow them to find *that which is lost*. Those who can retrieve those clues by following the appropriate directions will raise the Titanic.

Dear Friends:

I'm lost in the deep, far from light
But do not weep! Put it right.

I'll give you clues to find my site.
Write them down—make sure they're right.

Take my measure, use your mind,
And a treasure you will find!!

Signed,
??????

*File name: "Poem"*

CLUE 1:
Write the following letters on a piece of paper. They are clues to help you find that which is lost!

M I D

Now retrieve CLUE 2

*File name: "CLUE 1"*

CLUE 2:
Write the following letters on a piece of paper. They are clues to help you find that which is lost!

E N I

Retrieve CLUE 3

*File name: "CLUE 2"*

CLUE 3:
Write the following clue on a piece of paper. It will help you find that which is lost!

THE ? IS AN "A."

Retrieve CLUE 4

*File name: "CLUE 3"*

**CLUE 4:**
Write the following letters on a piece of paper. They are clues to help you find that which is lost!

I E A L E

Retrieve CLUE 5

*File name: "CLUE 4"*

**CLUE 5:**
On a piece of paper, write the sentence below. It's a clue to help you find that which is lost!

I'—/H—D———/—N/?/F—L—/C——L—D/
—IT—N——/F—N—/—E/IF/————/—A—I

Retrieve CLUE 6

*File name: "CLUE 5"*

**CLUE 6:**
Write the following letters on a sheet of paper. They are the clues to help you find that which is lost!

T A I C I D M Y

Retrieve CLUE 7

*File name: "CLUE 6"*

**CLUE 7:**
Write the following letters on a piece of paper. They are clues to help you find that which is lost!

O U C N

Retrieve CLUE 8

*File name: "CLUE 7"*

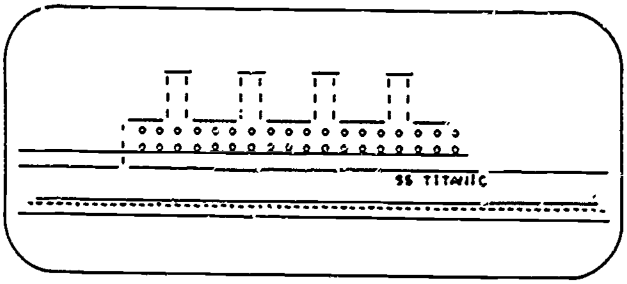
**CLUE 8:**
THIS IS YOUR LAST CLUE!

Put the letters you have written in the blank spaces in the sentence from CLUE 5. Be sure to put them in the order you uncovered them.

CLUE 3 is a special clue.

GOOD LUCK!

*File name: "CLUE 8"*



*After 75 years at the bottom of the sea, the Titanic has been found! File name: (Use the clues to find out!)*

The primary purpose of a word processor is to produce and edit text, which involves deletions and insertions. Since there is no penalty for revising on a word processor (no erasures, cross-outs or recopying), students are more willing to rewrite and perfect their work. To teach deletion techniques, direct the student to load "Max."

Direction: Move the cursor to the homonyms in this story. Delete the incorrect one. Only the homonym that fits the story should remain.

Max—the RODE/ROAD Warrior

In the DAZE/DAYS after the GREAT/GRATE war when civilization DYED/DIED and no one defended the WEEK/WEAK, THEIR/THERE came a REAL/REEL man. His name was Max. Max was not what he SEAMED/SEEMED to BEE/BE. As a man and BUOY/BOY, he followed the warrior WAY/WEIGH.

THEY'RE/THERE will never again be a hero such as he. THROUGH/THREW war and pestilence, along the desert RODES/ROADS, he fought the savages and ONE/WON. Each TAIL/TALE of daring, each FEET/FEAT of strength was told where good men MEAT/MEET.

Who'll RIGHT/WRITE the story of Max and his RAIN/REIGN as king of the highway? Who'll REED/READ and remember when Max defeated the barbarians?

*File name: "Max"*

The "Skeleton of a Story" is used to show the ease with which text can be inserted. Ideally, a printed copy of the activity (see page 19) is handed out as homework by the classroom teacher, then the students bring it, filled out, to the computer lab ready to make their insertions. When this activity is loaded from the disk, students are sure to note that the blanks have been replaced by parentheses. This was done to make the whole story fit on one screen.

**Skeleton of a Story**

Here are the "bare bones" of a story. By filling in the blanks ( ) in an interesting way, you can make any kind of story you want—mysterious, funny, sad, silly—it's up to you. Be sure to choose an interesting title. When you have finished your story, save the story on your disk and then make a printed (hard) copy of your story.

••••••••••••

I always knew my Aunt ( ) was a real ( ). Why, she ( ), and one day she ( ). But even I was surprised when she told us she planned to ( ). After all, she was ( ) years old, and this could be a ( ). We told her ( ) and begged her not to ( ), but nothing could ( ), and so, although we felt ( ), we watched her ( ).

( ) passed. No one heard a ( ) from Aunt ( ). We were beginning to wonder if ( ) when suddenly our aunt appeared. She had been ( ) and she seemed very ( ). ( )ly, she told us the whole ( ). It seemed that she had ( ) and ( ). Now she was ( ), and we all felt ( ). Since then, Aunt ( ) has never ( ). Instead, she spends her time ( ). What a ( ) she is!

*File name: "Skeleton"*

Students will want to save their versions of this story to their personal disks, and the teacher may want a printed (hard) copy for grading, so now is the time to introduce saving and printing text files. Encourage students to review their work on the computer screen and to make and save improvements before printing.

As the students print their work, you might take time to demonstrate some of the print options. Show them centering, left justification, right justification, center justification, and full justification. Printing is seductive; the story comes off the printer looking polished, and kids take pride in showing off their work.

Directions: AppleWriter II offers a way to move words and paragraphs very quickly. When the arrow in the top left corner of the screen is pointing left the words and paragraphs just deleted can be inserted in a new location. CONTROL D moves the arrow. CONTROL X moves a paragraph.

To correct the nursery rhyme below:

1. Place the cursor two spaces to the right of the word "go"
2. Type CTRL D
3. Type CTRL X
4. Move the cursor two spaces to the right of the word "went"
5. Type CTRL D
6. Type CTRL X
7. Put the rest of the lines of the rhyme in correct order.

Reminder: Because each line of a poem is followed by a RETURN, the computer treats each line as a paragraph. To move a single word type CTRL W.

The lamb was sure to go!
Its fleece was white as snow.
Mary had a little lamb.
Everywhere that Mary went,

Put the rhymes below in correct order.

To fetch a pail of water.
And Jill came tumbling after.
Jack and Jill went up the hill
Jack fell down and broke [illegible].

Along came a spider and sat down beside her,
Eating her curds and whey.
And frightened Miss Muffet away.
Little Miss Muffet sat on a Tuffet,

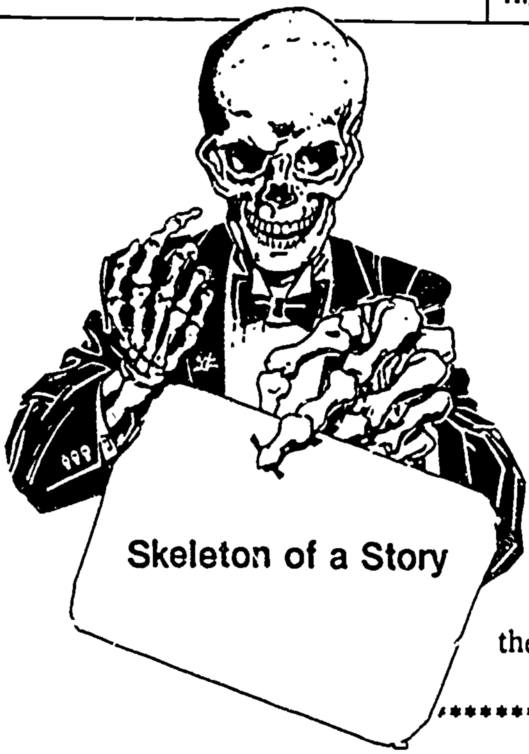
*File name: "Rhymes"*

Our final practice exercise shows the students how to move text. There is something exciting about pressing a key and watching a paragraph disappear. It's *aha!* time when the paragraph reappears in another location. Everyone knows nursery rhymes (if they don't, we write them on the blackboard), and it is fun sorting mixed-up ones into correct order.

After completing these exercises the students are ready to create their own composition as assigned by the language arts teacher. Writing assignments can be structured to meet the learning objectives of the language arts department.

Do word processors make better writers? Research indicates an improvement in writing ability. Whether or not this is always true, certainly there is more freedom to edit and more pride in a neatly printed final product.

*[Ellen Joslin, Computer Supervisor/Teacher, 9536 Park Highlands Drive, Highland Park I.S.D., Dallas, TX 75238.]*



Here are the "bare bones" of a story. By filling in the blanks in an interesting way, you can make any kind of story you want—mysterious, funny, sad, silly—it's up to you. Be sure to create an interesting title. When you have finished your story, save the story on your disk and then make a printed (hard) copy of your story.

*********

I always knew my Aunt __________ was a real __________. Why she ________________ ______, and one day she ____________. But even I was surprised when she told us she planned to ____________________. After all, she was __________ years old, and this could be a ______ ______. We told her that ____________________ and begged her not to __________, but nothing could __________. Therefore, although we felt __________, we watched her __________.

____________________ passed. No one heard a __________ from Aunt __________. We were beginning to wonder if ____________________ when suddenly our aunt appeared. She had been __________ and she seemed very __________. __________ly, she told us the whole __________. It seemed that she had __________ and __________. Now she was __________, and we all felt __________. Since then, Aunt __________ has never ______________. Instead, she spends her time ____________________. What a __________ she is!

*An ICCE Copy Me! Page*

*Developed by Ellen Joslin*

# 4.6

# SESSION 6: Prewriting Activities with Word Processing

## 4.6.1 Narrative Overview

The focus of this session is on developing compositions from specified topics. This is supported by activities relating to topic selection, clustering, and prompted writing.

**Preparation** for this session includes creating a sample of a *FrEdWriter* file that uses the "prompted writing" feature in that word processor. For details on how this is to be done, see the **Creating Prompts** handout, page 2 in the Handouts section.

In the **topic selection** activity, participants are encouraged to think creatively about topic generation. They are provided with two samples of lists of topics: **From Another Viewpoint** (which includes many examples of fantasy) and **I Remember** (which concentrates on memorable events and impressions). They should feel free to extend or modify the lists of topics they generated during the last session prior to choosing a topic.

The **prompted writing** activity offers participants a chance to view and modify a sample prompted writing file and create one of their own, if they wish. Teachers will find many uses for this *FrEdWriter* facility. Half the participants will be working with the trainer on the clustering exercise while the other half are working at the computers during this prompted writing activity. Thus, it might be well to find a participant who is already familiar with word processing (or, ideally, *FrEdWriter's* prompted-file utility) to assist participants with questions.

The **clustering** activity is a *prewriting* activity based on the work of Dr. Gabriele Lusser Rico. Many details and extensions to the activity are in her book, *Writing the Natural Way* (Tarcher/Houghton Mifflin, 1983). This activity is conducted entirely off the computer.

The basic idea of clustering is to expand upon a simple theme (expressed as a single word or a very short phrase) by creating a network of associations. The mechanics of doing this are very simple:

1. Write the theme in the center of a page and draw a circle around it. This makes it easy to identify the theme later on, when the page tends to get crowded.
2. Write around the theme any words or phrases that might be associated with the theme in a meaningful way. The idea is to explore as many associations as possible.
3. Work outward from the first level of clustering to create chains of association for the words or phrases that were inspired by the theme.
4. Stop when the associations seem to be exhausted or when the paper gets too crowded.
5. Analyze the network of associations for further links between the outer layers and the inner clusters. Many ideas for the content of the composition will occur to the writer at this point.

Details for conducting the exercise will be found in the instructional guide, **Conducting Clustering Activities**, which is largely based upon the second chapter of Dr. Rico's book.

The **free-writing** activity gives the participants a chance to use the clusters they have generated from topics to create their own compositions. Some may wish to use the time to turn their clusters into prompted files to serve as outlines for writing. Others may prefer to work from the clustering page they created. The participants should have the opportunity to print out their files, if this is possible in the facility you are using. If not, they should at least be able to view a demonstration of printing near the close of the session.

During the free-writing activity, try to locate a participant who would be willing to share his or her writing with the group during the next session. This is critical. You will need some sample text to work from to develop the notion of *conferencing,* a key feature of the next portion of the training. One very good idea is to offer to write a piece of your own; then when you finish conferring on the participant's writing, he or she can confer with you on yours, using the techniques you will have demonstrated.

In the session debriefing, concentrate on drawing out from the participants their initial impressions of using the word processor as a tool for composition. Some may express strong reservations about doing first drafts on the computer, electing instead to do them by hand and type them in later. This is a common response to composition using the word processor. In time, people usually become accustomed to and comfortable with using the computer for all stages of the writing process. However, some people need the personal interaction with their writing that comes from holding the pencil and working directly on the paper. This is a topic worth exploring with your participants.

There is quite a difference between composing at a word processor keyboard and composing with pencil and paper. Even if a person has quite good keyboarding skills, it generally takes quite a bit of learning time to become comfortable composing at the keyboard. Thus, you should expect that many participants will find that it initially seems easier to compose using pencil and paper, to produce a first draft, and then key it into a computer.

However, there are distinct advantages to becoming comfortable at composing at a keyboard. For most people, it is well worth the time it takes to become a reasonably good typist and to learn to use a word processor. This may be particularly true with grade school students, who face many years of further schooling and a lifetime of opportunity to profit from being able to make full use of word processing facilities.

## 4.6.2 Script

In this session, the participants will work with the lists topics they developed during the last session to select one which they will actually develop into a composition. Once they have made their selection, they will learn a method for expanding the topic through the use of a technique called *clustering*. They will also learn how to create *prompted writing files* with the special facilities that exist in the *FrEdWriter* program. Finally, they will get an opportunity to begin writing their compositions.

**Topics**

Process Writing — Idea-gathering and free-writing activities.

**Objectives**

- Participants will select a theme to develop.
- Participants will develop a cluster of thematic ideas for use in their compositions.
- Participants will work with and expand a prompted file.
- Participants will being writing a composition with *FrEdWriter*.

**Materials**

*Software:* *FrEdWriter, Prompted FrEdWriter File.*

*Handouts:* **From Another Viewpoint..., I Remember, Creating Prompts, *FrEdWriter* Prompts Guide Sheet, Clustering Exercise, *FrEdWriter* Print Options.**

*Other:* Sheets of unlined paper, pencils

**Preparation**

- Pre-load *FrEdWriter* and the *Prompted FrEdWriter File.*
- As the participants enter, have them save the *Prompted FrEdWriter File* to their own disks by following the directions on the *FrEdWriter* **Prompts Guide Sheet.**

**Activity**
10 Minutes

**Topic selection with *FrEdWriter***

- Using the *From Another Viewpoint* and *I Remember* handouts as guides, discuss with the participants the different styles of creating and choosing topics.
- Direct the participants to select one of the topics they have created or seen.

**Debrief**
10 Minutes

- What was your topic selection process?
- What internal process were you using to choose a topic?
- What applications can be made to other areas of the curriculum?
- What can you do to help students develop their own topics?
- Why is it important to select your own topic? (Relate this to the Ownership part of the definition of a problem.

**Activities**
50 Minutes

**Prompted Writing/Clustering activities**

- Make sure all computers are still loaded with the file "Prompts".
- Group orientation to using the prompted file (refer to the **Creating Prompts** and ***FrEdWriter* Prompts Guide Sheet**):
  a. What the prompts are for.
  b. How to use them.
- Split the group into two subgroups. *Group 1* will work with the prompted file on the computers, using **Creating Prompts** as a guide. *Group* 2 works on a clustering activity with the trainer, using the **Clustering Exercise** handout as a resource.
- After about 25 minutes, switch groups. (It would be appropriate for the 10 minute break to occur at this time.)

**Break**
10 Minutes

Most likely you will want to do this in the middle of the previous 55 minute activity.

**Debrief**
10 Minutes

After exploring the separate topics of prompts and clustering, try to draw out any ideas the participants may have about combining the two.

**Activity**
20 Minutes

**Free-writing with *FrEdWriter***

- The participants now get time to expand their topics into compositions.
- During this time, circulate among the participants, ready to answer any mechanical questions about working with *FrEdWriter*.
- Find one participant who will be willing to serve as a conferee for the next session.
- Remind the participants to save their files.

**Debrief**
10 Minutes

Draw out the participants' reactions to working with the word processor as an instrument for composition.

## 4.6.3 Timeline

| | |
|---|---|
| **0:00 — 0:10** | Topic Selection using *FrEdWriter* prompted file. |
| **0:10 — 0:20** | Debriefing |
| **0:20 — 1:10** | Prompted Writing / Clustering (rotating activities, about 25 minutes each). You may want to have the 10 minute break midway through this activity. |
| **1:10 — 1:20** | Break (if it wasn't done during the middle of the previous activity). |
| **1:20 — 1:30** | Debrief the Prompted Writing and Clustering activities. |
| **1:30 — 1:50** | Free-writing with *FrEdWriter*. |
| **1:50 — 2:00** | Session debriefing. |

## 4.6.4 Handouts

The pages of this section contain handouts needed in Session 6. The facilitator may find it useful to make some of these into overhead projector foils for use during the inservice.

**Index to Handouts**

# Creating Prompts With *FrEdWriter*

The purpose of this sheet is to give you some help setting up a prompt file to use with your students. Most of the information was taken directly from the documentation in Doc.D on your *FrEdWriter* disk. In your spare time, you might want to take a look at the different documents on your disk. There are some nice tips and useful information. It's easiest to get a printed copy of the documentation and read it later. A warning: *FrEdWriter's* documentation is *voluminous*. It may be best to have one person at your school print it out and then photocopy sets of the documentation for whoever needs it. Generally speaking, it is cheaper to use a photocopier than the type of computer printer available on most microcomputers.

Prompted writing is a special feature of *FrEdwriter* which lets you give on-screen prompts, or instructions, to students for guided writing activities. The prompt boxes are locked to prevent students from writing inside them. After responding to a prompt box, the student uses the Down-Arrow to move the cursor to the next prompt box and writes according to the instructions there.

When the student's finished work is printed, the prompts will not appear unless you change that option in the <P>rint mode. The prompts can also quickly (and permanently) be removed from the edit space, so that the rest of the file will be more condensed and thus easier to read.

