Selected References Related to the Practice of Instructional Development: A Place to Start

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This list of references in the field of ID is intended to help readers quickly locate key sources in selected areas. From there individual interests and needs will take readers on different paths. It is not an all-inclusive list of references for the field of instructional development but represents selections made by the authors. For convenience the references are organized in the following manner: (I) General Overview Material About the Instructional Development Process; (II) The Design of Instructional Materials—Theories and Practice; (III) Evaluation.

I. General Overview Material About the Instructional Development Process

Doing instructional development implies the use of a systematic approach to analyzing problems, developing solutions, designing materials, and evaluating the effectiveness of the program and materials. The sources listed below reflect a number of approaches to the instructional development process.

Baker, E. L. The technology of instructional development, In R. M. W. Travers (Ed.), *Second handbook of research on teaching*. Chicago: Rand McNally, 1973.

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Davis, R. H., Abedor, A. J., & Witt, P. W. F. *Commitment to excellence: A case study of educational innovation.* East Lansing, Mich.: Michigan State University, Educational Development Program, 1976.

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Kemp, J. E. *Instructional design: A plan for unit and course development.* Belmont, Calif.: Lear Siegler/Fearon, 1971.

Popham, W. J., & Baker, E. L. *Systematic instruction.* Englewood Cliffs, N. J.: Prentice-Hall, 1970.

Popham, W. J., & Baker, E. L. *Planning an instructional sequence.* Englewood Cliffs, N. J.: Prentice-Hall, 1970.

II. The Design of Instructional Materials—Theories and Practice

A. Content and Task Analysis

The development of approaches to determining the content for courses, programs, and materials has been a matter of serious investigation for some time. It is important for instructional developers to be able to use an effective set of procedures to analyze and sequence content.

Briggs, L. J. *Handbook of procedures for the design of instruction.* Pittsburgh: American Institutes for Research, 1970.

Briggs, L. J. *Sequencing of instruction in relation to hierarchies of competence.* Pittsburgh: American Institutes for Research, 1968.

Davies, I. K. Task Analysis: Some process and content concerns. *AV Communication Review*, 1973, *21*, 73–86.

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B. Instructional Design Theory and Practice

This area may be interpreted in many ways, to include everything from the writing of programed text units to educational filmmaking. For our purposes here, we will consider media development and selection separately. Sources listed here will, instead, focus on the inherent design necessary to ensure that learning takes place. Whether a concept is "taught" via a computer lesson, slide-tape, book of readings, lecture or seminar is a matter for consideration which is beyond the scope of this section.

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Faust, G. W. Selecting instructional strategies or once you've got an objective, what do you do with it? *Journal of Instructional Development*, 1977, *1*(1), 18–22.

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Glazer, R. Components of a psychology of instruction: Toward a science of design. *Review of Educational Research*, 1976, *46*, 1–24.

Hartley, J., & Davies, I. K. Preinstructional strategies: The role of pretests, behavioral objectives, overviews and advance organizers. *Review of Educational Research*, 1976, *46*, 239–265.

Kulhavey, R. W. Feedback in written instruction. *Review of Educational Research*, 1977, *47*, 211–232.

Ladas, H. The mathemagenic effects of factual review questions on the learning of incidental information: A critical review. *Review of Educational Research*, 1973, *43*, 71–82.

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Reigeluth, C. M. *Effects of generalities, examples, and practice instructional outcomes for concept classification, principle-using, and procedure-using tasks.* Doctoral dissertation, Brigham Young University, 1977.

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Wilson, B. E. Prerequisites for understanding: Implications for the design of instructional strategies and materials. *Journal of Instructional Development*, 1978, *1*(2), 17–21.

C. Design, Selection, and Use of Instructional Media

The state of the art in research about instructional media has moved from the comparison of one media with another to more useful work analyzing the interaction among various instructional media and learner characteristics. Nonetheless, much of the earlier research provides some foundation on which to base the selection of media for various instructional purposes. Media research is, to say the least, voluminous, but the following sources will be a good starting point:

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Allen, W. H. Instructional films. In L. C. Deighton (Ed.), *Encyclopedia of education.* New York: Macmillan, 1971.

Allen, W. H. Research on new educational media: Summary and problems. *AV Communication Review*, 1959, *2*.

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Dayton, D. K. Inserted post-questions and learning from slide-tape presentations: Implications of the mathemagenic hypothesis. *AV Communication Review*, 1977, *25*, 125–145.

