Evaluation of microcomputer courseware: Training for educators

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EVALUATION OF MICROCOMPUTER COURSEWARE:
TRAINING FOR EDUCATORS

A Project Submitted to
The Faculty of the School of Education
In Partial Fulfillment of the Requirements
For the Degree of

Master of Arts
in
Education: Elementary Option

By
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GENERAL INTRODUCTION

In 1982, TIME magazine chose as its' Man of the Year not a human at all, but a machine; the computer. The decision-makers at TIME felt that "there are some occasions, . . . when the most significant force in a year's news is not a single individual but a process, and a widespread recognition by a whole society that this process is changing the course of all other processes" (TIME, 1983, pg. 14). One of the "processes" that is most certainly being impacted by the computer is the educational process.

The sight of students using courseware on microcomputers is common in schools today. Unfortunately, many of the "educational" courseware packages that are available have been developed seemingly without thought to their value as tools in an educational setting. Often the programmers who develop courseware have no background in education or knowledge of educational theories.

Educators are choosing and evaluating this courseware. Decisions are often made without the use of effective guidelines to determine the program's educational worth. Many courseware packages are evaluated and purchased solely on the claims of the publisher or vendor, claims which can be exaggerated or misleading.

Evaluation forms and guidelines do exist. Unfortunately, teachers may be poorly trained in looking at
instructional materials analytically. Forms that appear complicated or time-consuming may be avoided. This is unfortunate because often such forms are well-designed and yield useful decision-making data. By training classroom teachers how to effectively evaluate courseware, poorly designed courseware can be eliminated from the curriculum and (hopefully) from the marketplace. Additionally, it would be hoped that informed teachers would be able to identify computer courseware that aids in reaching instructional goals and objectives.

With respect to computer courseware, an "informed teacher" can be defined as someone who knows how to find, select, and review educational computer programs for use in the classroom or computer lab. Teachers becoming involved in the implementation of microcomputers in their schools will have many questions. What software is available? How do I find it? Will it help me meet my goals and objectives? Will it meet the goals and objectives of my school and district? Will it meet the needs of my students? Is it really the best method for teaching what I want to teach? Where do I find guidelines for evaluation? Which evaluation form is best? What should I be looking for when I review courseware? The intent of this project is to answer these, as well as other relevant questions.
REVIEW OF THE LITERATURE

Evaluation is an ongoing part of the entire process of acquiring software. As a teacher locates, selects and reviews courseware, evaluation is taking place. A review of the literature on evaluation of instructional software gives insight into the evaluation process. Teachers who are enthusiastic about the use of computer-assisted instruction (CAI) in their classrooms (as well as teachers who have had the new technology forced upon them) will have questions about courseware. The answers to many of these questions can be found in the related literature.

Before making an intelligent assessment of any instructional medium, an educator must have an understanding of what evaluation is. While numerous definitions have been given for the term, Berk (1979) consisely defined evaluation as "the process of providing information for decision making" (pg. 4). Roth (1980) provided criteria for an evaluation model suitable for any instructional program. He states that criteria useful in computer courseware evaluation include components for evaluating context, process, product, needs assessment, implementation and outcome (vol. 1, 1980). Additionally, criteria for formative, summative and theory-based evaluation are needed for comprehensive courseware evaluation (Roth, 1980).
Many authors have written articles identifying criteria specifically important in the evaluation of courseware. Cohen (1983) identified attributes that he considered important in the design and development of educational software; he suggested these criteria be utilized as a checklist for evaluation. Steinberg (1983) discussed the need for in-depth evaluation of the suitability, quality, and student use of courseware. A cognitive theory approach to evaluation was suggested by Jay (1983), including recommendations based on cognitive theory and research on information processing abilities. Generally, the criteria for evaluation can be broken down into four areas. The National Science Teachers Association (NSTA) has labeled the four major criteria for evaluation as: Policy Issues, Science Subject Matter Standards, Instructional Quality, and Technical Quality (Texley, 1984).

When evaluating courseware it may be difficult to determine under which criteria a particular aspect of evaluation might fall. For instance, some authors include the ease of modifying the program under content quality (California Library Media Consortium, 1983), while others consider this to be a technical concern. Nonetheless, for any curriculum area the criteria for evaluation of computer courseware can be categorized: technical quality, content quality, instructional quality, and policy concerns.
Criteria for Courseware Evaluation.

