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ABSTRACT

CONDUIT is a consortium of five regional computer networks, and is designed to 1) establish a center for information collection and dissemination concerning computer-related curriculum materials; and 2) to identify and evaluate factors governing ease of movement of computer-related curriculum materials from one school to another. The information clearinghouse goal of CONDUIT will rely on a data base built from Entry Documentation Forms for each curriculum item. Testing will begin with workshops in seven different disciplines conducted by the regional networks, but the major testing will be conducted independently by the Human Resources Research Organization. CONDUIT's schedule calls for initial assembly of the data base and beginning of testing in the summer and fall of 1972, with a general catalog to be available in the summer or fall of 1973, and the final report to be completed by spring, 1974. (RH)

C O N D U I T

An Experiment in Educational Computer Usage

and

Program Exchange

Supported by the Office of Computing Activities

of the

National Science Foundation

Ronald Blum, Director
July 15, 1972

I. HISTORY AND GOALS OF CONDUIT

The CONDUIT consortium of five regional computer networks* was established in response to a strongly-felt need among academic users of computers for effective means of stimulating the diffusion of educational computer usage among institutions of higher learning. To quote from the original CONDUIT proposal of July 15, 1971:

> During the past decade, over twenty regional centers have been funded by the National Science Foundation to supply computer power to networks of colleges. Curriculum development has been at least one major goal of this support. Together with the regional projects, support has been given for a very large number of computer-based projects associated with single institutions or with specific developmental aspects of education and research.
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> ....
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> A very large cost to the Federal government has produced a wealth of materials whose availability is problematic due to several factors. Documentation is extremely scarce and generally so poor that it offers little help. Few centers of dissemination are set up to quickly and economically transport materials to other centers. Authors are hesitant to spend the time necessary to transport materials. Transportability itself is complicated by the variety of computer configurations supporting curriculum efforts and is a non-trival problem even when the two configurations are considered to be essentially identical. Once transported, there is little or no available data on whether the computer-based materials truly represent curriculum development or whether they will even be usable by instructors in traditional (or even innovative) courses or research. Related to the last-named problem is the general absence of classroom case studies in which the bugs accompanying the implementation of computer-based materials may have been delineated.
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> ....
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> The above barriers to the feasibility of transporting

*Oregon State University, Dartmouth College, North Carolina Educational Computing Service, the University of Texas at Austin, and the University of Iowa.

> curriculum materials have made curriculum development by this method intolerably slow and inefficient. Since this method itself is under challenge, despite the hundreds of requests for applications software from the few "free" centers, it seems necessary to test curriculum development by this process both as to the feasibility of the process and as to the educational benefit resulting from its accomplishment. It is to this purpose that this proposal is dedicated.

CONDUIT was proposed as an organization to deal with the problem of transportability of educational computer usage by (1) establishing a center for information collection and dissemination concerning computer-related curriculum materials and (2) conducting workshops and sustained classroom testing of such materials in order to identify and evaluate factors relating to their transportability; i.e., those qualities which affect their movement from one school to another. Although the promotion of educational computer usage and program exchange underlies this effort, the main thrust of CONDUIT is investigative, with a view to the ultimate determination of guidelines for transportability. These guidelines, embodied in the CONDUIT Final Report, would inform future curriculum projects of the factors necessary to insure that their programs and related curriculum developments will hold maximum promise of diffusing outward into the mainstream of higher education.

The first organizational meeting of CONDUIT took place in Austin, Texas, on January 24-25, 1972, at which the CONDUIT organizational structure (Sec. II) took shape and actions were initiated to prepare summer disciplinary workshops, select committees and faculty for testing, and set up documentation standards for the information center. A subsequent meeting of the Policy Board in Washington, D.C., on March 22, 1972, firmly established the goals and procedures of CONDUIT. A general four-day meeting in Atlanta, Georgia, June 11-14, served to fully coordinate the efforts of the Central office of CONDUIT, the regional networks, and the Evaluator (sec.II) to test transportability and finalize the specifications for the information center data base (Appendix B).

II. ORGANIZATION OF CONDUIT

The central office of CONDUIT, CONDUIT/Central, comprising the Director and his staff, is located at Duke University and coordinates the efforts of a Principal Investigator, Curriculum Coordinator and others at each one of the five member networks (see Appendix A). The policy, procedures, and goals of CONDUIT are determined by the CONDUIT Policy Board consisting of the following members, each of whom is the Director of his regional network and a Principal Investigator:

Thomas E. Kurtz	Dartmouth College
Gerard P. Weeg	University of Iowa

Louis T. Parker, Jr.	North Carolina Educational Computing Service
Larry C. Hunter	Oregon State University
Charles H. Warlick	University of Texas at Austin

Ronald Blum, the Director of CONDUIT, is responsible directly to the Policy Board.

The five regional networks are now serving about 97 institutions of higher learning with a population of around 275,000 students. They have already developed active computer networks and a significant base of computer-oriented curricular materials. They will coordinate their efforts and pool their existing resources to achieve the primary goals of the CONDUIT organization. The Curriculum Coordinator at each member network is responsible for the administration of at least one disciplinary workshop to indoctrinate participants in the classroom testing of transportability (Sec. IV), for the collection of materials for the information center (Sec. III), for the transportation of materials for classroom testing in his regional network and the collection of related statistics.

A Curriculum Committee was chosen for each discipline selected for transportability testing (Mathematics, Physics, Chemistry,Biology, Business & Economics, and Social Sciences), and was requested to review and/or prepare suitable computer-related curriculum materials. The substance and structure of each disciplinary workshop is their province, and the Director takes into account their recommendations concerning selection of faculty participants in these workshops.

Appendix A lists CONDUIT Curriculum Coordinators and Curriculum Committee members; in addition, the Policy Board has approved the Human Resources Research Organization (HumRRO) of Alexandria, Virginia, as consultant in test design to work directly with CONDUIT/Central on the collection and analysis of data on transportability. HumRRO will also be responsible for a final and independent evaluation of the results of the CONDUIT experiment. Dr. Robert Seidel is Project Director for the HumRRO effort; their Principal Investigator is Dr. Harold G. Hunter.

III. INFORMATION COLLECTION AND DISSEMINATION

In order to achieve the goal of establishing a center for information collection and dissemination of computer-related curriculum materials, the first step was to design a data structure which would be rich enough to accurately and reliably describe such materials and their usage. The resulting Entry Documentation Form is in Appendix B. These forms will be sent, in quantity, to the CONDUIT Curriculum

Coordinator at each regional network, who will be responsible for providing suitable information concerning the materials available through his network. These forms will be collected by CONDUIT/Central and the information transferred by means of punched cards to disk, creating a file managed by ASAP, a system providing retrieval, updating, and report-generating facilities which will be used in producing catalogs, annotated bibliographies, and responses to individual queries. ASAP is an easily-learned language, very close to English, and currently running at the Triangle Universities Computation Center, Research Triangle Park, North Carolina.