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Levie, W. H., & Dickie, K. E. The analysis and application of media. In R. M. W. Travers (Ed.), *Second handbook of research on teaching*. Chicago: Rand McNally, 1973.

Lumsdaine, A. A. Instruments and media of instruction. In N. L. Gage (Ed.), *Handbook of research on teaching*. Chicago: Rand McNally, 1963.

Molstad, J. A. Selective review of research studies showing media effectiveness: A primer for media directors. *AV Communication Review*, 1974, *22*, 386–407.

Olson, E. E. *Media and symbols: The forms of expression, communication, and education*. Chicago: National Society for the Study of Education, 1974.

III. Evaluation

The field of evaluation study is very large and includes work in a great number of areas, ranging from philosophy of evidence to statistical analysis. Generally though, references useful to instructional developers fall within a narrower range and deal primarily with five areas: A. General evaluation theories and models—program evaluation concerns; B. Needs assessment, front-end analysis, and planning; C. Formative evaluation for course/product improvement; D. Economic perspectives/program cost analysis; and E. Student evaluation of instruction.

A. General Evaluation Theories and Models—Program Evaluation Concerns

AERA monograph series on curriculum evaluation, vol. 1–7. Chicago: Rand McNally.

Bellack, A. A., & Kliebard, H. M. (Eds.). *Curriculum and evaluation*. Berkeley, Calif.: McCutchan, 1977.

Bloom, B. S., Hastings, J. T., & Madaus, G. F. *Handbook on formative and summative evaluation of student learning*. New York: McGraw-Hill, 1971.

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Taylor, P. A., & Cowley, D. M. (Eds.). *Readings in curriculum evaluation*. Dubuque, Ia.: William C. Brown, 1972.

Weiss, C. H. (Ed.) *Evaluating action programs: Readings in social action and education*. Boston: Allyn and Bacon, 1972.

B. Needs Assessment

Burton, J. K., & Merrill, P. F. Needs assessment: Goals, needs and priorities. In L. J. Briggs (Ed.), *Instructional design: Principles and applications*. Englewood Cliffs, N. J.: Educational Technology Publications, 1977.

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Kaufman, R. A. *Educational system planning*. Englewood Cliffs, N. J. Prentice-Hall, 1972.

C. Formative Evaluation for Course/Product Improvement

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Popham (Ed.), *Evaluation in education.* Berkeley, Calif.: McCutchan, 1974.

Baker, E. L. Generalizability of rules for empirical revision. *AV Communication Review*, 1970, *18*, 300–305.

Baker, E. L., & Alkin, M. C. Formative evaluation of instructional development. *AV Communication Review*, 1973, *21*, 389–418.

Cunningham, D. J. Evaluation of replicable forms of instruction. *AV Communication Review*, 1973, *3*, 351–367.

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D. Economic Perspectives

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Doughty, P. L., Stern, H. W., & Thompson, C. *Guidelines for cost-effectiveness analysis for navy training and education, NPRDC, Special report 76TQ-12.* San Diego, Calif.: Navy Personnel Research and Development Center, 1976.

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E. Student Evaluation of Instruction

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Cost Effectiveness Analysis (Continued from page 17)

Cost-Justification—an efficiency or monetary cost oriented set of strategies called upon when there is a requirement for defending or advocating a cost basis for a decision. For example "self funding" instructional improvement or media support centers are more and more being called upon to develop rationale for "charging" clients for services and products.

The following list and accompanying discussion is intended to help professionals either avoid several of the more vexing problems or make informed choices about the available tradeoffs.

Tradeoffs and Pitfalls for Evaluators and Instructional Planners

A. Evaluative Criteria
1. Define decision rules or criteria poorly.
2. Select wrong criteria.
3. Employ only a single criterion.
4. Emphasize throughput indicators.
5. Ignore spillover or unanticipated effects.
6. Overquantify.
7. Overgeneralize results.

B. Cost Issues
1. Rely on jurisdictional cost data.
2. Place undue emphasis on total dollar cost criterion.
3. Include sunk costs in cost analysis.
4. Assume unreasonable depreciation schedules.
5. Focus only on dollar expenditures.

C. Cost and Effectiveness Relationships
1. Misuse ratios.
2. Fail to fix cost or effectiveness.
3. Assume or imply causal relationships.

Evaluative Criteria

Define Decision Rules or Criteria Poorly

Studies conducted to aid decision-making often are well conducted and reported but fail to have any discernible impact. More often than not, the public and private criteria used by key decision-makers have not been determined nor used as primary components in the initial design. Of course, at times it is not in the interest of an individual or an institution to divulge some decision rules. In these instances, the evaluator's role and potential impact are considerably weakened.

