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AUTHOR Rogers, Donald D.
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ABSTRACT

The ability to develop lower unit cost instruction requires the ability to both determine the unit cost of current instruction and to predict with some degree of accuracy the unit cost of the proposed instruction. From the managerial viewpoint the cost of instruction can be determined by using basic design models which reflect the actual situation. By applying Tracey's Project MINERVA Model with its clearly described five instructional stages, the manager can cross reference each of the stages against his four general cost categories: salaries; supplies and materials; space; equipment. Implementation of this type of cost analysis will enable the manager to predict the cost of future projects, justify organizational changes, facilitate the formulation of institutional budgets and grant proposals, and testify to support needed from separate entities (federal government, institution, etc.). The author presents a simulated cost study with tabular summarization of the data. (MC)

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THE COST ANALYSIS OF INSTRUCTIONAL DEVELOPMENT: SOME MANAGERIAL CONSIDERATIONS[1]

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By

Donald D. Rogers
Media Education Center
University of Texas at Austin
604 W. 24th Street
Austin, Texas 78705

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> A major component of the reform we seek obviously must be increased productivity -- finding ways of getting more out of each dollar invested by turning away from obsolescent cottage industry methods through a major reordering of our principl resources, including teaching talent, and wider reliance on technology, which is our principal hope for the effective development and implementation of high-quality, lower unit cost learning. (National Association of Educational Broadcasters, 1972, p. 4)

Although the goals expressed in the quotation from Commissioner of Education Marland's Annual Report to Congress are probably acceptable to most educators, the methodology necessary to achieve these goals is, unfortunately, yet to be developed. For example, the ability to develop lower unit cost instruction requires the ability to both determine the unit cost of current instruction and to predict with some degree of accuracy the unit cost of the proposed instruction. While those educators engaged in instructional development have focused on the specification of instructional objectives, the design of evaluation instruments, the determination of aptitude-treatment interactions, and the production of instructional materials; the determination of procedures for ascertaining the cost of instructional development has been largely ignored. Since it is quite difficult to accurately predict the cost of proposed instruction without any knowledge of the cost of previously developed instruction, the first step toward achieving the goal of lower unit cost instruction must be the development and inplementation of a procedure for recording the costs which are incurred during the instructional development process. The purpose of this paper is to present the general outline of a procedure for classifying and analyzing these costs.

The first major problem encountered in recording the costs of instructional development is the categorization of costs according to the entities which have incurred them. Typically, the bulk of the cost of instructional development will be incurred by a single entity such as the federal government, a foundation, or an educational institution. This entity makes funds and/or facilities available to an individual who bears the primary responsibility for the project and the responsibility for insuring the most effective allocation of these resources. For the sake of convenience we shall call this individual the manager. If the costs of instructional development were met solely with the funds under the direct control of the manager, the process of recording the costs would be greatly simplified. Usually, however, at least part of the costs are incurred by entities which