**Technical quality.** Technical quality is often viewed as making use of the computer's "unique capabilities" (Allard and Reid, 1983; Joiner, Vesnel, Ross, & Silverstein, 1982; Levin, 1982; Slesnick, 1983). Classroom Computer News (1981) suggested determining if graphics and sound contribute or distract from a program. Joiner et al. (1982) pointed out that noisy courseware may be distracting to other students. Steinberg (1982) discussed how effective use of color can highlight or draw attention to information.


A third aspect of technical quality involves documentation. Cohen (1983) suggested manuals should be provided for instructor and student; he stated "To alleviate fears and resistance, both guides should be extremely well-organized, clearly stated, and provide a step-by-step approach" (pg. 13).

**Content quality.** When evaluating content quality, the reviewer looks for accuracy, bias or
stereotypes, and distortion of information. The California Library Media Consortium's evaluation form includes, under content evaluation criteria, concerns such as branching capabilities (moving to harder or easier material based on student responses), freedom from excessive violence or competition, appropriate interest and vocabulary levels, and correctness of spelling, grammar and punctuation (CLMC Form, 1983).

**Instructional quality.** Evaluation of instructional quality involves looking not only at the courseware but also at its documentation. Joiner et al. (1982) have recommended the following standards for evaluating instructional quality:

- Is the courseware explicitly tied to classroom curriculum, a taxonomy of objectives or a text series?
- Are the performance objectives and criteria for success clearly stated?
- If the program is designed for young children, can they understand what they are to do, the decisions that they are to make, the options that they are to select from?

The NTSA feels that well-designed programs allow the student options concerning the content, level of difficulty, and presentation rate, and suggests that the program's instructional strategies be based on relevant educational or psychological research (Texley, 1984).

Cognitive theory has come to play a part in instructional evaluation of courseware. Jay (1983) focused
on five information-processing abilities which should be taken into account in the evaluation of the instructional quality of educational software. These five factors are: 1. memory and attention, 2. language and text characteristics, 3. graphics and visual processing, 4. cognitive characteristics of users and 5. feedback to users.

Another part of instructional quality involves the pedagogical aspects of the program. These aspects can best be evaluated by observing student users. Steinberg (1983) states, "No matter how qualified the reviewers, whatever their profession, they do not know if a lesson really works until they have tried it with students for whom it is intended" (pg. 19). Observations of actual use of the program will point to strengths and weaknesses that might have been overlooked by the reviewer. According to Crovello (1982), students themselves are important software evaluators. The evaluation process may develop in student evaluators a deeper grasp of the subject matter presented in the program they are evaluating.

Policy concerns. The final aspect of evaluation is in many respects the most important. Some of the policy issues that may be relevant can be found in the NTSA evaluation form (Texley, 1984). Issues such as compatibility with the goals and objectives of the school, how well the software package fits in with the other
instructional materials being used, and analysis of the purpose and intent of the program can be considered during evaluation based on policy issues.

**How To Find Courseware**

Once familiar with the criteria for evaluation, the teacher is ready to begin the evaluation process of finding, selecting and reviewing courseware. A difficult task for the inexperienced user of CAI may be finding courseware to review. In a school district where courseware is selected and purchased by a trained individual or team, this may not be a problem. However, because of the rapidity with which this new technology has been introduced into education, classroom teachers may be required to find courseware on their own.

If the school district supports a technology library or center, this would be the first place to look for software. Technology centers usually publish listings of the programs they have available for review. If such a center is not available, the teacher might try a courseware vendor who carries educational courseware that will run on the particular microcomputer the teacher will be using. Many courseware directories are published which can be of help in learning the types of programs that are available and where they can be acquired.

One such publication, *Educational Software*
Directory (Chartrand & Williams, 1982) is typical of the type of directory available. Software directories usually include a short description of each program, publisher's name and address, subject area, intended grade level, format (diskette or cassette), hardware requirements, computer language used, and cost. Most software directories do not contain critical reviews of the courseware. For the teacher who is totally unfamiliar with the types of programs available for CAI, the software directory can be helpful in giving a broad view of computer courseware on the market today.

The type of evaluation done when looking for courseware will be very cursory. According to Holznagel (1983) this examination involves looking for completeness, operational readiness and suitability for the particular subjects and microcomputer. At this level, the reviewer will be looking mainly at policy issues, and technical quality.

Once familiar with the types of programs available, the teacher will be ready for the selection portion of the evaluation process. While some evaluation takes place when a teacher chooses courseware, selection implies more indepth evaluation; evaluating the merits of the program before selecting or rejecting it. Holznagel (1983) feels that this level of evaluation involves more objective data. The reviewer will be now looking at content quality and instructional quality, in addition to technical quality and
policy issues. If the teacher fails to reject the package at this level, more extensive evaluation will follow. This extensive evaluation would then make up the review portion of the process.