## STEPS TO CONSTRUCT A PROMPT BOX

| | | |
|---|---|---|
| 1. | <Open Apple>-P | Enters Prompt box mode |
| 2. | <Open Apple>-A | Prints top line |
| 3. | <Return> | Jumps to next line and prints side line |
| 4. | Enter your prompt | |
| 5. | <Open Apple>-Z | Enters bottom line, exits prompt mode |

*NOTE:* <Open Apple> is a key that you use just like the <control> key. Hold it down while you are pressing the other (usually a letter) key. The <Open Apple> key is directly to the left of the space bar. It has the outline of an apple on it.

## NOTES ON PROMPT MODE

To **Edit, Delete** or **Insert** text in existing boxes

1. <Open Apple>-P
2. Move the cursor to do editing
3. <Open Apple>-P

Two ways to see text without prompts

1. Hidden prompts
    <P>rint mode
        Print Prompts...................NO
        Print Destination............Screen or Printer

2. Permanently delete Prompts from text
    <Open Apple>-P
    <Open-Apple>-R
    Respond Y to "Are You sure?" prompt
    Cursor will appear at the top of the file

### PLANNING PROMPTS

The best prompts are planned ahead of time. Before using prompts with an entire class, test the prompt on a sample student. This can save you lots of confusion with the entire class.

### HELPFUL STANDARDIZATION

The last prompt box could have the PRESS CONTROL-B message to remind students to return to the <B>eginning of the file.

The first prompt boxes could contain directions such as USE THE ARROW KEY TO ADVANCE, DON'T USE THE RETURN KEY, directions for the heading or whatever else you would like to include such as "Don't forget to include your name," or " Be sure to brush your teeth tonight."

Prompts should be constructed with <W>idth set to 38. (Or just start *FrEdWriter* in 40 column mode) They look better on the screen and can then be used with both 40 and 80 column monitors.

# *FrEdWriter* Prompts - GUIDE SHEET

Most of the directions you need are in the first prompt box of the *FrEdWriter* Prompt file. However, when you are finished, there are a few things you need to do just to "clean house."

1. Follow the directions on a previous handout to **SAVE** your file to your diskette.
2. Press <control>-N to **NEW** (erase) memory. (Press "Y" when asked if you really want to erase.)
3. Press <control>-L to **LOAD.**
4. Type the name Prompts (*Note*: Capital P and the rest lower case.)
5. Press <control>-B to go to the **BEGINNING.**
6. Remove your diskette, smile and leave to make room for the next person.

# Saving The Prompted File

**To save the prompted file that you see on the screen do the following things:**

1. Insert your data disk into the disk drive.
2. Use the **CTRL - S** command to save the file. Press the **Right-Arrow** key to move the cursor past the end of the title of the file which is currently called ***Prompts.*** Press **<return>.**
3. The file will be saved on the data disk in the disk drive. When the save is finished the beginning of the prompted file will appear on the screen. Take out your data disk.

# From Another Viewpoint...

Try writing a brief story from one of these unusual points of view, or develop your own theme along these lines:

What a picture sees as it hangs from your wall.

What your mirror would say if it could talk.

Drinking a glass of water - from the water's vantage point.

How a computer feels about working in a school.

The autobiography of a statue or painting.

Tales of a classroom blackboard.

What the rails told the golden spike when America's first transcontinental railroad was completed.

What a shipwreck might whisper.

Tall tales that skyscrapers tell to one another on windy days.

Eavesdropping on the conversation of books after the library is closed.

An argument between a dentist's drill and a molar.

What your telephone thinks of a typical day at your house. (Remember: it can hear *everything*.)

A dialogue between your left and right shoes.

How your television feels about what it is showing you.

The tragic love of a tree for a telephone pole.

How an old road feels about being repaved.

# I Remember

Topic selection writing from a source of personal memory such as:
Six small puppies snuggled under the stairs.
Small flowers with frost on them.
A warm fire and a soft rug.
The roar of a waterfall.
My child's first cry.
Rafting on a river.
The last time I was late.
Fish splashing by the shore.
Squirrels running in the trees.
Telling stories around the campfire.
When I remembered what I'd forgotten.
An encounter with a storybook character.
The first time my car went out of control.
Moonlight glistening on bare skin by the pool.
What happened when I couldn't remember his/her name.

(Write your own topic ideas on the lines below)

# Clustering Exercise

Here are some words and phrases around which clusters may be built. There is nothing special about them; they were chosen at random from a dictionary, a thesaurus, bits of conversation, and radio programs. If none of them appeal to you, add a few of your own.

Choose one of these and create your own cluster from it.

RELEASE

DUST

PARTLY SUNNY

SILENCE

LEFT UNDONE

LICENSE

STORMY WEATHER

RUNNING

PUDDLE-JUMPING

WINNING

INVITATION

________________

________________

________________

________________

# Some Options To Print A File

After you have loaded *FrEdWriter* and have typed in some text you will want to save your file and then perhaps print it out.

## To print your file.

Make sure the printer is turned on and is connected to your computer. Press and hold down the **Control** key and then press the **P** key. Release both keys. The Print Options screen appears. Look at the options on the screen and see if you want to change anything. Use the **Up-Arrow** or **Down-Arrow** keys to highlight any option you want to change. The options are:

1. **Print This Document** - This means the current choices for options are acceptable. Press **<return>** and printing should start.

2. **Line Spacing** - The default value is single spacing. To change the value to double line spacing, highlight **Line Spacing** and press **<return>.** Highlighting Line Spacing and pressing Return acts as a toggle between single and double line spacing.

3. **Left Margin** - How far from the left edge of the paper to start printing. The default is 5 letters from the left. To change the value, highlight **Left Margin** and press **<return>**. At the bottom of the screen you are told the current Left Margin setting and are asked to **enter a new value**. Do so and press **<return>**.

4. **Page Length** - How many lines do you want to print on a page? The default is 66 lines. To change the value, highlight **Page Length** and press **<return>**. The current value of Page Length is shown and you are asked to **enter a new value**. Do so and press **<return>**.

5. **Top & Bottom Margins** - How far from the top of the page to start printing. The default is 10 lines. To change the value, highlight **Top & Bottom Margins** and press **<return>**. The current value is displayed of both the top and bottom margins and you are asked to **enter a new value**. Do so and press **<return>**.

6. **Form Feed** - Tells the printer to go to the top of a new page after the number of lines specified in Page Length. The default value is Yes. You normally don't need to change this.

7. **Line Feed** - Tells the printer to go to a new line each time a carriage return is found. The default value is No. You normally don't need to change this.

8. **First Page Number** - Tells you the number that will be put at the top of the first page. The default page is 1. Normally this value is not changed unless you are printing only a part of a multi-page document. To change the value, highlight **First Page Number** and press **<return>**. The current default value is shown and you are asked to **enter a new number**. Do so and press **<return>.**

9. **Print Pages** - Tells the printer which pages of a multi-page document to print. The default value is ALL. To change the value, highlight **Print Pages** and press **<return>**. You are asked "First Page To Print:". **Enter a page number** and press **<return>**. You are asked "Last Page To Print:". **Enter a page number** and press **<return>**. If you want to print the entire document, when you are asked "First Page To Print:", type in ALL and press **<return>**.

10. Print Prompts - When printing a prompted file you can either print the entire file complete with prompts, or you can print only your responses to the prompts in the file. If you want the entire file, then the answer to Print Prompts should be Yes. If you want only your reactions to the prompts in the file then the answer to Print Prompts should be No. To change the value, highlight **Print Prompts** and press **<return>**. This automatically changes the value.

11. Print Destination - Tells the print option where to print the document - either on the screen or on the printer. To change the destination of the printing, highlight **Print Destination** and press **<return>**. This automatically changes the value.

12. Top Line - Gives you the option of putting a header on every page. The default value is no header. To change the value, highlight **Top Line** and press **<return>**. At the bottom of the screen you are told "Type a New Top Line Below:. **Type in your header** exactly as you want it to appear and then press **<return>**.

# Conducting Clustering Activities

This **clustering** activity is a *prewriting* activity based on the work of Dr. Gabriele Lusser Rico. Many details and extensions to the activity are to be found in her book, *Writing the Natural Way* (Tarcher/Houghton Mifflin, 1983). This lesson is conducted entirely off the computer.

The basic idea of clustering is to expand upon a simple theme (expressed as a single word or a very short phrase) by creating a network of associations. The mechanics of doing this are very simple. Before we actually create our own clusters, let's examine some that have been created by others.

Examine the cluster on the theme, *A Rolling Stone Gathers No Moss*. Choose one "branch" and examine it, node by node. That is, think carefully about each of the nodes in the branch, what suggested the association, how one might elaborate on the association, and how the nodes are related. It can be difficult to guess the associations that are meaningful to the person who created this cluster, but can you imagine what they might be? Discuss the chain of associations you have examined with your activity partner. Don't hesitate to impose your own associations upon what you see and feel. If an interesting association occurs to you, add it to the chain and explain it briefly to your partner.

Now examine the cluster on *Letting Go*. Then read the brief essay that was generated from this cluster. Can you identify which branch or branches of the cluster this writer used in the essay? Discuss your observations with your partner.

Finally, try creating a cluster of your own. Look at the list of themes on the page titled **Clustering Exercise**. If any of these appeal to you, go ahead and work with it. If you would rather make up your own, that's fine too. Create your own cluster on a piece of blank paper by following these steps:

1. Write the theme in the center of a page, underline it and draw a circle around it. This makes it easy to identify the initial theme later on, when the page tends to get crowded.

2. Write around the theme any words or phrases that might be associated with the theme in a meaningful way. Circle each word or phrase and connect it with an arrow to the word or phrase that inspired it. The idea is to explore as many associations as possible.

3. Now work outward from the first level of clustering to create chains of association for the words or phrases that were inspired by the theme. You may find that you are developing long chains of single themes, each one leading to just one other. On the other hand, you may discover bursts of multiple associations from a small number of source words. You may even produce branches of both types on different areas of the same cluster. Any of these will give you good source material for your writing.

4. Stop when the associations seem to be exhausted or when the paper gets too crowded.

5. Analyze the network of associations for further links between the outer layers and the inner clusters. Many ideas for the content of the composition will occur to the writer at this point. If you have some, jot them down on the bottom of the page or on the back of the paper. If you feel "stalled", share your cluster with your partner, who may be able to help you find associations that are not obvious to you.

Now consider for a few moments how you will proceed to write. Will you choose only one chain? Will you try to develop several ideas that you find in different chains? If you compare two or more chains, do they invite interestingly different views of the same theme? Discuss these ideas with your partner.

Now, ask yourself two questions:

- Are you ready to write?
- Do you feel an *urge* to translate your ideas into text?

If your answer to either of these questions is affirmative, the clustering exercise has succeeded.

# Working with *FrEdWriter* Prompts

1. Insert the *FrEdWriter* disk into the drive and close the drive door.

2. Turn on the computer.

3. When the disk drive stops, choose Item 2 (Start *FrEdWriter*) from the menu by pressing 2.

4. Now press 4 so that the computer will display a text screen that is 40 columns wide. (It is possible to use the 80-column mode, but this exercise works better with 40.)

5. When the drive stops, press **Return** three (3) times. (You may wish to read each new screen as it appears, if you have never seen *FrEdWriter* before.)

6. You now have a blank *FrEdWriter* screen before you. If you wanted to use *FrEdWriter* to write something, you could simply start typing now in much the same way you would on an ordinary typewriter. However, you are going to work with an existing file called **PROMPT**. There are two versions of the **PROMPT** file on the other side of this disk. Take the disk out of the drive, turn it over, put it back in the drive and close the drive door.

7. Look on the keyboard for the key marked **Control**. You'll find it on the left side of the keyboard. This is a special key that is used in combination with other keys to send control messages to *FrEdWriter*. With your left hand, press the **Control** key and hold it down. While you are holding down the **Control** key, press the L key with your right hand.

8. Look at the bottom of the screen. By pressing **Control-L**, you have sent a message to *FrEdWriter* that you wish to load a file from the disk. If you are in Group 1, type **prompt1** (with *no* spaces) and press **Return**. If you are in Group 2, type **prompt2** (with *no* spaces) and press **Return**.

9. The drive will spin for a few seconds. Then you will see some text appear on the screen. This is the file that you have loaded from the disk. The *cursor* (a blinking square) appears below the last section of text. The cursor indicates the point at which the text that you type will appear. It is now at the "bottom" (end) of the file, and you need to place it at the beginning. Move the cursor to the beginning of the file by pressing the **Up-Arrow** key at the lower-right corner of the keyboard. As the cursor moves through the boxes, you will hear a clicking sound from the computer. This sound indicates that the cursor is moving through a *prompt box*. Keep holding down the **Up-Arrow** key until the cursor stops moving. When it stops, you will be at the "top" (beginning) of the file.

10. Read the directions in the first prompt box. You will use these prompts to write a descriptive paragraph about a favorite place of yours. Use the **Down-Arrow** key (right next to the **Up-Arrow**) to move the cursor below the *second* box (the one that begins COPY AND COMPLETE...).

11. Read the directions in the box that is above the cursor. Follow the directions by typing a sentence that will serve as a topic for what you will write. You will not have to press the **Return** key when you get to the edge of the page; the computer will move the cursor for you automatically when it runs out of space on the right side of the screen.

12. Move the cursor below the next box and type another sentence (or several sentences).

13. Repeat Step 12 until you have written something under every box.

14. Of course, what you have written does not look much like a paragraph with all those prompt boxes in the way. You can remove them by pressing **Control-P**. This sends a message to *FrEdWriter* that you want to print what you have written. Rather than printing your paragraph on a printer, you can "print" it onto the computer screen. Press the **Down-Arrow** key ten (10) times. This will highlight the **Print Destination** option. Now pres **Return**. Notice that the **Print Destination** has changed from **Printer** to **Screen.**

15. Notice that the **PRINT THIS DOCUMENT** line is highlighted again. You can print your paragraph onto the screen by pressing **Return** now.

16. Once your paragraph is printed, you can return to the prompted screen by pressing the **Escape** key. (It's marked **Esc**, and you will find it at the upper right-hand corner of the keyboard.)

17. If you have time, look at the guide sheet titled **NOTES ON PROMPT MODE**. It will show you how to make change in the text that is inside the prompt boxes. You may want to add some prompts of your own; just follow the directions on the guide sheet titled **Creating Prompts with *FrEdWriter*.**

18. When you have finished, save your file by following the directions under **Saving the Prompted File** on the guide sheet titled *FrEdWriter* **Prompts - GUIDE SHEET**. Take out the disk and turn off the computer.

# Beyond Merlin and His Magic Staff

by
Susan Whisenand

*The following article is excerpted from a packet of activities designed for use with FrEdWriter, a public domain word processing program.*

Computers process not only words, but thoughts and ideas in ways that seem almost magical. Paragraphs, sentences and words shift, move disappear and reappear with a rapidity that is astounding to the human mind. Magical though it seems, it is within the power of the magician, the writer, to bring about tricks that would make old Merlin stand in awe.

## In Search of Young Merlins

Merlin spent many hours in caves, creating mysterious effects and studying ancient tomes. Today that experience can be compared to prewriting as a young learner takes the first steps in the quest to discover where the computer will prove most important in the writing process. If the writing process is examined with the focus on the effective use of computers in writing, a system for creating young Merlins with powerful magic can emerge.

### Computer Prewriting

Students make lists, brainstorm ideas, create sentences, and expand on concepts by drawing, painting, coloring, and etching onto the screen their thoughts. Files become recipes, eliciting divergent responses and expanding creativity.

Keyboarding is a problem for the novice typist, but if the expectation is not perfection, then the joy of discovery can develop. Fortunately, several good keyboarding programs are currently available that are appropriate for students at the fourth grade level or up. Ideas may dictated to adults, older students or better typists.

### Computer Writing

Using interesting ideas from journals and other sources, thoughts are entered into the computer Work developed from clusters or prompts begins to become a piece of writing. Text can be typed individually or with a partner or helper who knows how to type.

### Computer Responding

Now the true power of the young learner begins to emerge. With print-outs, cursor movement, flexibility of change, insertion and deletion, the computer invites the child to play around with old ideas to make them better. If changes are made that the writer doesn't like, out they go. If changes make the writing better, they can be saved permanently or at least until the child wishes to change them again. Young magicians meet and respond to each other's magic touches to the written piece, making suggestions for improvements which do not involve the painful task of rewriting the work over again in handwriting. Teachers and other adults are asked to make suggestions that children now want to hear, because they do want to make their work better and closer to the original purpose for writing.

### Computer Revision

The writer uses suggestions to make changes; text is moved around, and new ideas are added and/or eliminated. The writer strives for clarity of purpose in communicating his real intention or point of view. The cursor zips around, the delete, insert, and move functions come alive, and the piece begins to take on its final form.

### Computer Editing

Computer and human power combine to give the young writer a chance for excellence. Teachers, parents and fellow students provide assistance in pointing out spelling, grammatical and punctuation errors. Again the cursor flashes onto the scene and, obeying its young master, corrects all the mistakes, making the writing ready for publication. All children at this point deserve and need a human helper. It's hard to proofread at any age to find errors, especially if one doesn't know where to look.

### Computer Evaluation

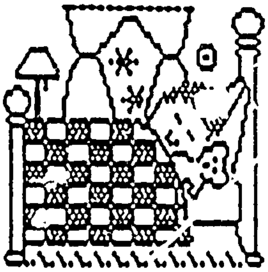
There are programs that analyze text for a variety of purposes. They look for certain types of words or phrase combinations. Some ask, through a prompt, for the student to enter appropriate text. The student is then required to respond to the text through a series of leading questions which may lead to rewriting. An excellent way to help students to evaluate their work is to have them print the work out double or triple spaced and to reread it for specific purposes, i.e., content, style, interest, spelling or grammar. The computer does not replace the human evaluator, it only acts as an assistant.

### Computer Publishing

Student work deserves recognition. Bulletin board displays, letters and stories sent over modems, anthologies, parent letters, school newspapers, poems, books, book fairs and oral

*Continued on page 32*

# DREAM FOCUS



All people need to dream. There are scientists who study dreams and can tell with special instruments how long and when people are dreaming. Think about your own dreams.

How long does it take you to fall asleep? ______________

_____________________________________________

Do you walk or move around in your sleep? __________

What kind of dreams do you have? ________________

_____________________________________________

Are your dreams in color or in black and white? ______

Do your dreams seem so real that when you wake up you are sure you've really had the experience? ______

Often dreams seem so real that it is hard to imagine that they really haven't happened. Take some time to think about a dream that you have had recently. Imagine that you are going to tell someone about your dream. Write about this dream as though you were telling it out loud. Below are some things to think about in dreams that will help you get started.

<u>People</u> <u>Colors</u> <u>Locations</u> <u>Sounds</u>

_____________________________________________

_____________________________________________

_____________________________________________

Beyond Merlin and His Magic Staff

*Continued from page 8*

readings provide opportunities for commending young writers. Works can be illustrated with borders from software such as *Print Shop* or other clip art programs.

