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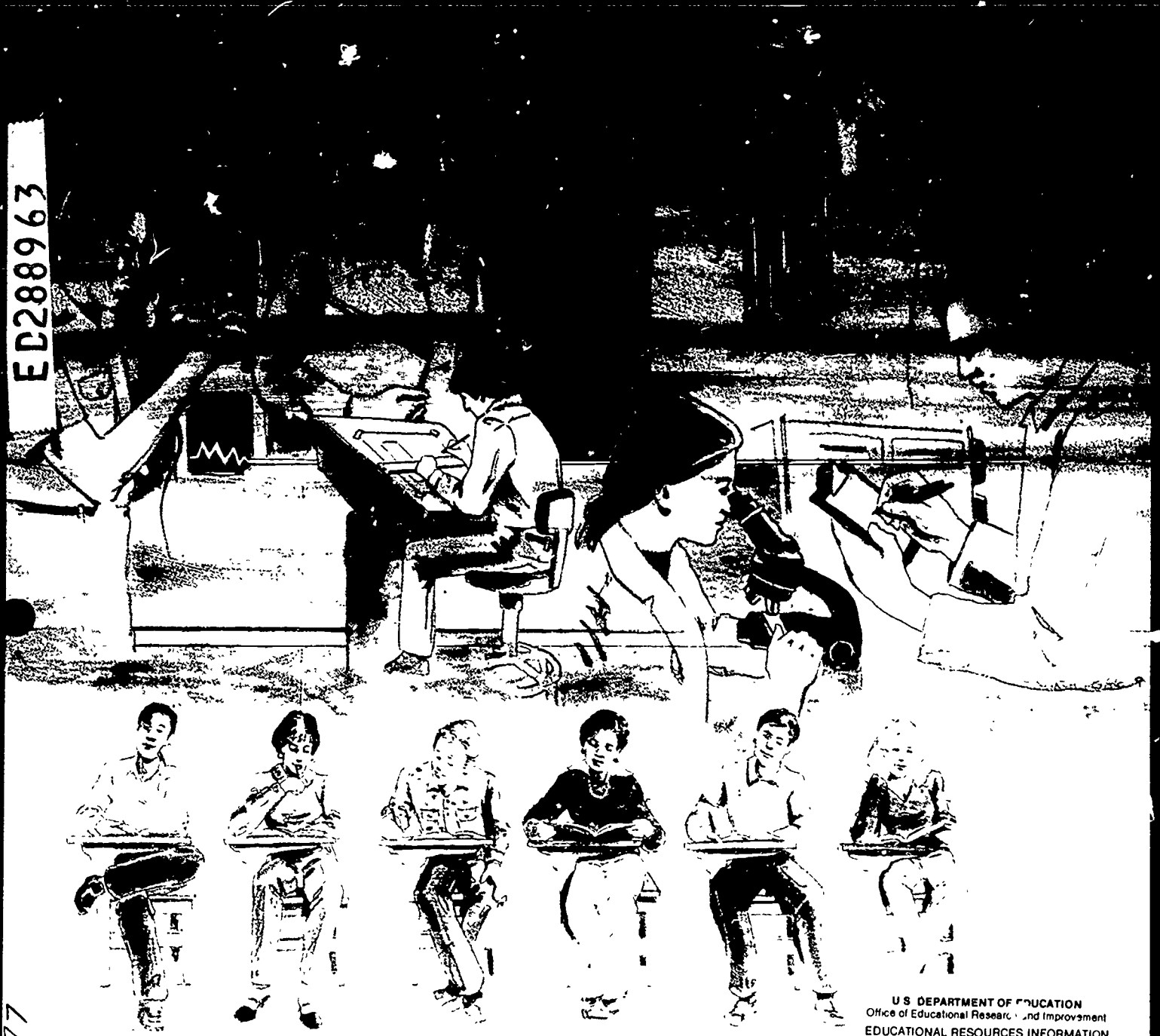
ABSTRACT

This guide contains a compilation of suggestions and guidelines to assist secondary-level teachers in planning to make the most effective use of computer-assisted instruction (CAI) through careful courseware evaluation. It is part of BASICS, a set of integrated materials developed to assist teachers, administrators, and counselors in bridging vocational and academic skills. An introduction defines CAI and relates it to the joint vocational-academic approach. The next three sections are structured around a checklist that deals with three major tasks: plan for effective use of the computer, establish guidelines for developing or evaluating software, and evaluate courseware. Three steps in planning for effective use of the computer are discussed: identify the benefits of CAI, identify appropriate tasks for CAI, and identify strategies for CAI. Establishing guidelines involves the following steps: identify the learning objectives and tasks, determine teaching effectiveness, evaluate appropriate use of computer capabilities, identify management possibilities, and evaluate documentation. The section on courseware evaluation provides information about microcomputer courseware evaluation sources and the Microcomputer Courseware Evaluation Form and Guide. (YLB)

Basics
Bridging Vocational
and Academic Skills



Technique for Computer Use: Software Evaluation

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THE OHIO STATE UNIVERSITY

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Strengthen basic skills by using . . .

TECHNIQUE FOR COMPUTER USE SOFTWARE EVALUATION

A Targeted Teaching Technique

Compiled and Adapted by

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FOREWORD

Converging factors point to a need to look for new pathways to vocational education excellence: the public's increased expectations regarding academic outcomes of education, heightened by a number of national reports; increased graduation requirements and declining vocational enrollments in many states; the emphasis in the Perkins Act on the need for strengthening academic foundations; and business and industry requests that entry-level employees have a more thorough knowledge of the basic academics they will need to apply in their vocational fields. Those concerned agree that students need to have stronger basic academic skills as they leave secondary education programs—stronger academic skills for graduation, for work, and for life.

The National Center has sponsored diverse efforts dealing with basic skills in vocational education from research to development to dissemination. Much has been learned about vocational students' basic skills learning problems. In order to make connections between research and practice, the National Center has, through synthesis and development, prepared an integrated package for teacher use, reinforcing this information with practical applications gleaned from teachers' repertoires across the nation. The products in the package are aimed toward enabling vocational and academic teachers to strengthen the academic component of vocational programs through joint effort.

The BASICS package provides resources in five focus areas: research findings, teaching techniques, instructional materials, instructional strategies, and support roles. The resources are organized in three looseleaf guidebooks for flexible use, and an accompanying videotape provides an orientation to the topic and to the package.

The Bridger's Guide orients administrators, counselors, teachers, employers, and families to the purpose and application of *BASICS*; individual roles are explained, resources identified, and implementation guidelines and strategies outlined in workshop format. Individual components to the guide are as follows:

- *Implementation Guide* describes the philosophy of BASICS and provides guidelines for implementing the program.
- *Support Roles for Basic Skills* describes the role of administrators and counselors in a program for improving basic skills.
- *Primer of Exemplary Strategies* provides teachers with examples of other teachers' successful efforts and diverse approaches.
- *Roadsigns from Research* (posters and brochures) highlights key research findings of interest to teachers in strengthening basic skills.

Targeted Teaching Techniques provides vocational and academic teachers with assessment, planning, and management tools to improve students' basic skills. Individual components are as follows:

- *Technique for Management: Time for Learning* lays foundations for more effective basic skills instruction through a study of the use of class time.

- *Technique for Remediation: Peer Tutoring* discusses the planning, implementation, and evaluation of peer tutoring programs to strengthen students' basic skills.

- *Technique for Computer Use: Software Evaluation* describes a procedure for joint evaluation of educational software for basic skills instruction.

- *Technique for Individualization: The Academic Development Plan* guides school staff through a systematic identification of individual student needs and steps to meet those needs.

- *Techniques for Joint Effort: The Vocational-Academic Approach* describes teaching techniques that vocational and academic teachers can use jointly to improve students' basic skills.

Developing an Instructional Program provides teachers with practical and theoretical information on development or selection of appropriate applied basic skills instructional materials. Individual components are as follows:

- *Instructional Materials Development* discusses the prerequisites of materials development, alternative curriculum types, and guidelines for materials development and review.

- *Supplemental Instructional Resources* identifies sources of basic skills instructional materials available for use with vocational students.

- *Instructional Assistance in Specific Basic Skills* prepares vocational teachers to help students gain reading, writing, oral communications, and math skills.

The National Center wishes to acknowledge the leadership provided to this effort by Dr. Robert E. Taylor, recently retired Executive Director. Appreciation is extended to the following individuals who served as a panel of experts to assist staff in planning strategy and recommending document content: Eugene Bottoms, Consultant to the Southern Association of Colleges and Schools; Michele Brown, Vocational Supervisor, Idaho Falls School District, ID; Alton Crews, Superintendent, Gwinnett County Public Schools, GA; Roger Faulkner, Instructor-Coordinator, Great Oaks Joint Vocational School District, OH; and Darrell Parks, Director, Division of Vocational and Career Education, Ohio Department of Education. Appreciation also is extended to Robert Hartwell, Pioneer Joint Vocational School, Shelby, OH and to Ruth Gordon of The National Center for their critical review of the document.

Special recognition is due the following National Center staff who played major individual roles in the development of the BASICS package: Richard J. Miguel, Associate Director for Applied Research and Development, and Michael R. Crowe, Project Director, for leadershp and direction of the project; Sandra G. Pritz, Senior Program Associate, Judith A. Sechler, Program Associate, and June Veach, Graduate Research Associate, for synthesizing and developing the documents; and Deborah Black for word processing the documents. Appreciation is extended to The National Center editorial and media services personnel for editorial review, graphics, and production of the documents.

Chester K. Hansen
Acting Executive Director
The National Center for Research
in Vocational Education

EXECUTIVE SUMMARY

Research has shown that microcomputers are providing valuable assistance in improving the basic skills levels of students. As computer costs decrease, the capability of computers increases, and software availability expands, great potential exists for continued expansion of effective and economical solutions to a variety of student learning needs.

Software programs in basic skills are available for many brands of microcomputers. Vocational courseware is available as well However, not all of these programs are of high quality. Evaluation of the software available is becoming organized, but in the final analysis, it is up to teachers to evaluate software for potential use by their students in computer-assisted instruction.