The information from the networks will be used for the early publicaton of a rough catalog. The materials will be screened to remove trivial, redundant, or erroneous entries. Simultaneously, a national mailing of the first CONDUIT Newsletter will proclaim the existence of the information center and invite contributions and inquiries from the general education community. It is planned that this stage will be reached by the autumn of 1972. All subsequent entries will be scrutinized by outside reviewers before acceptance by CONDUIT.

Ultimately, CONDUIT will provide, through CONDUIT/Central, four levels of documentation: (1) annotated bibliographies to be published quarterly with the Newsletter, (2) an annual catalog of holdings providing abstracts and other detailed information related to transportability, (3) selected segments of the data-base file components in response to individual requests, (4) non-proprietary ancillary textual materials provided by authors and distributed at nominal cost by CONDUIT/Central.

The Entry Documentation Form itself can serve as a guide to the data base structure for those wishing to search the CONDUIT files. Sufficient information will also be provided in the documentation for each entry to enable a prospective user to make a reliable decision on whether or not to transport a given entry, and if desired, how to obtain decks, tapes, and consulting services. Statistics will be kept on usage in order to determine what information is most relevant to the needs of the academic community, and what changes, if any, are needed as CONDUIT matures.

Initially, all requests to search the CONDUIT data base will be handled by mail so that queries can be processed in batches in order to minimize costs. However, ASAP also allows the files to be accessed by teletype; a highly desirable means of making information immediately available to the public. This capability would be very important should it prove possible to decrease line costs by means of, for example, tie-lines to selected centers in a national network. Therefore, any future file management system adopted by CONDUIT/Central should also have such a teleprocessing capability. If possible, certain components of such an interactive public file could be made available to users for entering their comments which

might then be periodically surveyed by CONDUIT/Central in order to improve the service.

It is anticipated that the Newsletter and Catalogs will keep the educational community abreast of the current availability of materials, thereby stimulating classroom usage and further development, while reducing useless duplication. From the point of view of the contributor to the data base, the publications should provide some welcome recognition and stimulus to his efforts in curriculum development.

If a teacher decides to consider materials for adoption, he may then obtain further and more detailed information on their transportability by querying the data base, the structure of which will be described in the Catalogs. At this point, either on receipt of textual materials from CONDUIT/Central, by purchasing commercially available texts, or by making direct contact with an appropriate computer center for the purchase of card decks or tapes, the teacher will be able to decide upon and implement usage of a particular data base entry. Although individual initiative on the part of the user is essential, CONDUIT proposes to provide him with a set of reliable stepping-stones to full implementation. In the process, we fully expect that our own standards of what constitutes adequate documentation will undergo modification in the light of experience and serve as a useful guide to others.

IV. TRANSPORTABILITY TESTING

In order to achieve CONDUIT's second major goal, the study of transportability through classroom testing, seven disciplines were selected as vehicles for educational computer suage. The choices were based on the availability of computer-related curriculum materials, particularly within the five networks, from which a body of resources could be synthesized to provide an adequate and sustained test of classroom usage over the next academic year, 1972-73. The disciplines selected were Mathematics, Physics, Chemistry, Biology, Social Sciences, Business & Economics. Six Curriculum Committees of practicing academicians (Appendix A) were established in each area (Business and Economics is under a single committee). Their activities varied, depending upon the type and availability of materials, from review and advice to actively synthesizing testable curricula obtained from various sources. These materials will be presented to participating faculty chosen from the five regional networks in Physics (Dartmouth, June 19-30), Chemistry (Texas, August 14-19), Economics and Business (Oregon State, August 14-18), Mathematics (Iowa, August 21-25), Social Sciences (North Carolina early October), and Biology (Iowa, December).

At the workshops, faculty will learn to use the materials, to understand their pedagogical function in the curriculum, and to appreciate the significance and types of data collection required

of participants during the school year. The purpose of the workshops is not teacher training per se but rather indoctrination in the purposes and procedures of the CONDUIT transportability experiment. It is essential that participants understand the need for reporting, for collecting data, for accumulating reliable statistics on usage and cost, etc. Participants supported through CONDUIT will obtain computing time through their regional centers where statistics on usage will be amassed.

Subsequent to these formal CONDUIT workshops, it is to be expected that CONDUIT personnel will cooperate, as time permits, with their regional networks to offer any of these workshops to a regional audience, with CONDUIT supplying needed documentation and obtaining additional statistics from attendees at any such workshops. However, the cost of such workshops would usually be borne by sources other than CONDUIT.

The Curriculum Coordinators will collect and transmit data to CONDUIT/Central on the technical transport of materials from one environment to another, as well as on the workshops themselves (see Appendix C). A number of individuals at non-member institutions have also expressed a desire to use our materials at their own expense and without the benefit of workshops. This will be done on an ad hoc basis; the concerned individuals have expressed a willingness to reciprocate by returning information directly relevant to CONDUIT's transportability test.

Test design and the collection and analysis of data will be performed by CONDUIT/Central in cooperation with the Human Resources Research Organization (HumRRO); however, HumRRO has also undertaken to perform an independent Evaluation, under their signature, of the transportability test when it is completed. This will form a part of the CONDUIT Final Report, however the Evaluation will be produced separately from CONDUIT/Central to avoid any possible bias.

V. FUTURE PLANS

The tentative schedule of CONDUIT operations is as follows: July-August, 1972: preparation of materials and their transportation for the Chemistry, Business & Economics, and Mathematics workshops. Collection of transportability data and workshop questionnaires. Movement of data bases for the October Social Sciences workshop. Transportation of materials to regional networks for use during the academic year 1972-73. Completion of Entry Documentation Forms by the Curriculum Coordinators and their collaborators; construction and filling of the data base at CONDUIT/Central.

September-October, 1972: preparation of materials and their transportation for the Social Sciences workshop. Collection of classroom data begins. Preparation of first CONDUIT Newsletter, mailing lists

and labels by CONDUIT/Central, with selected contributions from the regional networks. Initial planning for the Biology workshop. When the data base reaches a critical mass of 100-200 entries, initial catalog will be prepared for public distribution at nominal cost and advertised in the first Newsletter. The first mailing will be quite large (40,000-50,000 copies), with subsequent subscriptions available on request.

November-December, 1972: CONDUIT data base open to public for contributions and queries. Publication of first catalog by photocomposition from computer printout produced by a test-processing program such as FORMAT. Continued collection of data on technical transport and on classroom testing of materials. Biology workshop.