## Getting at the Art of Writing

"Dream Focus" is an activity taken from *Beyond Merlin and His Magic Staff*. The activities in this packet are designed to promote writing as an integral part of the art and science of communication. It is hoped the student pages along with the suggestions for teachers will promote writing experiences involving cooperative learning and will reach across the curriculum. If students are freed from the belief that a finished piece of writing is done in 20 minutes and can understand that writing is a process and an art form, the purpose of this packet will be accomplished.

Background

In 1983, California AB 2190 provided initial funding for the Goleta Union School District to develop a model inservice program in writing and problem solving using computers.

The purpose of this project was to train teachers by using district teachers who had expertise in writing and problem solving due to their involvement with the South Coast Writing Project and the Tri County Math Project. Preparation for these staff development programs resulted in the development of model lesson ideas for using the computer in writing and problem solving. The activities given in *Beyond Merlin and His Magic Staff* focus on the writing process. For more information on the packet, contact Judy Connors, Goleta Union School District, 401 North Fairview Ave., Goleta, CA 93117.

A *FrEdWriter* data disk of prompts for each activity in *Beyond Merlin and His Magic Staff* is available from SOFTSWAP. *FrEdWriter* is a public domain word processing program that is also available from SOFTSWAP. For a SOFTSWAP catalog, send $1 to Bruce Fleury, 3225 Petunia Ct., San Diego, CA 92117. ○

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*[Susan Whisenand, Foothill School, 711 Ribera Drive, Santa Barbara, CA 93111.]*

## DREAM FOCUS

Objective:

Students will write a short story that is related to a personal dream.

Grade Level:

Fourth through sixth.

Prompted Writing File

*FrEdWriter* allows you to create prompted writing files. The following screen shots show how the file appears on the screen. Students use the up and down arrows to move around the boxed areas. They can insert their own writing between prompts and print their results with or without prompts.

The prompts are similar to the questions on the worksheet included for this activity. Each prompt is further designed to lead students logistically through the activity. Similar files can be created with any word processor. (See "Creating Writing Lessons with a Word Processor" in the Language Arts column in the February 1986 issue of *The Computing Teacher*.) In *FrEdWriter* the prompts are protected from being accidentally erased or altered.

The worksheet and the prompted writing file provide students with two tools for developing and organizing their thoughts. You can decide how to best use them given the amount and availability of your hardware.

Purpose:

Using dreams as a basis students will have the opportunity to share ideas and feelings that become strange and interesting stories.

Materials/Equipment:

Paper, pencils, story written by teacher that relates a childhood dream, computer, word processing program. Optional—Goleta *FrEdWriter* file disk with *Dream Focus* prompts.

Teaching Procedure:

Prewriting—directed lesson/30 minutes

1. Teacher tells students about a dream or dream fragment experienced as a child. Describe the feelings the dream evoked.
2. Ask students to think of dreams that they had and to share them in small groups of three people. Students without ideas will think of some once they hear what others have to say.
3. Have students not relating dreams take notes for the student who is telling about his dream. These notes should be given to the dream teller to help with writing the first draft of the dream story.
4. On their own students individually cluster words associated with their dream.

Writing—20 minutes

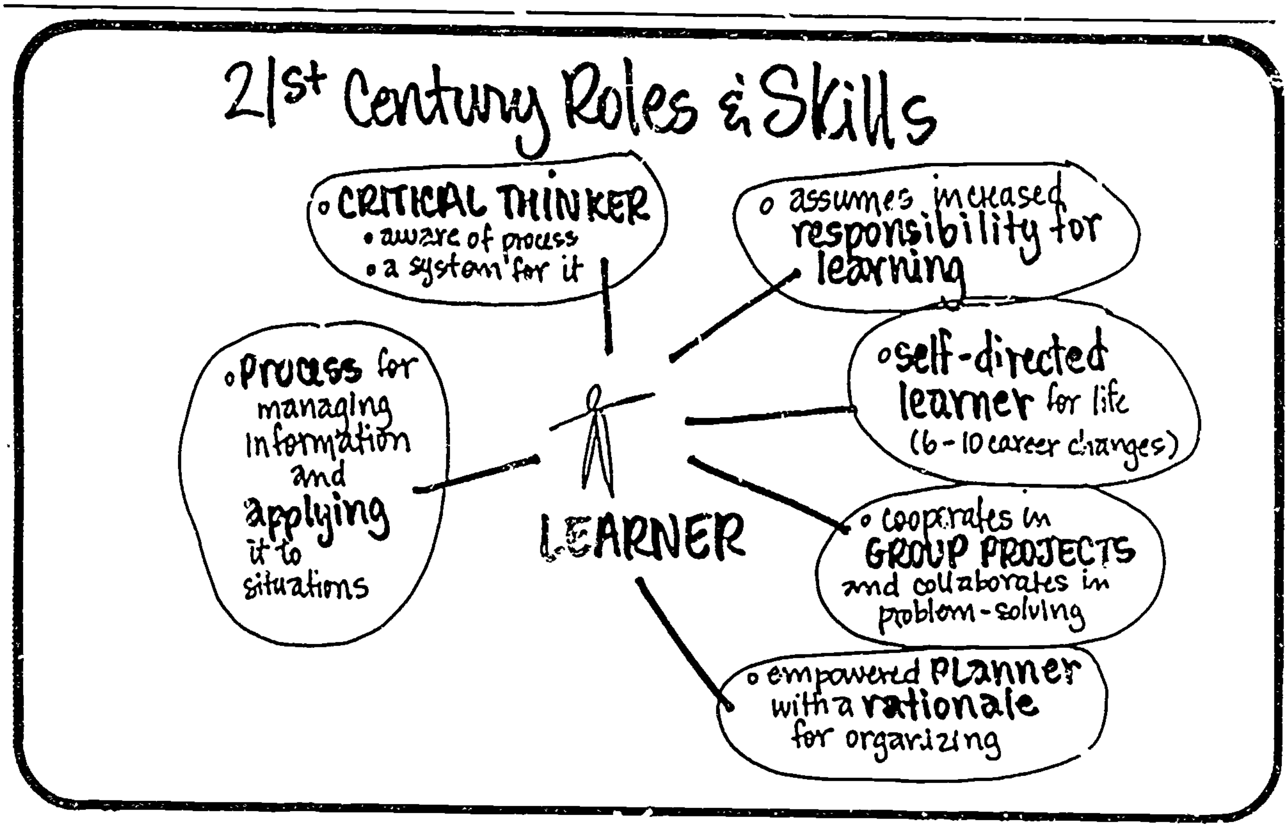
Using the notes from group members and individual clusters, students write up their dream. Encourage them to add details to make the dream vivid to other readers. The dream should be written as though it was being told out loud. Explain the use of first person as a style of writing. Type rough draft versions into the computer.

Responding—20 minutes

Have students read their dreams out loud to new groups of three. Ask students to give each other feedback as to what the dreams seem to mean and what is easy or hard to understand.

Revision to Publishing—Provide necessary sessions for students to revise and rewrite their stories. Let students work with partners making revisions on the computer. Publish with illustrations in class booklets. Display and encourage students to read the stories during independent reading periods.

*Continued on page 57*



SUZANNE BAILEY

**Beyond Merlin and His Magic Staff**
*Continued from page 32*

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••
••            DREAM FOCUS
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••
•• Use the down arrow key to move
•• through the activity.
••
•••••••••••••••••••••••••••••••••••••

•••••••••••••••••••••••••••••••••••••
••
•• Type your name below the prompt box.
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•••••••••••••••••••••••••••••••••••••

•••••••••••••••••••••••••••••••••••••
••
•• Type the date below the prompt box.
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•••••••••••••••••••••••••••••••••••••
••
•• As you read through the prompt,
•• you will be making notes below the
•• boxes to use as references when
•• you write your version of
••
••            DREAM FOCUS
••
•••••••••••••••••••••••••••••••••••••
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••
•• WHAT TIME DO YOU GO TO SLEEP AT
•• NIGHT? HOW MANY HOURS DO YOU
•• USUALLY SLEEP?
••
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•••••••••••••••••••••••••••••••••••••
••
•• HOW LONG DOES IT TAKE YOU TO FALL
•• ASLEEP?
••
•••••••••••••••••••••••••••••••••••••

•••••••••••••••••••••••••••••••••••••
••
•• DESCRIBE YOUR DREAM.  DO YOU DREAM
•• IN COLOR OR BLACK AND WHITE?
•• DO THE DREAMS SEEM SO REAL THAT WHEN
•• YOU WAKE UP IT ITS ALMOST LIKE YOU
•• REALLY HAD THE EXPERIENCE OF YOUR
•• DREAM?
••
•••••••••••••••••••••••••••••••••••••

•••••••••••••••••••••••••••••••••••••
••
•• Now imagine you are going to
•• tell someone about a dream.  Write
•• about this dream as though you were
•• telling it out loud.
••
•• START YOUR DREAM STORY BELOW THE
•• LINE.
••
•••••••••••••••••••••••••••••••••••••

•••••••••••••••••••••••••••••••••••••
••
•• Use Control 8 to go to the beginning
•• of the prompts.
••
•••••••••••••••••••••••••••••••••••••
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# 4.7
# SESSION 7: Process Writing Conferences and *Formula Vision*

## 4.7.1 Narrative Overview

This session contains two diverse experiences. One is a continuation of the study of the role of the word processor in the process writing model of composition instruction. The other is an exploration of the utility of a very novel piece of software called *Formula Vision* (developed by Gentleware, Inc. and now published by ISTE). Since the content of *Formula Vision* is plainly mathematical, this might seem a serious discontinuity. However, we believe the two activities to be compatible. Participants who are more comfortable with mathematics instruction than with language arts appreciate the break from the emphasis on composition in this portion of the training.

The instructions and ideas for conferencing that are embodied in the **Conferencing Guide** are taken almost directly from the work of Donald Graves, the author of *Writing: Teachers & Children at Work*. For further ideas about conferencing, consult the second section of that book, which deals with many matters in far greater detail than the **Conferencing Guide** does.

The fundamental idea to the process writing conference is to help the writer reflect on his own work in productive ways that will lead to improvement in writing. In the conference, the writer (the *conferee* ) reviews his or her work with a teacher or a peer (the *conferor* ), following a simple structure. The features of a quality writing conference include:

1. *Predictability*. The conferee should not be greatly surprised by the course of the conference. Lack of predictability in conferences may cause the writer to think that .
2. *Focus*. Only one or two features of the conferee's work should be dealt with at any one conference.
3. *Demonstration of solutions*. The conferor should *show* (not merely *tell* ) the conferee how a particular composition problem can be solved.
4. *Role reversibility* The conferee should feel free to ask questions, offer suggestions and demonstrate solutions of his or her own.
5. *Heightened semantic domain*. Both conferor and conferee should use the conference to practice the use of an appropriate level of language for discussing problems in composition.
6. *Playful structures*. Experimentation, discovery, and humor have their place in conferencing. The conference need not be a grim experience.

Graves calls these six elements the *scaffolding* (a term borrowed from the work of Jerome Bruner) upon which quality conferences are built. The course of the conference falls out from these. It follows a typical sequence:

1. The conferee reads the piece aloud.
2. The conferor makes one initial positive statement about the piece.

3. The conferor encourages the conferee to talk about the piece by asking short, open-ended questions like:
    "What is this about?"
    "How far along are you with this composition?"
    "What will you do next with this piece?"
    "What part do you like best?"
    "How did you happen to get on this subject?"
4. If the conferee clearly expresses a concern about some features of the composition, the conferor turns the attention of the conference to one or two of these. If the conferee expresses no concern, the conferor should tactfully point out some areas for improvement, if there is need.
5. The conferor *always* demonstrates ways of solving compositional problems, unless the conferee suggests them first.
6. The conference closes with suggestions regarding the point at which the next conference may be needed.

While the participants are conferencing, it is important to point out to them that one of the most widely-practiced features of the process writing model is the *peer conference,* in which students act as conferors to one another. Students learn the conferencing process mainly by example, through their experience as conferees with their teachers. Some more directive instruction may be helpful as well.

The role of the word processor in the writing conference is as a medium for including comments in the body of the text. Since any notes included in the body of a text may be easily deleted once the composition problem is solved, it is useful to type comments and suggestions directly into the text on the screen. It is also useful to have the entire composition printed out for conferencing, since it may be necessary to be able to reference substantial portions of the text that are widely separated from one another. This may be inconvenient to do on-screen, even if the word processor being used allows for two or more "windows" to be open on the text at once.

As for *Formula Vision,* this piece of software is essentially a one screen spreadsheet-like program that is specifically designed for setting up and solving multi-step problems based on math formulas. The origins of spreadsheets lie in business accounting practices. In essence, a spreadsheet is like a large sheet of paper divided into rows and columns, and an automatic calculating device that will do arithmetic on the rows and columns. The user of a spreadsheet builds a model (one might call it a business model, a mathematical model, or an accounting model) of a particular problem. Then the computer is used to carry out the computations needed to make use of the model. This is a very powerful idea.

Spreadsheets are such a powerful aid to modeling and problem solving that their use has gradually spread from the business world into other areas, and down into high school and junior high or middle school. At the lower grade levels the students have no business background and no understanding of accounting. Thus, direct instruction in use of a spreadsheet often seems rather artificial and forced. But the underlying ideas of modeling problems, and having the computer carry out the computations in the model, are an important part of problem solving and should be taught even at the grade school level.

*Formula Vision* is not a conventional spreadsheet. Rather, it is a spreadsheet-like program specifically designed for use in schools, and specifically designed to help teach some of the ideas of modeling and making use of a computer to carry out the computations in a model. Conventional spreadsheets allow only one piece of information to be stored in a cell, and that information can be either a **label** (that is, text specifying a name for the cell contents), a **value** (a literal number) or a **formula** (a calculation that may reference the content of other cells). *Formula Vision* differs from this in that it allows three pieces of information in each of its fifteen cells: a label, a value (either literal or a formula that will compute a value) and units in which the value is measured. *Formula Vision* is "smart" enough to detect proposed calculations that will result in mixed units (adding apples and oranges, for example), and it can combine units appropriately (dividing *feet* by *seconds* yields *feet-seconds* as resulting units. It can also track powers: multiply *miles* by *miles* and the result is stated in *miles*$^2$.

The task put before the participants is to learn some of *Formula Vision's* capabilities and determine its utility at their grade levels. Since the software clearly has application at grade levels above elementary, the immediate reaction of many teachers is that it is too sophisticated for their students. Upon reflection, though, many of them come to different conclusions. The developers of this software feel it is useful at the fifth grade and above. In many schools, the fifth grade is the first time students begin a serious study of formulas such as

AREA = LENGTH X WIDTH (area of a rectangle)

PERIMETER = 2 X LENGTH + 2 X WIDTH (perimeter of a rectangle)

AREA = SIDE X SIDE (area of a square)

PERIMETER = 4 X SIDE (perimeter of a square)

These are rather common formulas. But students consciously and unconsciously work with lots of other formulas. For example, there are 7 days in a week and (approximately) 365 days in a year. Thus we have

DAYS = 7 X WEEKS

DAYS = 365 X YEARS

*Formula Vision* is sold on a school site license basis. For $29.95 one gets a copy of the software, a manual, and the right to make unlimited copies of the software for use in one school. It runs on all Apple *II* computers, and an MS DOS version is also available.

## 4.7.2 Script

This session covers two diverse topics: the role of the word processor in process writing conferences and the usefulness of a novel piece of software, *Formula Vision,* in mathematics instruction. After viewing a demonstration of conferencing, the participants will conduct their own conferences at the computer workstations. In the mathematics activity, participants will explore the applicability of *Formula Vision* to the instructional content of elementary school mathematics.

**Themes**

Use of word processing in the process-writing conference.
Applicability of *Formula Vision* to elementary mathematics instruction.

**Objectives**

Participants will conduct writing conferences with one another using the word processor as a note-taking and idea-recording medium. Participants will relate their initial impressions of the utility of *Formula Vision* in the teaching of elementary mathematics.

**Materials**

| | |
|---|---|
| *Software:* | *FrEdWriter, Formula Vision.* |
| *Handouts:* | **Ideas for Conferencing,**<br>***Formula Vision:* A Self-Guided Tour.** |
| *Other:* | Printouts of participants' compositions |

**Preparation**

- Arrange for and set up a large-screen monitor and computer.
- As the participants enter, have them boot their copies of *FrEdWriter* on the computers.

**Activity**
10 Minutes

**Conferencing Demonstration I**

- Pair up with the participant who agreed to be the conference partner last week. Referring when necessary to the **Conferencing Guide,** conduct a process-writing conference using the cooperating participant's composition as source material.
- Be sure to demonstrate the utility of having both the screen-representation of the story and a hard-copy printout available during the conference.

**Debrief**
5 Minutes

- Draw out from the participants the features of conferencing that they saw demonstrated.
- Note any techniques that were *not* demonstrated and state why the ones demonstrated were chosen.

**Activity**
10 Minutes

**Conferencing Demonstration II**

- The cooperating participant confers with the trainer on a composition that the trainer has written.

**Debrief**
10 Minutes

- Debrief whole session with emphasis on the concepts of conferencing.

- Discuss when it is appropriate to concentrate on the text as it is represented on the computer screen and when it is better to work away from the computer.
- When working at the computer screen, is it better for the student to do the keyboarding, or for the teacher to do it?

**Activity**
30 Minutes

**Participants' Conferences**

- Direct the participants to pair up with a person with whom they feel comfortable talking about their writing.
- Each pair decides which of them will take the roles of conferor and conferee for the first round of conferences.
- The conferences begin using both the screen representation of the conferee's story and the hardcopy version of the story that they previously printed out.
- At about the 15 minute mark, the participants switch roles and the process begins again.
- Most likely you will want to have the 10 minute break occur at the "switch" time, in the middle of this activity.

**Debrief**
10 Minutes

- Discuss the usefulness of the **Conferencing Guide.**
- Prompt discussion of the conferencing process with questions like these:
  "How did you feel during the conference?"
  "How would the feeling of ownership affect what you had written?"
  "Can this process be adapted to the classroom?"
  "Could conferencing be used in areas of study other than creative writing?"

**Break**
10 Minutes

- Most likely have this in the middle of Participants Conferencing. Then conferencing discussion can continue during the break.

**Activity**
25 Minutes

***Formula Vision* Activity**

- Participants work in pairs at the computers to explore the capabilities of *Formula Vision* and its potential applicability to elementary mathematics instruction, using ***Formula Vision:* A Self-Guided Tour** as a guide sheet. They begin by loading the software.