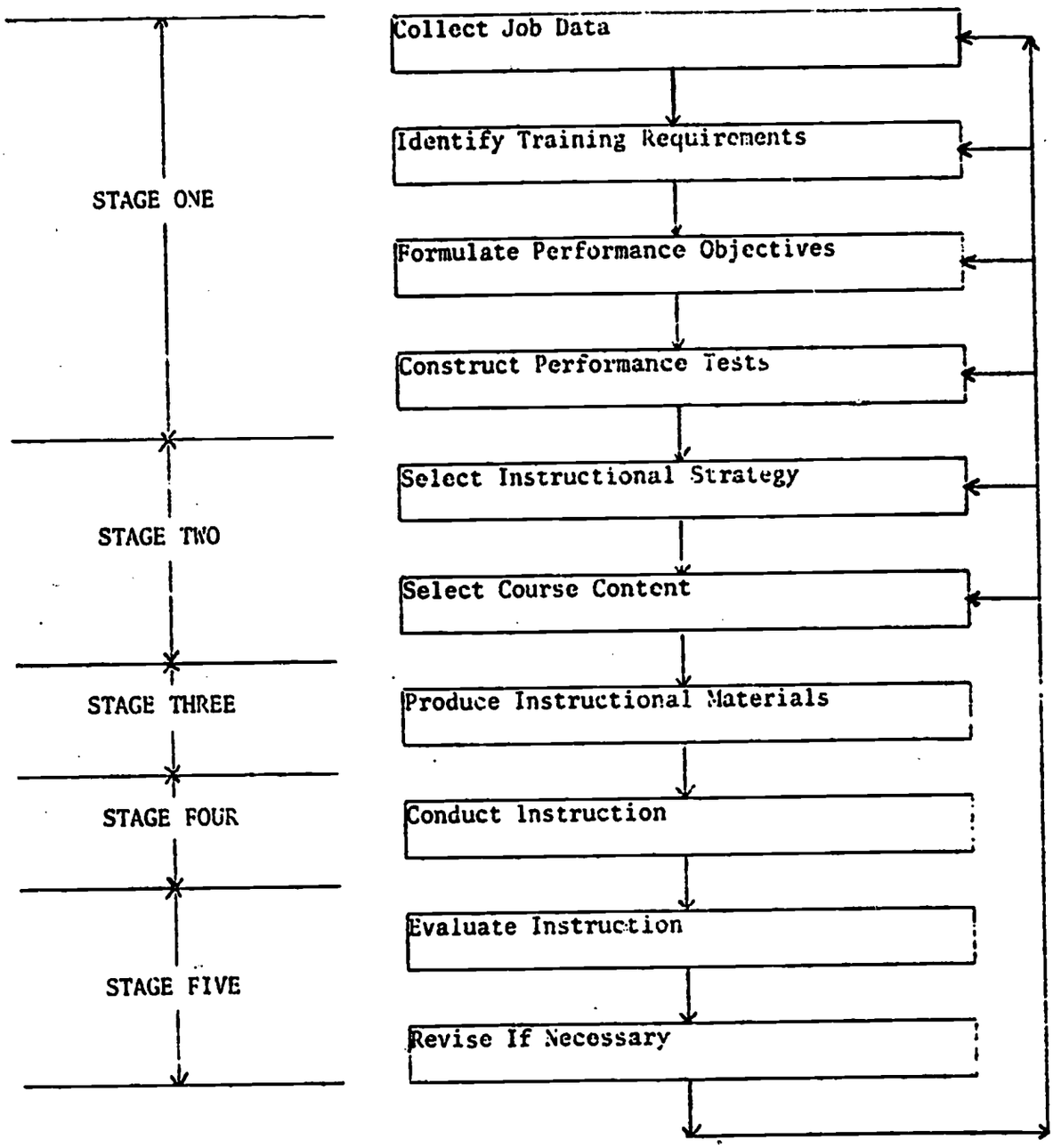
are at best only indirectly controlled by the manager. For example, insturctional design projects which occur within an educational institution frequently draw upon the talents of faculty who are not directly involved in the project. These faculty members will generally provide services which are not paid for with the funds that are controlled by the manager. On the surface it may seem reasonable for the manager to ignore the cost of these services since, from his perspective, they are being provided at no charge. Although the manager is not paying for these services, the institution which employs these faculty members probably is. If the manager ignores this cost, then he is ignoring part of the cost of the instructional development. While this may not be problematic at the moment, then the manager attempts to predict the cost of future projects, he may assume that he will receive an unknown amount of services at no charge. If these "free" services are not available, the manager will then incur an unanticipated cost. Therefore, to accurately plan future projects, the manager should be aware of the amount of services provided in the past at no charge. This will allow the manager to predict the cost of a proposed project under assumptions of various amounts of "free" services. (This will be discussed later.) When the project is being conducted within an educational institution but is being primarily funded by an external entity such as the federal government or a foundation, it may be desirable to know how much of the educational institution's own resources have been invested in the project. In addition to faculty time, these resources may include secretarial time, office supplies, and space.