This guide contains a compilation of suggestions and guidelines to assist secondary level teachers in planning to make the most effective use of computer-assisted instruction (CAI) through careful courseware evaluation. Vocational and academic teachers working together to develop and implement guidelines for courseware evaluation are in a particularly good position to provide for students' vocational *and* academic needs. The potential is great because each teacher brings the perspective of a different teaching context and/or discipline.

The guide is structured around a checklist that deals with three major tasks: plan for effective use of the computer, establish guidelines for developing or evaluating software, and evaluate courseware. These tasks highlight the importance of evaluating courseware only on the basis of carefully constructed plans for CAI use and established evaluation guidelines.

Three steps are discussed for teachers to plan for effective use of the computer. These include the following: identify the benefits of CAI, identify appropriate tasks for CAI, and identify strategies for CAI. Information on these topics was compiled from two 1983 publications of the National Center, *Microcomputers in Voc Ed: A Decision Guide* (Zahniser, Long, and Nasman) and *Microcomputer Software for Adult Vocational Education: Guidelines for Evaluation* (Stone).

Establishing guidelines involves the following steps: identify the learning objectives and tasks, determine teaching effectiveness, evaluate appropriate use of computer capabilities, identify management possibilities, and evaluate documentation. Material for these topics was adapted from the Stone work previously cited.

The task of actually evaluating courseware begins with identifying potentially suitable courseware Then, to facilitate the evaluation, *Courseware Evaluation: Form and Guide for Vocational and Technical Education* (Chase, Gordon, and Makin, 1984) are presented. This material was developed at the National Center to respond to the need for a mechanism for a detailed and comprehensive courseware evaluation.

INTRODUCTION

Research Findings:

Interactivity is the current technological buzzword—and with good reason. Theorists have long agreed that the most effective learning occurs when the learner has a sense of control, is actively involved, gets immediate feedback, and has a high level of expectation about his or her ability to master the material . . . computer-assisted instruction (CAI) does just that.

Chris Lee. "Adding the New Technology to Your Training Repertoire." *Training: The Magazine of Human Resources Development*. April 1982.

The classification of an item of software as good or poor (useful . useless) is, in the final analysis, a professional judgment. It is our privilege to make such judgments and our fate to live with the results. All the world's questions, checklists, consultants, and research are means, not ends, in this decision-making process.

B. Kansky, W. Heck, and J. Johnson. "Getting Hard-Nosed about Software: Guidelines for Evaluating Computerized Instructional Materials." *Mathematics Teacher*. November 1981.

Research has shown that microcomputers are providing valuable assistance in improving the basic skills levels of students. As computer costs decrease, the capability of computers increases, and software availability expands, great potential exists for continued expansion of effective and economical solutions to a variety of student learning needs.

Software programs in basic skills are available for many brands of microcomputers. Vocational courseware is available as well. However, not all of these programs are of high quality. Evaluation of the software available is becoming organized, but in the final analysis, it is up to teachers (not necessarily computer teachers or computer directors) to evaluate software for potential use by their students in computer-assisted instruction.

Definition of Computer-Assisted Instruction (CAI)

Authors use a variety of terms when referring to the use of computers in instruction. Such terms include computer-based instruction (CBI); computer-assisted learning (CAL); computer-assisted instruction (CAI); and computer-managed instruction (CMI). Generally, the choice of terms is determined by whether the author is writing about an instructional delivery system or about a particular group of related instructional applications.

The material in this and the next chapter is adapted from Zahniser, Long, and Nasman (1983) and Stone (1983)

In both theory and practice, it is often difficult to distinguish between CAI and CMI. This is because some of the existing courseware and software programs developed for instructional purposes are used both to deliver concepts and information to a student (CAI) and to diagnose the student's learning patterns and problems and prescribe remediation (CMI). In this guide, the term CAI will be used as primary.

The literature related to computer-assisted instruction contains a variety of definitions for the term. Some authors suggest that any instructional use of the computer is CAI, while others are much more specific in regard to the types of instructional applications that can be considered CAI. Inherent to all definitions, however, are the concepts that the computer can be helpful in delivering instructional materials to students, and that the term *CAI* encompasses several different learning strategies.

Frenzel (1980) describes and defines CAI as

> the process by which written and visual information is presented in a logical sequence to a student by a computer. The computer serves as an audiovisual device. The students learn by reading the text material presented or by observing the graphic information displayed. The primary advantage of the computer over other audiovisual devices is the automatic interaction and feedback that the computer can provide. Multiple paths through the course material can be taken, depending upon the individual student's progress. (p. 86)

A Joint Vocational-Academic Approach

Vocational and academic teachers working together to develop and implement guidelines for software evaluation are in a particularly good position to provide for students' vocational *and* academic needs. The potential is so great because each teacher brings the perspective of a different teaching context.

A special concern for academic teachers' choice of software to strengthen basic skills arises partly because there has been relatively widespread discussion about CAI being especially suitable for basic skills instruction. The agreed-upon potential in this area has resulted in a relatively large amount of basic skills software being produced. The challenge, then, is to select by careful evaluation from this large supply.

A special concern of the opposite nature exists for vocational teachers, since the market for vocational education software is smaller than that for general education software. This means that commercial software publishers will not be able to realize so large a profit from vocational software as they will from software prepared for the general education market. Because of this constraint, there may be a smaller supply of "canned" or commercial software programs available for many vocational education courses. One source of information about available vocational education software is the database for Vocational Education Curriculum Materials (VECM), which includes almost 1,000 courseware listings. This database is maintained by the National Center for Research in Vocational Education (phone toll free within the continental United States, 800-848-4815; in Ohio, 614-486-3655). A VECM listing describes the courseware and its availability. A few of these listings include evaluations done on a voluntary basis. These evaluations are summarized in ERIC (The ERIC Clearinghouse on Adult, Career, and Vocational Education).

Yet another issue is that the vocational curriculum must to some extent reflect the requirements of local employers. Because of this, mass-produced, commercially prepared software will not, nor can it be expected to, satisfy the local curriculum needs of many vocational programs. Given this situation, the ability of the vocational community to adapt software or to generate its own software becomes extremely important.

It is clear that both vocational and academic teachers have an important role to play in establishing the guidelines for developing or evaluating computer software and then in applying those guidelines. A joint effort should result in the use of software that is both vocationally and academically effective.

One way to implement such a joint effort in evaluation is for a vocational teacher to team up with an academic teacher to establish the guidelines. Then each can review the software independently—the vocational teacher focusing on specific vocational skills and the academic teacher focusing on the basic skills areas. The courseware selections would be made by joint review of their ratings.

Additionally, vocational and academic teachers can offer much and profit much from the cross-fertilization that occurs through their joint software evaluation. As they discuss ways to evaluate software for their programs more effectively, they are likely to move toward greater vocational-academic integration of their courses. Learning gains in both vocational and academic courses should result from greater integration and coordination.

What Follows

The next section contains a compilation of suggestions and guidelines for planning to make the most effective use of CAI through careful courseware evaluation. The checklist on the next page provides an overview of the items to be considered. Readers who are already familiar with particular items on the checklist may choose to skip over the discussion of those topics. The last portion of the guide presents an evaluation form that can be duplicated for use in courseware evaluation.

PLAN FOR EFFECTIVE USE OF THE COMPUTER

CHECKLIST—TECHNIQUE FOR COMPUTER USE

- ☐ Plan for effective use of the computer
  - ☐ Identify the benefits of CAI
  - ☐ Identify appropriate tasks for CAI
  - ☐ Identify strategies for CAI
- ☐ Establish guidelines for developing or evaluating computer software
  - ☐ Identify the learning objectives and tasks
  - ☐ Determine teaching effectiveness
  - ☐ Evaluate appropriate use of computer capabilities
  - ☐ Identify management possibilities
  - ☐ Evaluate documentation
- ☐ Evaluate courseware
  - ☐ Identify potentially suitable courseware
  - ☐ Use the courseware evaluation guide
  - ☐ Use the courseware evaluation form

Identify the Benefits of Computer-Assisted Instruction

Because of its potential for interaction and for individualizing and personalizing instruction, the computer can be a powerful tool for strengthening students' basic skills. Use of the computer has the effect of providing time that a vocational (or academic) teacher may not be able to provide to help students deal with basic skill needs. Some teachers feel that the use of computers detracts from interpersonal interaction in the learning process. However, use of a computer may actually enhance personal interaction between students and the teacher since it can free teachers from basic instructional tasks and allow them to manage learning and to concentrate on students' other concerns.

As a learning tool for basic skills instruction, the computer has unique qualities. It has no feelings; it doesn't criticize, sympathize, become angry, interpret, or react except in the ways in which it has been programmed. This is at once a limitation and an asset. While the computer cannot sense a student's lack of understanding nor adjust its explanations to nuances of a student's interpretation of material, it can pose the very same question ten, fifteen, even a thousand times without any trace of impatience at the lack of a correct response. The computer gives all students the same reaction whether they are young, old, black, white, female, male, quick, slow, rich, or poor. This admittedly mechanistic quality of the computer has the advantage of being totally impartial and nonjudgmental. It can eliminate the anxiety often present in conventional classrooms, particularly with learners who have had negative experiences with education. Students who lack basic skills do not have to try to mask their inadequacies, because the computer is private as well as patient and consistent. Students using a computer do not have to waste energies over being "liked" (feeling approval) or "disliked" (feeling humiliated) and can, therefore, concentrate more completely on solving the problem or digesting the material presented.

On the other hand, some students need the reassurance that can be provided only by human contact. Teachers using microcomputers to provide instruction should make sure that they or other resource persons are available to assist students and to offer guidance and support.

While a computer makes no emotional judgments about the student user, its capacity for storage and retrieval of information does allow for individualization of student use so that individuals not only interact with material at their own level and speed but also receive instant individualized responses. Through the microcomputer's interactive capabilities, CAI instruction adapts to the student's needs by processing the response to a question and coming back with whatever instruction is required. When evidence is given that a student has mastered the concept or instructional objective, the lesson proceeds. Individualization is a very important feature of computer instruction, since students have a variety of learning needs and learn at varying speeds. (To help monitor, use **BASICS' Technique For individualization: The Academic Development Plan.)**

Unlike most other teaching methods or technologies, computers offer students the opportunity to follow a number of different learning directions or "paths." For example, if a student has already mastered part of a computerized lesson, he or she may choose to skip that section of instruction and "branch out" or proceed into new material. In other cases, the student may need to spend extra time reviewing difficult sections of the lesson—a process that is well facilitated by the microcomputer's backtracking or "looping" capabilities.