**Debrief**
10 Minutes

- Prompt discussion with questions such as these:
  "What areas of mathematics instruction are best supported by a tool like *Formula Vision* ?"
  "What role might *Formula Vision* play in teaching students how to work with word problems, especially multi-step problems?"

## 4.7.3 Timeline

| | |
|---|---|
| **0:00 — 0:10** | Conferencing Demonstration I. |
| **0:10 — 0:15** | Debrief the demonstration of conferencing. |
| **0:15 — 0:25** | Conferencing Demonstration II. |
| **0:25 — 0:35** | Debrief the demonstration of conferencing. |
| **0:35 — 1:05** | Participant's Conferences; if participants seem willing, have the break in the middle of this activity, and have participants continue to conference with each other during the break. |
| **1:05 — 1:15** | Debriefing of participants conferencing with each other. |
| **1:15 — 1:25** | Break (if it hasn't already occurred). |
| **1:25 — 1:50** | *Formula Vision* activity. |
| **1:50 — 2:00** | Debrief possible uses of *Formula Vision* . |

## 4.7.4 Handouts

# Ideas for Conferencing

Encourage the writer to speak first.

Be predictable in order to be unpredictable.

Ask and wait, and make the question open ended.

Listen for what the writer has to tell you.

Look for potential

Follow (rather than lead) the writer.

Ask questions you think the writer can answer. You might want to try a "What if?" question. "What if you interchanged the order of these two paragraphs?" "What if you placed greater emphasis on this topic?"

Help the writer to focus.

Be aware that the writer has ownership in the writing. Encourage increased ownership.

Be aware that you are asking the writer to share personal and perhaps intimate ideas and feelings. Respect this sharing and intimacy.

# *Formula Vision:* A Self-Guided Tour

Your experience with *Formula Vision* will be broken into two parts. First you will go through a demonstration of the program then you will have a chance to experiment a bit.

## TO RUN THE DEMO

Begin by loading the software.

1. You should be looking at the title screen of *Formula Vision*, the one with the fancy graphic. Press <**spacebar**>.
2. You should now see the **OPTIONS MENU.** Press 3 to see a demo of *Formula Vision.*
3. Follow the directions given as you go through the demonstration sequence.
4. When you reach the last screen which begins with the sentence "It's time to actually play with *Formula Vision*!" you are almost through. Read the screen and press the **spacebar**.
5. The next screen asks you to turn the disk over. Please do so and press <**return**>.

## TO EXPERIMENT WITH BUILDING FORMULAS

Now you are presented with the (empty) FV spreadsheet. One line is dark; this line is the **cursor**. You can use the four Arrow keys to move the cursor around.

- Try moving the cursor about now. You will notice that as the cursor moves, several messages appear at the bottom of the screen. Play around a bit and figure out what the three different messages are.
- Place the cursor in the upper left corner cell, immediately below the word **tools**.
- Let's walk through a simple example. Consider this problem:

Henry's chicken pen is a rectangle ten feet long and eight feet wide. How many feet of fence wire does he need to go around the pen?

We will use the following formula for this problem:

PERIMETER = 2* LENGTH + 2*WIDTH

We can see that there are three "variables": LENGTH, WIDTH, AND PERIMETER. *A variable is a named quantity whose value can change.*

- The cursor should be in the cell located just below the word **Tools.** Move it there if necessary. Then type the word LENGTH (we are going to label the first cell LENGTH), and press the Down-Arrow once so the cursor is at the **value** position for the cell.
- Type the value 10 and then press the Down-Arrow once so the cursor is at the **units** position for the cell. (Remember, Henry's chicken coop is 10 feet long.)
- Now type FEET for the units for this cell, and the Down-Arrow key. You have completed the first cell. It is labeled LENGTH, it has a value of 10, and the units are feet.

- Now fill in the label (WIDTH), value (8) and units (FEET) for the second cell. Then use the Down-Arrow to position the cursor at the label line of the third cell.

- The label for the third cell is PERIMETER. Type it in and press the Down-Arrow key to position the cursor on the value line of the third cell. Type the following formula:

2*LENGTH + 2*WIDTH

- You will notice that whatever you type appears at the bottom of the screen. If you make any mistakes, use the **<delete>** key to erase them. When you have finished, press **<return>**.

- Instantly you will see that the PERIMETER's cell receives a new value. If you have been careful, the value will be 36 (which is 2*10 + 2*8). This value will be expressed as 36.000. (There are ways to control the number of decimal digits but we aren't going to mess with them now.)

- Notice also that the units line of the PERIMETER cell has been filled in for you.

- Now do a little experiment. Use the Up-Arrow key to move the cursor to the value line in the cell labeled LENGTH. Change the value to 12, and see what happens to the value in the PERIMETER cell.

- Use any time left to explore the program. You might want to try typing **<control>-?** at different places on the screen just to see what happens (Then you again you might not.) You may also type in some formulas of your own. For instance, what would have happened if the formula given in the example above was:

PERIMETER = LENGTH + LENGTH + WIDTH + WIDTH

- What happens if you move to a fourth cell, label it AREA, and type in the following formula for its value?

LENGTH * WIDTH

# 4.8
# SESSION 8: Revising and Editing with a Word Processor

## 4.8.1 Narrative Overview

In this, the final session, the focus is on both effective use of word-processing software and bringing closure to the series of training sessions. Time is spent on the revision/editing phase of process writing. Time is provided for debriefing the entire eight-session inservice and for some final assessment of the inservice series.

The **Revision/Editing** activity is based on one (or more) of the documents produced in the previous week by one (or more) of the participants. The idea here is to introduce to the participants the notion of editing one another's work, a critical activity in the type of classroom writing environment espoused by our model. You may find participants extremely reluctant to do this, since they are almost certainly unaccustomed to this practice. On the other hand, the conferencing experience of the last session may have given them a higher level of confidence in sharing their work with others. You will have to depend on the trust you have developed with them over the course of the training.

The idea of peer conferencing is very important. Most adults are uncomfortable in sharing their writing with their peers. It is not surprising, since they have had little experience in doing so. The introduction of peer conferencing into elementary schools may lead to a new generation of adults who feel comfortable in sharing their writing.

Another difficulty with this peer conferencing activity is that the actual revision possibilities with the text cannot be determined until the text is in hand after the close of Session 7. This need not be a great difficulty; if the participants have followed your directions and written with fluency, there will be minor errors aplenty and a variety of opportunities to practice block moves. **Under no circumstances should you make changes of any kind to the text submitted by the participants.** This might greatly undermine their willingness to share their work, since it is an unspoken way of telling them that their work is somehow not acceptable. The importance of absolute acceptance of the writer's product and the writer's control of that product cannot be overemphasized. By submitting their work for a shared editing experience, the participants are "letting go" of a personal and private product. Their generosity and good faith deserve universal respect.

It is helpful to the learning outcomes of this session if a xerox-type copier can be made available so that all the participants can share the results of the editing. It is particularly important for those who have submitted their work for group action. If no copier is available, the participants should receive copies of the work from this session at some point after the training, since it is an important element of closure for both this activity and for the relationships developed during the training.

The **Debriefing the CI$^3$ Model** may be viewed as optional, but it may be more important to your participants than you realize. The CI$^3$ training model follows standard practice in almost all respects, with one important exception: the avoidance of explicit specification of planned outcomes at the outset of training. In almost every activity we have carefully used a discovery-based model of instruction. We have immersed participants in an activity, and then "teased out" the purpose and goals of the activity through the debriefing. You may find this topic for lively discussion, since at least some of your participants are certain to have been trained in models of teaching that call emphatically for initial statement of objectives at the outset of each lesson. Moreover, some of your participants are likely already or may well become inservice providers in their own right. You would like them to understand and to make use of this type of discovery-based inservice presentation.

The **Letters to Ourselves** activity was developed during the training, and has proven itself to be useful. The activity presents participants with a chance to "make a promise to themselves" about what activities they intend to carry out in their own teaching situations as a result of this training. The participants write their "promises" on semi-form letters and seal them in envelopes addressed to themselves. The trainer collects them, promising to mail them to the participants at a future date. (We found 8-10 weeks to be a reasonable period between the collection and the mailing of these letters.)

The **End of Sessions Assessment** activity in the original training series was an opportunity to collect immediate data about the participants' immediate reaction to the entire series. You may find it useful to conduct follow-up studies later, as well.

It might be useful to build in some time for another closure activity. If you have had participants who have distinguished themselves in some way during the training, it might be a good idea to have some brief and light-hearted recognition of their accomplishments or vagaries. Certificates or other instruments of recognition are easily generated with programs like **Certificate Maker**, or modest trophies can be acquired from hobby and craft stores. While it is very important to keep the mirthful aspects of such awards within the bounds of kindness and good taste, it may be a good idea to turn much of the planning of such a ceremony over to a self-appointed committee of participants. You may find that such a group springs up of its own accord. You should also be prepared for some recognition of your own efforts, the nature of which, like the course of some elements and outcomes of this training series, is likely to be wholly unpredictable!

There are, of course, many ways to structure a series of inservice sessions. If participants have good access to computers in their schools, then it is reasonable to "require" implementation of the key inservice ideas during the inservice series. If there has been substantial implementation during the series, it is good to use the final session for reports on this implementation. What went well, and what didn't work as expected? What will participants do differently the next time they implement the ideas they have been learning? Remember, the ultimate purpose of the inservice series is to improve how teachers teach and the nature and quality of education being received by students. This can only occur if participants make use of their new knowledge and skills.

## 4.8.2 Script

In this final session, the participants close out their writing activities with a round of revision and editing, first of a common file (to practice editing a document similar to their own with similar characteristics) and then of their own work. The same rules of conferencing that applied in the previous session also apply here.

Time is also given in this session to allow the trainer to debrief the training model used throughout this series. By now the participants should be comfortable with the debriefing method, so they should be encouraged to identify the practices they have seen in repeated use. The trainer's role is to supervise and summarize the discussion.

The **Letters to Ourselves** activity is an indispensable component of the training. These letters are promises that participants make to themselves. You and any other trainers or supervisors who are with you in this session should write these letters at the same time the participants do. You might promise some special post-training support. The letters need not be shared; indeed, the activity may have better long-term effect if they remain private and secret

In addition to setting private goals, it is important to give the participants time to discuss how they can support one another's efforts. For example, participating teachers will certainly want to hear if the participating administrators are able to provide resources to allow such activities as those demonstrated during the sessions.

Trainers will almost certainly wish to collect some data about their performance and the content of the training at the close of this session, so time is provided. It may also be desirable to conclude with some sort of awards ceremony, every training series has its heroes and heroines, and this is the best time to recognize them and their contributions.

**Topics**

- Process Writing — revision and editing.
- Understanding the CI$^3$ Model of Training.
- Setting objectives for personal achievement.
- Planning for follow-through and continuation/extension of training through mutual support.
- Assessing the value of the training.

**Objectives**

- Participants will practice revision and editing of common and individual documents.
- Participants will discuss the merits and characteristics of the CI$^3$ Model of Training.
- Participants will set objectives for application of what they have learned from this training in their own classrooms.
- Participants will arrange for appropriate follow-through to assist one another in the transfer of training to their classrooms.
- Participants will complete an assessment of the training.

| | | |
|---|---|---|
| **Materials** | *Software:* | *FrEdWriter, common and individual story-file diskettes.* |
| | *Handouts:* | Letters to Ourselves. |
| | *Other:* | End of sessions assessment instrument. |

**Preparation**

- Pre-load *FrEdWriter* and the *common story-file diskette* on each computer.
- Have the participants save common story on the *common story-file diskette* to their own disks.

**Activity**
35 Minutes

**Revision-Editing**

- Participants confer on the common story. After discussing potential modifications, they use *FrEdWriter* functions (including, if applicable, the **Move** function) to change the text.
- During debriefing, note some *caveats* about block moves (such as destroying the chain of pronoun reference by moving the antecedent *below* the pronoun that refers to it, or unintentional disturbance of the story sequence). The use of a word processor makes it easy to introduce certain new types of errors into one's writings.

**Debrief**
25 Minutes

**The $CI^3$ Model:**

- Ask participants to identify *what they perceived to be* the key elements of $CI^3$ training. Review and summarize their comments in light of the content of the **$CI^3$ Training Model** paper in this notebook.
- Review the forms, logs, lesson plans, and other resources used in the training.
- Comment on methods for translating what was learned in training to classroom/lab practice.

**Break**
10 Minutes

- You may want to have better refreshments than usual, and extend the length of the break. Celebrate the end of the inservice sessions!

**Activity**
10-15 Minutes

**Letters to Ourselves**

- Using the **Letter to Myself** form (or not, if they choose), participants write a letter to themselves, describing some computer-related classroom activity that they will have completed or have in progress within the next 8-10 weeks. (If there are adequate computers and printers, encourage participants to compose their letters at the computers and print them out.) Participants seal the letters in envelopes which they address to themselves. Facilitator collects the letters and mails them in about 8-10 weeks.

**Follow-through and continuation planning**
20 Minutes

- Participants meet with others from their own schools to determine when they will next get together, how they will get whole school involvement, and how they can be supportive of each others efforts to implement the knowledge and skills they have acquired during the inservice series.

**End of Sessions Assessment**
15-20 Minutes

## 4.8.3 Timeline

| | |
|---|---|
| **0:00 — 0:35** | Hands-on, revision of writing activity. |
| **0:35 — 1:00** | Debriefing the CI$^3$ Model. (Cut this a little short if more time is needed for the break.) |
| **1:00 — 1:10** | Break. |
| **1:10 — 1:25** | Letters to Ourselves activity. Encourage participants to do this on the computers if adequate facilities exist. |
| **1:25 — 1:45** | Follow-through and continuation planning, with participants meeting with others from their own school. Stress the need for participants to continue to support each other. |
| **1:45 — 2:00** | End of Sessions Assessment. (This is conducted by the project evaluator if there is one.) |

## 4.8.4 Handouts

**Index to Handouts** **Page**

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# Letter To Ourselves

I, ______________________, promise to have completed the following computer-related activities in my classroom and/or lab by the time I receive this letter:

1. ______________________________________________

______________________________________________

______________________________________________

______________________________________________

2. ______________________________________________

______________________________________________

______________________________________________

______________________________________________

3. ______________________________________________

______________________________________________

______________________________________________

______________________________________________

4. ______________________________________________

______________________________________________

______________________________________________

______________________________________________

Sincerely,

Your Name ______________________

## COMPUTERS AND THE LANGUAGE ARTS

Edited by *Lynne Anderson-Inman*

# Microcomputers and the Improvement of Revision Skills

*by*

*Ernest Balajthy, Robert McKeveny and Lori Lacitignola*

One of the principal obstacles to effective revision is the drudgery involved in rewriting. The painful experience of rewriting by hand, or even retyping, discourages students from making the changes needed to improve their compositions. Students think of classroom revision as punishment for not catching "mistakes" the first time. As a result, students often develop a negative attitude toward revision.

Microcomputers have already begun to revolutionize writers' concepts of revision. Used as a tool to free students from the mechanical burden of recopying, word processing programs can provide a writing environment where revision is both encouraged and easily accomplished. This increased ease of editing has helped students develop a more positive attitude toward writing (Piper, 1983; Rodriguez, 1984).

There is also evidence to suggest that using word processing programs for writing and revision will affect the quality of student compositions. Instead of limiting their changes to the more superficial tasks of correcting misspellings or punctuation errors, students using word processors are often motivated to deal with higher level aspects of writing such as coherence and idea content. For example, in evaluating the effects of word processing software combined with training and teacher direction, Collier (1983) found increases in the number and complexity of operations students used to revise their compositions. Students using word processors made two-thirds more substitutions and reordered their sentences twice as often as students not using word processors.

### The Teacher's Role

It is important, however, for teachers to realize that simply making word processors available to students will not automatically improve their writing or revision skills. Unfortunately, writing instruction in some classes has been replaced by instruction in the mechanics of word processing—how to adjust margins or print double-space, for example. There is a clear failing in such instruction. Word processing must supplement writing instruction, not replace it. Teachers still need to teach students the writing process, guide their construction of compositions and provide feedback helpful for revision. Word processors are simply tools that facilitate student output and encourage students to experiment with language.

This experimentation with language, viewing written text as fluid rather than static, is the key concept instructors should communicate to students. When word processors were first introduced into classrooms, many teachers believed children would just naturally carry out such experimentation. After all, they reasoned, it is easy to change a sentence or paragraph to see how an alternate construction reads. It is easy to move paragraphs to see if a different organizational pattern might improve the composition. Since these revisions are easy to do, won't all students do them?

> *Unfortunately, writing instruction in some classes has been replaced by instruction in the mechanics of word processing.... Teachers still need to teach students the writing process....*

After several years researching the effects of word processors in the classroom, educators have found that students do not automatically engage in such in-depth experimentation (Hansen & Wilcox, 1984). While there is a statistically significant difference in the amount of writing and revision done by children using word processors than by those using pencils, this difference is often so small that it is of little *educational* significance. Instead of thoughtfully analyzing and revising composition structure, students using word processors will often limit their changes to superficial, mechanical alterations, unless taught by teachers to do more sophisticated revisions.

It is even possible that the computer itself inhibits experimentation. Perl (1980) noted that writers need to skim their text in order to maintain control over the evolution of ideas. And Harris (1985), in a study of six students using word processing, found that the small amount of text allowed on a monitor at one time seems to deter students from making large-scale organization changes. This finding is supported by observations that many students prefer using hard-copy printouts to analyze overall composition structure.

It seems clear that "the instructor cannot remain passive and let the students figure out for themselves how they will write on the machines" (Hansen & Wilcox, 1984, p. 3). Teachers must target their attention to at least two factors: modeling the revision process and monitoring student revisions.

**Modeling revision.** Teachers have long known the importance of modeling the thought processes involved in improving text by revision (Norton, 1985). This modeling should also occur in classes where word processors are used. For example, class discussion may focus on revisions by professional authors and show examples of the changes made between their first drafts and final copies. In addition, student compositions can be projected on a screen using an opaque projector, allowing the teacher to talk through the thought processes involved in improving early drafts.

*Teachers must target their attention to at least two factors: modeling the revision process and monitoring student revisions.*

Use of the word processor and large monitors (or projection systems) facilitates the modeling of revision strategies. Changes can be made in the text to illustrate specific types of revision, and the modified text can be neatly printed within seconds. Sections of text can be easily moved from one part of the composition to another and new paragraphs can be added as quickly as they can be typed into the computer.