Holznagel (1983) lists three major sources for obtaining expert data on software evaluation: MicroSIFT by the Northwest Regional Educational Laboratory (NWREL), Micro-Courseware PRO/FILES, by the EPIE Institute, and professional journals and magazines such as AEDS Monitor and Electronic Learning. The teacher could make use of these sources during any phase of the evaluation process, but they would be particularly helpful in reviewing software that is not available for hands-on evaluation.

This partial review of the literature has yielded information useful in the development of a teacher training program in computer courseware evaluation. As more literature is reviewed, the additional information gained will lead to refinement of the training proposal.
STATEMENT OF OBJECTIVES

As a part of training in computer awareness and computer literacy, classroom teachers will be able to:

- evaluate courseware based on four criteria: technical quality, content quality, instructional quality, and policy issues.

- find software via directories, vendors, technical journals.

- select software via hands-on review or by using reputable sources such as MicroSIFT, Micro-Computer PRO/FILES, or professional journals and magazines.

- find and use existing forms and guidelines for evaluating courseware.

- modify, if necessary, existing forms and guidelines to meet personal, school or district goals and objectives.

- become more reliable evaluators of computer courseware.
DESIGN OF PROJECT

As part of a total program in training teachers to be computer aware and computer literate, this project will train teachers in finding, selecting and reviewing computer courseware. It is assumed that teachers involved in this particular aspect of computer literacy would be familiar with terminology, and technical aspects of computer use (i.e. loading and running programs).

Mode of presentation

Via a diskette presentation on an Apple IIe or a TRS-80 Model 1 or 3, the trainee will be shown, in a logical and sequential manner, how to find, select and review courseware.

The diskette presentation is in the form of a tutorial presentation, including branching for reteaching or reinforcement. The program will allow the user to skip material that is already familiar.

Rationale

There is an abundance of evaluation forms and guidelines as well as articles and books on how to evaluate educational materials in general and computer software in particular. Unfortunately, they are not always used. Even
when they are used, if the reviewer has not been trained in how to use them effectively, their reliability may be questionable. By giving an introduction, via the computer, regarding what to look for and why, it is expected that evaluations will be more beneficial. As more teachers are trained in skills of evaluating courseware and these evaluations accumulate, additional insight will be gained as to which software packages are effective and which are not.

Design

Introduction. Ex. Welcome to the world of computer courseware evaluation. In this short presentation we will inform you of ways to find, select, and review courseware for use in the classroom or in the computer lab.

Statement of purpose. Ex. This diskette program is intended to be an aid to you, the evaluator, in determining the strengths and weaknesses of computer courseware. You will be shown:

1. What computer courseware evaluation is all about.
2. How to find courseware.
3. How to select appropriate courseware for review.
4. How to critically review courseware.
5. How to find evaluation guidelines and forms.
You may follow the program sequentially from Part 1 to 5 or you may enter the number of the area you are interested in. Type in your selection (1, 2, 3, 4, or 5).


In this section the trainee is introduced to the four aspects of evaluation: technical quality, context quality, instructional quality, and policy issues.

Part 2. How To Find Courseware

In this section, if the computer running the diskette is also connected to a printer, trainees are given instructions enabling them to acquire a current listing of software sources. This feature allows adaptation of the computer program to include regional or local sources of computer software. The list of sources can be updated as necessary.

If the computer is not connected to a printer, the computer would tell the trainees where they can find a printed listing of software sources (Supplement 1). This listing includes software directories, national vendors, and additional suggestions for finding courseware. This listing makes up the "core" of the listing available via the printer.
The trainee is informed that at this level of evaluation, courseware can be rejected based on technical quality or policy issues. The trainee can branch back to sections of Part 1 dealing with these terms if so desired.


The design of this section is similar to that of Part 2. The major sources of software evaluation are listed (See Supplement 2). Again, the program is adaptable so local sources for evaluation, such as school district technology centers, can be included.

The trainee is informed that courseware can be rejected during the selection process based on any of the four criteria. Through the use of examples, trainees will be shown that cursory examination of the program based on the four criteria can result in rejection of a program. If a program passes this cursory examination, the reviewer will then need to do an in-depth critical review (Part 4).
Part 4: How To Critically Review Courseware.