Clearly, therefore, the computer offers to both vocational and academic teachers a technology that is different from other audiovisual media such as films, filmstrips, and audio and video tapes. These latter items in particular allow only one path through the instructional material from start to finish. As such, they do not permit nearly so many options for creating totally individualized and interactive instruction that the microcomputer does.

The one-to-one interaction between students and the computer, often enhanced by color, sound, touch, graphics, and animation, can keep students involved and motivated to a remarkable degree and can greatly extend their attention span. This motivation can be especially important for students who have a passive or a negative approach to learning.

In addition to providing motivation, the computer is capable of animating a process, such as the construction of an automobile engine, designing schematics and graphs, and presenting routine drill and practice in the guise of a game. The computer can make many routine vocational learning tasks palatable as well as make less routine, otherwise inaccessible learning activities accessible to students.

Any exposure to computers can be a great benefit to students, since computer experience is becoming a requirement for much entry-level employment. In the huge white-collar field of office work, all but the most menial jobs now require the ability to use computers at some level of competence, or soon will. Even entry-level file clerk jobs are affected as filing systems become databases. Computers have become so common that some people have suggested that computer literacy be considered a basic skill.

By working with computers in their day-to-day training, students develop competence in handling menu-driven programs and learn the basic vocabulary of the technology. They come to accept computer work as routine. The apprehension many have about this new technology is reduced or disappears. Students develop a positive attitude toward the computer and feel better able to participate in a computerized world.

Additional benefits that deserve at least brief mention include the computer's ability to—

- provide embedded remedial instruction of which the student may not necessarily be aware.
- provide enrichment material within the program;
- track progress throughout the program, and, indeed, throughout a series of programs on varied material;
- provide video and audio support via peripheral devices linked directly to the computer; and
- provide a massive information base—either by direct display of the material itself or by directing the student to the appropriate medium. (Herriott, 1982)

Obviously, the use of computers with appropriate, well-designed software can dramatically and dynamically enhance instruction.

Identify Appropriate Tasks for CAI

Teachers' plans for use of the computer in instruction should stem from their instructional goals and objectives. Teachers need to analyze those goals on a task-by-task basis to determine which teaching techniques can best assist in reaching them. The computer offers a fresh and creative approach to learning that makes it a candidate for consideration as a teaching tool for many tasks.

Tasks that require drill can be made more interesting by computer, because problems can be randomized. Tasks that require routine computations can be performed more quickly—thus allowing students to examine higher-level concepts. Students can study or work with phenomena on a computer that in real life would be beyond them because of factors of time, cost, or physical danger. Tasks for which a large amount of material needs to be displayed lend themselves to computer instruction.

Computers are most appropriate for tasks that can be explicitly defined. For example, they can be programmed to provide immediate feedback for specific answers and to advance students automatically to more difficult material when satisfactory competency is demonstrated. This individualization of feedback and pace is especially helpful in strengthening basic skills.

Computers cannot be used for every instructional task. Time at a computer is not an effective replacement for hands-on learning (e.g., a laboratory experiment). Neither should students be asked to read large amounts of material on a computer if the information can be provided equally well on paper. Often, psychomotor skills can be taught most effectively in ways other than by computer.

Identify Strategies for CAI

CAI can be implemented in the vocational or academic classroom in several different ways. A consensus has not yet been reached on which of these modes are most appropriate for CAI. In any case, it is important to recognize some of the more common modes:

- **Drill and practice.** This use of the computer takes "advantage of the computer's tireless patience and ability to provide immediate feedback and reinforcement to prescribe, provide, and monitor potentially very complex drill and practice activities which can be tailored to a student's individual needs." (Forman 1982, p. 44)

  Drill and practice are often discounted by the academic community, even though it is the method used to master specific academic areas. It is especially critical for students who come from homes where conventional curriculum topics are not supported.

  For such children, drill and practice take place only at school. These children rarely see or hear the basic rules of many subject areas used outside of school. They do not have the supervision, extra time, or support needed to practice the skills that stem from basic curriculum concepts.

  Students need to practice. They need to practice what they have been taught so that they can use it with ease. Teachers simply do not have the time to give individualized drill and practice to each student in their classes, much less evaluate the results and provide feedback. (McDaniels 1985, 146-7)

- **Tutorial.** "Depending on the capabilities and the storage capacity of the computer system, [this use of the computer is a dialogue] between the learner and the designer of the educational program. The computer acts as a 'tutor' to teach the student concepts and skills. . . ." (ibid.)

  Subjects like the basic skills can be taught well on computers because they have the advantage of being well defined, highly teachable through tutorial instruction. (McDaniels, 1985, 147)

- **Simulations.** In this regard, the computer is used ". . . to simulate or generate environments for the learner so [the student] can change variables and explore situations in a manner that might have been too expensive, too restricted by time limitations, too dangerous, or impossible to allow the student to explore in the real world." (ibid.)

- **Problem solving.** "In this mode, the student uses the computer to solve problems that would take many hours or excessive computation to solve by hand. . . ." (Molettiere, Konsynski, and Stott 1980, p. 149)

- **Inquiry.** "In this mode, a database of information is developed which the student can query for facts about a topic. An example of the inquiry mode is PIP, or "Product Information Package"—a database of product information that marketing personnel can use to keep up-to-date on tariff status and product options." (ibid., p. 149)

- **Demonstration.** The correct method of performing a task can be shown with the aid of a microcomputer, and the computer can repeat the demonstration over and over without boredom or frustration.

- **Writing.** As a tool for creating text, the computer, coupled with word-processing software, can vastly simplify and speed up the tasks of editing. Rearranging sentences or whole paragraphs, altering a word or phrase, and correcting spelling and punctuation are all faster and far easier to cope with on the computer than with a typewriter or pencil. By reducing this drudgery in writing, and particularly in rewriting, the computer makes the challenge of expressing oneself "on paper" less intimidating. As a result, students may be able to learn writing skills more effectively and with less stress on a computer. (Stone, 1983, p. 4)

These modes of instruction plus other imaginative ways to implement CAI in the classroom offer rich possibilities for the strengthening of students' basic skills. Yet the computer cannot be viewed as a panacea. And the use of the computer in the most effective way depends not only on the selection of appropriate tasks and strategies, but also on the use of quality software. The remainder of this guide suggests ways to ensure the use of quality software.

ESTABLISH GUIDELINES FOR DEVELOPING OR EVALUATING COMPUTER SOFTWARE

Just as it has become clear that education can benefit tremendously from computer-assisted instruction, it is also true that care must be taken to avoid the pitfalls that go along with an enthusiastic rush to embrace a new technology. One such pitfall would be the failure to question whether computer-assisted instruction is the best technique for a particular task. Another pitfall is the use of software from the large pool of mediocre (or worse) programs that have been produced as the industry has scrambled to respond to the market.

As Lundeen (1983) notes,

> Educational software is available from a variety of commercial and noncommercial sources. Library media specialists, school teachers, and students may also develop their own. The area of microcomputer educational software is disorganized and largely centered around a cottage industry lacking standards, quality control, and direction. Programs vary widely in quality, and the accompanying documentation (instruction for use) is often inadequate. Costs vary from a few dollars to several hundred dollars for individual software packages, and may not be related to the quality of the program. (p. 116)

The following material specifies the issues that are important for the establishment of guidelines for selection of quality software.

Identify the Learning Objectives and Tasks

The two most important questions to be answered in either the development of software or the evaluation of an existing program are, "What educational objective is addressed?" and "What is the student's learning task?" The more specific the objective, the easier it is either to evaluate or to plan a program. Once the objective and task have been identified, peripheral questions need to be asked, such as, "Is the computer appropriate for the accomplishment of this objective?" and "What category of computer software (e.g., drill, tutorial, simulation) can provide the best vehicle for reaching this objective?"

At this point it might be advisable to look at the ways in which the particular task or objective has been approached in traditional teaching environments and ask, "In what way will computer-assisted instruction be more effective than established techniques for achieving this goal?"

Developers can identify specific areas in which computer use could be constructive by asking, "What elements of the particular discipline or subject matter have traditionally posed teaching problems, and why?" If the problem is, for example, one of possible student injury or damage to expensive equipment caused by students' attempts to get experience in assembly or diagnosis, a

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The material in this chapter has been adapted from Stone (1983).

computer simulation is suggested. If the problem is that students are not motivated to drill themselves in a required vocabulary or in basic skills, a lively computer game that demands accuracy and speed in the problem area may stimulate students to practice.

Determine Teaching Effectiveness

The entire program must be planned and evaluated to ensure that it provides an effective learning experience. This is the major and overriding concern. Even if the objective and task are well defined, and creative use is made of the computer's special capabilities, nothing will be gained unless the program meets other standards as well.

Information Content

The educational content should represent the best knowledge currently available in the area and should be correct. As any experienced software reviewer knows, errors creep into programs as they do into textbooks. A recent run-through of a word game, for example, revealed "concieve" given as the correct spelling of "conceive." An otherwise humorless drill in vocabulary introduced each lesson as "EXERCIZE." Careful review of the content is important. Presentation of wrong information only makes learning more difficult for students.

Response Handling

Another teaching consideration that is vital to the success or failure or a program is how incorrect student responses are handled. Some programs refuse to accept an answer in a different form and continue only to pose the question until the student has arrived at the programmed correct answer. Such treatment could be a model of frustration. At the other extreme, the program will respond simply "INCORRECT" and proceed to the next question or section of the exercise, leaving the student without any knowledge of the answer desired.

An example of ineffective response handling is the following: A mathematics drill posed the question "3/5 + 3/5." A student answer of "6/5" elicited a response of "INCORRECT." To a second try of "6/5," the computer responded, "Please reduce." Clearly, the computer had been programmed to expect the answer "1 1/5," the correct answer in mixed number form. The student, however, had not been given the instruction to enter answers in mixed number form. More important, the answer "6/5" is not only correct but it cannot be reduced, although it may alternatively be expressed in mixed-number form.

An effective option for handling an error is to allow the error and illustrate the consequences. In a paramedic training program that used simulation, the choice of "artificial respiration" rather than "tourniquet" for a slashed wrist could result in the death of the patient. The attractiveness of this approach is illustrated by the answer of one video arcade afficionado who was asked, "What is so great about video games?" He said, "You can die so many times."