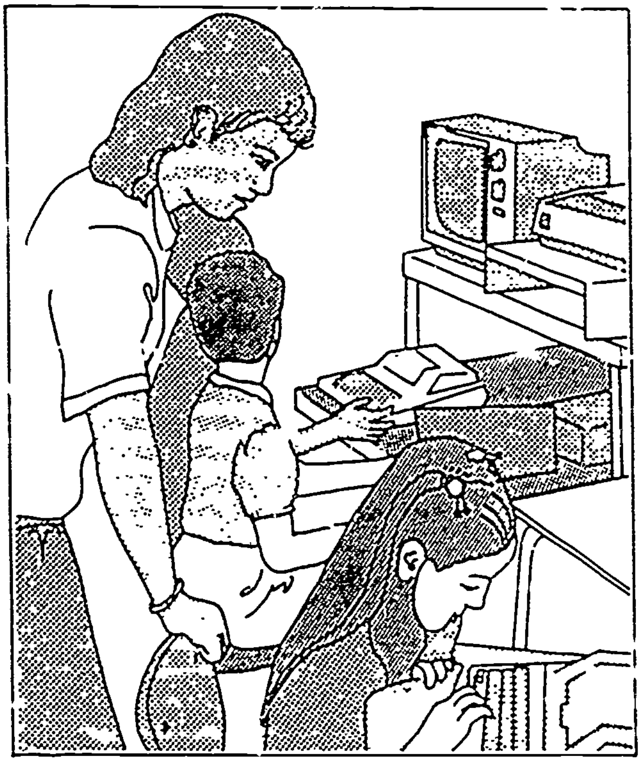
Teachers may carry out such modeling in small groups or whole-class situations. Copies of compositions to be discussed can be distributed for prior reading so that informed discussion takes place and students have immediate access to the entire composition. Students can also be assigned to work in pairs or small peer groups to provide feedback and suggestions to one another. In individual conferences with the teacher, students can bring their disks and make the suggested changes instantly.

**Monitoring revision.** Feedback on the appropriateness of revisions is also central to successful use of word processors. High school students and even at-risk college students often lack the language and conceptual sophistication to choose correctly from written alternatives. If students cannot tell which way of making a statement is more effective, they certainly cannot be expected to feel successful experimenting with language. Using a word processor will not suddenly confer linguistic or conceptual knowledge upon students. The teacher's critique and constant monitoring of production remains vital. Graves' (1976) work with the development of the writing process has shown that adults must work with students *during* writing rather than only *after* the written material has been produced.

Students can also play a role in monitoring the revision process. Assigning students to work in small groups to share disks and files encourages peer feedback. They can work together to organize and polish their written work, providing group evaluations of clarity and coherence as well as suggestions about usage (Schwartz, 1985). Groups also give writers a sense of audience, which leads to increased reading-writing integration within the classroom.

### Teaching Revision Skills

A variety of exercises can be created with word processors to encourage the kinds of revision students ought to employ as they write. Each exercise can be stored in a word processing file on disk. Instructors might want to keep a master disk of such exercises and have students make personal copies for themselves so the exercises can be completed without altering the original.



For example, one file might include paragraphs of expository text with the sentences typed in jumbled order. Students read the paragraphs and decide on an effective sentence order, then they rearrange the sentences using the word processor's MOVE commands. Another file might contain a sample composition that lacks connectives and transitions. Students can then insert these items to provide structural coherence to the composition. Pairing students to work on these exercises encourages discussion and promotes closer analysis. Final copies of the results can be printed and submitted to the instructor. Even better, the teacher can meet with the students and discuss results as they appear on the monitor, having the students make necessary corrections or changes on the spot.

Software designed to teach effective revision skills can also be used. *Electric Writing: Editing on Paper and Screen* is a double-sided disk of text files containing editing exercises. Skills on this disk include deleting letters and words, correcting misspelled words, ordering sentences in paragraphs, replacing words, inserting punctuation, combining sentences and ordering paragraphs. These files are designed for use with the *Bank Street Writer* or the *Milliken Word Processor*. In the exercises, the student helps an imaginary children's magazine editor. The editor gives hints on how to delete, insert, correct and move text, then the student follows those directions to edit article-like compositions. The program reinforces word processing and revision skills.

Students carry out tasks similar to the following: In an exercise deleting sentences that do not belong in the text, the student is given preliminary instruction on what makes a sentence essential or non-essential to a paragraph. The teacher then provides copies of an article containing errors of essential and non-essential sentences in paragraphs. Students are instructed to delete the nonessential sentences in each paragraph. After the students correct the errors on paper, they use the word processor to edit an identical file from the *Electric Writing* disk. Results can be printed on paper or submitted to the teacher for feedback on the disk.

The New Jersey Reading Association Microcomputer Committee makes two disks of exercises available to reading teachers, *NJRA BSW #1* and *NJRA BSW #2*. The disks are similar in format to the *Electric Writing* disks described above, and both are compatible with *Bank Street Writer*. Teachers seeking other ideas for exercises that employ word processing revision capabilities can check word processing manuals specifically designed for classroom use, such as *The Milliken Word Processor* and *Bank Street Writer*. Richards' (1984) and Milone's (1985) books on word processing activities for the classroom offer many ideas that can be used to develop exercise disk files, as does the *Activity Book for the Bank Street Writer* (Scholastic, 1984).

A second possible role for software when teaching revision is to analyze text. Spelling checker programs such as *Bank Street Speller*, *MECC Speller*, *Milliken's Spelling Checker*, *Sensible Speller* and *Webster's New World Spelling Checker* identify misspellings in text and enable students to command automatic corrections. After typing text, the student loads a spelling checker into the computer. The program then reads the text and uses its bank of stored words (a software dictionary) to identify possible misspellings. The spelling checker then enables the student to make any necessary corrections by highlighting the word in the text and providing a sequence of commands to change the spellings. The process is repeated for all misspelled words.

Grammar checking programs can be used to check students' use of appropriate grammar. *Sensible Grammar* checks for punctuation errors and misused phrases under categories such as cliche, pompous, vague and redundant. It works with many ProDOS word processing programs (*AppleWorks*, *Apple Writer*, *pfs: Write*, etc.) or with ASCII files. *Ghost Writer*, also available for a number of word processors, checks for homonym errors but is actually more of a style analyzer. Students can check their writing samples for a variety of transitions, overly long sentences, passive verbs, nominalization and repetitive use of words.

Also available for post-writing analysis are grammar checkers built into larger, more integrated packages. *Writer's Helper*, for example, is an integrated series of programs designed to assist writers in defining a topic and writing coherently about that topic. The style analyzer contained within the program assesses sentence length and text difficulty and checks for errors in grammar, punctuation and usage. The MECC Composing Information Series is a similar set of integrated programs including *MECC Writer*, *MECC Write Start*, *MECC Speller* and *MECC Editor*.

DLM has recently published a text analysis program within its adventure story program *The Writing Adventure*. Its proofreading subprogram scans children's word processed stories to identify a variety of possible errors, such as use of who-whom, its-it's, and so forth. The grammar checker is designed to pinpoint sections of text with a high probability of inappropriate usage. The relevant grammar rules are displayed on the monitor with examples of accurate and inaccurate usage. As with all these grammar checking programs, final determination as to whether a change should be made is up to the writer.

Thesaurus software can be used to supply writers with synonyms. Caution should be exercised, however. These programs are often far more awkward and time-consuming to use than a printed thesaurus and frequently offer fewer synonyms. In addition, use of thesaurus software can lead to stilted writing and misspelled words.

While text analysis programs cannot provide the quality of feedback possible from a trained teacher, they can serve two important functions: First, spelling checkers and style analyzers can perform a preliminary analysis of targeted features, allowing students to correct obvious errors before submitting a composition for review. Second, these programs can be used to perform analyses of written work that the teacher will not have time to correct in detail.

## Conclusion

In any effective writing process approach to teaching composition, the teacher's role will remain crucial as modeler and monitor. With easy-to-learn word processing programs available, microcomputers will inevitably play an increasingly central role in writing instruction. Integrated packages such as *The Writing Adventure* and *Writer's Helper*, which guide students through choosing topics, organizing their ideas, writing and revision, are already available. Such programs will free teachers from the more mundane tasks associated with writing instruction and allow students greater independence and more personalized guidance as they write.

Computers cannot replace teacher feedback on writing. They do serve to make the teacher's job easier, encourage increased writing and closer revision, provide limited analysis of composition quality and establish an effective setting for peer discussion and group feedback.

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# INSTRUMENTS AND EVALUATION

## 5.1

## Evaluation Overview

### Rational for Evaluating Inservice Programs

The planned outcome of many inservice programs is a set of changes in attitude or behavior. While formal evaluation provides staff developers with a useful tool in planning, designing, developing, and implementing of staff inservice, "systematic evaluation of inservice programs is the exception rather than the rule" (Gall & Renchler, 1985, p. 28.). The literature survey conducted by Vivian Johnson (1988) for her Ph.D. dissertation indicated that very few inservice projects are adequately evaluated either while they are being conducted or after they have been conducted. That is, very few inservice facilitators gather data that could be used to judge the effectiveness of their work.

There is a substantial literature on effective inservice practices. In addition to Johnson (1988), a good starting point for the novice student of this field is Wade's (1984-85) meta-analysis of 91 inservice studies. There is a very substantial bibliography in Joyce and Showers (1988). A number of effective practices identified by Stecher and R. Solorzano (1987) are listed in Table 1 given on the next page.

Evaluation studies provide staff development personal with a mechanism for judging the effectiveness of a program. The evaluation processes is divided into two components: formative and summative. A key point to remember is that the development of formative and summative evaluation plans should always occur in conjunction with the planning, design, and development of inservice programs.

Formative evaluation concentrates on measuring the immediate success of the program. It begins with a needs assessment. Then as the project continues, it provides feedback for the improvement and development of the ongoing activities. Goals of a formative evaluation include.

1. Developing a permanent record of conditions prior to inservice. (This use also needed for summative evaluation, since it provides a baseline for measuring change.)

2. Determining staff development required for improvement of the school, curriculum, etc.

3. Ensuring the inservice program is implemented as effectively as possible.

4. Identifying unanticipated outcomes.

Of the objectives listed, developing a record of pre-inservice conditions is typically eliminated from evaluation plans. This occurs because plans for formative evaluation are neglected until inservice is about to be implemented or is in progress. But without a record describing the pre-inservice conditions, it is difficult to determine the type or degree of change that occurs during and following an inservice. This impacts judging the overall effectiveness of a program (summative evaluation), especially when the expected outcomes of an inservice are changes in participant attitudes, behaviors or values.

While formative evaluation is valuable, it provides little insight about the factors that affect institutionalization -- that is, long term acceptance and implementation -- of a change (Fullan, 1982). To determine the long term changes that are maintained following inservice requires summative evaluation. Summative evaluation is also used for accountability, certification, selection or continuation of an established program. It concentrates on measuring the **residual effect** of the program over time (6-12 months or more after the project has ended). Unfortunately, summative evaluation is typically neglected.

## Table 1: Effective Computer Inservice Practices

1. Extensive practice with computers.
2. Comfortable and relaxed atmosphere.
3. Appropriate balance between lecture and guided practice.
4. Individual attention.
5. Knowledgeable trainers.
6. Detailed curriculum guides and lesson plans.
7. Clear and relevant objectives.
8. Lesson-related materials and handouts.
9. Inservice lessons linked to instruction.
10. Peer interaction.
11. Voluntary participation.
12. Strategies for teaching heterogeneous classes.

The content of this table is from "Characteristics of effective computer in-service programs." by B.M. Stecher and R. Solorzano, 1987, Pasadena, CA: Educational Testing Service. Copyright 1987 by Educational Testing Service.

Why should you interested in the residual effect? After all, formative evaluation can be designed to measure specific content, skills, or instructional strategies learned by participants during the inservice. But unfortunately, research indicates that knowledge, behaviors, and skills acquired during inservice are seldom transferred to classroom situations. The problem is that without examining the residual effect over time (longitudinal formative or summative) you are unable to determine the overall effectiveness of your inservice program.

A major goal in summative evaluation is to produce accurate descriptions of the program along with measures of its effects (i.e., changes in participant attitude or behavior). These descriptions are valuable for a number of reasons. Typically the program description includes estimations of program cost and helps decision makers determine if the program is worth continuing based on its costs. Program description can also serve as planning documents for people wanting to duplicate the program or adapt it to another setting. Program descriptions also document where you started from, your current state and where you want to or plan to go. Including descriptions of where you plan to go ties summative evaluation to the first stage of formative evaluation, the needs assessment process.

A final and neglected use of evaluation is for improving recycling of inservice programs. Many inservice providers present their inservices several times per year over a period of years. Keeping track of what presentations go well, what software is useful and the needs of those in the workshop make it easier to improve the next cycle.

Stecher and Solorzano (1987) identify two problems that result from the lack of evaluation research. One, without evaluation research it becomes difficult to judge the relative merits of inservice programs (summative evaluation). Two, without evaluation research, developers have little data to guide them in developing new programs and improving existing ones (formative evaluation).

Planning for evaluation encourages developers to operationalize the goals, objectives, and outcomes of an inservice program. The process of operationalizing encourages developers to divide the change into smaller pieces thus avoiding the pitfall of trying to accomplish a complex change in one step. Evaluation is a constant reminder that change is difficult, complex, and takes a long time.

## Current State of Computer Inservice Evaluation

A review of the literature indicated the majority of computer related inservice is not evaluated. When evaluation does occur, it is usually on a small scale and is "one shot," taking place during or within several days of the inservice. The most frequent evaluation goals are determining modifications required for program improvement, making quantitative judgments of whether inservice occurred, and validating that funds were spent on the development and/or initiation of the proposed program or course.

The two most frequently used criteria for measuring the quality of an inservice program are.

1. Changes in participant attitude toward computers.

2. Changes in participant computer literacy or knowledge/skills about particular aspects of using computers.

The selection of these criteria is based on the notion that as participants develop a higher level of computer literacy and knowledge/skills, and positive attitudes toward computers, they will increase their classroom use of computers. *The limited research does not support this notion*! This is a very important point. An inservice can be quite effective in increasing teacher knowledge and skills in the computer field, and have little impact on the teacher's students.

Studies by Vockell & Rivers, 1979, Mitchell, 1986, and Van Walleghem, 1986, suggest that positive attitude toward computers and computer literacy does not have much to do with classroom use of computers. The longitudinal follow-up completed by Vockell and Rivers (1979) indicated that participants completing an introductory course subsequently tended not to use computers in their classrooms. Subjects attributed their non use of computers to lack of access rather than a lack of knowledge on how to use them.

Two studies addressed the relationship between changes in teachers' willingness to use computers following inservice and actual classroom use of computers (Mitchell, 1986; Van Walleghem, 1986). These studies indicated that while teacher willingness to use computers increased following inservice, this willingness did not correlate well with actual computer use in the classroom.

## Planning to evaluate a computer related inservice

The evaluation of a computer related inservice should be designed to measure the extent that inservice objectives were achieved, identify problems associated with implementing the inservice objectives in the classroom, and measure the long term effect of inservice objectives on student achievement. The evaluation plan should contain two phases, formative and summative, with approximately equal amount of time and effort allocated to each.

Summative evaluation should focus on:

1. Participant knowledge about computers. (Is there a change that can be attributed to the inservice?)

2. Participant attitude toward computers. (Is there a change that can be attributed to the inservice?)

3. Participant instructional and professional use of computers. (Is there a change that can be attributed to the inservice?)

4. Changes in the instructional use of computers by the students of the inservice participant. (Is there a change that can be attributed to the inservice?)

Pre and post questionnaires are effective instruments in measuring changes in participant knowledge and attitude, but remember that increased willingness to use computers does not correlate well with actual computer use in the classroom. If the goal of your inservice is to increase classroom use of computers, your evaluation plan must use additional criteria besides changes in participant knowledge and attitude.

Longitudinal evaluation is the only way to determine if sustained changes in classroom use of computers have occurred following inservice. The evaluation should use of a multi-method approach, including both quantitative and qualitative measures. The multi method approach helps expose the numerous factors (access to computers, lack of administrative support, teachers not seeing a value in the innovation, etc.) that inhibit or prevent teachers willing to use computers from actually doing so. Measuring changes in classroom use of computers requires base line data on instructional use of computer use prior to the inservice. Changes in computer use that occur during formative evaluation are insufficient to judge the extent of computer implementation in the classroom. It is necessary to use longitudinal, summative evaluation techniques to see if gains made during an inservice program are sustained.

Summative evaluation also serves other purposes. Plans for longitudinal evaluation are evidence of an institution's long term commitment to implementation of the innovation (it simply is not going to fade away). Identification of factors that impact on the residual effect of inservice can facilitate making changes in the culture and organization of the school necessary to maintain the innovation. Fullan and Pomfret (1977) believe the main problem in implementing curriculum innovations is "that curriculum change usually necessitates certain organizational changes, particularly changes in roles and role relationships of those organizational members most directly involved in putting the innovation into practice (p. 337). ... Often the organizational (role relationship) change aspects of curriculum projects are left implicit in the plans (p. 337)." Longitudinal evaluation makes explicit the organizational and cultural changes that must occur for computers to become an everyday instructional tool. Only when these changes are made explicit can they be addressed in an overall plan for staff development.

## Selection of an evaluator

In an ideal situation the use of an outside evaluator to assist in the planning, design, and development of an inservice program is highly recommend. This is especially important if the inservice developers have little experience with evaluation and/or if the inservice is to be presented more than once. An evaluation expert can anticipate generic problems associated with the evaluation process and help train inservice personal in the development of an evaluation plan.

An unfortunate reality is that many inservice projects may not have the resources to obtain the services of an external evaluator. This places the evaluation component in the hands of inservice developers. If inservice personal are unfamiliar with evaluation process, they should solicit as much help as they can from experienced evaluators. It is recommended that the draft evaluation plan be submitted to an external evaluator for review and comment, even if the external evaluator cannot participate in the development and implementation process. No matter who ends up planning and conducting the evaluation, the process should occur in conjunction with the initial planning stages of the inservice.

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## Role of local evaluator

The primary role of the local evaluator is to gain consensus on the decision to evaluate, and to plan and implement the evaluation. When planning the evaluation, it is necessary to gain administrative and participant support for the process. Typically this requires convincing people of the value of evaluation and dispelling its negative image. A large body of research supports the need for continuous evaluation of any change effort (the change process, models of effective staff development, and innovation and implementation attempts).

Gaining administrative support is especially helpful, particularly when additional resources are required to conduct the evaluation. Participant support is critical and cannot be taken for granted. Prior to the inservice -- that is, during the needs assessment interaction with potential participants discuss the value of evaluation in helping to judge the reasonableness of inservice objectives, in assessing reasonable timelines for integrating computers in the classroom, for assessing the extent of resources necessary for this change to occur, and for helping administrators keep in touch with the actual realities of a classroom situation. Remember that participants may be distrustful of the evaluation process, so try to allay their fears. Creating an atmosphere conducive to evaluation should occur with planning what to evaluate.