Winter-Spring, 1973: Collection and analysis of statistics on usage, on faculty and student acceptance of curriculum-related materials, on costs, etc., to continue through the remainder of the school year. Probable marked decline of technical transport activities for Curriculum Coordinators during this period, perhaps to be replaced by selected regional workshops in various disciplinary areas, CONDUIT acting as consultant and collaborator. Continuing contact and consultation between Curriculum Coordinators and their participating faculty with ad hoc local workshops as needed. Expansion of the data base; dissemination of materials through quarterly Newsletters, responses to inquiries, etc. Planning for a General Catalog of critically reviewed entries from the data base, Review of documentation standards, possibly in cooperation with other information centers and archives both domestic and foreign.

Summer-Fall, 1973: publication and distribution of General Catalog, summer Evaluation Workshop, and writing of Final Report and HumRRO Evaluation Study. Continued publication of Newsletter and updating of data base.

Winter-Spring, 1974: completion of data collection and analysis, publication of Final Report by CONDUIT/Central.

Appendix A: CONDUIT Curriculum Coordinators and Committees.

Curriculum Coordinators

John M. Nevison, Dartmouth College
Judith C. Malkin, The University of Texas at Austin
James W. Johnson, The University of Iowa
Joseph R. Denk, North Carolina Education Computing Service
Jo Ann Baughman, Oregon State University

CURRICULUM COMMITTEES*

Mathematics

Donald McLaughlin, Augustana College, Rock Island, Illinois
Thomas M. Gallie, Duke University, Durham, North Carolina
Frank Kosier, University of Iowa, Iowa City, Iowa
Paul Yale, Pomona College, Claremont, California

Chemistry

Joseph Denk, North Carolina Educational Computing Service, Research Triangle Park, N.C.
Ronald Collins, Eastern Michigan University, Ypsilanti, Michigan
K.J. Johnson, University of Pittsburg, Pittsburgh, Pennsylvania
Joseph Lagowski, University of Texas at Austin, Austin, Texas

Physics

John Merrill, Dartmouth College, Hanover, New Hampshire
Ronald Blum, Duke University, Durham, North Carolina
Alfred Bork, University of California, Irvine, California
John Robson, University of Arizona, Rucson, Arizona

Biology

Delmas Allen, Clarke College, Dubuque, Iowa
Donald M. Huffman, Central College, Pella, Iowa
Austin Brooks, Wabash College, Crawfordsville, Indiana

Social Science

Ronald Anderson, University of Minnesota, Minneapolis, Minnesota
G. Robert Boynton, University of Iowa, Iowa City, Iowa
Edmund Meyers, Dartmouth College, Hanover, New Hampshire
Joseph Denk, North Carolina Educational Computing Service, Research Triangle Park,N.C.
Hugh Cline, Russell Sage Foundation, New York, New York

Economics and Business

Michael Hall, Lawrence University, Appleton, Wisconsin
James Johnson, University of Iowa, Iowa City, Iowa
William Cage, Wake Forest College, Winston-Salem, North Carolina
Clifford Gray, Oregon State University, Corvallis, Oregon

*Committee Chairmen listed first.

Appendix B: CONDUIT Entry Documentation Form (EDF)

The forms on the following pages are being printed in quantity and distributed to the Curriculum Coordinators for the collection of documentation for the CONDUIT data base. On the basis of that experience the forms may or may not undergo further alteration before being distributed to the public. Typically, a potential contributor will receive (1) a brief cover letter, (2) a thesaurus of suggested subject matter descriptors to aid in file searching, (3) a single four-page form (pp.1-4 of EDF) to be returned for review along with sample I/O and ancillary materials, (4) a single two-page form (pp. 5-6 of EDF) for reporting technical transport information in the event that his contribution is accepted for entry into the CONDUIT data base and catalog.

CONDUIT

DEPARTMENT OF PHYSICS
DUKE UNIVERSITY
DURHAM NORTH CAROLINA 27706

A RESOURCE FOR EDUCATIONAL COMPUTER USAGE

Information for Contributors

CONDUIT, the non-profit consortium of the five regional computer networks shown at the left, is dedicated to serving the educational community through the study and stimulation of the exchange of computer-related curriculum materials. Much of this effort is devoted to providing reliable and comprehensive information and documentation on such materials. The central element in this service is the CONDUIT Data Base. This will contain extensive information about the disciplinary, educational, and computer characteristics of each "entry," which may be a single program, a series of related programs, a special applications package, or even a textbook. From the Data Base, CONDUIT will produce annotated bibliographies as well as catalogs containing more detailed information. In addition, it will be possible for individuals to request a search for certain types of material and to obtain copies of non-proprietary materials through CONDUIT's central office, located at the above address.

If you have produced computer-related curriculum materials which you wish to make available to the educational community, you are invited to submit their description for inclusion in the Data Base, even if they are proprietary. CONDUIT will, in most cases, undertake to distribute, on request, textual materials **not** otherwise available to the public. This non-profit service will not infringe on the author's right subsequently to amend, withdraw, copyright, or sell such materials. CONDUIT's sole interest is to encourage the widest possible distribution and use of computer-related curriculum materials and to provide a vehicle for the recognition of the efforts of their developers. Placing the copyright notice " © (Your Name, Year)" just after the title reserves and protects your right to register the copyright at some later date, should you so desire. Any distribution of materials without this notice places the work in the public domain. If your materials are produced under institutional sponsorship or grant aid you should verify whether the name of the sponsor must be attached to the copyright notice.

To submit an entry to the Data Base you are requested to complete a four-page Entry Documentation Form and return it to the above address, along with any ancillary materials, references, and/or sample input and output. Your entry will be reviewed and, if accepted, added to the Data Base, announced in our Newsletter, and published in our annual Catalog. The information it contains will be made available free or at nominal cost to all who are interested in the educational uses of the computer.

The information required on the Form is of two types: keyword descriptors of fixed format used to facilitate searching, and free-format items to provide flexibility and answer more general queries. For your convenience the rectangles on the Form are divided and spaced for a standard pica size typewriter (10 characters per inch). **Please print or type.** By filling out the form in the manner indicated you will aid us in coding your entry, thus making our service more readily available to the educational community.

An experiment in educational computer usage and program exchange sponsored by the National Science Foundation

Suggested Subject Matter Descriptors for the CONDUIT Entry Documentation Form

The following list contains general disciplinary descriptors culled from various sources, including the 1971 Abridged Edition of the Dewey Decimal Classification (Forest Press, New York), a universally recognized standard available in most libraries. Use of these terms where possible (see item 1.4 of the Form) will make information about your entry more accessible to others. Several descriptors may be used in combination to provide a more specific description; e.g., *Physics, Fluid Mechanics, Numerical Analysis, Applications,* or *Economics, Business, Finance, Management.* For this reason descriptors are included (e.g., *Plants, Institutions, Applications,* etc.) which may be used in several different contexts.