Instructional development projects also occasionally draw upon the talent of students who are interested in the project. This is most common in universities where graduate students will typically provide services because they desire experience. The costs of these services are not met with the funds controlled by the manager nor are they met by the institution's funds. Nevertheless, these costs must be recorded for the same reason "free" faculty services must be recorded.

At this point, three separate entities have been identified. Depending upon the situation, each may incur part of the cost of instructional development. The cost incurred by each should be recorded and reported separately. This facilitates not only the planning of future projects, but also the analysis of the cost of the current project. This procedure provides complete management information. Since the manager is only responsible for the effective allocation of the resources which are under his direct control, he can not be held accountable for the allocation of the resources of the other entities. If the analysis of the current project indicates that resources which are not under the manager's control are being used ineffectively, then, in future projects, these resources may be brought under the manager's control in order to increase effectiveness. For example, instead of drawing upon "free" faculty services, a faculty member may be assigned part-time to the project and placed under the supervision of the manager.

Several models for the systematic development of instruction are currently being used in a wide variety of situations. These models range from the very simple to very complex specifications of step-by-step approaches to developing instruction. Since these models do not currently incorporate a cost analysis, a modified version of the relatively simple Project MINERVA Model developed by Tracey (Tracey, Flynn, and Legere, 1967) will be utilized as the basic design model. This model will be divided into five stages. The costs which must be recorded at each stage will then be briefly described.

Modified MINERVA Model



The MINERVA model is not a linear model but has been modified to this form for the purposes of analysis.

Stages of Instructional Development

The first stage of instructional development consists of those activities which culminate in the specification of performance or behavioral objectives of the type described by Mager (1962), the construction of measuring instruments designed to determine the achievement of the objectives, and the establishment of the criteria required for mastery. The scope of these activities varies. Occasionally, the instructional design process is initiated by an instructor whose students are failing to achieve his well-stated objectives. Or, the process may be begun because of the need to teach a new skill or technique which has not yet been defined in terms of objectives. Instructional development nearly always occurs as a response to a need or a problem. The exact nature of this problem will determine the activities which occur prior to the specification of objectives and measuring instruments.

The activities in the first stage are generally performed by the instructor or content matter specialist and an instructional designer with expertise in the specification of objectives and the development of measuring instruments. The major cost incurred during this stage is the cost of the time expended by the content matter specialists, the instructional designer and their secretarial support. The costs of supplies consumed during this stage are usually quite minor. The level of productivity at this stage depends upon the interaction of the two individuals. Occasionally, a great deal of time will be spent establishing a personal relationship and/or role expectations.

The second stage of instructional development is devoted to the selection of instructional strategy and course content. The selection of instructional strategy consists of deciding to use either an expository or inquiry approach for achieving an objective (Gerlach and Ely, 1971, p. 15). Both approaches may be utilized for different sets of objectives within the same module. At this stage, the degree to which content is specified varies considerably. In some situations, the content will be delineated only in general terms. The exact content will be determined as part of the process of producing the instructional materials. On the other hand, some instructional designers prefer to specify the exact content during this stage. The costs associated with the specification of content are primarily the costs of the time used by the members of the instructional design team.

According to the modified MINERVA model, the third stage consists of the production of the instructional materials. However, before the materials can be produced, the method of presenting the materials must be determined. The objectives may be achieved through a variety of alternate methods.

The following is a list of possible alternatives:

1. Film
2. Videotape
3. Programmed text
4. Text material
5. Lecture
6. Slides
7. Filmstrips
8. Audiotape
9. Transparencies
10. Real objects

These alternatives may be used alone or in combination. For example, an instructional module may include a lecture, a slide/tape presentation and a programmed text. While the number of possible alternatives may be large, the number of viable alternatives in a given situation may be much smaller. The use of a programmed text is not a viable alternative if an appropriate text is not commercially available and the talent required to produce a programmed text can not be secured. The choice of a viable alternative is frequently a function of the available resources rather than a function of the objectives. The cost associated with the production of instructional materials includes the time spent by the producer, the materials consumed, and the cost of using the necessary production equipment.