## Evaluation objectives and topics

Inservice evaluation should address the content of the inservice, the presentation of the material (that is, the quality of work being done by the inservice facilitator), changes in the participants, and impact on the students of the participants. Impact on students is the most difficult to determine. It should not be attempted on a formal level (summative evaluation) until a certain predetermined level of classroom computer use is documented. That is, measuring the impact on students, of a computer inservice for teachers, is a complex and demanding task. It requires careful collection of baseline data (where the students are at the beginning with respect to the types of changes being fostered through the inservice).

Computer inservice is a new area. Little agreement exists among educational computer experts as to the most appropriate scope and sequence for computer related inservice. The small body of existing evaluation research is helpful in guiding the planning and design of computer inservice, but there is a word of caution. Use the research as a guide, but also tailor the inservice content to reflect the unique nature of your school district, and its long and short range computer goals. Ideally, inservice would be closely tied to carefully developed plans for instructional use of computers in schools that have been developed by the schools and districts of the educators who will participate in the inservice. The planning process is part of the needs assessment effort.

Formative evaluation occurs simultaneously with the initial needs assessment, the initial planning, and the actual conduct of the inservice. A growing body of literature on effective inservice practices and effective computer inservice practices is starting to surface (refer to Table 1). Inservice developers should use this limited research to guide their development of inservice delivery systems. Practitioners can also help the field of educational computing by making systematic studies of which techniques are the most effective and under what conditions.

Table 1 lists a number of possible areas for formative evaluation. That is, the inservice facilitator may decide to implement a number of the suggestions given in that table. Formative evaluation can help the facilitator to determine how well such a decision is being implemented.

Formative evaluation prior to and during the inservice measures how well the content met the current needs of participants. Longitudinal formative and summative evaluation determines when specific inservice programs are outdated and new ones need to be developed. It is important to remember that the goals of computer education are changing. The direction and content of computer related inservice will require careful monitoring to ensure it meets the needs of teachers, and is continually updated to reflect changes in the field.

Determining the content of a computer inservice typically begins with a needs assessment. The needs assessment process can be viewed as a special type of evaluation. The goal of needs assessment [illegible] describe what you want the final state to be, assess the current state, and determine if their is a discrepancy between the two. If a discrepancy exists, intervention is necessary. Inservice is a common component of the intervention process.

The introduction of any innovation requires an assessment of the staff skill level with regards to the innovation, staff attitude toward the innovation, and the characteristics of the school climate that impact on implementation of an innovation.

A formal formative evaluation plan typically includes pre and post questionnaires to determine participant knowledge and attitude. This approach is quick and efficient but lacks descriptive detail, provides little evidence on participant computer skill level, and provide little insight into the problems teachers face when trying to use computers in the classroom. Combining questionnaires with informal approaches results in a richer description and may identify unanticipated problems or concerns. Informal approaches include engaging staff in informal conversations and structured interviews, attending staff meetings, and talking with administrators.

Assessment of participant initial skill level is both a delicate issue and difficult. Most inservice teachers object to the idea that they might be given tests of their knowledge and skills in an area such as instructional use of computers. This suggests that instead one should use observational techniques. These should include unobtrusive observation (walk-bys of teacher classrooms, noting who is using school computer facilities, sign out sheets for mobile computers, department requests for software and hardware) and obtrusive observation (classroom visitations). An excellent reference on unobtrusive evaluation techniques is Webb et al (1966).

Currently there is little theoretical basis for the development of effective computer related inservice. Without the development of this knowledge, staff developers will continue to reinvent the wheel every time they need to conduct computer related inservice. Documenting, through evaluation, the successes and failures can help us build a common knowledge base useful to both researchers and practitioners.

## Magnitude and extent of the evaluation

The appropriate magnitude and extend of an evaluation is dependent on the magnitude of your staff development goals for integrating computers into the classroom. Small and simple goals requires smaller evaluations, while complex goals require substantial evaluation efforts. As a very rough rule of thumb, you might think of spending approximately ten percent of the inservice time, effort, and money on evaluation.

Longitudinal evaluation is a systematic way to detect permanent changes in participant behavior, the types of changes, and if the changes were the anticipated ones. Measuring changes in participant behavior enables you to assess the level of implementation that has occurred following inservice. Determining the level of implementation is important because with complex changes (such as increasing in-class computer use) staff developers frequently under estimated the time required to bring about a permanent change. Remember, evaluation of the impact on students can not be determined unless some predetermined level of in-class computer use has been achieved.

To date, most evaluation efforts have been small scale and short term. These evaluations concentrate on measuring the appropriateness of inservice content and materials, the effectiveness of the delivery system, and immediate changes in participant attitude, knowledge, or skill level occurred. This information is especially important when developing new inservice programs. However, without knowledge of the long term residual effects, it is difficult to determine what changes occurred and if they were maintained. This prevents staff developers from systematically planning what should be done next or what additional interventions are necessary before moving on.

## Collecting evaluation data

One overriding concern of any evaluation plan is to *not* overwhelm the subjects with additional work. This is especially true when working with classroom teachers. Frequently, teachers attend inservice programs following a full day of classes and are tired. However, teachers respond positively when they feel the information provided by them is valued and will be used by the project developers.

A substantial amount of data can be gathered quite quickly if the data collection instruments are carefully designed. Keep it short and simple (KISS) is a reasonable motto. The evaluator should think carefully about the purpose of each question. How will the data be analyzed, and how will it be used?

It is also important to be aware of the attitude of the subjects you are working with. A volunteer group in general will be more respective than a coerced group. Evaluation of the the CI$^3$ project suggests that a volunteer group selected to participant via a competitive process will the most likely to participate in a longitudinal evaluation. (That is, the ideal situation is that the participants volunteers, and more people volunteer than can be accommodated.)

It is highly recommended that all evaluation information be anonymous. (By this we mean that the facilitator of the inservice should not be able to connect formative and summative evaluation data collected during and after the inservice with specific individuals in the inservice.) It is a fact of life that any evaluation is stressful to people participating in it. Making all data anonymous does two things. One, it helps assure subjects their responses will not result in negative or punitive actions. Two, it creates an atmosphere where teachers are comfortable responding in an honest and frank manner to evaluation questions.

The problem of evaluation stress is compounded when computers are involved. Computer related inservice can produces high levels of stress because of the difficulty associated with integrating computers into the classroom. The combination of the normal evaluation stress and stress related to computers has the potential for creating an extremely bad situation. Reducing both sources of stress is extremely important if you want to be successful in this major change effort.

## An example

In this section we will describe the development of an instrument for evaluating a computer inservice. We include the instrument that was developed and a sample of the outcomes obtained when the instrument was used with a group of secondary school science teachers who were participating in a series of inservice sessions. We will cover purposes, instrument design, file construction, statistical analysis, and interpretation. The ideas illustrated here are equally applicable in inservices in math, science, social studies, elementary education, etc.

The purpose of our evaluations in the CI$^3$ project were three fold: 1) formative, 2) summati and 3) long term residual. Here we will concentrate on the formative and summative aspects of one workshop devoted to integrating computers into the middle and secondary school science curriculum. The same ideas can be applied to inservices aimed at other groups of educators.

**Concern for the participant:** Participants do not come to us to be evaluated, they come to learn. One must keep the forms and the evaluation brief. We allow about 40 minutes for the whole process during the eight two-hour inservice sessions, with 20 minutes devoted to mid course session and 20 minutes devoted to evaluation during the final session. The inservice providers were not in the room during the collection of data, the outside evaluator distributed, collected and analyzed the data.

**Form Development:** Many of the forms we are using to illustrate the process (a number of additional forms are given in the next chapter) were developed following observations of the sessions. The local evaluator attended the majority of the inservice sessions and had a good idea of what the content was for each session. The specifications driving the writing of the forms were to assess 1) quality of the delivery of the information, 2) interest of the material to the participant, and 3) relevance of the materials to the teaching tasks of the participants.

An evaluation instrument was developed to specifically fit the software used in the sessions. The science inservice sessions used Macintosh computers and the primary piece of software was MicroSoft Works, an integrated package. Most of the inservice participants did not have access to Macintosh computers in their schools. (This means that modifications of the instrument will be needed to fit other inservices which use different hardware and software, and focus on different subject matter.)

All evaluation instruments should end with a series of open ended questions. However, it is prudent to restrict the space allowed for writing open ended responses.

The usual method of form development involves a stage in which there is a pilot test of the form itself. In informal and semi-formal situations, this can be accomplished with a small number of people. The main ideas is to be sure that the wording is clear.

**Questionnaire specifications:** The instrument given in Figure 2 was used to evaluate a computer workshop designed for a mixed audience of absolutely novice and more experienced users of computers. All were middle school and high school science teachers. The main long term goal of the workshop was to increase the use of computer as a tool in the science classes taught by the participants.

The goals of the questionnaire were to evaluate the technical quality of the delivery, the specific action of some of the components, and whether the participants were able to see the major goal of the workshop. There were a few questions aimed at specific problems such as the effect of computer labs on instruction and the problems that participants may have had shifting to an unfamiliar computer. (While a number of participants had encountered the Macintosh before, relatively few had substantial experience with this machine.)

Questions 1, 7, 14, 15, 16, 18, 20, 22, and 25 are directed to the delivery of the workshop. Question 25, I would recommend this workshop session for other teachers, is particularly important. If the responses to this question was negative, then there would have been the need for extensive soul searching and a change in direction.

Questions 4, 8, 10, 11, and to some extent 9 are directed to the type of programs being presented in the first half of the workshop. In these sessions the general presentations covered using the computer and databases. This was what was being taught, it was not negotiable. Negative responses to these questions would have led to a rethinking of the delivery system, not a reemphasis on other materials.

Question 2 and 4, are directed at the general idea of the workshop. These questions were covered more thoroughly in the evaluation at the end of the workshop.

Question 23, 24, 27, and 29, were directed to some problems revolving around transferring from Apple to Macintosh computers. Question 26 was very specific because the evaluator noticed that some of the participants seemed to be having difficulty with the mechanics of typing.

**In summary:** We expect to ask questions focused at the content of the workshop. We expect to take a very brief look at the effectiveness of the delivery systems which include the quality of the teaching and the programs demonstrated.

**Results:** Figure 2 presents the evaluation instrument and sample data collected about halfway through the inservice. The relevant information to examine is the mean responses to each of the Items 1-25. It is well not to overwhelm the user of the data with statistical excesses from packaged programs. The inservice facilitator may be able to modify the inservice sessions in response to major deviations from what was anticipated Means, rounded to the nearest .5, suffice for this purpose. Of course, some inservice facilitators will want to see more detailed statistics. We have not included additional statistical data here, but the evaluator of the project provided as much detail as the facilitators desired.

Output in the form of Figure 2 contains information that is very helpful. In particular, question 3 reveals that participants see the ability to use computers more in the future as being enhanced. It is quite apparent that the overall evaluation of this workshop is good. The participants feel more confident with computer (Q1), find the material worthwhile (Q14), and see the workshop as relevant. Some of the texture of the situational setting can be found in the participants responses to the questions about availability of computers (Q21 and Q13). Those delivering the workshop should be proud of the responses to Q14, the binder and handout materials are useful; Q16, the workshop lived up to my expectations; and Q25, I would recommend this workshop to others. Responses to all these questions are near the top of the scale.

There are worries; Q2 indicates that they are not using the computer more. Q9 and Q11 indicate that more time should be spent on why databases are needed and the game of the week.

It is important to remember why this particular workshop was selected for illustration. It was the first time the science inservice was offered to a group of teachers, and it was the first time the inservice facilitator was in charge of such an extensive inservice series of sessions. Different computers were used (that is, Macintosh computers instead of the Apple 2 computers that the participants might have anticipated). The second presentation of the material (that is, a replication of the inservice series done the next year) showed that the providers made some changes that were reflected in the participants responses. The evaluator does not recommend cross groups comparisons because conditions and clients are not constant.

**Science Inservice Evaluation Instrument (This is the start of Table 2)**

(*Note*: This instrument was designed to require about 20 minutes to complete. The small letter "m" in the response field indicates the Mean Response of a group of science teachers who were participating in a sequence of eight two-hour computer inservices.)

**Instructions:** Please take about 20 minutes of your time to fill out the form. It is designed to help us assess the quality and effectiveness of the inservice, and to improve it. All responses will be confidential. Only summary statistical data and responses that cannot be used to identify specific participants will be provided to the inservice facilitator.

In the following questions, a response of 1 indicates that you strongly disagree with the statement, while a response of 5 indicates that you strongly agree with the statement. A response of 3 is neutral.

| | | Disagree | | | | Agree |
|---|---|---|---|---|---|---|
| 1. | I feel more competent with computers than I did at the start of this workshop. | 1 | 2 | 3 | 4 | 5 |
| | | | | | m | |
| 2. | I am using computers more with my students than I did at the start of the workshop. | 1 | 2 | 3 | 4 | 5 |
| | | | m | | | |
| 3. | As a result of this workshop, in the future I will be able to use computers more with my students. | 1 | 2 | 3 | 4 | 5 |
| | | | | | m | |
| 4. | I can see ways to integrate the programs demonstrated in the workshop into my curriculum. | 1 | 2 | 3 | 4 | 5 |
| | | | | | m | |
| 5. | As a result of this workshop, I have found programs not demonstrated in the workshop and integrated them into my curriculum. | 1 | 2 | 3 | 4 | 5 |
| | | | m | | | |
| 6. | I have been able to interest other teachers in what we have been doing in these workshops. | 1 | 2 | 3 | 4 | 5 |
| | | | | m | | |
| 7. | The sessions contain too much information to absorb comfortably. | 1 | 2 | 3 | 4 | 5 |
| | | | m | | | |
| 8. | I would like to see some programs demonstrated that are directly related to science. | 1 | 2 | 3 | 4 | 5 |
| | | | | | m | |
| 9. | The Game of the Week has been helpful. | 1 | 2 | 3 | 4 | 5 |
| | | | m | | | |
| 10. | The sessions have helped me recognize non computerized database applications in my classroom. | 1 | 2 | 3 | 4 | 5 |
| | | | | | m | |
| 11. | I feel that databases have a legitimate role in science classrooms. | 1 | 2 | 3 | 4 | 5 |
| | | | m | | | |
| 12. | Time should be spent exploring practical problems like getting students to the computers. | 1 | 2 | 3 | 4 | 5 |
| | | | | m | | |

13. The greatest block to using computers is lack of access. 1 2 3 4 5
m

14. The contents of the binder (the handouts) is worthwhile. 1 2 3 4 5
m

15. The workshop activities are relevant to my current classroom needs. 1 2 3 4 5
m

16. This workshop has lived up to my expectations. 1 2 3 4 5
m

17. I have learned a great deal about computers from other participants in the inservice. 1 2 3 4 5
m

18. We should take more time to explore the programs that we have seen in the workshops. 1 2 3 4 5
m

19. The instructors should have spent more time assessing existing computers skills in the group of participants. 1 2 3 4 5
m

20. The written materials clearly explain the software that we are using during the workshop sessions. 1 2 3 4 5
m

21. The district emphasis on computer laboratories for word processing limits access to computers at those times I might use them for science. 1 2 3 4 5
m

22. The progress of the workshop through the computer programs we have explored is slower than I would have liked. 1 2 3 4 5
m

23. Transfer (of my previous computer knowledge) from other computers to the Macintosh was relatively easy for me. 1 2 3 4 5
m

24. Learning the mechanics of using the computer is more the responsibility of the individual teacher (via working outside of the workshop) than it is of the workshop facilitators during workshop sessions. 1 2 3 4 5
m

25. I would recommend this workshop for others. 1 2 3 4 5
m

**Instructions:** The following four questions can be answered Yes or No. Please circle your choice.

(*Note to reader*: The percentages given are data from the same group as above.)

26. I am a reasonably competent touch typist. Yes 67% No 33%

27. I was familiar with the Macintosh computer before the start of the workshop. Yes 42% No 58%

28. The bulk of the material we have covered was familiar to me before the start of the workshop. Yes 25% No 75%

29. I was familiar with the Apple *II* computer or other computers before the start of the workshops. Yes 67% No 33%

**Instructions:** Please provide brief responses to the following questions. Use the back of the page if necessary.

30. What is the most positive aspect of the workshop?

31. What are the factors most needing improving?

32. Please write up three ideas that you think you have picked up that may be directly applicable to your classes.

33. Any other comments you would like to make would be appreciated.

**Table 2: Science Inservice Evaluation Instrument**

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# 5.2
# EVALUATION FORMS

This section contains samples of a number of the evaluation forms used during the NSF project inservices.

# Principal Interview Form (Needs Assessment)

Name: ______________________________

School: ______________________________

Date: ______________________________

Principal interviews are conducted as part of the needs assessment. The idea is to interview the principals (or other high level school administrators) in the schools of the inservice participants. Ideally, the people being interviewed would also participate in all of the inservice sessions, or at least in a significant number of them. Research suggests that this is highly desirable if the intent is that the inservices will lead to changes in the classroom. School administrators are key educational change agents. Unless they give open and strong support to teachers working to make change in the curriculum, relatively little change is apt to occur.

One typically begins an interview by explaining its purpose and what the information will be used for. The person being interviewed should be assured that the information will be confidential. Some people doing interviewing find it desirable to use a tape recorder. If this is done, be sure to ask the interviewee if he/she minds being recorded. Since direct quotes of the answers are not needed and many people feel uncomfortable talking into a recorder, it is probably better to not make use of a recorder

When several people are to be interviewed for the same purpose, it is helpful to have a script or a sequence of questions that all will be asked. However, feel free to deviate from the script in order to follow up on important issues.

1. What do you perceive are the most pressing needs related to the use of computers in your school? (*Note*: Presumably the interviewee knows that your orientation is toward instructional uses of computers. However, you might find that the answer provided is oriented toward administrative uses. If so, you might want to try this question again, but emphasizing instructional uses.)

2. Please describe the role and duties of the computer coordinator or computer building representative at your school. (If there is no such person, probe to find the name of the person who tends to do the most in helping the school make instructional use of computers.)

3. Please describe some of the instructional uses of computers currently occurring at your school.

4. What computer equipment is available for use by students and teachers at your school? Where and/or how is it situated?

5. What training has your staff had in the use of computers?

6. What training have you had? (Describe how you use computers to do your job.)

7. Does your school have a written set of long-range plans for instructional use of computers? (If yes, can you provide me with a copy? What are some of its key goals?)

8. Does your school district have a written set of long-range plans for instructional use of computers. (If yes, can you briefly describe the plans?)

9. Are there other important things I should know about instructional use of computers in your school that would be helpful in designing and conducting inservice for your teachers?

