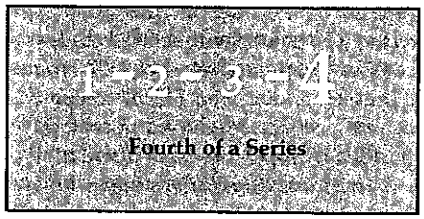
Cost-Effectiveness Evaluation: A Case Study of an Innovative Program in Higher Education

Jerry Klein
Associate Professor
University of North Carolina at Wilmington
Wilmington, NC 28403

Philip Doughty
Associate Professor
Syracuse University
Syracuse, NY 13210



ABSTRACT: This article reviews the cost-effectiveness evaluation component of a project that was undertaken to design and implement an instructional model for providing graduate programs to adults employed full time and residing in remote locations. Through the project, alternative instructional delivery models were compared with respect to costs in achieving program outcomes. The paper reviews the study in the context of a cost-effectiveness evaluation model suggested by Lent (1979) in a previous articles in this series. The processes, conditions, outcomes, and difficulties of each phase of the study are discussed in the sequence presented by Lent: (a) preparing for and establishing conditions of the study, (b) identifying alternatives, (c) designing the cost-effectiveness comparison, (d) determining costs, (e) determining outcomes, and (f) assembling and reporting the findings. A final section of the paper discusses the benefits and problems associated with cost-effectiveness evaluation.

This case study and the project upon which it is based (Klein, 1978) reflect in many ways the professional values of faculty members and administrators of a single graduate institution. Although the intent of this article is to present an example of a generalizable set of cost-effectiveness evaluation procedures applied to a development project, this particular institution and its personnel are probably not representative of conventional academe. It is a tribute to both faculty and administrators that a level of mutual trust existed allowing faculty to focus upon institutional mission and professional roles and not be concerned about the potential for misuse of faculty time allocation data. Energies devoted to course and program development endeavors were highly regarded by all parties thus allowing free and usually willing reporting of faculty time. Developers and evaluators should be reminded that this pleasant circumstance is not always to be expected.

Overview

The 1970's saw dramatic changes in higher education. Student enrollments declined, budgets were reduced, and a different student population emerged—a population in which many of the students were adults with family and job responsibilities. Consequently, it is very possible that higher education's major mission in the 1980's will be to provide inexpensive, easily accessible educational programs to the working adult. As universities and colleges respond to these changes and begin redirecting their efforts and resources to meet this mission, cost-effectiveness evaluation will play an important role in designing appropriate instructional systems.

Conditions and Preparation of the Study

The West Virginia College of Graduate Studies (CGS) received a grant from the Fund for the Improvement of Postsecondary Education (FIPSE) to develop a model for providing graduate programs to adults in remote locations. The major activities of the project were directed at designing a system for delivering courses in remote locations by enhancing the present rather innovative efforts of the college. CGS was established in 1972 and given the mission of providing a viable graduate curriculum to citizens of central and southern West Virginia. The college has no campus and offers only post-baccalaureate work. Regular full-time faculty are located in leased facilities at undergraduate institutions in Charleston and Beckley and all courses are held in the evening at locations throughout the region. The college also relies heavily on the use of

EDITOR'S NOTE

This is the fourth in a series of articles on the use of cost-effectiveness analysis to evaluate instructional programs. The first article (Doughty, *JID*, 2(4), summer 1979, pp. 17–25) provided an overview of conceptual and practical criteria for judging and designing cost-effectiveness studies. The second article (Lent, *JID*, 3(1), fall 1979, pp. 26–33) provided a detailed model of the methods of cost-effectiveness analysis as it is used to inform decisions about instructional development efforts and other applications of educational technology. The third article (Beilby, *JID* 3(2), winter 1979–1980, pp. 29–34) went into more detail about Phase IV ("Determine Costs") of Lent's cost-effectiveness model. It presented a model and procedures for cost analysis.

The present article, the concluding one of this series, presents an applied case study of cost-effectiveness analysis in an instructional development context that demonstrates many of the features, methods, and problems of the kind of studies described in the first three articles.

part-time adjunct faculty and the basic mode of course delivery requires that faculty drive to various locations and conduct 3-hour classes.