Goals

While the actual goal of any instruction is student mastery of material, subsidiary goals can be introduced to make attainment of mastery more interesting. By way of example, the three programs described below each purport to increase speed and accuracy of typing.

The first program is tutorial. The student is given information about where to locate the fingers of each hand on the keyboard and is then presented with sequenced drills. At the end of an exercise, a score is awarded reflecting words per minute and errors made. The student is then advised to repeat the lesson or advance to the next drill. In this program, motivation to continue is sustained primarily by the student's desire for mastery, although the score may be motivational.

The second typing program starts by asking the student to set goals both in words per minute (wpm) and permitted errors per line. A beginner may elect to try for 5 wpm with a generous allowance of errors. The more advanced typist may opt for 80 wpm with no errors. Progress through the sequence of drills is governed by whether or not the student-set goal is achieved.

A third program provides a sequence of drills, but the format is that of an arcade game. Enemy craft approach the student's spaceship; to save the ship, the student must type letters, words, or phrases before the alien craft attacks.

The first of these typing programs is likely to attract only students who are highly self-motivated. For those who are afraid of failure and easily discouraged, the second version may be more appropriate. For others who might not have the self-discipline to expend time and energy on drill, the arcade game format might well be the most successful.

Some people support the notion that learning is "serious business" and that devices to make learning fun are, therefore, suspect. Nevertheless, the attraction of games and the success of game-formatted learning experiences have led software producers to market an increasing number of educational games Research on the educational value of electronic games tends to support the instructional value of such formats (Malone 1981). Although very few educational programs created specifically for vocational training are yet on the market, in considering purchase of those that are available or the development of new software for vocational purposes, the game treatment should be examined for its relationship to the educational objective as well as for its motivational value.

Is the gaming element merely a reward for successful performance? Does the correct answer, for example, simply provide the player with the opportunity to participate in the "game"—permitting the shooting of a basket in basketball or the spinning of a spinner to determine a move or is the format intrinsically related to the subject matter? Such a relationship exists in educational games in which the goal of speed and accuracy is directly related to the pressure of "enemy" attack, which increases as the player becomes more adept. Another example is an estimation drill based on bowling in which the better the player's estimate, the more pins are knocked down.

Both have benefits. In the former case, correct performance is encouraged because playing the game is an immediate goal. This approach has practical value and can be applied to a wide range of subject matter.

Time Use and Timing

How much student time must be spent on a program for the student to master the material? In judging or planning software, teachers should consider the time required. An automated accounting program for bookkeeping students may consume sixty hours of student time. On the other extreme, as little as ten minutes a day spent on drill and practice can be effective. Simulations take varying amounts of time depending on the complexity of the problem, but most take more than a single forty-five minute period. When computer use will, in all probability, take more than one class

period, teachers should plan for the recording of students' progress throughout the program so that they need not start from the beginning on succeeding sittings.

Timing within a program must also be considered. Is there a specific limit on the amount of time allowed for student response? Is that limit reasonable or, better still, can it be preset by the student or teacher? What happens if the time limit is exceeded? If there is no limit, does the program have any signal (such as a beep or flashing screen) to attract a user's attention to the fact that a response is required?

Language and Instruction

Software programs, like all educational materials, must be geared to the reading capability of the intended user. Programs to be used in basic skills instruction should have a clearly identified reading level. When programs are to be used with students who may have difficulty reading, supplementary vocabulary help can be provided through the computer's branching capabilities.

Instructions for the operation of the program must be geared also to the reading level of the intended user. If the user's reading level is a problem, one solution is to teach operation of the program orally and ask users to pass along the instructions. When appropriate to content, this works well and can provide valuable enhancement of self-image to the user-teacher. Where written instructions are necessary, text should be displayed with space between lines and without crowding the screen. Users must be allowed to read at their own pace. A mechanism, therefore, should be built in to allow them to advance to the next "page" by depressing a particular key.

Finally, safeguards should be built into the program so that, if instructions are not followed, the program responds appropriately. Incorrect execution of instructions should not "break" the program (return it to the beginning) but should result in further instruction to the user on how to proceed.

Testing Software

It is essential to test a software package. Not until material has been field-tested over a reasonable length of time, can one be certain that problems have been eliminated. Results of field tests should be made available to those who wish to purchase the software. It is best to confer with someone at an institution that is already using the software.

Software should be purchased only from a marketing source that allows a reasonable examination period. Fortunately, more and more software producers are offering to refund the purchase price if software is returned within a thirty-day period.

Societal Issues

In recent years much criticism has been leveled at tests and workbooks that are inherently sexist, racist, or propagandistic. Instructional material reflects the prejudices of its authors. This is no less true of instructional software. The computer's interactive capability and its power to involve the user impose a responsibility on the purchaser or developer to be aware of any implicit values in a given piece of software.

One must at least ensure that computer response to user input is not derogatory or ego deflating. The nonjudgmental quality of the computer is much proclaimed as one of its virtues, but software is only as nonjudgmental as its authors.

Evaluate Appropriate Use of Computer Capabilities

Some aspects of teaching effectiveness need to be carefully considered especially when the instructional vehicle is the computer, which has unique capabilities. These aspects are graphics, sound and speech, interaction, and randomization. All of these can be used effectively to support basic skills instruction.

Graphics

The extent to which the graphics treatment is integrated with the subject matter may be difficult to judge, but it is not hard to perceive when the graphics overpower the learning objective, becoming the focus of the user's attention. Creating graphics is such fun that the programmer can become infatuated with the sight of the images, little realizing that the student will become bored and impatient with purposeless repetition or long sequences of pictures that require no response. Any graphics display that impedes the students' progress through the program or that consumes time with nonlearning and nonmotivational activities should be avoided.

Graphics displays should not reward incorrect or inappropriate responses. An oft-cited example is a computer version of the familiar HANGMAN game in which students may deliberately try to misspell a word in order to view the dire, but visually intriguing, consequences. At the other end of the spectrum is the program that neglects the computer's ability to model or picture, relying on word-for-word duplication of some textual material.

Some text is, of course, necessary in most programs. Care must be taken to ensure that such text, when presented on the computer screen, is clear and easy to read. Since regular computer characters are small and often fuzzy when reproduced on a screen, particularly if a television is used as a monitor, special alphabetics may be required. Care must also be taken to ensure sufficient contrast between characters and background. Green against blue may look lovely on a color monitor, but a user with a monochrome screen may see nothing at all.

Sound and Speech

If sound is a feature of the program, similar criteria apply. Does the sound serve a purpose, or is it merely a distraction? Is the program just as effective with the sound turned off? Can you, in fact, turn it off? In a classroom with a number of machines operating, too many bleeps, bangs, wooshes, and fanfares played at too high a volume could create seriously annoying distractions for students and teachers alike.

Speech synthesis capability, not yet fully implemented on microcomputers, may nevertheless be necessary for special applications such as a substitute for text in a program aimed at the semiliterate. Some software producers have found ways to integrate tape recordings with computer software designed to drill spelling or a foreign language, or simply to introduce a neophyte to computer use. Such a circumvention of the speech synthesizer may be worth consideration if vocalization is a necessary part of the software.

Interaction

By far, the most important and effective capability of the computer to motivate learning and to drill, remediate, teach, or model educational material is its capacity for immediate response to the user's input. With computer-assisted instruction, each student can be steadily and actively engaged in the practice of a skill, the development of an idea, the exploration of a concept, or the evolution of a problem-solving strategy. Students need not sit waving their hands in the air for attention or wait days or even weeks between taking a test and receiving the results. It is unfortunate that more software does not take advantage of this capability.

Programs that are structured like books equipped with automatic page-turning devices or film that rolls on regardless of the viewer's input should be avoided. In fact, it is useful when reviewing or creating software to be aware of the percentage of time the user will be actively engaged and of the mechanisms built into the program to remind the student that some response is required. Building in student choices and decision-making can keep instruction lively. When developing software, developers should maximize user interaction within the confines of the educational objective.

Randomization

Much educational software calls upon the computer's ability to randomize words, numbers, questions, and so forth. Suppose a test poses ten questions but draws on a list of a hundred or more items. The items for the particular drill or test are selected by the computer's random number generator, a built-in function of the computer. Randomness varies from model to model. If the software under consideration relies upon randomization, it might be well to run some diagnostic tests on the random number generator of the machine to be used.

Identify Management Possibilities

Teachers can reasonably expect a computer to aid in the management of instruction, that is, to keep individual student records, calculate individual and group averages, generate progress charts, and maintain and update other statistical information. Ideally, this kind of computerized record keeping would be integrated with a branching program that administers tests, assigns student work on the basis of the computer-evaluated test results, and conveys any and all results to the teacher on demand. This has, in fact, been achieved in the computer-managed instruction (CMI) packages marketed on mainframe and minicomputers, such as Control Data's PLATO package. Such a complex integration of management and instructional functions, however, has not been satisfactorily achieved with microcomputers.

Some management programs for microcomputers correlate student data, but teachers must regularly compile and feed in that data. Also, some sequenced curriculum programs test students and assign appropriate work, but currently these two functions have not been successfully correlated in microcomputer software.

The record-keeping capability of most educational software is limited to tracking errors made during the use of the program and providing a summary on the screen at the end of the exercise or session. An option to print out this summary can be, and sometimes is, included.

In evaluating the management capability of microcomputer software, it should be kept in mind that, in the present state of the art, a barter situation exists: increased capacity for record keeping usually means decreased program flexibility.

Evaluate Documentation

"Documentation" refers to the body of written material accompanying a software or hardware package. Good software documentation includes the following:

- Clear marking on the outside of the package of the make and model of microcomputer for which the software is intended.
- Information on the copyright and licensing conditions of the individual package.
- A list, again on the outside of the package, of all equipment needed for the proper operation of the software including the memory requirements.
- Step-by-step directions for activating the software. These should include instructions for the order in which each peripheral piece of hardware is to be turned on, and all other information necessary to ensure that an inexperienced user can make the program run.
- Explanatory material relating to lesson content, including a description of a sample run-through. For the teacher this material should include an outline detailing typical classroom and/or student assigned use, instructional level, teacher options, and management and editing capabilities. Material for the student should include a menu of options, the goal of the program, and what, if anything, the student must contribute to the interaction.
- If the material is to be edited by the teachers, instructions for editing designed for a person with little or no computer experience.
- Supplementary worksheets and textual material if dictated by content.