In this section, the trainee is shown how to evaluate courseware based on the four criteria of technical quality, content quality, instructional quality, and policy issues. The program includes a branching capability to allow the trainee to refer back to Part 1 for clarification of these four criteria. Each of the four criteria are broken down into relevant questions that the trainee can ask as they review a software package (See Supplement 3). Excerpts from existing courseware are shown to demonstrate how the criteria can be met effectively. Occasionally it may be necessary to include programs that do not meet the criteria, in order to make a point.

To vary the presentation format, the trainee may be asked to rate a particular aspect of a program against a particular criteria. Because of the selective nature of this type of evaluation, there can be no "right" or "wrong" responses. However, with responses given on a continuum, (ex. from "extremely poor" to "extremely good"), the computer is programmed to respond to any response given. If the example is meant to show that the criteria was not well met, but the teacher responds that the criteria was acceptably met, the computer then branches to reteach that particular aspect of courseware evaluation.
For example, if the criteria under investigation is:

"Are high-level thinking skills encouraged?"

and the example is:

a drill and practice of multiplication facts

one would expect the reviewer to give that particular program a low rating on high-level thinking skills. If the teacher felt drill and practice did involve high-level thinking, the program would branch to an explanation of high-level thinking skills and an explanation of why this particular program was not strong in that area.

**Part 5. How To Find Published Evaluation Guidelines and Forms.**

This program is intended to give the teacher an overview of courseware evaluation; it is not meant to be a comprehensive course in evaluation. In this part of the program, the trainee is given a listing of existing forms and guidelines. As in Parts 2 and 3, the program is adaptable to include local forms and guidelines. Teachers can access this listing via the computer (and print it out if connected to a printer) or use a supplementary printed list (See Supplement 4). Part 5 also includes some examples of existing forms.
LIMITATIONS

A major limitation of this project is evaluation of the program itself. Using a computer software package to teach how to evaluate computer software packages leaves one open to criticism if the program is not well-designed. Formative evaluation has been a "must" during development, however, field-testing of the program has not been accomplished.

Another limitation lies in determining if this project is meeting all of its objectives. How does one measure if an individual is a "better" evaluator after this program than they were before other than by a program post-test?

The desire to include actual examples of courseware in this program has been limited by the need to avoid infringement on copyrights. Additionally, it is understandably difficult to procure permission to use examples that exemplify poor courseware!
Reference Notes


Levin, D. These experts can wake you from the software nightmare. The Executive Educator, March, 1982, 26-28.


COURSEWARE SOURCES


A listing of more than 200 vendors with addresses, phone numbers, program subject areas, grade levels, computers to run the programs, and program price ranges.


Includes listings of 10 software directories, 13 catalogs, 7 review sources and 5 clearing houses.


Includes publisher's name, address and phone number; distributors; date of original release; intended grade level; format (cassette diskette); hardware requirements; language; cost; source code (availability of the original program code or statements to be modified); description.


Listing, by subject area, of software available for review at the TECC Center, 3939 - 13th Street, Riverside, CA 92502 (714 - 788-6596).

Cue Software Catalog

Available from:

- Ann Lathrop, Softswap Chairperson
- Microcomputer Center, SMERC Library
- San Mateo County Office of Education
- Redwood City, CA 94063
- Cost: $1.00

JOURNALS AND MAGAZINES

- *Classroom Computer Learning* (formerly *Classroom Computer News*) ($19.95/yr.)
- *Computing Teacher* (ICCE Journal) - $21.50/yr.
- *Educational Technology*
- *Electronic Learning* ($19.00/yr.)
- *Creative Computing*
- *Feelings II* (Apple only)
- *Compute* (Atari, Commodore, Pet, Apple & Ohio Scientific
- *Softtalk* (Apple only)
SELECTING COURSEWARE

School microware reviews. Dresden Associates, Inc.
P. O. Box 246, Dresden, MA 04342.

A user review, independent of courseware publishers, organized by major disciplines and subjects for grades K to 12. Evaluations include summary ratings of Apple, Atari, Pet and TRS-80 courseware with extensive positive and negative comments.

EPIE microcomputer software report. EPIE Institute,
P. O. Box 620, Stony Brook, N.Y. 11790.
Cost: Micro Courseware Pro/Files - $125.
Microgram Newsletter - $16.

PRO/FILES includes: producer, copyright, intended user specified by publisher, curriculum role (i.e. language as, supplemental, tutorial), content topics, ratings of 1-10 for instructional design and software; analysis summary, and recommendations to the publisher.