# School Site Information Sheet

(*Note*: It is often quite desirable to hold inservice sessions in the schools of the participants. This form is designed to aid in collection of information about the computer facilities available in a school that might be available for inservice sessions and/or that might be available to inservice participants for their personal use and use with students.)

Site ____________________ Contact Person ____________________

Which equipment is available? ____________________

When is equipment available? ____________________

Where is equipment available? ____________________

What is the procedure for organizing or obtaining equipment for use in the classroom?

____________________

What is the procedure for securing the lab? ____________________

What software is available? ____________________

How is it obtained? ____________________

Time schedule? (Obtain a copy of the school and its teachers' time schedule.)

# CI$^3$ Teacher Needs Assessment

**Name:** ________________________________

**School:** ________________________________

(This instrument is designed to be filled out by teachers who might be interested in participating in a computer inservice. One way to make use of this instrument is to meet with the teachers in a school who have expressed some interest in an inservice. Discuss the nature of the types of inservices that might be possible. Answer their questions. Then have each person who might be interested in participating in an inservice fill out the following form. Assure the teachers that the results will be confidential.)

**Instructions:**
For numbers **1-5** below, please **circle** yes or no.

1. Have you requested that your school or department purchase any software within the last year?

   **YES NO**

2. Have you used the school district's software preview center within the past 12 months?

   **YES NO**

3. Does the integration of the computer in education change the priorities of what should be taught in the curriculum?

   **YES NO**

4. Do you plan to purchase a personal computer within the next 12 months?

   **YES NO**

5. Do you have a computer in your home? **YES NO**

   If you circled **YES**,

   (a) What brand and model is it?

   (b) How much is it used, and for what purposes?

   (c) Do you bring it into the classroom? **YES NO**

**Instructions:**
For numbers **6-14** below, please write a **brief** answer.

6. List the **subject areas** in your curriculum where you think computer use is currently helping **your students.**

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7. List the general types of **computer applications** you think are currently helpings **your students.**

8. List the **subject areas** in your curriculum where you think computer use is currently helping **you.**

9. List the general types of **computer applications** you think are currently helping **you.**

10. List the areas (not necessarily in your classroom) where you might like to use a computer if you could gain appropriate training and access to facilities (ie., any kind of personal use, recreation, database, gradebook, etc.).

11. List the **names** of the computer programs/packages (titles) you have ordered or requested to be ordered for educational/school use in the last year.

12. List the **names** of the top 5 computer programs/packages (titles) that you use or have used most frequently with your students.

13 (a) List the **names** of the top five computer programs/packages (titles) that you use in your role as an educator or for personal use.

(b) Indicate the **approximate number** of computer programs/packages you use with your classes? _______

(c) Indicate the **approximate number** of computer programs/packages that you use for personal use? _______

14. What kind of inservice or workshops would you like to see in the future? What characteristics and content would they have to have so that you would probably participate on a voluntary basis?

# Concerns Questionnaire

Name ______________________________

Date ______________________________

The purpose of this questionnaire is to determine the concerns people have about future educational innovations. The items were developed from typical responses of school and college educators who ranged from having no knowledge at all about various innovations to many years experience in using them. Therefore, *a number of the items may appear to be of little relevance to you at this time.* For the completely irrelevant items, please circle "0" on the scale. Other items will represent those concerns you *do* have, in varying degrees of intensity, and should be marked higher on the scale, according to the explanation at the top of each of the following pages.

For example:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| | Not true of me now | | Somewhat true of me now | | | Very true of me now | |

| | |
|---|---|
| 0 1 2 3 4 5 6 7 | This statement is very true of me at this time. (Circle the 7. A slightly less strong response would be given by circling the 6.) |
| 0 1 2 3 *4* 5 6 7 | This statement is somewhat true of me now. (Circle the 4. A slightly weaker response would be given by circling the 3 while a slightly stronger response would be given by circling the 5.) |
| 0 *1* 2 3 4 5 6 7 | This statement is not at all true of me at this time. (Circle the 1. A slightly stronger response would be given by circling the 2.) |
| *0* 1 2 3 4 5 6 7 | This statement seems irrelevant to me. (Circle the 0.) |

Please respond to the items in terms of *your present concerns,* or how you feel about your involvement or potential involvement with *integration of computers into instruction.* We do not hold to any one definition of this innovation, so please think of it in terms of *your own perception* of what it involves. Since this questionnaire is used for a variety of innovations, the term *computer integration* never appears However, phrases such as "the innovation," "This approach," and "the new system" all refer to *computer integration.* Remember to respond to each item in terms of your *present concerns* about your involvement or potential involvement with *computer integration.*

Thank you for taking time to complete this task.

Procedures for Adopting Educational Innovations/CBAM Project
R&D Center for Teacher Education, The University of Texas at Austin

0 1 2 3 4 5 6 7
Not true of me now — Somewhat true of me now — Very true of me now

0 1 2 3 4 5 6 7 I am concerned about evaluating my impact on students.

0 1 2 3 4 5 6 7 I would like to revise the innovation's instructional approach.

0 1 2 3 4 5 6 7 I am completely occupied with other things.

0 1 2 3 4 5 6 7 I would like to modify our use of the innovation based on the experiences of our students.

0 1 2 3 4 5 6 7 Although I don't know about this innovation, I am concerned about things in the area.

0 1 2 3 4 5 6 7 I would like to excite my students about their part in this approach.

0 1 2 3 4 5 6 7 I am concerned about time spent working with nonacademic problems related to this innovation.

0 1 2 3 4 5 6 7 I would like to know what the use of the innovation will require in the immediate future.

0 1 2 3 4 5 6 7 I would like to coordinate my effort with others to maximize the innovation's effects.

0 1 2 3 4 5 6 7 I would like to have more information on time and energy commitments required by this innovation.

0 1 2 3 4 5 6 7 I would like to know what other faculty are doing in this area.

0 1 2 3 4 5 6 7 At this time, I am not interested in learning about this innovation.

0 1 2 3 4 5 6 7 I would like to determine how to supplement, enhance or replace the innovation.

0 1 2 3 4 5 6 7 I would like to use feedback from students to change the program.

0 1 2 3 4 5 6 7 I would like to know how my role will change when I am using the innovation.

0 1 2 3 4 5 6 7 Coordination of tasks and people is taking too much of my time.

0 1 2 3 4 5 6 7 I would like to know how this innovation is better than what we have now.

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0 1 2 3 4 5 6 7

Not true of me now　Somewhat true of me now　Very true of me now

| | |
|---|---|
| 0 1 2 3 4 5 6 7 | I am concerned about students' attitudes toward this innovation. |
| 0 1 2 3 4 5 6 7 | I now know of some other approaches that might work better. |
| 0 1 2 3 4 5 6 7 | I don't even know what the innovation is. |
| 0 1 2 3 4 5 6 7 | I am concerned about about not having enough time to organize myself each day. |
| 0 1 2 3 4 5 6 7 | I would like to help other faculty in their use of the innovation. |
| 0 1 2 3 4 5 6 7 | I have a very limited knowledge about the innovation. |
| 0 1 2 3 4 5 6 7 | I would like to know the effects of reorganization on my professional status. |
| 0 1 2 3 4 5 6 7 | I am concerned about conflict between my interests and my responsibilities. |
| 0 1 2 3 4 5 6 7 | I am concerned about revising my use of the innovation. |
| 0 1 2 3 4 5 6 7 | I would like to develop working relationships with both our faculty and outside faculty using this innovation. |
| 0 1 2 3 4 5 6 7 | I am concerned about how the innovation affects students. |
| 0 1 2 3 4 5 6 7 | I am not concerned about this innovation. |
| 0 1 2 3 4 5 6 7 | I would like to know who will make the decisions in the new system. |
| 0 1 2 3 4 5 6 7 | I would like to discuss the possibility of using the innovation. |
| 0 1 2 3 4 5 6 7 | I would like to know what resources are available if we decide to adopt this innovation. |
| 0 1 2 3 4 5 6 7 | I am concerned about my inability to manage all the innovation requires. |
| 0 1 2 3 4 5 6 7 | I would like to know how my teaching or administration is supposed to change. |
| 0 1 2 3 4 5 6 7 | I would like to familiarize other departments or persons with the progress of this new approach. |

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## Demographic Self-Description

PLEASE COMPLETE THE FOLLOWING:

1. What percent of your job is:

   Teaching ____% Administration ____% Other (specify)____________%

2. Do you work: full time _____ part time _____

3. Female _____ Male _____

4. Age: 20-29 ____ 30-39 ____ 40-49 ____ 50-59 ____ 60-69 ____

5. Highest degree earned:

   Associate _____ Bachelor _____ Masters _____ Doctorate _____

6. Year degree earned: _____ 7. Total years teaching _____

8. Number of years at present school: _____

9. In how may schools have you held full time appointments?

   one____ two ____ three ____ four ____ five or more ____

10. How long have you been involved in computer integration, not counting this year?

    never ___ 1 year ___ 2 years ___ 3 years ___ 4 years ___ 5 years or more ___

11. In your use of computer integration, do you consider yourself to be a:

    nonuser ___ novice ___ intermediate ___ old hand ___ past user ___

12. Have you received formal training in computer integration (workshops, courses):

    yes _____ no _____

13. Are you currently in the first or second year of use of some major innovation or program other than computer integration?

    yes _____ no _____

    If yes, please describe this program briefly.

Procedures for Adopting Educational Innovations/CBAM Project
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# Computer Attitudes Survey

Name: ____________________

School: ____________________

(*Note*: It is relatively common to administer an attitude scale before and after an inservice, and perhaps a third time for long term follow-up. This is done as part of the summative evaluation of an inservice. As for all collections of evaluative information, participants should be reassured that the information collected will be confidential and will not affect their grade in the inservice. Ideally, this survey form would be administered, collected, and analyzed by someone other than the inservice facilitator.)

**Instructions:**
Please circle the number that best describes your attitude. If you strongly agree with the statement circle 1 for strongly agree. If you strongly disagree with the statement circle 5. Circle 3 if your attitude toward the statement is neutral.

| | Strongly Agree | | | | Strongly Disagree |
|---|---|---|---|---|---|
| 1. Computers can improve learning of higher order skills. | 1 | 2 | 3 | 4 | 5 |
| 2. Computers will improve education. | 1 | 2 | 3 | 4 | 5 |
| 3. Computers can improve drill and practice. | 1 | 2 | 3 | 4 | 5 |
| 4. Computers will create jobs needing specialized training. | 1 | 2 | 3 | 4 | 5 |
| 5. Computers will improve health care. | 1 | 2 | 3 | 4 | 5 |
| 6. A person today cannot escape the influence of computers. | 1 | 2 | 3 | 4 | 5 |
| 7. Computers will displace teachers. | 1 | 2 | 3 | 4 | 5 |
| 8. Computers will dehumanize society. | 1 | 2 | 3 | 4 | 5 |
| 9. Computers can teach better than teachers. | 1 | 2 | 3 | 4 | 5 |
| 10. Computers are beyond the understanding of the typical person. | 1 | 2 | 3 | 4 | 5 |
| 11. Computers will replace low-skill jobs. | 1 | 2 | 3 | 4 | 5 |

Scale from *Computer Attitudes Factor Structure* developed by Bannon, Susan H., Marshall, Jon C., and Fluegal, Susan in Cognitive and affective computer attitude scales. A validity study. *Educational and Psychological Measurement*, *45*, 679-681.

# Sample Results from Computer Attitudes Survey

The Computer Attitudes Survey was administered to 28 participants at the beginning and end of an eight-session inservice designed to teach tool use of computers in the curriculum. The table below gives the means of their responses. The last column gives the results of a 2-tail t-test, and indicates a significant change only on the first item.

| Item Number | Beginning Mean | Ending Mean | 2-tail t-test p = |
|---|---|---|---|
| 1. | 1.786 | 1.250 | .026 |
| 2. | 1.857 | 1.929 | .731 |
| 3. | 1.571 | 1.714 | .355 |
| 4. | 1.407 | 1.500 | .490 |
| 5. | 2.036 | 1.857 | .408 |
| 6. | 1.357 | 1.429 | .691 |
| 7. | 4.571 | 4.750 | .259 |
| 8. | 4.179 | 4.250 | .646 |
| 9. | 4.500 | 4.643 | .460 |
| 10. | 4.357 | 4.714 | .096 |
| 11. | 3.321 | 3.500 | .456 |

## Ease of Use Attitude Survey

**Name:** ______________________

**School:** ______________________

(*Note*: This attitude survey form could be administered concurrently with the Computer Attitudes Survey. For many teachers, their attitude toward ease of availability and access of computer software and hardware may be a major determining factor in whether they make instructional use of computers for themselves and their students.)

**Instructions:**
The following activities relate to the ease of using computers and software in your curriculum and classroom. For numbers 1-7, please circle the number that best describes your attitude towards each activity. The scale runs from 1 (Very Difficult) to 5 (Very Easy).

| | | | | | |
|---|---|---|---|---|---|
| | Very | | | | Very |
| Difficult | Easy | | | | |
| 1. Obtaining a computer and monitor for use in my class is | 1 | 2 | 3 | 4 | 5 |
| 2. Obtaining the proper software is | 1 | 2 | 3 | 4 | 5 |
| 3. Scheduling the use of the computer lab for my class is | 1 | 2 | 3 | 4 | 5 |
| 4. Obtaining time for setting up the computer in my class is | 1 | 2 | 3 | 4 | 5 |
| 5. Obtaining time for learning how to use and review new software is | 1 | 2 | 3 | 4 | 5 |
| 6. Obtaining time for using the computer within the present curriculum is | 1 | 2 | 3 | 4 | 5 |
| 7. Using a computer and software in my class is | 1 | 2 | 3 | 4 | 5 |

8. The number of machines available for use in my classroom is __________.

9. The number of teacher(s) who share the available machines is __________.

# Participant Log Sheet

(*Note*: Participants were requested to keep a daily log of their computer use and related activities during the weeks of the inservice sessions. These were turned in each week and provided the inservice facilitator with valuable formative evaluation information.)

Name ______________________________ Date____________

Please use this form to record **all** of your computer-related activities, both at school and at home, during the week. This log sheet is not used for grading purposes. Its purpose is to provide formative evaluation information to the inservice facilitator.

**Monday**

**Tuesday**

**Wednesday**

**Thursday**

**Friday**

**Weekend**

**Use back of sheet for notes, additional comments, and questions you would like to ask the inservice facilitator.**

# Social Studies Inservice Evaluation Form

(*Note*: A formative evaluation form of this sort can be used in almost any inservice directed toward helping participants learn to make increased and appropriate instructional use of computers in their classrooms. The sample form provided here was designed for use in an inservice for secondary school social studies teachers. With slight modification it can be used in a math, science, elementary school, etc. inservice. Participants should be assured that their answers will be kept confidential and will have no bearing on their grade in the inservice, if grades or other requirements have been established for satisfactory completion of the inservice. It is desirable that this form be administered by someone other than the inservice facilitator and that the results be compiled by someone other than the inservice facilitator. The inservice facilitator should only receive summary statistical data and participant comments that cannot be associated with specific participants. Note also that the same form could be used several times during an inservice that extended over a number of sessions.)

Name: ______________________

School: ______________________

We are interested in your overall evaluation of this workshop. For numbers 1 - 34, please circle the number that best describes your attitude. If you agree with the statement circle 5 for agree. If you disagree with the statement circle 1. Circle 3 if your attitude toward the statement is neutral.

| | | Disagree | | | | Agree |
|---|---|---|---|---|---|---|
| 1. | I feel more competent with computers than I did at the start of this workshop. | 1 | 2 | 3 | 4 | 5 |
| 2. | My students have increased their classroom use of computers as a result of this workshop. | 1 | 2 | 3 | 4 | 5 |
| 3. | Lack of student access to computers is the greatest block to my integrating computers into the curriculum. | 1 | 2 | 3 | 4 | 5 |
| 4. | I feel competent integrating the software programs and activities demonstrated in the workshop into my teaching. | 1 | 2 | 3 | 4 | 5 |
| 5. | I have sought out and located software programs not demonstrated in the workshop and integrated them into my curriculum. | 1 | 2 | 3 | 4 | 5 |
| 6. | I have been able to interest other teachers in what we have been doing in these workshops. | 1 | 2 | 3 | 4 | 5 |
| 7. | Too much information was presented during the sessions to absorb comfortably. | 1 | 2 | 3 | 4 | 5 |
| 8. | I would like to see the workshop demonstrate software programs and activities more directly related to my content area. | 1 | 2 | 3 | 4 | 5 |

Disagree Agree

9. Time should be spent exploring practical problems like getting students to the computers. 1 2 3 4 5

10. As a result of this workshop I will increase my instructional use of computers with my students. 1 2 3 4 5

11. The contents of the participant notebook and handouts will be useful in planning and developing computer related activities for my classes. 1 2 3 4 5

12. I have started collecting computer software disks. 1 2 3 4 5

13. This workshop has lived up to my expectations. 1 2 3 4 5

14. I have learned a great deal about computers from other participants in the workshop. 1 2 3 4 5

15. More time should have been set aside for participants to explore the software programs and materials demonstrated during the workshop. 1 2 3 4 5

16. The written materials clearly explain how to move through the programs. 1 2 3 4 5

17. The progress of the workshop is slower than I would have liked. 1 2 3 4 5

18. The information presented in the sessions is relevant to my classroom. 1 2 3 4 5

19. I would recommend this workshop to other teachers. 1 2 3 4 5

20. I am not convinced that computers will increase student achievement in my content area. 1 2 3 4 5

21. I now talk more to other teachers about computers than I did at the start of the workshop. 1 2 3 4 5

22. Money for computers should be shifted from other areas of the school budget. 1 2 3 4 5

23. The instructors should have spent more time demonstrating a greater variety of software. 1 2 3 4 5

24. The greatest block to my using computers in the classroom is my philosophical disagreement with their worth in my content area. 1 2 3 4 5

25. The progress of the workshop is faster than I would have liked. 1 2 3 4 5

Disagree Agree

26. Lack of teacher access to computers is the greatest block to my using computers. 1 2 3 4 5

27. I would like a workshop leader to come into my classroom and demonstrate a lesson using the computer as an instructional tool. 1 2 3 4 5

28. I feel more comfortable using computers with my students than I did at the start of the workshop. 1 2 3 4 5

29. I am willing to have someone come into my classroom and observe me using computers with my students. 1 2 3 4 5

30. I am more inclined to let students use computers to develop an understanding of concepts and ideas than I was at the start of the workshop. 1 2 3 4 5

31. I would have liked time during the workshop to modify and/or develop computer activities for use in my classroom. 1 2 3 4 5

32. I would prefer that all workshop participants be teaching the same courses and grade levels. 1 2 3 4 5

33. I found it easy to get access to computer hardware and software between sessions to try out ideas we learned in the workshop. 1 2 3 4 5

34. I would be more likely to use computers if there was a computer resource person I could consult with at my school. 1 2 3 4 5

For questions 35 - 40 circle, please circle yes if you agree with the statement and no if you disagree with the statement.