Summaries of previous evaluations of the software are valuable, as are reference sources. Some particularly complex software includes a "hotline" telephone number that teachers and/or students may call for information about operational problems they incur in using the software.

Manuals accompanying software and hardware have been severely criticized for their abstruseness, for the use of unexplained technical language, and even for blatant errors. Obviously, documentation should be clear and accurate, but one should not assume that it will be.

A final and important note: software (and hardware) should be fun to use. Through the use of computers, the learning process should not only be facilitated but also made more enjoyable. Before using a program in the classroom, educators should ask themselves, "Would I like to use this particular software to learn?"

EVALUATE COURSEWARE

Because the supply of courseware is large and growing, the identification of potentially suitable courseware to evaluate is an important time saver for teachers. On the next page is a reprint of an ERIC Digest with information about microcomputer courseware evaluation sources.

The Microcomputer Courseware Evaluation Form and Guide that follow the ERIC Digest were developed in response to a widely felt need in vocational and technical education for a means to determine the quality of the growing number of microcomputer instructional programs, or courseware, available today. The form and guide provide the mechanism for a detailed and comprehensive courseware evaluation. These can be used by vocational and academic teachers who need to determine the quality of courseware and by developers who seek to produce high-quality courseware.

As teachers seek to strengthen students' basic skills through CAI and as they review courseware for this purpose, they should be aware that some courseware provides basic skills instruction overtly, perhaps labeled as communications (reading, writing, speaking, listening), mathematics, or science. In other courseware, basic skills instruction is embedded in vocational or other course materials. In the latter case, it might be advisable to use two copies of the form for the evaluation—one for the ratings relative to basic skills, and one for the overall course.

Another point of differentiation is between courseware that is to be used for an entire group and that to be used for specific individuals. Courseware for a group must be suitable for the range of learning needs and styles within that group. Courseware for an individual can be evaluated according to that person's learning needs and learning style.

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ERIC DIGEST

MICROCOMPUTER COURSEWARE EVALUATION SOURCES

The Dilemma: Too Much Choice

More than 10,000 instructional software packages have been published for elementary and secondary schools—thousands in each major discipline. We know, from magazine and journal laments, that much of this courseware is of poor quality. Faced with such an overwhelming supply, how can you increase the probability of purchasing *good* courseware for your school system?

The Solution: Courseware Evaluation

Fortunately, others have addressed this problem and have implemented a solution: evaluating large numbers of courseware packages. Thus, your school system can begin its task by identifying *potentially* suitable courseware through the evaluations available from one or more evaluation projects. After verifying that the content of some of the courseware is appropriate to your needs, you can select these few programs for your own specialists to evaluate prior to purchase.

Some Cautions

Not all sources of courseware evaluations are equally reliable. Before depending on the conclusions reached by a particular evaluation service, learn what you can about the evaluation methods and criteria it employs. It is especially important that evaluations include:

- critical appraisal of *content* accuracy,
- in-depth consideration of the appropriateness and effectiveness of the *instructional strategies* employed, and
- input from testing with *students*.

Note, too, that some evaluation services also consider how closely a given courseware package matches a state or local curriculum. This *selection* phase may not yield conclusions that are valid for your school system.

Useful Sources of Courseware Evaluations

Identified in this Digest are just a few of the most comprehensive and readily accessible sources of courseware evaluations. Described below are reviews available from two major courseware evaluation projects and those published in two magazines. Also highlighted are two sources that identify only high quality courseware (according to different criteria). Courseware evaluations are also available through clearinghouses established by several states and provinces, including Alberta, British Columbia, California, Florida, Iowa, Maryland, Minnesota, New York, North Carolina, Texas, and Utah.

MicroSIFT Courseware Evaluations. Holznagel, D. C., & Weaver, D. W. (Eds.). (1982-1985). *Courseware evaluations, sets 1-16*. Portland, OR: Northwest Regional Educational Laboratory. (ERIC Document Reproduction Service Nos. ED 226 765 (sets 1-5); ED 234 772 (sets 6-8); ED 239 606 (set 9); ED 245 666 (set 10); ED 249 918 (sets 11-12); ED 260 710 (sets 13-14); see the April 1986 issue of *Resources in Education* (RIE) for the ED number for sets 15 and 16.

Probably the most thorough and consistently reliable evaluations are published by the MicroSIFT project. Each courseware package is reviewed by at least three professionals and tested with students from the intended audience group.

The synthesized evaluations include descriptions of the courseware (objectives, prerequisites, content and structure, documentation, potential uses), appraisals of major strengths and weaknesses, and a check against more than 20 content, instructional, and technical criteria. The evaluation concludes with a summary of the content; instructional and technical ratings; and an overall recommendation statement (highly recommend, recommend use with little or no change, recommend use only if certain changes are made, or do not recommend). A modified format has been developed for science courseware that includes descriptions of science processes and concepts and three additional content and instructional criteria.

These evalutions (issued periodically in sets of 75 to 90) may be obtained from the ERIC Document Reproduction Service (call 1-800-227-3742, prices vary), or through the online Resources in Computer Education (RICE) database available through BRS (call MicroSIFT: 503-248-6800 Ext. 551). Some of the later sets contain evaluations of courseware that has been revised since an earlier MicroSIFT evaluation was published. Sets 15 and 16 will be the last sets of evaluations to be published by the MicroSIFT project in the current form, but the project will continue to collect evaluations and make them available through the RICE database.

EPIE Micro-Courseware FRO/FILES. (1982-1985). *Microcomputer courseware profiles & evaluations*. Water Mill, NY: EPIE Institute. Available by subscription.

A comprehensive evaluation service is provided by the Educational Product Information Exchange (EPIE) in cooperation with Consumers Union (CU). Each Courseware PRO/FILE is synthesized from the reviews of two or more evaluators, who have usually tested the courseware with students.

Every 3- or 4-page Micro-Courseware PRO/FILE and Evaluation contains a lengthy description and evaluation of content, teacher and student use, and management, often including photos of sample screens. Instructional design and software design are also appraised under the general headings of goals and objectives, contents, methods and approach, and evaluation and management. A summary of the evaluation is provided on the first page, along with recommendations to the producer. These are accompanied by overall ratings of instructional design and software design (in earlier PRO/FILES) or a summary recommendation (in more recent PRO/FILES).

Also published by EPIE Institute and Teachers College Press, Columbia University, is *TESS: The Educational Software Selector* (1985 Edition, $59.95). This guide includes review citations and an indication of whether a review is favorable.

Electronic Learning, Burroughs, R. (Ed.). New York: Scholastic. Published monthly September, October, and January through April; published bimonthly November/December and May/June.

Each issue of this magazine for teachers includes an entire section on the instructional applications of computers. In addition to discussing how computers can be used to help teach, for example, foreign languages or business education, contributors to that section provide comparative evaluations of several relevant courseware packages. The reviews, completed by a single evaluator, are not detailed, but do provide a concise overview of each program's strengths and weaknesses, along with seven ratings (instructional design, content, appropriateness, interest level, ease of use, support materials, and overall value). Also included are the publisher's comments on the evaluations, if available.

Educational Technology, Lipsitz, L. (Ed.). Englewood Cliffs, NJ: Educational Technology. Published monthly.

Every issue of this well-respected publication includes reviews of two or more courseware packages. Each evaluation is provided by a single professional, who judges the program against explicit criteria and who is required to test the courseware with one or more students representative of the intended audience. The prose evaluation reports consist of a detailed description of the courseware package and a critical evaluation of its strengths, weaknesses, and potential use. Publishers are given an opportunity to respond to the reviews.

Mattas, L. L. (1985). *Only the best. The discriminating software guide for preschool-grade 12*. Sacramento, CA: Education News Service. ERIC Document Reproduction Service No. ED 256 294.

For those who do not have the time to read hundreds of individual evaluations, *Only the Best* is an excellent resource. In it, Mattas has identified 113 programs that received the most agreement on high quality among the 16 evaluation services whose courseware reviews she examines. A one-page report is provided for each program.

Also included in *Only the Best* are brief descriptions of 189 "nearly qualifying" programs and 13 more that Mattas considers "worth looking at." (For courseware in these last two groups, you would certainly want to read one or two more thorough reviews before making a decision to select any of the packages.)

NEA Educational Computer Service (1985). *The yellow book. A parent's guide to educationally sound courseware*. Washington, DC. National Education Association.

Teachers/reviewers of the NEA Educational Computer Service examined 1,500 courseware packages from which they identified as being of high quality, the 272 programs described in *The Yellow Book*. The descriptions provided for each package are brief, giving an overview of the content and a summary of the evaluator's comments and recommendations. Again, you would probably want to conduct your own evaluation of any of these packages you consider.

Also identified in this publication are subsets of the 272 programs that are available in versions for specific microcomputers, including many less popular models.

This digest was prepared by Robin Taylor, Coordinator of Computer Education, University of Maryland Baltimore County, Catonsville, MD 21228. December 1985.

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COURSEWARE EVALUATION GUIDE

Evaluation Form Explanation

Part A

Part A contains descriptive information about the courseware product and should be filled out as accurately and completely as possible The needed information may be located in the hard-copy documentation or within the program itself Part A can serve as an initial screening device to determine whether the courseware review should be continued, for example, if the courseware is not compa. ble with the hardware or instructional setting, it probably would not be worthwhile to continue the evaluation process.

Part B

Related evaluation criteria are organized into eight sections. Each section represents a cluster of criteria needed for courseware evaluation and selection. It is important to note, however, that another element must be added to these criteria in order to arrive at a suitable evaluation of the courseware· your own judgment. Although each criterion is an important indicator of quality, the overall evaluation of the courseware depends on your analysis of these criteria in relation to your own needs. therefore, it is important to keep several points in mind when completing this part of the evaluation form:

- The criteria in the courseware evaluation form are numerous but not exhaustive and represent current knowledge and perceptions regarding courseware evaluation. As technology advances, interpretations of what constitutes high-quality courseware may change.

- An attempt has been made to present the criteria objectively. However, some criteria reflect a certain deg ee of subjectivity and personal values (e.g., "Program promotes productivity").