Prior to the project, CGS had been in existence for 2 years when both faculty and administrators began to experience difficulties in delivering courses and programs, and alternatives were being proposed. Within this context, the FIPSE project was undertaken to demonstrate the feasibility of one alternative for delivering courses, and the cost-effectiveness component was designed primarily to determine the economics of the FIPSE-funded model. There were, however, several groups interested in the project with other concerns and needs for the study to address. College administrators (the president and academic deans) were concerned with realizing the expressed mission of the college on a limited budget, meeting political pressures for delivering promised courses and programs to areas not being served fully and at the same time maintaining academic credibility, and identifying and trying out viable cost-efficient instructional alternatives while maintaining present efforts. Faculty and program chairpersons were concerned with problems associated with academic quality control of courses taught by adjunct professors, the tremendous amount of faculty time consumed in traveling to teach courses, and the quality of programs that were essentially "off-campus." These concerns were identified by project staff at both formal and informal meetings with administrators and faculty and through a survey instrument designed to determine faculty concerns and attitudes toward a variety of policies for program improvement.

It was decided that while the project and study would be concerned primarily with developing one alternative and determining its cost effectiveness, there would be other related purposes:

- to inform the primary decision-makers concerning "real" costs of current practices as well as the FIPSE-funded model;
- to guide administrators and faculty in focusing upon a range of decision variables reflecting program costs, instructional effectiveness, academic quality, and other benefits than were presently being considered. (It was determined, for instance, that most college faculty had a rather limited view of "costs" and "good instruction");
- To assist administrators and faculty in understanding, deriving, analyzing, and comparing viable alternatives in program design and delivery; and
- to provide a framework for identifying costs, personnel, and organizational structures required to support alternative instructional delivery models.

These purposes suggest that the project staff (two instructional designers) assumed that they could have a significant impact on the decision-making process within the institution. This assumption proved valid throughout the entire project.

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Identifying Alternatives

The second phase of the cost-effectiveness model involved the derivation and specification of alternatives to be considered and compared in the study. With respect to this phase, the project was quite fortunate. As mentioned above, problems and alternatives were being presented by a variety of groups and individuals. In the year prior to the project, academic deans had requested written reports on problems and alternatives from faculty, and meetings had been conducted to discuss the problems and alternatives. Consequently, there was a comprehensive set of fairly well articulated concerns, objectives, and constraints that had consensus among faculty and administrators. Early project efforts were thus focused upon formally stating these goals and constraints. The primary goals were to deliver academically sound courses and programs in remote locations and to meet the needs of adult students in terms of time constraints imposed by full-time employment and family obligations. The primary constraints were to keep program costs at acceptable levels, reduce faculty travel time, and maximize use of available resources.

In the initial stages of the project, two alternatives were considered for comparison: the present CGS model of course delivery and the FIPSE-funded model of course delivery. As noted above, the CGS model involved having regular or adjunct faculty drive to a given location and conduct instruction in the traditional lecture/discussion form. The FIPSE model involved the use of predesigned courses that would permit students to complete assignments and instructional activities on an independent basis through the use of mediated and printed materials housed in various locations (centers). Courses would then be conducted and managed by CGS faculty visiting the centers as necessary. Throughout this paper, the term CGS course will be used to denote courses conducted via the CGS model discussed above, and FIPSE course will denote courses conducted according to the FIPSE project model of instruction.

In deriving alternatives based on systems-oriented technology, several relevant comments seem appropriate here. With respect to instructional development in this higher education context it appeared that faculty found it difficult to conceive of a real alternative to professors delivering instruction. Most faculty simply viewed the use of technology as a different way of getting the teacher's message to the student. Consequently, techniques such as brainstorming that are presumably designed to generate alternatives did not result in real "alternative" alternatives. Instead, we found that additional new approaches surfaced during the design, development, and implementation of a given alternative. Hence, it was imperative that designers be open, public, and low-keyed in conducting their activities, and thus let things evolve. For instance, in meeting with the academic deans, one dean remarked that the use of predesigned courses seemed to be an excellent way to maintain academic quality of courses taught by adjunct instructors. As a result, an additional dimension was given to the project: that of designing courses that could be delivered by adjunct faculty.

A second set of issues which impacted the creation of feasible alternatives re-

lated to faculty attitudes about driving the so-called West Virginia "turnpike" through the mountains in winter, their image of graduate instruction, and their evolving concerns about potentially low enrollment in repeated offerings of any single course offered in relatively remote locations. These, combined with the predesigned course recommendation, led to discussions about single faculty members managing several courses at once in more than one location. Once relieved of being the sole source of content and structure as well as skill-practice exercise supervisor, faculty (and administrators) were then able to create reasonable and acceptable instructional delivery alternatives.