Select Wrong Criteria

It is often tempting for evaluators to select criteria that can be easily defined and/or quantified, but are irrelevant to the decision. On the other hand, criteria are also selected because of their obvious potential impact, but they too may be the wrong or educationally insignificant ones. Dollar costs measures are as likely to be improperly or insufficiently reported as are outcome measures or indicators. Compromise is often in order when such criteria are strongly endorsed by key decision-makers.

Employ Only a Single Criterion

How often have we reviewed studies that report results of no significant difference when in fact there were highly significant differences in other variables or criteria? The fact that there are no differences in dollar costs to an institution for instance may ignore a requirement for the expenditure of extensive out-of-class time by learners. To rely on a single criterion, however encompassing it may be, places considerable faith in the planner or evaluator to select or create the ultimate, all purpose measure or indicator that communicates to all.

Emphasize Throughput Indicators

In the absence of ultimate criteria or measures based on need, job analysis, performance requirements, or whatever, proxy measures are often used as indicators or substitutes. This is of course acceptable practice. However, misleading conclusions are often drawn when throughput indicators, such as student-credit-hour or contact hour data are used as primary evidence of quality or efficiency rather than as idiosyncratic, noncomparable ratios of throughput. Such indicators are standard measures in many educational contexts but although they are necessary components in many studies, caveats about their limitations should accompany any comprehensive report that also contains other evidence of impact.

Ignore Spillover or Unanticipated Effects

A myopic fixation on established criteria excluding consideration of other direct evidence may not identify the alternative that compares favorably on selected criteria but excels or fails miserably in some additional area. Comments such as: "Learners came in apprehensive and left hostile . . ." or "The reading instruction system was very efficient. Isn't it a shame the students are no longer interested in going to the library?" provide insights into effects on systems well outside the one being considered. Obviously speculation on attribution and causality issues related to established criteria is always in order, but to ignore "other effects" shows evidence of limited vision.

Overquantify

In the quest to demonstrate the science of cost-effectiveness analysis, many individuals and disciplines require that all criteria be quantified in some fashion. Never mind the concern that in so doing, the evaluator has now become decision-maker by providing all standards of value and worth and utility rather than reserving those perogatives for the decision-maker(s).

Overgeneralize Results

As generally applied, cost-effectiveness studies are not designed to generate universal or broadly generalizable results. Studies are conducted to inform and perhaps influence organizational behavior, or at times, individual decision-makers. Expectations of theory-driven, empirically validated generalizable models of cost-effectiveness analysis are unrealistic given the purpose and focus of this process. It is more likely that current CE methodology and purpose will and should prohibit attempts at application in classic research paradigms.

Cost Issue

Rely on Jurisdictional Cost Data

Most primary sources of dollar cost information aggregate and report those data according to "authority areas" or "domains of responsibility" that do not represent program, system, or result areas. Such jurisdictional costs provide accounting information to ensure budgetary compliance but rarely do they relate directly to outcomes or program goals. Generally speaking, program or functionally related cost data are not available from existing records and must be collected or projected by the evaluator or instructional planner/developer.

Place Undue Emphasis on Total Dollar Cost Criterion

A false assumption often made or implied in evaluation or planning reports is that the total dollar cost of an alternative, including design, development, implementation, and lifetime operation, represents the total spectrum of the negative dollar costs. For instance, it may be the case that the salary of a master instructor, skillful programer, or competent manager can be accurately reflected. It is another issue entirely to assume that simply listing such salaries ensures those individuals' availability. In addition, reporting only total system costs does not permit scrutiny of cost-time phasing issues such as heavy front-end loading vs. potentially more costly continuing operational expenditures.

One useful way to think about and report program costs is to consider documenting monetary expenditures in a variety of ways including the following categories:

- Technical costs—How much does it cost? Each resource including capital expenditures and all personnel are identified and costed. Project phase specification or life-cycle phasing of expenditures is an extremely useful but rarely done way to portray these kinds of costs.
- Economic costs—What kinds of costs? Variable, fixed, direct, indirect, etc., costs are identified and reported. Occasionally amortization or depreciation schedules and discounting rates are included but then usually incorporated as part of the technical cost reporting scheme.
- Accounting costs—What types of costs? Initial capital investments and projected major investment or replacement expenditures are reported separately from current and lifetime operation expenses. This type of analysis is particularly important when considering instructional alternatives that differ considerably in labor intensity or in the application of high-technology options.
- Financial cost—Who pays? Often true or comprehensive costs of a program are shared by different contributors. This is the case for both direct and indirect costs. The notions of cost sharing by students (books, lab fees, travel expenses), academic vs. administrative (e.g., facilities) budgets, direct tuition vs. tax supported contributions are all examples of the financial cost issue.