The fourth stage of the modified MINERVA model consists of conducting instruction. This first use of the newly produced instruction is considered to be part of the development process. At this stage, the instruction is still undergoing formative evaluation (see Bloom, Hastings, and Madaus, 1971). The costs of utilizing the instruction consist of the cost of the teachers, administrators, equipment, and space which is used.

The fifth stage of the modified MINERVA model consists of the evaluation and the revision of instruction. The evaluation instruments may be administered by the students, the instructor, an assistant, or a secretary. They may be administered on a group or individual basis. No matter who administers the measuring instruments, these instruments may be scored by the students, the instructor, an assistant, a machine, or a secretary. One exception to these generalizations warrants mention. When a computer is employed to manage instruction, the evaluation instruments are both administered and scored by the computer. The costs of producing the instruments may be included in the cost of administration.

Once the instruments have been administered and scored, the data which have been generated should be analyzed and used as a basis for revising both the instruction and the measuring instrument, if necessary, and for providing diagnostic and/or prescriptive information to each student. During this stage, the costs of revising, analyzing the data, and providing diagnostic information should also be recorded.

These costs are primarily the costs of the time required to analyze the data and prepare the diagnostics. However, the cost of the diagnostic materials must be recorded and may be quite significant.

Since the primary focus of this paper is the classification of costs, a detailed procedure for recording costs will not be presented. Typically, specially designed forms are used to record the amount of labor, materials, and machine time which are used in the instructional design process. Samples of the forms developed by the author (Rogers, 1972) at the Media Education Center, University of Texas, will be made available upon request. These forms are general in nature and may be easily modified for local use.

Having briefly discussed the instructional development process, the cost incurred during the process, and the entities which incur these costs; a general model for classifying these costs will now be presented. All costs should be assignable to one of the four general categories listed below:

01 Salaries
02 Supplies and Materials
03 Space
04 Equipment

To provide more complete management information, the costs attributable to each of these categories should be classified according to the stage of the instructional design process at which they are incurred and according to the entities which incur them. Forms such as those mentioned earlier may be used to record the costs as they are incurred. The costs may then be taken from the forms and summarized in a table like the one presented below. A separate table is required for each entity.

Major Cost Categories	Instructional Development Stages					Totals
	One	Two	Three	Four	Five	
Salaries						
Supplies & Materials						
Space						
Equipment						
Totals						

The cells of the table contain the costs which can be attributed to each category during each stage of instructional development. This table draws together and summarizes all the cost data. This data can be analyzed using the table alone, or it can easily be reformulated, depending upon the nature of the analysis.

To show the various methods of analysis, a simulated cost study of an instructional development project will be presented. While the costs are similar to those incurred in a real project, the costs reported in this paper are not the real costs of any project with which the author is associated.[2] The project to be analyzed was supported by three entities: the federal government, the college, and graduate students. The costs incurred by each entity are summarized in the tables which follow.

[2]The disclosure of the costs incurred by a project is considered to be the prerogative of the manager, not the cost accountant.

TABLE ONE: Cost Incurred by Federal Government

Major Cost Categories	Instructional Development Stages					Totals
	One	Two	Three	Four	Five	
Salaries	$1,200	$1,000	$ 800	$ 200	$ 800	$4,000
Supplies & Materials	30	20	2,000		1,000	3,050
Space	300	300	300		300	1,200
Equipment	20	20	400	60	250	750
Totals	$1,550	$1,340	$3,500	$ 260	$2,350	$9,000

TABLE TWO: Cost Incurred by College

Major Cost Categories	Instructional Development Stages					Totals
	One	Two	Three	Four	Five	
Salaries	$ 200	$ 200	$	$ 500	$ 100	$1,000
Supplies & Materials						
Space	100	100	100	300	100	700
Equipment	5	5	100	15	65	190
Totals	$ 305	$ 305	$ 200	$ 815	$ 265	$1,890