The Cost Effectiveness Comparison

The third phase of the cost-effectiveness evaluation was to articulate the specifics for the cost-effectiveness comparisons including defining the various evaluative criteria.

The criteria employed in the present study fell in two categories: cost factors and outcome factors. The basic cost-related criterion centered around the standard (and easily understood) efficiency comparison of cost-per-course offering. In addition to this cost-efficiency criterion, others of importance were development cost of FIPSE courses, operating costs of FIPSE courses and CGS courses, and faculty time utilization on both FIPSE and CGS courses.

Although collected and available, student learning outcome measures were not considered in the comparison of alternatives. There were several reasons for this decision. FIPSE courses were developed according to the systems approach which included the specification of learning objectives, design of instruction with field tests, and revision until students achieved the prespecified objectives. Standard CGS courses did not employ such development strategies. Second, there was not an opportunity to compare two forms of the same course. Outcome criteria collected but not compared included student attitudes, convenience to students, amount of instructor-student contact time, number of students served per course, and faculty acceptance.

Two forms of cost-effectiveness analysis were employed. The first was what Lent (1979) refers to as the ratio model. In our study, the ratio was simply the mean cost per course delivery in which FIPSE course development costs were averaged over a 5 year period. In addition to the ratio model, it was decided that ranges and means would be reported of faculty hours spent on development of FIPSE courses, dollar costs for materials and printing, travel costs and time, faculty time spent on various course functions including planning, instruction, evaluation, and travel, and scores on an instrument measuring student attitude toward course methods.

In summary, the cost-effectiveness evaluation model was designed to address the following questions:

- How much does it cost to develop a FIPSE course?
- How much does it cost to operate a FIPSE course?
- How much does it cost to operate a CGS course?
- How do faculty use their time in both FIPSE and CGS courses?
- Does the FIPSE model reduce faculty travel time?
- What are the student attitudes toward the FIPSE model?
- Will faculty accept the FIPSE model?
- Can adjunct faculty conduct a FIPSE course with the assurance that course objectives will be met and result in positive student attitudes?
- What will be required in terms of personnel and funds to continue to develop FIPSE-type courses on a long-term basis?

> "It seems to us that cost-effectiveness analysis in addition to providing useful data in and by itself, will result in several side effects."

Determining Costs and Outcomes

Phases four and five of the study involved determining costs and outcomes of various alternatives. As recommended by Beilby (1979), in order to determine costs and faculty use of time on both FIPSE and CGS courses, data were classified along two dimensions: resources used and various course development and operation activities. In addition, data on total course and total CGS time were collected on participating faculty. Resources used in designing and conducting courses were documented and reported by categories such as faculty time, materials, printing, photocopy, and other (e.g., actual travel expenses). Activity variables included: planning/designing instruction, large-group instruction, small-group and one-to-one instruction, evaluation, travel, and other. For all FIPSE courses cost data were collected separately for development and operation. Examples of how resources were charged to activities are as follows: faculty member spends 3 hours preparing a lecture—charged to planning; FIPSE staff spends 3 hours on formative evaluation—charged to design; faculty member photocopies article for lecture preparation—charged to planning; and faculty member spends 4 hours organizing and setting up materials for FIPSE course in a center—charged to planning of an operating course.

In collecting data pertaining to faculty time, an instrument in the form of a weekly log was used by faculty and project staff. This instrument consisted of one sheet and is shown in Figure 1. The instrument was also used by faculty in developing courses in which all time would be charged to category A, planning, preparing, designing. To collect actual dollar costs for materials, printing, and photocopying, three additional forms were used. These forms requested faculty to identify the item of material, printing and photocopy; classify the item as planning/design, instruction, or evaluation; and enter the dollar cost amount for the item. These forms were maintained by secretaries under the supervision of the faculty.

To collect data on student attitudes toward FIPSE courses, an instrument was developed, tried out, analyzed, and revised. The instrument measured student attitude toward adequacy of methods, instructor effectiveness, course methods in general, use of time, and course relevance. This instrument was administered to all students enrolled in FIPSE courses at the end of the semester

Course _____ Week _____ To _____		Mon	Tue	Hours Spent Wed	Thu	Fri	Sat	Sun
A. Planning, preparing, researching, designing instruction, lectures, activities, tests, evaluation								
B. Instruction	Large group, class lectures, presentations, discussions, films							
	One-to-one, small group interactions, instruction, feedback							
C. Evaluation of student, grading, administering tests								
D. Travel (to _____) Number of trips _____								
E. Other (number and specify on back)								

Total time on course _____

Number of hours devoted to all COGS activities this week _____

FIGURE 1. Faculty time log.

including courses conducted by CGS faculty who participated in the design of the course, CGS faculty who were not involved in the design of the course, and adjunct faculty.