Abnormal Psychology
Absolutism
Abstract Processors
Accounting
Acoustics
Administration
Adolescent Psychology
Advertising
Agricultural Machinery
Agriculture
Algebra
Algorithms
Analog Computers
Analysis
Analytical Chemistry
Anatomy
Angiospermae
Animal Husbandry
Anthropology
Applications
Applied Physics
Applied Psychology
Approximations
Architecture
Arithmetic
Arithmetic Units
Art
Artificial Intelligence
Assemblers
Astronomy
Astrophysics
Atmospheric Physics
Atomic Physics
Audio-Visual
Authoritarianism
Automata
Borgaining Processes
Behavioral Sciences
Bibliographies
Biochemistry
Biology
Biophysics
Bird
Botany
Business
Calculus
Calculus of Variations
Capital
Carbon Campounds
Cartography
Cellular Biology
Ceramics
Chemical Physics
Chemical Reactians
Chemistry
Child Psychology
Climatology
Cognition
Combinations
Combustion
Commerce
Communication
Community
Comparative Government
Comparative Psychology
Compilers
Complex Variables
Components and Circuits
Computers
Computers and Society
Computers, Architecture
Computers, Design
Computers, Engineering
Computers, Languages
Computers, Logic
Computers, Operation
Computers, Programming
Computer Sciences
Constitutionalism
Construction
Consumption
Control Units
Convergence
Cooperatives
Credit
Crop Science
Crystallography
Cultural Anthropology
Curriculum
Data Processing
Debugging
Decision Theory
Democracy
Demography
Descriptive Government
Despotism
Development
Diagnosis
Differential Equations
Differential Psychology
Diffusion
Digital Computers
Diseases
Distribution
Documentation
Dynamic Programming
Dynamics
Ecology
Economic Biology
Economic Growth
Economic Planning
Economics

Economic Systems
Economic Theory
Ecosystems
Education
Education, Adult
Educational Institutions
Educational Psychology
Education, Primary
Education, Remedial
Education, Secondary
Electoral Processes
Electricity
Electric Power
Electromagnetism
Electronics
Elementary Particles
Elements
Elites
Elitist Systems
Engineering
Engineering, Acoustic
Engineering, Aerospace
Engineering, Chemical
Engineering, Civil
Engineering, Hydraulic
Engineering, Electrical
Engineering, Electronic
Engineering, Machine
Engineering, Mechanical
Engineering, Military
Engineering, Mining
Engineering, Municipal
Engineering, Nautical
Engineering, Nuclear
Engineering, Sanitary
Engineering, Transport
Entomology
Environmental Sciences
Error Analysis
Evolution
Experimental Psychology
Experiments
Feudalism
Field Theory
File Management
File Structure
Finance
Financial Economics
Financial Institutions
Finite Differences
Fiscal Policy
Fluid Mechanics
Food Chemistry
Food Technology
Formal Languages
Functional Analysis
Game Theory
Gasdynamics
Gases
Genetic Psychology
Genetics
Geography
Geology
Geometry
Geometry, Non-Euclidean
Geometrical Optics
Geophysics
Government
Graph Theory
Group Behavior
Guidance and Counseling
Gymnospermae
Hardware
Heat
Heuristic Methods
History
Holography
Home Economics
Horticulture
Humanities
Human Physiology
Hybrid Systems
Hygiene
Ideation
Ideologies
Income
Income Distribution
Industrial Chemicals
Industrial Psychology
Industry
Information Retrieval
Information Science
Information Theory
Inorganic Chemistry
Inorganic Compounds
Instrumentation
Intelligence and Aptitudes
International Relations
Insects
Instruction
Insurance
Institutions
Integral Calculus
Integration
Interest
Interpreters
Invertebrates
Investment
Journalism
Kinematics
Kinetic Theory
Labor
Laboratory Apparatus
Land Economics
Land Use
Language
Lasers
Law
Learning
Legislation
Library Science
Linear Programming
Linguistics
Liquids
Machinery
Machine Languages
Macroeconomics
Magnetism
Mammals
Management
Manufacturing
Marketing
Mathematical Models
Mathematical Physics
Mathematics
Matrices
Measurement
Mechanics
Medical Institutions
Medical Sciences
Medicine
Memory
Metallurgy
Meteorology
Microbiology
Microeconomics
Micro-Organisms
Microscopy
Military Science
Mineralogy
Modern Physics
Molecular Biology
Molecular Physics
Money
Monte Carlo Methods
Morphology
Motivation
Motor Functions
Motors
Multiprocessing
Multiprogramming
Music
National Income
Natural Resources
Navigation
Nonlinear Programming
Nuclear Chemistry
Nuclear Physics
Numerical Analysis
Nutrition
Oceanography
Operations Research
Optics
Organic Chemistry
Organization
Paleontology
Partial Differentials
Pathology
Pattern Recognition
Perception
Personnel Management
Petrology
Pharmacology
Philosophy
Physical Anthropology
Physical Chemistry
Physical Optics
Physics
Physiological Psychology
Physiology
Plant Diseases
Plant Management
Plants
Plasma Physics
Political Action
Political Science
Political Theories
Political Parties
Politics
Pollution
Populations
Power Generation
Power Plants
Power Transmission
Printing
Probabilistic Processes
Probability
Processors
Production
Program Maintenance
Programmed Learning
Programming
Programming Languages
Propulsion
Psychology
Public Administration
Public Finance
Public Health
Public Relations
Public Utilities
Public Works
Quadrature
Qualitative Analysis
Quantitative Analysis
Quantitative Psychology
Quantum Chemistry
Quantum Mechanics
Radiation
Radioactivity
Random Processes
Reading
Real-Time Computing
Real Variables
Relativity
Religion
Rent
Reptiles
Revenues
Revolution
Role Playing
Role Theory
Sampling
School Administration
Small Groups
Social Change
Social Class
Social Conflict
Social Institutions
Social Interaction
Socialization
Social Pathology
Social Planning
Social Psychology
Social Sciences
Social Services
Social Structure
Social Welfare
Sociology
Sociometrics
Software
Solid State
Solutions
Sorting
Space Physics
Spectroscopy
Spermatophyta
Statics
States
State-Individual Relation
Statistical Mechanics
Statistics
Stochastic Processes
Stoichiometry
Storage and Retrieval
Storage Units
Summation of Series
Supervisory Systems
Surveying
Switching Theory
Symbolic Logic
Taxes and Taxation
Taxonomy
Teaching
Tensors
Tests and Testing
Textbooks
Thermodynamics
Topology
Trade
Transistors
Transportation
Trigonometry
Unicellular Animals
Utility Programs
Vacuum Technology
Vectors
Vertebrates
Wave Mechanics
Waves
Zoology