Swift's educational software directory 1983-84
Apple II edition.
Available from:
Sterling Swift Publishing Co.
7901 South I-35
Austin, TX 78744
Cost: $14.95

Headings include: publisher, author, program/series name, suggested grade, general description, support material, unique features, hours of material, management system, teacher modifiability, compatibility, up to 3 reviews, memory needed, additional hardware needed, comments and cost.

Courseware reviews 1982: 50 classroom-based evaluations of microcomputer programs
Complied by:
California Library Media Consortium for Classroom Evaluation of Microcomputer Courseware
Available from:
SMERC Library Microcomputer Center
San Mateo Co. Office of Education
333 Main Street
Redwood City, CA 94063

Each evaluation is based on a minimum of 2 independent reviews. Data is collected until a pattern of responses can be determined. At least one review will indicate student reaction to the program.

Identifies: publisher, price, contents, equipment needed and computer language, subject, grade level and type of program, suggested appropriate group size(s), whether single concept design or part of a larger instructional package or curriculum series. Also included critical review of the programs that have been published in journals as well as compatibility and overall opinion.
What To Consider When Evaluating Courseware:

1. DOCUMENTATION
   Is it:
   - Available
     A. For the teacher
     B. For the student
   - Clearly Written
   - Adequate

2. GENERAL DESIGN
   Does the package:
   - Make Appropriate Use Of Computer Capabilities?
   - Follow Sound Instructional Organization And Theory?
     Screen is attractive and not over-crowded.
     Instructions are simple and clearly stated.
     Amount of text on screen presents only one idea at a time.
     Learner is informed of objectives.
     Demonstration is provided if necessary.
     Student can control the rate of presentation.
     The time allowed for the student to respond is not too long or too short.
     Reading level is appropriate.
     Allows student to skip familiar material or instructions.
     Branches to easier or harder material based on student responses.
     Keeps the student informed of how well he/she is doing or has done.
     Duration does not exceed the attention span of the intended user.
     Student can run the program without teacher aid.
     Provides a means for the teacher to be informed of student progress.
     Allows the teacher to make modifications to the program.
     Contains correct punctuation, grammar, and spelling.
-Respond to errors in a helpful manner.

  Assists the student if they are having difficulty with the instructions.

  Provides more information, a clue or a hint if the student is unclear about what is expected.

  Should not inadvertently reward wrong answers

-Respond To Success In A Positive, Enjoyable And Appropriate Way?

-Allow The User To Interact With The Computer?

  Hitting only "RETURN" or "SPACE BAR" can be boring

-Present Information In A Variety Of Formats? (Pictorial, Numerical, Graphic, and Colorful)

  Graphics and Color should be used in ways that are appropriate and helpful.

  Colors should be true and relevant.

  Graphics should be imbedded in the content, not just "tacked on."

-Run Without Errors Or Problems?

  Will the program accept the correct answer in various forms?

  When nonsensical or incorrect answers are inputted, the program should not fail.

-Avoid Inappropriate Competition, Excessive Violence, and Stereotypes?

-Fit Well Into The Curriculum?

  Can it be correlated with other materials available, such as texts.

  Suggest appropriate support materials.

3. CONTENT

  Does It:

  -Present Material That Is Factually Correct?

  -Present Content That Is Relevant And Meaningful?

  -Do What It Is Suppose To Do In Terms Of Its Objectives?
FORMS AND GUIDELINES FOR EVALUATING COURSEWARE

FORMS:

Checklist for identifying learning program characteristics from:

Evaluation Form from:

TECC Evaluation Form from:
California Library Media Consortium for Classroom Evaluation of Microcomputer Computer Courseware
SMERC Library Microcomputer Center
San Mateo Co. Office of Education
333 Main Street
Redwood City, CA 94063
(Available at TECC Center, Riverside)

Microcomputer Instructional Software Evaluation Form from:

School Microware Evaluation Form from:
Dresden Associates, Inc.
P. O. Box 246
Dresden, MA 04342
(Detailed review form that assesses over 45 program characteristics).

MECC Evaluation Form from:
Minnesota Education Computer Consortium
Publication's Office
2520 Broadway Drive
St. Paul, MN 55113
GUIDELINES:


--------"Evaluator's Guide For Microcomputer-Based Instructional Packages" available from:
International Council for Computers in Education
c/o Dept. of Computer and Information Science
University of Oregon
Eugene, OR 97403
Developed by: N.W. Regional Educational Laboratory.
Includes review forms and sample reviews.

--------"Guidelines for Evaluating Computerized Instructional Materials" available from:
National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 22091
Cost $3.75
Includes information on obtaining software, guidelines for review, and evaluation form.


Supplement 4 (GUIDELINES cont.)