- No relative importance is assigned to individual criteria. The value attached to individual criteria is situation-dependent, each user must weigh criteria in light of the situation.

- The suggested evaluation procedure does not explicitly provide for observation of student use of the courseware. This could be included in an evaluation, however, at the judgment of the user.

In completing Part B, the user should first decide which whole sections are applicable to the specific courseware being reviev ed and then mark each section either ____ A for applicable or ____ N/A for not applicable Then a response should be given for every criterion in each section marked A:

- YES indicates that the criterion is fulfilled.

- SOMEWHAT indicates that the criterion is only partially fulfilled.

Pages 23 through 43 are reprinted from Chase, Gordon and Makin (1984).

- NO indicates that the criterion is not fulfilled within the program but should be
- N/A indicates that the criterion is not fulfilled and does not need to be

The COMMENTS column should be completed, at least for every item checked SOMEWHAT, to explain further why that rating was given When "Application" is checked for Program Mode under Instructional Setting in Part A of the courseware evaluation form, Section VIII should be completed along with any other applicable sections This is a separate section because of the importance of application programs in vocational and technical education and because they require a different set of criteria for evaluation

Part C

The purpose of Part C is to provide a means of summarizing your ratings of the courseware being evaluated. Although a complete review using the entire evaluation form is recommended in certain circumstances Part C could be combined with Part A and used as a short evaluation or initial screening device

Glossary

Branching	Program is designed so that student progress is determined by the specific answers given
Courseware	Combination of disk (or other medium of transfer) and the accompanying documentation and materials for instruction
Disk	Thin, usually flexible, plate on which data or programs are stored
Documentation	The description and instructions for use of a program Documentation may be in hard copy or within the program itself
Feedback	Response of program to user input of information
Hardware	Either a single item or collection of mechanical or electronic items required for use of a microcomputer program Examples of hardware include monitors and printers
Memory	The section of the computer where instructions and data are stored
Menu	List of choices within a program from which the user makes selections
Program	Microcomputer unit of instruction that can stand alone
Program Mode	The method or strategy used in the presentation of the subject matter
Series	A group of separate programs related to one another in that each program bears, in addition to its own title, a collective title applying to the group as a whole.
Support Materials	Items that support the activities of the persons using the program (e.g., student workbook).

Suggested Courseware Evaluation Procedure

The following is a suggested procedure for evaluating vocational and technical education courseware It is intended for beginning courseware evaluators Experienced courseware evaluators and professional reviewers can follow the procedure as is or adapt it in accordance with their background and need The steps in the procedure are as follows.

1 Review the evaluation guide and form

2 Review the documentation found in the hard copy and in the program This will necessitate a cursory run-through of the program

3 Complete Part A of the courseware evaluation form The user may not be able to complete all information requested in Part A Complete as many of the items as possible

4 Determine the feasibility of continuing the courseware evaluation. If there is compatibility between the items completed in Part A and user needs, the evaluation process should proceed If there is incompatibility the evaluation process may be discontinued

5 Run the program as a good student, making correct responses

6. Rerun the program as a poor student, making incorrect responses.

7. Complete Part B of the courseware evaluation form depending on the program mode checked If an application program is included in the courseware, complete Section VIII and any other applicable sections of Part B If the program mode is other than application, complete all applicable sections of Part B, excluding Section VIII.

8 Summarize your ratings in Part B by completing Part C of the courseware evaluation form.

9. Decide if the courseware meets the needs of the students

Figure 1 presents this suggested courseware evaluation procedure schematically

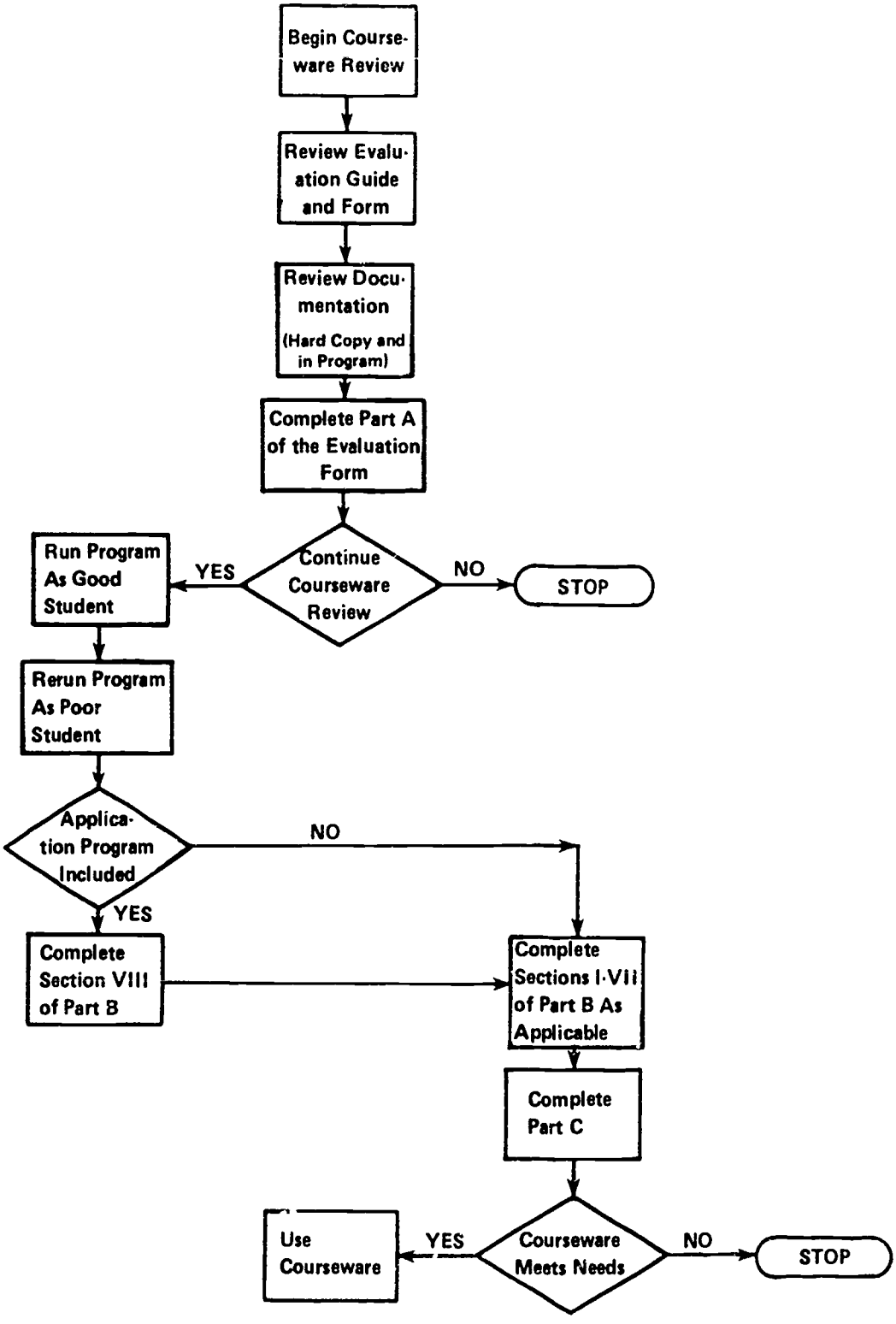
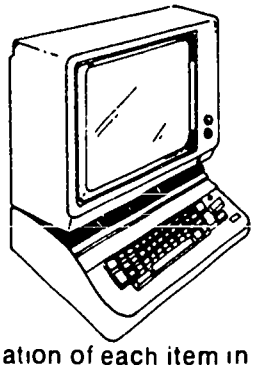


Figure 1. Suggested courseware evaluation procedure



Courseware Evaluation Form Item Definitions

Part A

An explanation of each item in Part A of the evaluation form is provided on the following pages

I IDENTIFICATION

Program Title	Name of the specific microcomputer instructional program (e g , *Introduction to Patterns*) and date of development.
Series Title	Name of the microcomputer instructional program series of which the specific program is a part (e.g., *Know Your Pattern* is a series of programs).
Vocational Area(s)	One or more vocational or technical areas for which the program could be used: agriculture, business and office, health, home economics, industrial arts, marketing and distributive education, and trade and industrial.
Subject Area(s)	A more specific content level under the vocational area (e.g., textiles and clothing).
Topic(s)	Specific topic(s) covered in the subject area specified (e.g , pattern alterations)
Developing Agency	The organization, agency or individual producing the courseware, address and phone.
Author(s)	Writer(s) of the content of the program.
Programmer(s)	Person(s) writing the content in programming language.

II. HARDWARE REQUIREMENTS

Microcomputer	Type of microcomputer needed to run the program (e g , Apple IIe).
K Memory Required	Amount of memory needed to run the program (e.g., 48K).
Medium of Transfer	Means used for storing the program (e g., flexible disk).
Programming Language	Language used to program the content (e.g , BASIC).
DOS Specifications	Disk operating system required (e.g , 3.3).
Other Specifications	Any additional requirements in relation to hardware.
Peripherals Needed	Any add-on hardware units required to run the program (e.g., two joysticks).

III PROGRAM FEATURES

Network Version Provided	Program runs on a centrally located microcomputer and is relayed to numerous student terminals
Multiple Copies Required	Disk must remain in disk drive during operation of the program; requiring multiple copies if the program is used by students simultaneously
Program Can Be Modified	Teacher can exercise the "list" command (access the lines making up the program) to make additions, deletions, or alterations
Program Protected	Program cannot be listed (e g , lines making up the program cannot be accessed)
Data Disk Needed	Data on file disk are required for the retrieval of information needed to run the program (e g , employees and salaries to generate a payroll).
Field-Test Data Available	The results of field testing are available to prospective users of the program.

IV INSTRUCTIONAL SETTING

Program Mode	Strategy or method used to present the content
	Application: Provides a service by performing a job (e g , spreadsheet).
	Drill and Practice: Provides repetition of information or skill previously acquired
	Educational Gaming: Presents facts in new interesting ways and provides for logical guessing
	Simulation: Presents real or imaginary events, compressing extended time to develop problem-solving skills in a safe environment.
	Tutorial: Introduces new concept(s) and provides for mastery learning by giving immediate reinforcement
Student Target Population	Type(s) of student for which the program was developed.
Grade Level(s)	Educational level(s) for which the program is intended.
Instructional Grouping	Instructional grouping(s) of students with which the program can be used. If designed for group use, will the program stimulate cooperative or competitive interaction?
Prerequisite Student Skills	Competencies students must have before using the program.