CONDUIT ID # _ _ _ _ _ _ (3–8)

1. IDENTIFICATION

1.1. Entry (CARD #1)

Title (if any) — TITLE (9–66)

Code name or mnemonic (if any) — MNEMONIC (67–76)

This Date (two digits each; e.g., January, 1972 = 0172) — [ ][ ] / [ ][ ] (77–78 / 79–80)

1.2. Authors (CARD #2)

Senior author or author to contact for further information — LAST NAME, INITIALS (9–32)

Second author (if any) (33–56)

Third author (if any) (57–80)

1.3. Address of first author named in 1.2. above. (CARDS #3-4).

DEPARTMENT AND INSTITUTION OR ORGANIZATION (9–80)

STREET ADDRESS OR P. O. BOX, CITY, STATE, COUNTRY (if not U.S.) (9–75) ZIP (76–80)

1.4. Subject (CARDS #5-7)

Use as many of the boxes at right as needed to list appropriate keywords for the disciplines, areas, and topics which most accurately describe this entry. The cover letter lists some suggested categories; you may also select a. / other relevant descriptors.

SUBJECT DESCRIPTORS

9–32
33–56
57–80
9–32
33–56
57–80
9–32
33–56
57–80

CONDUIT ID # 3 _ _ _ _ _ 8

1.5. Computer Languages (card #8)

List up to six languages in which this entry is available. If the entry requires more than one language, (e.g., FORTRAN and ASSEMBLER) list each one separately.

COMPUTER LANGUAGES

9 20
21 32
33 44
45 56
57 68
69 80

1.6. Brief Abstract (cards #9-10). Free-format description for Annotated Bibliography. (Also see 2.9 below.)

9 80
9 77

1.7. Is the computer software proprietary? ○ Yes (78 80) ○ No (78 80)

2. EDUCATIONAL PARAMETERS

2.1. Target Population (cards #11-12). Free-format description of type(s) of student(s) for whom the entry is intended.

9 80
9 56

2.2. Educational Level. (card #12)

Check the circle(s) corresponding to the educational level(s) which are appropriate. The keywords are shown in the boxes.

Pre-college or high school	○	PRE (57 60)
Freshman	○	FR (61 64)
Sophomore	○	SOPH (65 68)
Junior	○	JR (69 72)
Senior	○	SR (73 76)
Graduate	○	GRAD (77 80)

CONDUIT ID # _____ (3–8)

2.3. Educational Usage. (card #13)

USAGE

Approximate instructor learning time, assuming no previous experience (9–16)

Typical implementation time (17–24)

Typical run-times for program(s) (25–32)

2.4. Mode of Usage. (cards #13-14). Check circle(s) for keywords.

MODE

◯ Problem solving, data analysis, etc.	COMPUTATIONAL (33–47)
◯ Modeling, computer animation, Monte Carlo methods	SIMULATION (48–62)
◯ Instruction by computer	TUTORIAL (63–77)
◯ Computer-managed instruction	CMI (78–80)
◯ Computer instructs, responds to student	CONVERSATIONAL (21–35)
◯ Decision-making	GAMING (36–50)
◯ Student interacts directly and immediately	INTERACTIVE (51–65)
◯ Computer administers tests, drills, etc.	DRILL-REVIEW (66–80)

2.5. Published Text. (card #15). Give the following free-format information or check circle if none. ◯ NONE (9–12)

AUTHOR, TITLE, PUBLISHER, YEAR (9–80)

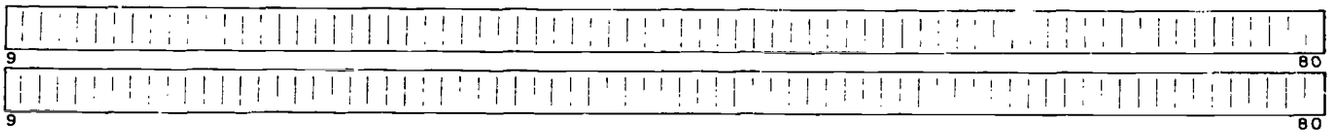
2.6. Materials. (card #16)

Check circle(s) describing type(s) of material(s) which can be made available through CONDUIT for distribution to the public at nominal cost.

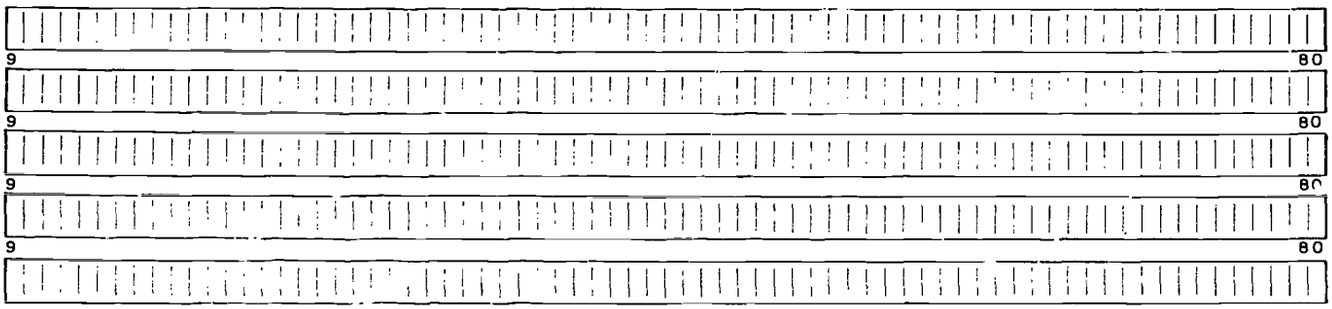
AVAILABLE MATERIALS

◯	NONE (9–22)
◯	TEACHER GUIDE (9–22)
◯	STUDENT MANUAL (23–36)
◯	PROBLEMS (37–50)
◯	EXPERIMENTS (51–64)
◯	PROGRAM MANUAL (65–78)