35. I have spent more time watching others use the computers in the workshop than I have spent in using them myself. Yes No

36. The goal of this workshop should be developing teacher skills in the practical use of the computer. Yes No

37. I felt pressure to attend this workshop from other sources. Yes No

38. I would rather spend more time with the computers and less time concerning ourselves with issues such as other resources in the school. Yes No

39. The goal of this workshop should be developing an understanding of how to integrate computers into my content area. Yes No

40. I have increased my understanding of how to use computers as a problem solving tool as a result of this workshop. Yes No

For numbers 41 - 48 please circle the number the best describes your attitude toward each of the software programs listed. If you think the program was excellent circle 5 for excellent. If you think the program was poor circle 1. Circle 3 if your attitude toward the program is neutral. Please do not refer to your handouts or notebook; we are interested in how you remember these software programs.

| | | Poor | | | | Excellent |
|---|---|---|---|---|---|---|
| 41. | United States Database | 1 | 2 | 3 | 4 | 5 |
| 42. | North American Database | 1 | 2 | 3 | 4 | 5 |
| 43. | President Elect | 1 | 2 | 3 | 4 | 5 |
| 44. | The Other Side | 1 | 2 | 3 | 4 | 5 |
| 45. | U.S. History | 1 | 2 | 3 | 4 | 5 |
| 46. | Easy Graph | 1 | 2 | 3 | 4 | 5 |
| 47. | MECC Graph | 1 | 2 | 3 | 4 | 5 |
| 48. | Bank Street File | 1 | 2 | 3 | 4 | 5 |

Please write brief answers to the following questions.

1. Has the workshop been relevant to your needs?

2. Has the workshop been organized in a way that facilitated learning? If not, how can we improve it?

3 Please write a short description (2 or 3 sentences) of what you perceive as the purpose of the workshop.

4. Identify the most positive aspect(s) of the workshop?

5. Please describe two or three ideas demonstrated during the workshop that are directly applicable to your classes.

6. What can we do to improve this workshop and others like it?

7. Please feel free to make any general comments about the in-service.

# 5.3
# LONG TERM FOLLOWUP EVALUATION

As indicated in Section 5.1, relatively few inservice projects conduct meaningful long term followup evaluation to determine possible effects of the inservice. The NSF project conducted quite a bit of long term followup evaluation. Most of this research was conducted by two graduate students who were employed by the project and conducted the evaluations as part of their Ph.D. dissertation research. The references to their Ph.D. dissertations are given below. Each of these dissertations is available for $20 from the International Council for Computers in Education, 1787 Agate Street, Eugene, Oregon 97403.

Hanfling, Seymour Samuel ( December 1986). A formative evaluation of elementary and secondary staff development inservices on integrating computer innovations into the curriculum. Ph.D. Dissertation, University of Oregon.

Johnson, Vivian Patricia ( August 1988). An exploratory case study describing the long-term residual effect of the computer-integrated instruction inservice (CI$^3$ project). Ph.D. Dissertation, University of Oregon.

The following pages contain some of the instrumentation that was used in the long term evaluation. Much more detail is provided in the Ph.D. dissertations. Readers interested in the details of such long term evaluation are well advised to begin by reading Vivian Johnson's dissertation.

# CI$^3$ Inservice Participant Focused Interview
# (Long Form)

Site: ______________________ Date: ___________________

Subject: ____________________ Researcher: ______________

## Introduction

| | |
|---|---|
| Purpose | This interview is part of the CI$^3$ inservice follow-up. The interview is a major source of data to help us determine the residual effect of the inservice you completed. |
| Topics to be covered | Interview questions will briefly cover the following topics: your teaching experience, your experience with computers, features of the inservice, your attitude and expectations about using computers in education, and how completing the inservice affected you. If there is time available at the end of the interview, please feel free to go back and provide more detail on specific questions. |
| Ethics | I would like to tape record this interview only for the purpose of validating the accuracy of my questions. The taped interview will be heard by only myself and (list and other names and explain why they may also listen to the recording). Your name will never be mentioned, nor will any particular response be connected to you. In addition, you may turn the tape recorded off at any time. |
| Concerns of respondent | Do you have any questions or concerns before I begin? |

**Experience** (Time allocation 5 min)

Teaching — How long have you been teaching (brief)?

Computers — Briefly describe your experience with computers.

If experienced, what brands of computers do you feel *comfortable* using?

___ Apple

___ Atari

___ Commodore (PET)

___ Macintosh

___ IBM

___ Radio Shack

___ Commodore C-64

___ Other (Note Brand)

**Inservice Features** (Time Allocation 5-7 min.)

Content — What did you perceive as the *subject* of the inservice you completed?

Positive features — What were the *features* that made the inservice work best for you? Examples?

(As a backup, show list of inservice features and ask: Do you remember any of these features?)

Limitations — What *features* of the inservice *limited* its success?

(As a backup, show list of features and ask: Others say these features are the most important, what would you add or delete? Did your inservice have these?)

| | |
|---|---|
| Changes over time | Would your answers have been different just after you finished the inservice? |
| **Attitudes and Expectations** | (Time allocation 10 min.) |
| Computers in education | What do you think we should be doing with computers in education? |

Probe to elicit teachers' perceptions in the following areas: appropriate uses of computers

____ enrichment ____ remediation

____ regular instruction

If time permits suggest teachers describe some specific examples of appropriate uses.

| | |
|---|---|
| Teaching | What would you like to be doing with computers in your own classroom? |
| Effect on students | What effect will classroom use of computers have on your students? |
| | How will they respond? What will they learn? |
| Reason for inservice | Why did you sign up for the inservice?<br>Was it voluntary? __ yes __ no |
| Anticipated Outcomes | What did you hope to learn? What did you hope to be able to do? |
| **Outcomes** | (Time allocation 15 min.) |
| Expectations | Did you learn what you hoped to learn?<br>Why? Why not? |
| Knowledge and Skills | Describe what you learned? What facts and skills? |
| Teaching | Did the inservice affect the way you teach? Either how you teach or what you teach? |
| Students | Name the computer applications that you feel are the most beneficial to your students?<br>(Provide only word processing as an example of a computer application.) |

| | |
|---|---|
| | Have you seen changes in your students since using computers in the class?<br>(Possible examples: student attitude towards school, towards learning, towards subject matter.) |
| Plans | What do you plan to be doing with computers in the future? |
| Problems | What factors influence your choice to use or not use computers in your classroom.<br>(If participants have difficulty answering this questions - suggest they think about the following: access to computers, time issues, support from school administration, etc.<br>What problems have you had trying to use computers that the inservice did not prepare you to solve? |
| Changes in inservice | How would you change the inservice<br>(Omit if time becomes a problem) |
| **Final Instructions** | We are at the end of the interview, is there anything else you would like to mention or a question you wish to go back to.<br>**Please thank the individual for their time and input and tell them they have been very helpful.** |

# CI$^3$ Inservice Participant Focused Interview
# (Short Form)

**Name:** ______________________

**School:** ______________________

**Date:** ______________________

**Instructions:**

Instruct the participant to answer the following questions as briefly as possible. (*Note*: Use the same confidentiality discussion as is given with the Long Form.)

1. Describe the purpose of the CI$^3$ computer workshop.

2. State why you participated in the CI$^3$ computer workshop.

3. List three changes, in you as an individual or teacher, that can be attributed to your participation in the CI$^3$ sessions.

    a)

    b)

    c)

4. Identify the three most important experiences that occurred during the training.

   a)

   b)

   c)

5. List the **subject areas**, identified in the training, where computer use benefits **your students.**

6. List the **computer applications,** identified in training, that benefit **your students.**

7 List the **subject areas,** discussed in training, where you think computer use **benefits you.**

8. List the **computer applications,** utilized in training, that **benefit you.**

9. Do you feel you know enough about computers to make **effective** use of them in **your** teaching?

10. How has the **non-computer content** of what you teach been affected by your increasing computer knowledge?

# CI$^3$ Project Long Term Assessment

Name: ____________________

School: __________________

**Instructions for Part 1:**
For numbers **1-9** below, please circle yes or no.

1. Do you still have, use, or reference the **computer workshop** handouts/materials?

YES NO

2. Prior to the computer workshop, was there an in-school computer interest or support group at your school?

YES NO

3. Following the completion of the workshops, has a computer interest or support group been formed?

YES NO

4. Have you requested that your school or department purchase any software within the last year?

YES NO

5. Do you use the school district's software preview center?

YES NO

6. Do you have a computer in your home?

YES NO

If you circled **YES**,

(a) What brand and model is it?

(b) Do you bring it into the classroom?

YES NO

7. Do you plan to purchase a personal computer within the next 12 months?

YES NO

8. Does the integration of the computer in education change the priorities of what should be taught in the curriculum?

YES NO

9. Do you feel that you know enough about computers to make effective use of them in your teaching?

**YES NO**

10. (a) List the **names** of the top five computer programs/packages that you use either in your role as an educator or for personal use.

(b) Indicate the **approximate number** of computer programs/packages you use with your classes? ______

(c) Indicate the **approximate number** of computer programs/packages that are for your personal use? ______

11. List the **names** of the top five computer programs/packages (titles) that you use or have used most frequently with your students.

**Instructions for Part 2:**
Please answer each of the following questions with a checkmark (√).

1. Before the inservice sessions, how involved were you in integrating computers into your curriculum?
   ___ none ___ slightly ___ somewhat ___ very

2. Since the inservice training, have you increased your involvement in the integration of computers into the curriculum?
   ___ none ___ slightly ___ moderately ___ much

3. Before the training, were you part of a local computer support group?
   ___ Yes ___ No

4. Since the training, have you been involved in starting a local computer support group or become a member of one?
   ___ Yes ___ No

5. Since the inservice sessions, have you increased you communications with others about integrating computers into the curriculum?
   ___ Yes ___ No

   If you checked "yes" to question number 5, please indicate the approximate number of people you have communicated with in each of the following categories:

| Approximate Number of People | Categories |
|---|---|
| ________ | Shared information with people unaware of how to integrate computers into the curriculum. |
| ________ | Exchanged information with people already involved with integrating computers into the curriculum. |
| ________ | Contacted other inservice session participants. |

6. Have you used any of the materials you received at the inservice sessions? ___ Yes ___ No

   If you checked "yes," how useful did you generally find the materials to be? Please check one.
   ___ Useless ___ Hardly useful ___ Somewhat useful ___ Very useful

7. Do you think the type of training you received helps to promote computer integration into the curriculum? ___ Yes ___ No

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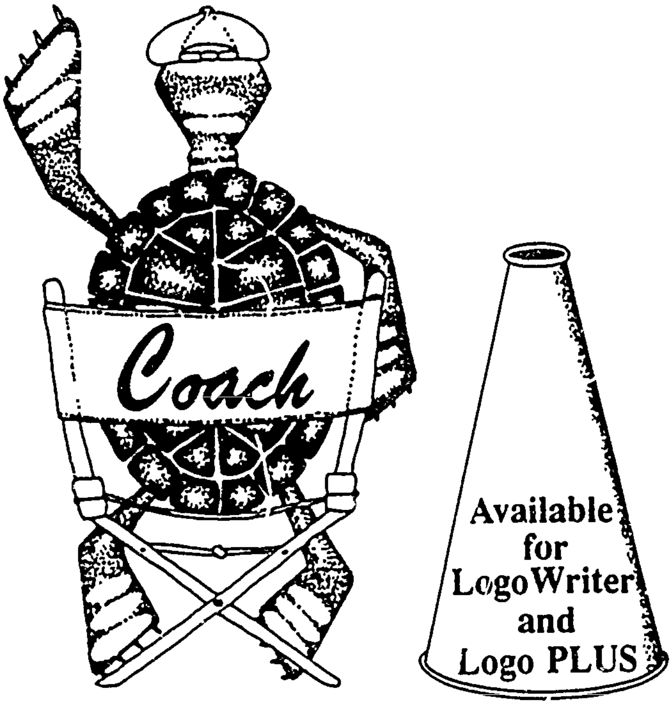
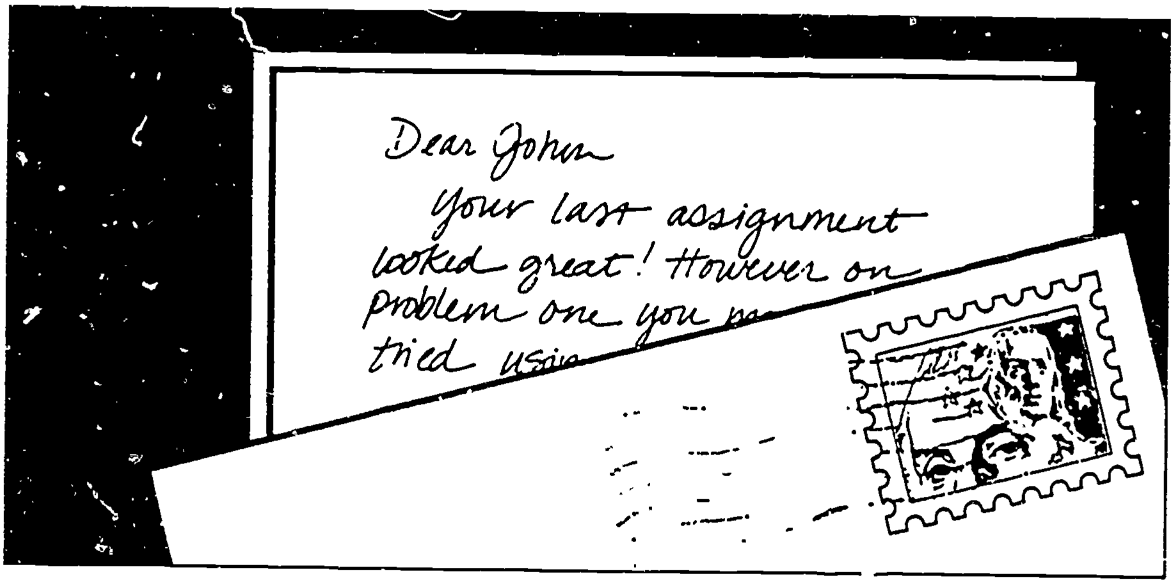
# The turtle moves ahead.



# Finally, a long distance relationship that won't break your heart.



Dear John

Your last assignment

looked great! However on

problem one you

tried

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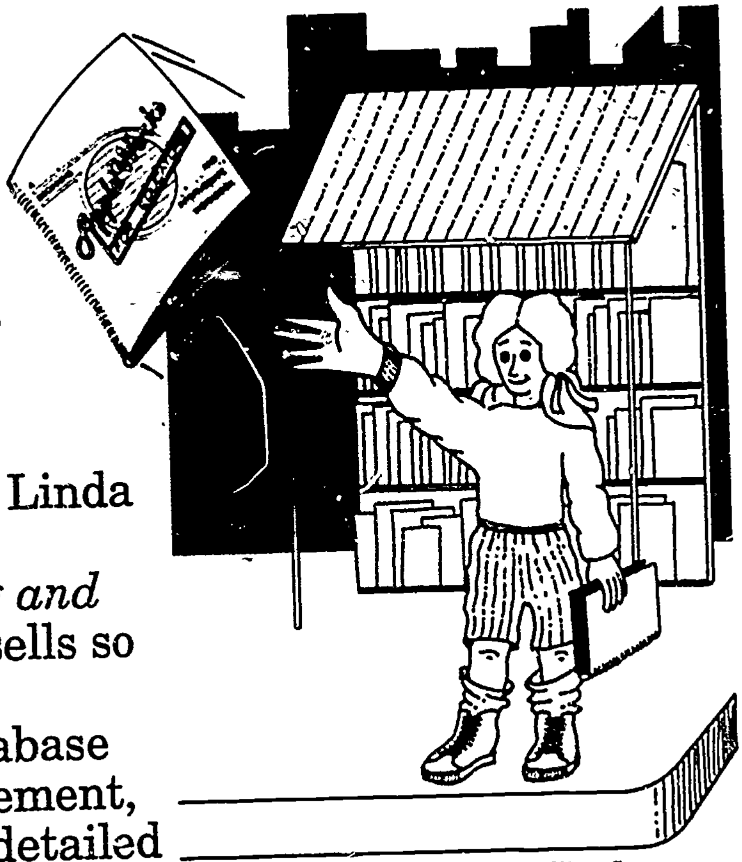

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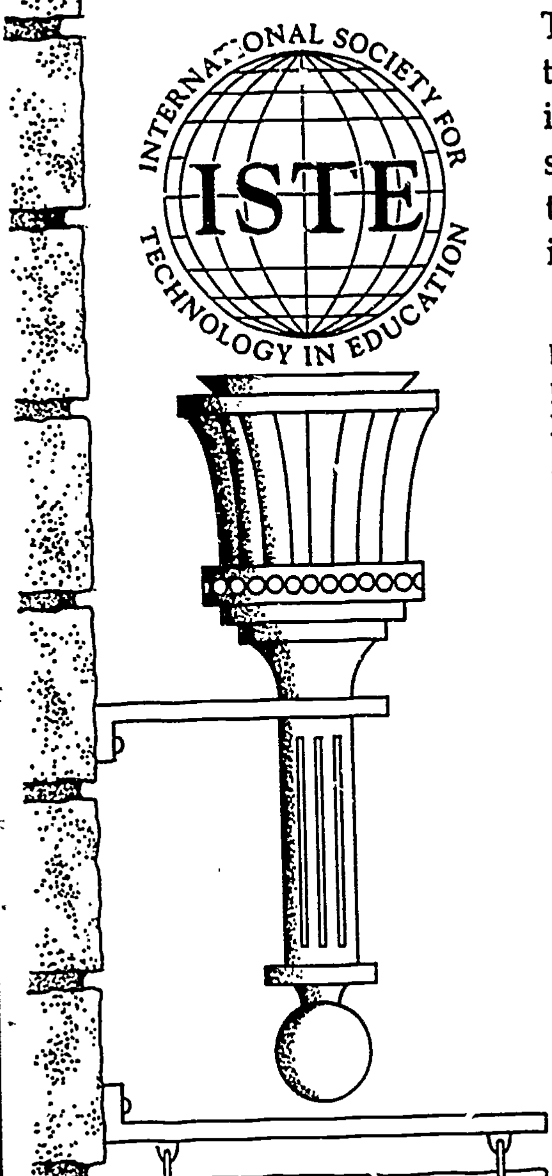

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