Documentation	Instructions for using the program Specify whether these are given in the program or in printed form
Student Support Materials	Accompanying materials for student use (e g , handouts, workbooks).
Teacher Support Materials	Accompanying materials for teacher use (e g , program guide, tests)
Correlated Materials	The program and other instructional materials (e g , textbook) are complementary
Estimated Time for Use	Approximate time required to use the entire program

V. AVAILABILITY

Free, Loan, Duplication, Sale, Rent	Means by which the program may be obtained
Copyright Restrictions	The program is copyrighted (i e , reproduction or distribution of the program is forbidden without approval).
Back-up Policy	Vendor makes a second copy of the program available free or at a reduced cost
Preview Policy	Courseware may be previewed before purchase under certain conditions.
Update Policy	Vendor provides revised versions of the program
Contact	Name, address, and phone of organization, agency, or individual from which the courseware may be obtained.

Part B

An explanation of each criterion in Part B of the evaluation form is provided on the following pages

I. SUBJECT MATTER

1 Subject matter is a timely practical component of the curriculum and reflects information or skills that can be used by students in their occupational fields.

2. Learning outcomes are clearly identified for students Objectives are presented at the beginning or placed throughout the program to reflect the progressive order of the desired learning.

3. Information is correct (e.g., graphs, text, statistics).

4 Subject matter is organized to reflect the usual sequence of events (e g., simple to complex, chronological order).

5 Racial, ethnic or sex groups are neither overrepresented nor underrepresented There are no inaccurate or biased generalizations about the characteristics of these groups

6 Vocabulary, readibility level, difficulty of the material, and interest level are suited to the students

7 The subject matter reflects the actual knowledge and skills currently used in the occupational area

8 Subject matter is written and presented in a manner to engage and maintain students' interest in learning the concepts or skills

9 Important ideas and concepts are reinforced (e g , by emphasis, repetition, questioning) These same ideas and concepts are synthesized in summary

10 Microcomputer capabilities (e g , immediate feedback, untiring repetition) appear to provide one of the best ways of presenting the subject matter

II. TECHNICAL PRESENTATION

1 Program runs consistently throughout without glitches (e g , program does not stall)

2 The program displays text, makes calculations, draws graphics, and gives feedback fast enough to maintain students' interest

3 Information is displayed in a format that is well designed and uncluttered Text is not obscured by overlay of graphics

4 Words are spelled correctly, grammar and punctuation are accurate throughout the program.

5 Instructions are consistent and unambiguous, complete, understandable directions are given for running the program

6 When color is used, it does not detract from the intended purpose of the program (e g , color makes material more realistic and interesting)

7 Audio is clear in tone and understandable The audio does not distract students from the educational impact of the program The program has an option to delete the audio when desired.

8 Graphics, either still or animated, do not detract from the subject matter presented. They illustrate and add meaning to the material.

III. STUDENT INTERACTION

1. Students can use the program without excessive assistance from the teacher.

2 Program promotes active rather than passive involvement of students by encouraging thinking and problem solving.

3 Students have control over the amount of time spent on each activity, thus individualizing the instruction to their specific needs

4 A list of choices from which students can select is provided Easy access to this list is available so students can make other selections when desired

5 The program offers a way of going back to make changes when a wrong answer or response is given

6 The complexity of the type of response is based on the capability level of the students (e g , excessive keyboarding is not required if it has not been taught)

7 The program is "crash-proof " It does not stop or forfeit information when students either give wrong responses accidentally or try deliberately to make it fail

8. When a student requests "Help," the program gives further instructions, reviews previous instructions, or provides assistances in progressing through the program

9. The program provides students with the opportunity to exit when necessary (e.g., class period ends before program is completed) and to reenter at point ended, rather than start at beginning of the program again.

10 Students can change the order in which they go through the program This permits them to go back to review or pick up information not covered.

IV. PROGRAM INTERACTION

1 Program interacts as soon as student response is made (e.g., informs student of accuracy of answers, presents further information, or explains previous information).

2 If the wrong answer is given, the program provides further information or clues (e.g , number of letters in the correct word is provided.)

3 Correct responses are recognized in a positive manner (e.g., student is complimented on correct answer). The program's response to incorrect answers is not so interesting that incorrect responses are encouraged.

4 Students are not addressed in a derogatory manner (e.g., "You dummy") when incorrect answer is given.

5. Program does more than merely review the material; it provides the reason that the answer is incorrect (e.g., "Answer B is wrong because . . .").

6 The student is not permitted to continue making incorrect answers indefinitely. It is not possible to arrive at the correct answer by the process of elimination.

7. The type of positive reinforcement changes as the program progresses, since feedback such as "You're terrific" becomes tiresome when overused.

8. Program offers activities based upon the student's responses. Branching offers alternative activities, with different levels of difficulty or interest. Looping is a repeat of the activity for review.

9 The type and content of the feedback are geared to student comprehension

V STUDENT EVALUATION

1 Evaluation included in the program (whether test items or performance type) is based on the stated student objectives and indicates progress toward attainment of the objectives

2 The results of each student's performance on the evaluation are provided by the program (e g . test score, items correct, items wrong) This information is protected by a separate password for use by the individual student and the teacher.

3 Program identifies for individual students the items for which correct and incorrect responses were made This assists students and teachers in understanding what corrective measures need to be taken This information is protected by a separate password for use by the individual student and the teacher

4 A composite view of class performance is given (e.g . average, range, percentiles) on the evaluation This information is protected by a separate password for use by the teacher

5 Hard copy of both individual student and composite class results is available to the teacher to facilitate record keeping Hard copy of individual test results is available to the student

6 The type of test item used (e g . true-false, multiple choice, performance) is varied to reflect the best method of determining student attainment of objectives

7 Test items are easy to understand Content and vocabulary are consistent with those in the subject matter presented.

8. A data bank of test items provides the teacher with the capability of generating tests by a random sampling of items.

VI. DOCUMENTATION

1. The language, vocabulary, and organization of the material in the documentation are easily comprehended.

2. All information is correct (e.g . graphs, text, statistics)

3 Expected learning outcomes are listed. If particular skills are to be developed, they are specified.

4 An explanation of the ideas and principles from which the program was developed is given

5. The particular skills to be learned through using the program are stated

6 The teacher is given specific suggestions on where and how to combine the program with the existing curriculum.

7 Suggested follow-up activities geared to the students are given to reinforce the information presented.

8 Recommendations on where and how to use all student materials are given

9 All necessary information is provided so that teachers or students can run the program from start to finish regardless of prior experience.

VII WORK BEHAVIORS

1 Students are made aware of their competencies in relation to their intended occupations Individual strengths and weaknesses can be determined and used as guidelines for further development.

2 Program presents all work as tasks to be approached and carried out in a conscientious manner Regardless of the nature of the work, students are always encouraged to "give it their best effort."

3 Program encourages the achievement of maximum outcomes through the use of available resources

4 Positive behaviors are advocated for getting, performing, and keeping a job These behaviors include dependability, punctuality, cooperation, and initiative.

5 Program encourages students to solve problems and make decisions that have transferability to their occupations and everyday lives.

6 Emphasis is placed on "people skills"—the ability to communicate and get along with people

7 Students complete the program feeling that they have accomplished something. Equally important, the means of accomplishment leaves students feeling good about themselves and their ability to complete the task.

8 Individual creativity is promoted through the opportunity to develop new ideas, products, or ways of performing tasks.

VIII. APPLICATION PROGRAMS

1. Program offers sufficient versatility and detail that the coverage and complexity of the program can be changed to meet the specific needs of the students using it.

2. Specific commands or instructions to enter and manipulate data are logical in nature and simple to use.

3. Process required to change data (frequently numbers) is simple to understand and easy to use.

4. Information being used in the program can be corrected or changed at any time without having to rerun the entire program.

5. All fields and variables necessary to perform the task are available, or the program is adaptable so the necessary variables and fields can be added.

6 Program provides the same answer or outcome each time, so that one can depend on its accuracy

7 Program performs the task it is supposed to do

8 Supplementary information or data source is provided to use in learning to run the program

9 Program provides for printer use when hard copy of the resulting information is advantageous

10 The sequence in moving from one operation to another is easy to understand and implement

11 Program is either *bundled* (designed to be compatible with other application programs) or *integrated* (developed specifically to be combined with other particular application programs)

12 Tutorial program presents the concepts and information needed in learning to operate the application program

Part C

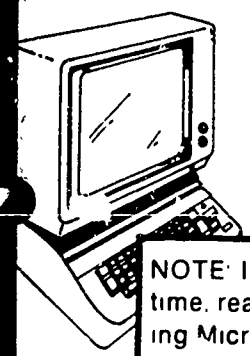
An explanation of each item in Part C of the evaluation form is provided as follows.

1 SUMMARY COMMENTS	Describe the advantages of this particular courseware If possible, compare it with other courseware reviewed. Describe the disadvantages of this particular courseware If possible, compare it with other courseware reviewed. Explain different ways the courseware might be used in learning situations, both in the classroom and in informal settings.
2 SUMMARY OF SECTION EVALUATIONS	Summarize the rating of the courseware by section of Part B of the evaluation form.
3 FINAL RECOMMENDATION	Give a final overall rating of the courseware for instructional use and a brief explanation of why that rating was given.

Features of the Evaluation Form

The Microcomputer Courseware Evaluation Form on the following pages—

- is comprehensive, covering all areas of vocational and technical education,
- may be adapted to meet specific instructional needs,
- can be used with all types of courseware,
- is flexible in that only applicable sections need to be used,
- provides space for written comments in addition to checked ratings,
- allows Part A, Description, and Part C, Summary, to be combined and used as a cursory screening evaluation if desired, and
- has an accompanying guide to assist in the use of the form.