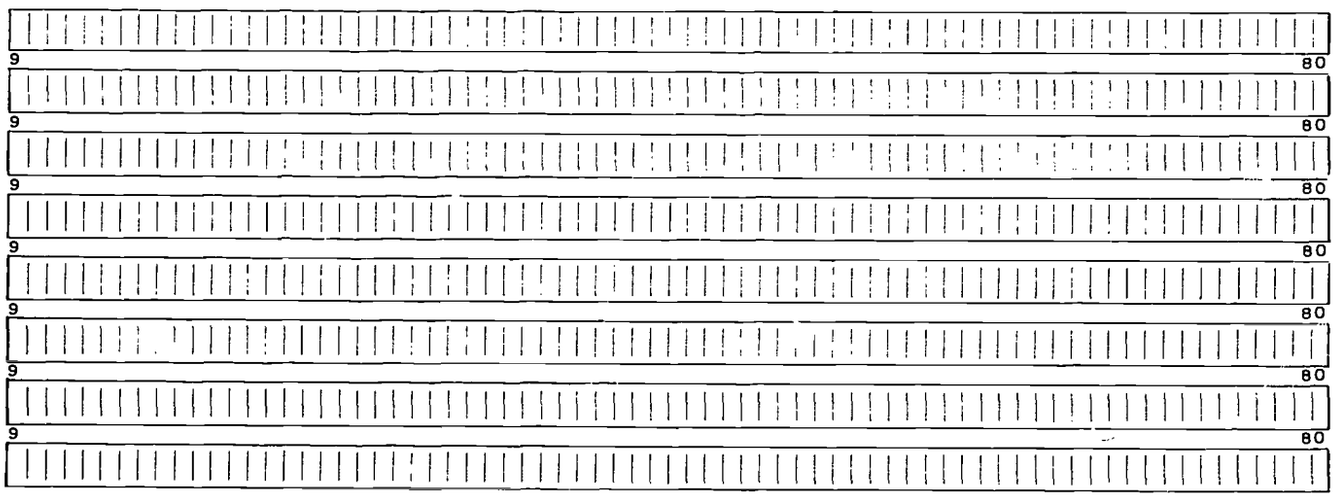
2.7. Reviews. (cards #17-18). Free-format citations of any published reviews of this entry.



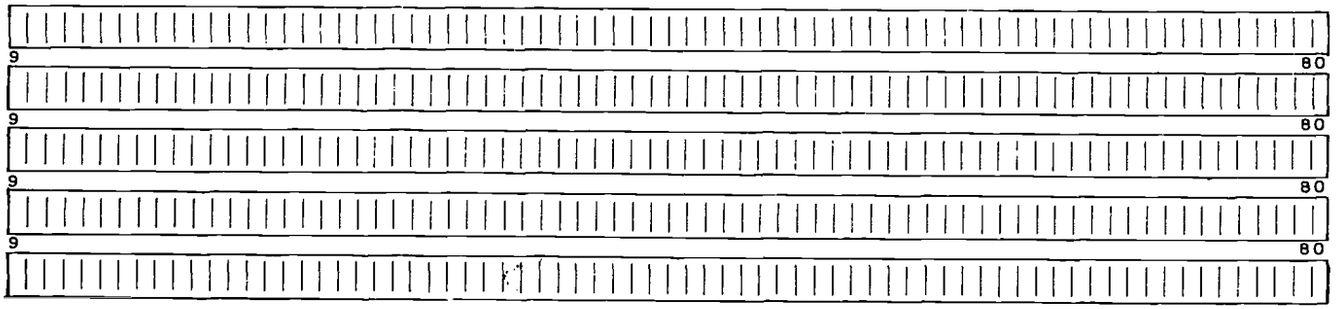
2.8. References. (cards #19-22). Free-format information about bibliographic references, audio-visual aids, etc. Include author(s), title, medium, and source of materials when possible.



2.9. Abstract. (cards #23-30). Free-format expansion of the Brief Abstract of item 1.6., if desired, for describing your entry in greater detail, including any relevant points that may have been omitted from the preceding items.



2.10. Commentary. (cards #31-35). Additional free-format information such as (1) program length or scope, (2) number of facilities where it is running, (3) number of classes, teachers, or students who have used the entry, (4) batch-interactive convertibility, (5) maximum permissible response times in interactive mode, (6) special considerations of a restrictive nature, or (7) other pertinent aspects of the entry and its usage.



3. PROGRAMMING AND SUPPORT

3.1. Facility. (cards #36-37). Computer facility where entry is now available and running. If there is more than one, give *your* source facility.

NAME OF FACILITY AND INSTITUTION OR ORGANIZATION

9 80

STREET ADDRESS OR P.O. BOX, CITY, STATE, COUNTRY (if not U.S.) ZIP

9 75 76 80

3.2. Computers. (card #38). Make and model of the above computer facility (e.g., IBM 360/75, UNIVAC 1108, etc.). If you know of *other* types of computers on which this entry is running, print or type the address and the person to contact there for further information.

MAKE, MODEL

9 22

ADDRESS OF FACILITY CONTACT

MAKE, MODEL

23 36

37 50

51 64

65 78

NOTE: *The following information refers only to the first facility, listed in* **3.1** *above.*

3.3. Operating System. (card #39)

9 22

3.4. Processing. (card #39). Check one or both circles.

○ BATCH 23 33

○ INTERACTIVE 34 44

3.5. Storage Devices Required. (card #39).

○ NONE 45 48

If any disks, tapes, etc. are required, list them in free-format at the right.

STORAGE DEVICES

45 80

3.6. User I/O. (card #40). Input/output media for users of entry. Check circle(s).

○ CARDS 9 20

Typewriter, teletypewriter, alphameric input to CRT

○ KEYBOARD 21 32

○ PAPER TAPE 33 44

Cathode Ray Tube display of any kind, whether storage, refreshed, or merely the equivalent of a teletype.

○ CRT 45 56

Line printer, teletypewriter, or other source of printed hardcopy, including CRT microfilm recorders.

○ PRINTER 57 68

Picture-drawing devices such as plotters, CRT's, and printing devices when used in this manner.

○ GRAPHIC 69 80

3.7. Memory. (card #41)

If permanently stored give types and amounts, and *minimum* core storage needed to run

MEMORY
9 44

3.8. Language(s) (card #41) required

LANGUAGE(S)
45 80

3.9. I/O Devices (card #42). Special input or output devices (free-format information).

9 80

3.10. External. (card #43). Free-format names, descriptions of external program, special subroutines, or adjunct files (if any).

9 80

3.11. Sources. (card #44). of programs available to external users.

- ○ CARDS 9 18
- ○ LISTING 19 28
- Magnetic tape ○ MAG TAPE 29 38
- ○ PAPER TAPE 39 48
- ○ OTHER 49 58

If "OTHER," please specify 59 74

3.12. Support. (card #44) for external users. Check one.

- ○ NONE 75 80

Programs guaranteed debugged at the source facility.

- ○ DEBUG 75 80

Consultation available for debugging program for external user (CONDUIT will not provide information about charges for such services).

- ○ MODIFY 75 80

3.13. Documentation (card #45) available to external users

- ○ NONE 9 20
- ○ FLOW CHART 9 20
- ○ SYSTEM CHART 21 32
- ○ SAMPLE I/O 33 44
- ○ WRITE-UP 45 56

3.14. Contact. (card #45) at facility, if other than first author in item 1.2., who can supply information about program support and transportation.

57 80

Appendix C: Data Collection Forms.