Cost and outcome data were collected for five FIPSE courses and four CGS courses.

Assembling and Reporting the Findings

The final phase of the project involved the synthesis, analysis, and reporting of the findings. In this study preliminary results were reported to deans and faculty concerning the general costs and outcomes of FIPSE courses. The final written report contained findings which compared FIPSE and CGS courses (Klein, 1978).

In a preliminary report, project staff were able to specify the nature and estimates of the costs involved only in designing and developing a course. However, findings with respect to student attitudes could and were reported as an indication of project effects. Preliminary information was presented in several settings including: a large group faculty meeting in which the project staff presented the rationale, processes, outcomes, and implications of the FIPSE project; private discussions with the president and deans; a report to the long-range planning committee; a report to the college reorganization committee; report to the faculty affairs committee; and report to the deans for financial affairs and admission/records.

In the final report, several types of information were presented. With respect to development, costs figures were reported for developing six courses specifying the various cost categories mentioned above. The actual findings are shown in Table 1. In reporting costs and faculty use of time in operating courses, mean faculty hours spent, and percentage of faculty total semester time were reported for various course functions. These data are shown in Table 2. In addition, mean course operating costs for FIPSE and CGS courses were reported. These data are shown in Table 3.

It may be of some interest here to note several items of information not represented in these particular tables. For instance, one faculty member teaching CGS courses discovered after carefully maintaining his log that he spent more time traveling than in conducting instruction. Second, the FIPSE model as implemented appeared to lead to a reduction in operating costs and faculty travel time. One of the most interesting observations was that the FIPSE-systems approach to course design and implementation substantially reduced faculty time devoted to conducting a course but yet there was only a slight difference in direct instruction or student instructional contact time between CGS and FIPSE courses.

Benefits and Problems of Cost-Effectiveness Evaluation

In reflecting on the project, it appears that several important statements can be made with respect to the role of cost-effectiveness evaluation in instructional systems design.

First, it appears that the project had significant impact on the decision-making process within the institution and the cost-effectiveness component con-

TABLE 1. Development cost per course

Course	Faculty			Production				Total faculty + Production
	Hours	Percentage of CGS semester time	Cost[a]	Materials	Printing	Photocopy	Total	
Ed. 530	201	23	2,300	1,770.50	97.37	222.41	2,090.28	4,390.28
Ed. 535/532	163	20	2,000	851.30	60.57	9.71	921.58	2,921.58
Ed. 500	32	4	400	1,399.70	231.03	237.03	1,868.17	2,268.17
Ed. 531	322	40	4,000	855.15	84.91	1.94	942.00	4,942.00
Ed. 540	110	14	1,400	0	32.32	55.38	87.70	1,487.70
Ed. 536	128	17	1,900	2,868.66	29.20	24.37	2,922.23	4,822.23
Mean	159	20	2,000	1,290.89	89.23	91.96	1,471.99	3,471.99

[a]Based on $10,000/semester including salary and benefits.

TABLE 2. Mean faculty hours and mean percentage of faculty time per semester on FIPSE and CGS course functions

Course function	Mean faculty hours		Mean percentage faculty semester time	
	FIPSE courses n=5	CGS courses n=4	FIPSE n=5	CGS n=4
Planning	14	69	2	9
Large group instruction	8	31	1	4
Small group instruction	21	4	3	6
Evaluation	16	36	3	4
Travel	33	58	4	7
Total course time	84	198	13	22

TABLE 3. Mean course operating cost for FIPSE and CGS courses offered at a distance

Category	Operating cost (dollars)[a]	
	Mean FIPSE n=5	Mean CGS n=4
Development (Averaged over 5-year period)	$ 694	0 (All sunk costs)
Travel		
Expenses	136	430
Faculty salary	439	718
Total	642	1,148
Instruction Faculty salary[a] for planning, instruction, and evaluation	899	1,490
Materials, printing, and photocopy	67	87
Total	$2303	$2,725

[a]Costs for faculty were based on $10,000/semester including salary and benefits.

tributed to this impact. In discussing this impact it should be noted that as a result of the project, a college-wide committee for reorganization requested that a new position be established for instructional development. Funds for this position were submitted in the asking budget to the Board of Regents as well as funds to support the activities. Deans in two of the college's four divisions requested positions for their own instructional designers to continue FIPSE-type efforts, and indicated that they would trade a faculty position for the instructional design position.