COURSEWARE EVALUATION FORM

NOTE: If you are using this form for the first time, read the instructions in the accompanying Microcomputer Courseware Evaluation Guide

Evaluator _____

Position _____

Date _____

Part A: Courseware Description

In the following sections, record descriptive information about the courseware that you are evaluating

I. IDENTIFICATION

Program Title _____ Date _____

Series Title _____

Vocational Area(s) _____

Subject Area(s) _____

Topic(s) _____

Developing Agency _____

Street or P O. Box _____

City _____ State _____ Zip _____ Phone( ) _____

Author(s) _____

Programmer(s) _____

II HARDWARE REQUIREMENTS

Microcomputer* _____
(brand/model)

K Memory Required _____
(number)

Medium of Transfer (include number of each):

- ___ Tape cassette
- ___ ROM cartridge
- ___ 5¼" Flexible disk
- ___ 8" Flexible disk
- ___ Other _____ (specify)

Programming Language _____ DOS Specifications _____

Other Specifications _____

Peripherals Needed (check all that apply):

- ___ Color monitor
- ___ One disk drive
- ___ Two disk drives
- ___ Plotter
- ___ Game paddle(s)
- ___ Joystick(s)
- ___ Modem
- ___ Mouse
- ___ Printer
- ___ Graphics tablet
- ___ Light pen
- ___ Voice/sound instrument
- ___ Clock
- ___ Video disk
- ___ Touch screen
- ___ Ten-key number pad
- ___ Other _____ (specify)

*NOTE: Provide the above information for any additional hardware on which this program can be used. _____

_____

_____

III PROGRAM FEATURES (check all that apply)

- ___ Network version provided
- ___ Multiple copies required
- ___ Program can be modified
- ___ Program protected
- ___ Data disk needed
- ___ Field-test data available

IV INSTRUCTIONAL SETTING

Program mode (check all that apply)

- ___ Application
- ___ Drill and practice
- ___ Educational gaming
- ___ Simulation
- ___ Tutorial
- ___ Other _____ (specify)

Student Target Population (check all that apply)

- ___ Regular
- ___ Disadvantaged
- ___ Handicapped
- ___ Limited English
- ___ Bilingual
- ___ Gifted

Grade Level (check all that apply)

- ___ K-6
- ___ 7-8
- ___ 9-10
- ___ 11-12
- ___ 13-14
- ___ Adult
- ___ Higher Education

Instructional Grouping (check all that apply)

- ___ Individual
- ___ Small group (up to 4)
- ___ Large group (4 or more)
- ___ competitive interaction
- ___ cooperative interaction

Prerequisite Student Skills (specify) _____

Accompanying Materials (specify types)

Documentation _____

Student support materials _____

Teacher support materials _____

Correlated materials _____

Estimated Time for Use _____

V. AVAILABILITY

- ___ Free _____ (copies)
- ___ Loan _____ (time)
- ___ Duplication (requestor supplies disk)
- ___ Sale $_____
- ___ Rent $_____ _____ (time)

Copyright Restrictions (explain) _____

Back-up Policy (explain) _____

Preview Policy (explain) _____

Update Policy (explain) _____

Contact _____

Street or P O Box _____

City _____ State _____ Zip _____ Phone ( ) _____

Part B: Courseware Evaluation Criteria

Indicate the applicability of each section to the courseware being evaluated by checking either "___ A" (applicable) or "___ N/A" (not applicable) If a section is not applicable, proceed to the next section If a section is applicable, check the column that indicates how well the courseware meets each criterion. Include any comments.

	YES	SOME-WHAT	NO	N/A	COMMENTS
I. SUBJECT MATTER* ___ A ___ N/A					
1 Subject matter has educational value.					
2. Student objectives are stated.					
3. Subject matter is accurate.					
4. Subject matter is logically presented.					
5. Subject matter is free of race, ethnic, sex, and other stereotypes.					
6 Subject matter is on the level of the students.					
7 Information and skills presented are comparable to those used in the home, business, or industry.					
8. Subject matter motivates students to learn					
9 Subject matter is reviewed and summarized					
10. Program utilizes the unique capabilities of the microcomputer to present the subject matter.					
II TECHNICAL PRESENTATION ___ A ___ N/A					
1. Program is free of technical problems.					
2. Presentation rate is adequate to maintain interest.					
3. Information on the screen is easy to read.					
4. Program is free of spelling and grammatical errors.					
5. Program instructions are easy to follow.					
6. Color increases the instructional value of the program.					
7. Audio increases the instructional value of the program.					
8. Graphics increase the instructional value of the program.					

*Identify the specific basic skills area or vocational program.

	YES	SOME-WHAT	NO	N/A	COMMENTS
III STUDENT INTERACTION ___ A ___ N/A					
1. Students can use the program with minimal assistance					
2 Students are actively involved in the program					
3 Students control the pace of the program					
4 Students can access the program "menu(s)" to change activities					
5 Students are permitted to change answers					
6. Methods of responding correspond to the level of the program.					
7 Students' errors of entry are processed so that the program continues to run.					
8 Students can access available "help" and "hint" options at any time					
9. Students can enter or exit the pro.- n as desired.					
10 Students control the sequence of the program.					
IV. PROGRAM INTERACTION ___ A ___ N/A					
1. Feedback is i' ediate					
2. Cues and ; are provided to assist students in ing correctly					
3. Feedback rei . es the correct responses					
4 Feedback is nonthreatening.					
5. Program helps students understand wrong answers.					
6. Program gives the correct answer after a reasonable number of tries.					
7. Positive reinforcement is varied.					
8. Program has the ability to branch/loop depending upon students' performance.					
9. Feedback is on the level of the student.					
V. STUDENT EVALUATION ___ A ___ N/A					
1. Evaluation provides a means for measuring attainment of objectives					
2. Program reports which items were missed and which were correct.					

	YES	SOME-WHAT	NO	N/A	COMMENTS
V STUDENT EVALUATION—*Continued*					
3 Individual student performance results are available to the teacher.					
4. Class performance results are available to the teacher.					
5. Program provides for printed copies of evaluations.					
6 Test item formats are suited to the material being tested.					
7. Test items are clearly stated					
8. Test item bank is provided.					
VI. DOCUMENTATION ___ A ___ N/A					
1 Documentation is easy to understand.					
2 Documentation is accurate.					
3. Student objectives are stated.					
4 Underlying concepts are outlined.					
5 Skills to be developed are specified					
6. Procedures for integrating the program into the curriculum are provided.					
7. Follow-up activities are suggested.					
8 Documentation explains the intended use of support materials.					
9 Sufficient information is provided to operate the program.					
VII. WORK BEHAVIORS ___ A ___ N/A					
1. Program helps students identify their vocational skills.					
2. Program promotes pride in work.					
3. Program promotes productivity.					
4. Program encourages good work habits.					
5 Problem solving is encouraged.					
6. Program promotes good human relations skills.					
7. Program provides an opportunity for work satisfaction and self-fulfillment.					
8. Program encourages creativity.					

	YES	SOME-WHAT	NO	N/A	COMMENTS
VIII APPLICATION PROGRAMS ___ A ___ N/A (to be completed for application programs only)					
1 Program is adaptable to the needs of the student.					
2 Commands are easily remembered					
3 Information is easily manipulated					
4. Corrections are easy to make					
5 Program includes all necessary variables					
6. Program performs reliably					
7. Program efficiently achieves its intended purpose.					
8 Trial data are supplied for learning to run the program.					
9 Program provides for use of printer when hard copy of information is advantageous					
10. Program moves from operation to operation efficiently.					
11. Program is compatible with other application programs.					
12 Program has a supplementary tutorial program available					

Part C: Courseware Evaluation Summary

1. SUMMARY COMMENTS

   Identify strengths of the courseware

   Identify weaknesses of the courseware:

   Describe uses of the courseware in an instructional setting:

2. SUMMARY OF SECTION

   Rate the quality of the courseware for each applicable section of this form by checking the appropriate column; if not applicable, check N/A.

	YES	SOME-WHAT	NO	N/A
I. SUBJECT MATTER: Content has educational value.				
II. TECHNICAL PRESENTATION: Program is free of malfunctions.				
III. STUDENT INTERACTION: Students are actively involved with the program.				
IV. PROGRAM INTERACTION: Feedback is effectively employed.				
V STUDENT EVALUATION: Evaluation adequately measures student progress.				
VI. DOCUMENTATION: Documentation is sufficient to run the program.				
VII. WORK BEHAVIORS: Program assists students in developing positive work attitudes and skills.				
VIII. APPLICATION PROGRAMS: Program performs the task for which it is intended.				

3. FINAL RECOMMENDATION

   Check your recommendation for the courseware and explain your reasons below.

   ___ Highly recommend
   ___ Recommend
   ___ Recommend with reservations
   ___ Do not recommend

_____

_____

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BASICS ORDER FORM

BILL AS LISTED BELOW
- ☐ Bill Me
- ☐ Bill My Agency/Organization on Purchase Order No. _____
  - ☐ Purchaseing Order Enclosed
  - ☐ Confirming P.O. to Follow

REMITTANCE
- ☐ $_____ U.S. enclosed CK No. _____ (payable to the National Center for Research in Vocational Education)
- ☐ Payable on receipt of invoice

CHARGE TO MY CREDIT CARD ☐ ☐

_____ Expiration Date _____
Credit Card Number mo. yr.

_____ $ _____ U.S.
Name on Card (Print or Type) Amount

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Authorized Signature Date

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Telephone Number

* Agreeing to pay the sum, set forth to the bank which issued the card in accordance with the terms of the credit card.

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Agency

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Name/Title

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Street Address

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Agency

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Street Address

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Signature Date

OFFICE USE ONLY Date _____

Authorization _____

Order No.	Title	Unit Price	Quantity Ordered	Extended Price
SP300A	**The Bridger's Guide** (includes)	$ 75.00		
SP300AA	Implementation Guide	10.95		
SP300AB	Primer of Exemplary Strategies	11 95		
.	Improving the Basic Skills of Vocational-Technical Students: An Administrator's Guide	12.00		
.	Integration of Academic and Vocational-Technical Education: An Administrator's Guide	14 00		
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SP300AD	Roadsigns from Research (black-line masters)	14.95		
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SP300EE	Technique for Individualization: The Academic Development Plan	9.95		
SP300	**BASICS: Bridging Vocational and Academic Skills** (complete set at 10% discount)	198.00		

•Obtain additional copies by contacting American Association for Vocational Instructional Materials (AAVIM). 120 Driftmier Engineering Center. Athens. GA 30602.

Sub Total $ _____
(less ____ % discount. as applicable) Minus _____
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The Ohio State University