Name of Form	The purpose of the form is to provide information on:
1. Technical Transport Data Collection	the types of technical problems, their solutions, and accurate costs associated with the transportability test.
2. Curriculum Coordinator Technical Transport Time Sheet	the time spent to complete specific activities involved in the transport process.
3. Programmer Transport Log	the major difficulties to be overcome while actually moving programs.
4. Curriculum Coordinator Event/Problem Log	the problems encountered by a curriculum coordinator and effective solutions for these.
5. Workshop Administration Data Collection	accurate costs,logistics and problems of running a workshop.
6. Faculty Baseline Data	factors that are important in successful utilization of transported materials by faculty participants.
7. Workshop Attitude Survey	the effect of the workshop and the subsequent experiences with the transported materials on faculty attitudes about utilization of the computer in the classroom.
8. Materials Evaluation	the relevance, desirability and feasibility of the workshop materials according to individual needs and goals of the faculty user.
9. Workshop Evaluation	the information that will be used to improve future workshops.

TABLE OF CONTENTS

OF DATA COLLECTION FORMS

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TECHNICAL TRANSPORT

DATA COLLECTION

General

The purpose of the data collection effort is to:

1. identify manpower and dollar costs associated with the transport of materials; and to

2. gain insights into transportability problems.

Specific

Please submit all items below to CONDUIT Central.

1. Programmer Profiles. For each programmer:

   a. Name
   b. Years of programming experience
   c. Computer language skills
   d. Academic subject matter knowledge
   e. Position with the computer center
   f. Salary per hour

2. Work Statements. A definition of tasks to be performed in transporting each package, with estimated completion dates. The following tasks are illustrative only.

   a. Package: SIM-GAME

   b. Tasks and estimated completion dates:

      (1) convert all sample programs to FORTRAN--June 30
      (2) annotate listings for program logic--July 14
      (3) prepare two sample runs--July 21
      (4) debug and verify program output--August 1
      (5) write operational instructions--August 15

3. Network Configuration

   a. Central Computer
      (1) manufacturer
      (2) model
      (3) core capacity

   b. Terminals (for each terminal in the network)
      (1) manufacturer
      (2) model
      (3) location (e.g., math department, Gill College)

   c. Operating System Software
      (1) name
      (2) summary of features

   d. Available Language Compilers

   e. Types of Processing Services (e.g., interactive, remote batch, instant batch)

4. Weekly Technical Transport Time Sheets (enclosed) for each package during its transport period.

5. Monthly Dollar Charges for computing and auxiliary services associated with the technical transport of each package.

6. Weekly Programmer Transport Logs (enclosed) for each package being transported.

7. Monthly Event/Problem Logs (enclosed) for each package being transported.

8. Copies of all final materials, including materials to be used by faculty users and their students, with notes describing necessary changes from materials received from the source network.

Summary

The eight types of data are reviewed below, together with the suggested data source and submission schedule.

Data	Source	Submission
Network Configuration	Coordinator	one-time
Separately for each package:		
Work Statement	Coordinator	one-time
Programmer Profile(s)	Programmer	one-time
Time Sheet*	Coordinator	weekly
Dollar Charges	Coordinator	monthly
Event/Problem Log*	Coordinator	monthly
Transport Log*	Programmer	weekly
Final Materials	Coordinator	one-time

Data on the three items marked by an asterisk--time sheets, event/problem logs, and transport logs--should be submitted on the forms provided.

CURRICULUM COORDINATOR TECHNICAL TRANSPORT TIME SHEET

(man hours)

Name_____ Week ending:_____

	math	physics	social science	chem	econ & business	biology
1. definition of transport specifications						
2. coordination with programmer						
3. consultation with developer or source network						
4. reproduction of materials						
5. administrative						
6. user/operation documentation						
7. other (specify)						
8. other (specify)						

PROGRAMMER TRANSPORT LOG

Name: _____ Package: _____

Week Ending: _____ Network: _____

Total man hours spend working on the package this week: _____

Division of your time in hours:

_____ studying materials

_____ consulting the developer

_____ converting the programs

_____ debugging and verifying program results

_____ writing operational instructions

_____ installing system on program library

_____ other (specify): _____

Computer time used on the package this week:

_____ run time (batch jobs)

_____ terminal connect time

_____ CPU time

Special transport problems (not normal debug problems). Examples may include problems with documentation, errors in the materials, problems of computer environment (operating system, batch versus interactive), etc. If no problems occurred, enter "NONE".

PROBLEM	ACTION/SOLUTION

Core required for this package _____

CURRICULUM COORDINATOR EVENT/PROBLEM LOG

Name_____ Package_____ Month ending_____

Examples of events and problems that should be recorded include problems with the original materials, contacts with other networks, contacts with the developer, production of transport products (e.g., placing the program on the public library), a demonstration of the materials, production of a computer operating guide, or a crash problem.

Person involved (name, institution, position)	Event/Problem	Action/Solution

NOTE: Use additional sheets as necessary.

WORKSHOP ADMINISTRATION

DATA COLLECTION

General

The purpose of the data collection effort is to:

1. develop accurate figures for total workshop costs; and

2. gain insights into the logistics and problems of running workshops.

Specific

Submit a report to CONDUIT Central no later than four weeks following the completion of the workshop. The report should contain:

1. A narrative summary, in chronological format, describing major activities, problems encountered, and their resolution. Depending upon the workshop, items may include:

   a. arranging lodging and meals
   b. arranging computer time
   c. arranging transportation
   d. production of pre-workshop and workshop materials
   e. reimbursement of faculty expenses

2. Total man-days spent planning and administering the workshop. Provide separate estimates for yourself and the workshop leader(s), divided into pre-workshop and workshop man-days.

3. Total dollar costs of workshop planning and administration. Itemize such costs as:

   a. computer time charges
   b. honoraria to workshop leader(s)
   c. production costs of workshop materials
   d. costs of your time (from item 2 above)
   e. reimbursements to faculty participants (include all claims for reimbursement, even if they are to be paid by another CONDUIT network).

FACULTY BASELINE DATA

Name _____

Department _____ Institution _____

City, State, Zip _____

Faculty Position _____ Age _____ Tenured? Yes No

Years of Teaching Experience _____ Number of faculty in your department _____

How many faculty in your department used computers in their courses last year, excluding yourself? _____

Name any other department in your school that used computers for instruction last year. _____

Describe any previous experience you have had using computers in instruction and any computer-based instructional materials you have developed yourself:

_____

_____

_____

(use reverse if more room is needed)

Describe computing facilities available to you _____

_____

Rank yourself as one or more of the following in order of importance you attach to your work in this area (e.g., "first," "second," etc.)