Include Sunk Costs in Cost Analysis

When comparing feasible alternatives, one option may well be to continue an existing system that has already been implemented. In this case, an equitable analysis would consider only the future costs of operating and maintaining that system, not the sunk costs that were allocated in the past. In their attempt to be comprehensive, overzealous evaluators often include such costs rather than limiting the data to those that relate to future expenditures and outcomes. One instance where some of these costs should be included is when the data are to be used to project budget requirements to replicate the system in another setting.

Assume Unreasonable Depreciation Schedules

One way to distribute the cost of large initial hardware expenditures is to depreciate them over some specified number of years. Combining the notions of technological and content obsolescence with time or use-based depreciation is also legitimate and recommended. Problems arise, however, when analysts make unwarranted assumptions about lifespans of computer and video systems or course content, thus making it easier to justify high front-end expenditures. This is one area where careful judgment and public assumptions are basic requirements. A different but related issue concerns the assumptions made about the number of cycles an instructional program or system will be offered, as well as the number of learners or participants served during the projected lifetime of an alternative. These items have tremendous, almost overpowering impact on decisions related to judging economy of scale. Judicious estimates with supporting rationale help offset the healthy skepticism decision-makers have about such data.

Focus Only on Dollar Expenditures

Economists are quick to point out that costs are not simple negative consequences of a decision. There are, however, many decisions or alternatives that have cost implications of some kind for a variety of audiences. Negative benefits such as low student and faculty morale, study time diverted from other courses, and professional time diverted from other scholarly endeavors are examples of the broad range of costs that are not represented by balance sheets and voucher records. Such costs are real and of likely impact; although attempting to quantify and value them in dollar terms is usually not recommended.

Cost and Effectiveness Relationships

Misuse of Ratios

Some economists argue that the ultimate in scientific approaches to cost-effectiveness analysis is to quantify the evaluative criteria, preferably in dollar terms, so that benefit-to-cost ratio comparisons can be made. This approach combines the overquantification pitfall with a more fundamental problem: the lack of attention to the size or magnitude of the numerators and denominators. Most decision-makers are capable of selecting betting odds of 3 to 1 over a ratio of 5 to 2. Of course what wasn't considered was the additional information that 3:1 was actually $30 to $10 and the 5:2 indicated a benefit of 5 million dollars for a required capital investment of 2 million dollars. In this case, not only did the ratios dictate the decision, the initial selection was likely the wrong one.

Failure to Fix Costs or Effectiveness

Literature from many fields abounds with the notion that cost-effectiveness analysis is a process that identifies the alternative that requires minimal resources and provides maximum effectiveness. It can be argued that this is based on the assumption that if you search hard enough or design creatively then you will eventually discover the alternative that provides infinite effectiveness for zero cost. Briefly, a more tenable guideline reads as follows: (1) identify a desired level of effectiveness and then examine the cost of alternative means of achieving that level, or (2) specify a budget level and examine the level(s) of effectiveness that might be achieved through different alternatives. Seldom, if ever, is either of these realized. As a minimum gesture developers and evaluators should underscore the considerable problems associated with comparing alternative with unlike resource requirements *and* levels of effectiveness. Other major instructional variables such as time are also likely candidates for inclusion in such studies. Making such comparisons between multiple alternatives is often simplified by considering successive pairs of alternatives (two at a time) until all possible pairs have been analyzed.

Assume or Imply Causal Relationships

To specify, measure, and report resource requirements, process descriptions and system outcomes is a legitimate responsibility of any professional. However, to imply or assume that direct causal relationships exist between these variables requires a technical and conceptual leap well beyond current Olympic standards. Cost-effectiveness reports should always contain caveats concerning correlation, causality, and attribution.

Next Steps

Instructional planners and evaluators interested in pursuing these cost-effectiveness issues and procedures further are likely to be initially encouraged and then dismayed. Many cost-effectiveness related studies, articles, and texts have been published in the past 6 to 7 years. None of them claim to be *the* comprehensive guide. In addition, considerable translation of terminology and concepts is required. Explanations and examples contained in the publications cited in the reference list are particularly relevant, require less translation than most, and merit consideration.

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