TABLE THREE: Cost Incurred by Graduate Students

Major Cost Categories	Instructional Development Stages					Totals
	One	Two	Three	Four	Five	
Salaries	$ 600	$ 300			$ 300	$1,200
Supplies & Materials						
Space						
Equipment						
Totals	$ 600	$ 300			$ 300	$1,200

TABLE FOUR: Cost Incurred by All Entities

Major Cost Categories	Instructional Development Stages					Totals
	One	Two	Three	Four	Five	
Salaries	$2,000	$1,500	$ 800	$ 700	$1,200	$6,200
Supplies & Materials	30	20	2,000		1,000	3,050
Space	400	400	400	300	400	1,900
Equipment	25	25	500	75	315	940
Totals	$2,455	$1,945	$3,700	$1,075	$2,915	$12,990

TABLE FIVE: Percent of Total Costs per Category

Major Cost Categories	Instructional Development Stages					Totals
	One	Two	Three	Four	Five	
Salaries	16.54%	12.41%	6.62%	5.79%	9.93%	51.28%
Supplies & Materials	.25%	.16%	16.54%		8.27%	25.23%
Space	3.31%	3.31%	3.31%	2.48%	3.31%	15.71%
Equipment	.21%	.21%	4.13%	.62%	2.60%	7.78%
Totals	20.31%	16.09%	30.60%	8.89%	24.11%	100.00%

TABLE SIX: Percent of Total Costs Incurred by Federal Government

Major Cost Categories	Instructional Development Stages					Totals
	One	Two	Three	Four	Five	
Salaries	60.00%	66.67%	100.00%	28.57%	66.67%	64.52%
Supplies & Materials	100.00%	100.00%	100.00%		100.00%	100.00%
Space	75.00%	75.00%	75.00%		75.00%	63.16%
Equipment	80.00%	80.00%	80.00%	80.00%	79.36%	79.79%
Totals	63.16%	68.89%	94.59%	24.19%	80.62%	74.44%

TABLE SEVEN: Percent of Total Costs Incurred by College

Major Cost Categories	Instructional Development Stages					Totals
	One	Two	Three	Four	Five	
Salaries	10.00%	13.33%		71.43%	8.33%	16.13%
Supplies & Materials						
Space	25.00%	25.00%	25.00%	100.00%	25.00%	36.84%
Equipment	20.00%	20.00%	20.00%	20.00%	20.64%	20.21%
Totals	12.43%	15.68%	6.41%	75.81%	9.09%	15.63%

TABLE EIGHT: Percent of Total Costs Incurred by Graduate Students

Major Cost Categories	Instructional Development Stages					Totals
	One	Two	Three	Four	Five	
Salaries	30.00%	20.00%			25.00%	19.35%
Supplies & Materials						
Space						
Equipment						
Totals	24.41%	15.43%			10.29%	9.93%

These tables provide data which may be used to predict the costs of similar future projects. The data also indicate the levels of support which must be sought from each entity for a similar future project. If the college will only provide 8% of the total cost, then the manager must ask the federal government for an additional 10% or attempt to increase graduate student support by an additional 75%. An anticipated change in the support provided by one entity will indicate the changes which must occur in the support provided by the other entities.

The data may also be used as a basis for organizational changes. In this example, the manager could argue that the loss of "free" graduate student services could severely harm a future project. Therefore, an additional graduate student should be added to the staff. The manager may also argue that an additional faculty member should be assigned to his staff on a part-time basis. This argument has merit since the college is already incurring the cost, but these costs are not under direct administrative control.

Naturally, the cost data from one project can be generalized only to proposed projects which are quite similar. However, when data on a variety of projects has been collected, the manager should be able to make accurate cost predictions. This ability will certainly facilitate the formulation of institutional budgets and grant proposals. Hopefully, this ability will also allow the manager to predict which of many instructional alternatives can be produced at the lowest cost, thus taking one of the first steps toward the goal of lower unit cost learning.

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