Teacher _____ Researcher _____ Curriculum Developer _____

Professional societies and special interest groups to which you belong (you may abbreviate, but do not use initials only):

_____

_____

In the following items describe your computer experience as either

"ONCE" "SOME" or "OFTEN"

Used canned programs _____ Wrote computer programs _____
Used computers in research _____ Read about such usage _____
Attended seminars or short courses on computers _____
Wrote specifications for computer programs _____
Used computer services on my campus _____
Read articles about instructional uses of computers in my field _____
Had my students use computers in previous courses _____
Used computers in the type of course treated in this workshop _____

CONDUIT WORKSHOP

Attitude Survey

Name _____

General: This questionnaire asks for your views on the educational uses of computers. The purpose is to determine whether these views are affected by workshop attendance, and by subsequent experiences back at your home institution.

Specific: For each statement below, enter a number from 1 to 5 indicating the extent of your agreement:

1 - strongly agree
2 - agree
3 - neutral
4 - disagree
5 - strongly disagree

_____ Computer technology has provided great educational breakthroughs in my field.

_____ The major reason I am attending this workshop is to learn about computers.

_____ The academic subjects covered in this workshop are of special interest to me.

_____ All students majoring in my field should have experience with computers.

_____ Computer oriented instruction greatly increases student interest.

_____ My field has great potential for educational computer applications.

_____ Classroom computer usage detracts from learning important concepts.

_____ Computers help bridge the gap between the classroom and the real world in my field.

_____ My personal prestige will increase from participating in this workshop and classroom test.

_____ I expect my personal involvement with computers to increase greatly over the next several years.

MATERIALS EVALUATION

Name _____

General. Statements below concern the relevance, desirability, and feasibility of the workshop materials for you.

Specific. The form consists in three pages. Each page concerns a different area. For example, the first page deals with relevance.

GO THROUGH EACH PAGE TWICE BEFORE GOING ON TO THE NEXT PAGE.

The first time, enter checks in the righthand columns (for yes, no, or undecided). Line out or skip all items that are irrelevant or completely unimportant to you.

The second time, enter numbers from 1 to 3 in the lefthand column, to show the importance of each item. Skip all items you skipped before.

1 - extremely important
2 - important
3 - low importance

Finally, answer the question at the bottom of the page.

Then go on to the next page.

A sample page on buying a car might appear as follows, when completed:

		Yes	?	No
_____	This car has enough horsepower.	----------		
2	My wife likes it.			X
1	It has adequate safety features.	X		
1	The price is reasonable.		X	
_____	I can get the color I want.	----------		
2	The warranty and maintenance seem adequate.		X	
	I HAVE DECIDED TO BUY THIS CAR.		X	

RELEVANCE

	These materials:	Yes	?	No
_____	are compatible with my instructional methods.	____	____	____
_____	represent a desirable educational reform.	____	____	____
_____	are compatible with my course content and texts.	____	____	____
_____	are appropriate in difficulty for my students.	____	____	____
_____	will help my students understand the real world implications or uses of the instruction	____	____	____
_____	present information I could not otherwise cover.	____	____	____
_____	allow my students to learn more independently.	____	____	____
_____	will teach my students new and important skills.	____	____	____

COMMENTS:

THESE MATERIALS ARE RELEVANT TO MY COURSE. ____ ____ ____

DESIRABILITY

	These materials:	Yes	?	No
_____	occupy enough students for enough time.	____	____	____
_____	broaden course-related student experiences.	____	____	____
_____	use student time efficiently.	____	____	____
_____	can be easily tailored into my course.	____	____	____
_____	include adequate instructor guidance.	____	____	____
_____	assign me an acceptable instructional role.	____	____	____
_____	include adequate student guidance.	____	____	____
_____	provide feedback information to me and my students on instructional goals and progress.	____	____	____
_____	require computer skills of the students that are unrelated to course goals.	____	____	____

COMMENTS:

THESE MATERIALS ARE DESIRABLE FOR MY COURSE. ____ ____ ____

FEASIBILITY

		Yes	?	No
_____	I have enough <u>support</u> to use these materials (training, guidebooks, etc.)	___	___	___
_____	I can solve any <u>management</u> problems (justifying credit hours, arranging student space, scheduling individual meetings, etc.)	___	___	___
_____	I have enough <u>time</u> to integrate and use these materials.	___	___	___
_____	I can solve any problems of scheduling students onto computer terminals.	___	___	___

COMMENTS:

IT IS FEASIBLE FOR ME TO USE THESE MATERIALS.	___	___	___
<u>I PLAN TO USE THESE MATERIALS IN MY COURSE</u>.	___	___	___

Name _____

WORKSHOP EVALUATION

General. This form asks for your reactions to the workshop. The information will be used to improve future workshops.

Specific. Unless otherwise indicated, answer with "yes", "no", or "?".

Exceptions are direct questions, such as "How many weeks notice did you receive?"

Comment freely.

PRE-WORKSHOP

Announcement

1. How many weeks notice of the workshop did you receive? ____

2. _____ This was enough advance notice.

3. How did you first learn about it? _____

_____

4. _____ The advance information was adequate.

Pre-Workshop Materials. SKIP THIS IF YOU DID NOT RECEIVE ANY MATERIALS.

5. How many hours did you spend reading the materials? ____

6. How many hours did you spend working any exercises? ____

7. _____ The pre-workshop materials helped me prepare for the workshop.

8. _____ The workshop corresponded to the pre-workshop materials.

WORKSHOP

General

9. _____ I understood the objectives of the entire workshop shortly after it began.

10. _____ I understood what was expected of me throughout.

11. _____ I understand just what I will have to do once I get home.

12. _____ New classroom ideas were followed immediately by practice on the computer.

13. _____ Each new point was related to the overall workshop goals.

14. The pace was: (too fast ____) (too slow ____) (about right ____).

15. _____ The workshop measured up to my expectations.

Lectures

16. _____ The workshop leader did not confuse me with computer talk.

17. _____ The classroom sessions did not go too long before I had a chance to practice on the computer.

18. _____ I received enough examples.

19. _____ I was given enough sample printouts.

20. _____ Handouts were clear and to the point.

21. _____ I understood the classroom presentations.

Lab Sessions

22. _____ I received enough individual attention.

23. _____ I had enough time on the computer.

24. _____ I did not have to wait too long to get on the computer.

25. _____ Computer response time was fast enough (e.g., the time to get back a program run, or for the computer to react)

26. _____ I mastered all the computer skills necessary to use the materials.

27. _____ I practiced everything I may need to teach the academic portion.

28. _____ The instructions or guidebooks were clear and to the point.

29. _____ I received frequent feedback on how I was progressing.

30. _____ Practice sessions were clearly related to classroom sessions.

COMMENTS

Comment freely on any aspect of the workshop. Include comments, if you like, on activities occurring outside the workshop itself, such as transportation arrangements, lodgings, meals, and the like. If you comment on a previous item, please include the item number.