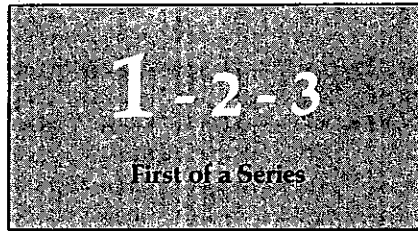


# Cost-Effectiveness Analysis Tradeoffs and Pitfalls for Planning and Evaluating Instructional Programs

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## Overview

The instructional planner and evaluator, depending upon prior education, experience, and current context, may owe primary professional allegiance to any number of associations and academic disciplines. Descriptors such as media professional, educational researcher, evaluator, economic analyst, instructional designer, operations researcher, curriculum specialist, and systems analyst represent some of the monikers used by professionals who perform the development and evaluation functions.

Regardless of professional affiliation and title, professionals making decisions

about instruction must consider issues related to costs and effectiveness. How and when these issues are considered are becoming major concerns in these times of retrenchment and resource reallocation.

It is not the intent of this article to provide an all-purpose recipe for the conduct of cost-effectiveness studies. Attempts at such a cookbook approach would likely result in something akin to gastronomic distress. To date, what has been produced in fields outside conventional education contexts is the articulation of cost-effectiveness guidelines that include issues, outlines, procedures, examples, and references (Doughty, Stern & Thompson, 1976; Quade, 1976).

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## Editor's Note

Economic analysis, cost-effectiveness (CE) analysis, and program cost analysis all have considerable potential in planning, implementing, and evaluating instructional development projects. Whether such methods are feasible or likely to lead to more efficient or effective development is in part a function of *how* they are applied. Considerations of *why* they might be used are, perhaps, of equal importance.

The *JID* editorial board has approved the publication of a three-part series of articles devoted to these issues. The leadoff article, which presents conceptual and practical criteria for judging and designing cost-effectiveness oriented studies, is presented in this issue. A subsequent issue will present discussions focusing on the technical and methodological issues inherent in most, if not all, CE studies. These will include a consideration of CE methods employed in instructional technology and a more detailed account of the techniques of program cost analysis. The third issue will present an applied case study example that demonstrates many CE features and several of the pitfalls in a potentially useful study conducted in an ID context.

The series is intended to present a rather comprehensive but terse state-of-the-art picture of cost-effectiveness methods in the context of instructional development.

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Ultimately the question is asked: Where does the developer or evaluator begin in developing a cost-effectiveness analysis perspective? This article outlines several issues that distinguish studies and projects that have incorporated this perspective from those that have not.

One of the major problems is the perception that cost-effectiveness analysis does not require any particular technical or professional competence, but does include a requirement for copious quantities of common sense and sound logic. Considerable and continuing support for this notion is supplied through the proclamations of decision-makers in almost every field. Written and oral utterances such as: "We developed it in a cost-effective manner . . ." or "The benefits were maximized while the costs were cut 20 percent . . ." or "Our benefit-cost ratios prove . . ." or "The decision was made on the basis of cost-effective reasoning . . ." all serve to perpetuate the illusion of science and truth.

Somewhat farther along this art-science continuum falls a relatively select but growing number of individuals who mask their more sophisticated blunders with verbiage and jargon peculiar to their particular field of inquiry. Most of these are the results of errors in logic or false assumptions. Economic analysts, summative evaluators, cost analysts, program budgeters, and operations researchers all have high potential for inclusion in this club. An even more unfortunate situation arises when a quality piece of work is obfuscated by the author in catering to external requirements for specialized language, format, or purpose. Such is often the case with parochial professional journals and research oriented dissertation committees.

Add to this the confusion over concepts or terms such as the following:

*Cost-Benefit* or *Benefit-Cost Analysis*—conventionally an "ends oriented" approach that requires a quantitative valuation of both resource inputs and outcomes.

*Cost-Effectiveness Analysis*—a "means oriented" approach employed where the task is to select a strategy or product from a set of alternatives designed to accomplish specified goals. In addition there is less emphasis on numerical or monitory quantification of outcomes.

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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 accom-

pany 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 prerogatives 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 programmer, 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 real-

ized. 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 Olym-

pic 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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