It seems to us that cost-effectiveness analysis in addition to providing useful data in and by itself, will result in several side effects. It will likely cause a variety of groups of people to focus on "real" costs of current practices. For instance, most faculty had not previously shown much concern about determining how they actually spent their time. In conducting this study, the importance of this variable became salient. In this instance, as a result of faculty logging their time, the faculty affairs committee initiated actions aimed at weighing various faculty activities and developing an instrument to collect faculty time data devoted to these functions. This kind of information has been useful in setting and revising faculty promotion and tenure policy.

One of the most important benefits of conducting a cost-effectiveness evaluation as part of this instructional development effort was that it provided the course designers with both access and insight into the decision-making process within the institution. By considering economic criteria, project staff were required to determine real dollar costs and

values as well as consider areas of concern from the viewpoints of a variety of groups of people. It was important to note that each group had an investment in the institution and shared or wished to share in the decision-making process. In fact, conducting such a credible cost-effectiveness evaluation likely placed the designers in a leadership role in deriving and evaluating instructional and organizational alternatives that will have a long-term impact on the organization.

In this project, it was evident that cost-effectiveness evaluation had multiple benefits for various audiences, but there were also several problems that must be considered. An individual conducting such a study must consider his or her role and purpose for the study. If, as in our case, the study is part of an instructional development project, the project staff will have to determine if they are conducting the study to "prove" the worth of their project or to truly determine the cost-effectiveness of viable alternatives. In the present study, the project staff were more inclined toward the former role and hence a more cost-effective instructional delivery model might have been designed. Secondly, there still appear to be several methodological problems in determining, analyzing, and reporting dollar costs in a valid and meaningful way.

Cost-effectiveness analysis applied to instructional development is still in its infancy and considerable efforts will be required to gather reliable and useful cost information. Unlike collecting many outcomes-oriented data, most instruments, procedures, data gathering techniques, and reporting procedures will basically have to be invented during the process of the study. This invention process will require additional personnel time and other resources and concerned parties should devote time during the early stages of project planning to determine if the costs of a cost-effectiveness evaluation are worth the variety of benefits to be gained. This then represents the process being used upon itself to consider alternatives and tradeoffs—not an altogether inappropriate activity for instructional developers and evaluators.

Final Observations

It would be improper if this article (and by implication its authors) stopped here with this Walt Disney-like ending. Several final comments about purity and precision are required. Using several of the tradeoff and pitfall issues discussed in the initial article of this series (Doughty, 1979), it is fairly easy to identify several major "threats to validity" that plague and bless most development-cum-evaluation studies.

One of the areas of concern in this study (and most all other cost-effectiveness studies in higher education) is the use of throughput measures as indicators of efficiency and, by inference, effectiveness. The typical case employs the cost-per-enrolled student or even student-credit-hour ratio as a principal measure. A primary focus of this project was course quality and not enrollment, so the useful, if somewhat misleading, ratio of cost-per-course offering was used to convey comparative data to the many decisionmakers.

A related but even more complex set of concerns focuses upon the recommendation—some say requirement—to fix one of the two variables in a comparison of the cost-effectiveness of instructional alternatives. Careful review of the several instructional delivery methods employed in the CGS and FIPSE courses reveals that there were considerably more than two variables considered for each and *none* was fixed. Although a fairly reasonable case can be made for assuming that the different classes of enrollees were essentially similar, cursory inspection exposes differences in course content, instructors, and instructional approaches which included considerable variances in student class time, faculty time, and student study time.

A standard set of functional cost-analysis procedures, a la Beilby (1979), does permit some reasonable comparison of development and operation costs but these were also different across alternatives. The range in total dollar costs can be attributed primarily to differences in the instructional delivery options which require markedly different *absolute* (total hours) and *relative* (percentage of available) faculty time.

So, what conclusions can a developer turned part-time cost-effectiveness evaluator draw from such a case study—or even from this four article series? It should be fairly obvious that a *Fantasia* equivalent in the cost-effectiveness literature has yet to be created—and that there is still ample room for researchers, developers, evaluators, and animators to improve the process.

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