Association for Educational Communications and Technology

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About this issue...

Two long and comprehensive articles, the first self-instructional ID Training Module, and an Index to Volumes 1, 2, and 3 of JID highlight this issue which marks the end of JID’s third year.

Andrews and Goodson have done an extensive analysis of 40 models of instructional design, identifying which design tasks are included in each and what the bases for, purposes of, and uses for each are. This type of analysis should help developers in their reading of, selection of, and/or use of ID models.

Baba et al. present a detailed case study of the application of instructional development to the design of a telecourse. They address both the theoretical issues involved in their project (ID model used, evaluation procedures, etc.) and the practical elements they encountered (for example, getting team members to work together).

The ID Training Modules Department moves from bibliographies to a self-instructional unit in this issue. Using the technique of adjunctive programming, the unit uses behavioral objectives, information presentation, practice exercises with feedback, and references to additional readings to teach an objective approach to scoring essays.

It is customary for journals to provide subject, title, and author indexes at the end of each year to facilitate reader access to information. With this issue, JID joins in the practice and presents an index to all material published in Volumes 1, 2, and 3. This will help readers who subscribed after we began publication to identify what they missed and which back issues they need to obtain.

A final word: You may have noticed that the arrival of your JID has not always coincided with the season indicated on the cover (for example, receiving the winter issue on the first day of spring). With this issue, we have caught up with our time schedule, and you can now expect to receive JID regularly in September, December, March, and June. BUT ONLY IF YOU REMEMBER TO RENEW YOUR SUBSCRIPTION WHEN IT RUNS OUT.—K.H.S.
A Comparative Analysis of Models of Instructional Design

Dee H. Andrews
Psychologist
Naval Training Equipment Center
Orlando, FL 32792

Ludwika A. Goodson
Instructional Designer
L. R. O'Neall and Associates, Ltd.
Tallahassee, FL 32301

Abstract. Models of instructional design help educators to design instructional patterns that presumably have proven successful in past instructional endeavors. The writers examined 40 models of instructional design from a variety of sources. The 40 models were divided into categories based on the models' most pertinent characteristics. The purposes and uses of these models are discussed and an explanation is offered of why so many different models exist. The writers concluded that because of the varying levels of quality of models, educators must be especially careful in choosing which model to follow when designing instruction.

Introduction

According to Friesen (1973, p. 1), instructional materials can be designed and created in two ways. The first way requires a master teacher, working alone to create an inspired work of art. The second requires the application of a system of logic in order to accomplish specified learning objectives. Although the "tried and true" master teacher method has a long history, it often is unaccompanied by empirical verification of effectiveness. By contrast, the scientific method requires the acquisition of learning data to provide feedback for the revision process. That is, a systemic or systematic approach is characterized by an input-output-feedback-revision cycle similar to the cybernetic model shown in Figure 1.

The purpose of this paper is to list and describe a representative sample of the instructional design models that have evolved from this basic systematic approach.

Instructional design models come from industry, education, the military branches, and a variety of other sources. They are often viewed, therefore, as valid only for vocational education. To make an effective choice the educator may want to know where the model comes from; why it was developed; how it relates to the educator's specific goals and setting; and what kind of documentation, application, and/or validation the model has undergone.

Past experience has shown that models of instructional design are important in education and that the systematic approach is both logical and useful. However, educators are often confused about which model to use because of the bewildering array reported and because of the omission of some basic component from the literature that describes the model or reports on how the model has been used. Another reason for the less than satisfactory acceptance of the systematic approach is the apparent absence of validation for many models. (In this paper, validation refers to confirmation of the degree of fit among objectives, form of instruction, and context of learning.) Other reasons seem to be the weak or nonexistent theory base for many models and the visible cost of design—a cost which may seem high because many educators fail to balance the cost of applying the model against the quality or utility of its outcome. Finally, there is the problem of how to interpret the concept systematic. For some, the components of the model are systemic, each affecting the others so that a change in one requires a change in other components. But for others, the components of the model are only procedural, a plan of separate steps, each proceeding in a sequence that is more linear than systemic.

To provide a more comprehensive idea of what constitutes a model of instructional design, this study will accomplish the following objectives:

1. Examine several possible definitions of models of instructional design.
2. Present the purposes for having and using models of instructional design.
3. Propose two categorical schemata for 40 existing models according to origin, theoretical underpinnings, purpose and use, and degree of documentation.
4. Offer an explanation for the existence of the large number of models of instructional design.
5. Suggest guidelines for use by instructional designers and educators to facilitate their choice of an appropriate model.

Definitions of Models of Systematic Instructional Design

A model is usually considered to be an abstraction and simplification of a defined referent system, presumably having some noticeable fidelity to the...
rearranging or controlling the variables to achieve specific outcomes.

A model is a representation of a system or process, used to understand or predict its behavior. Instructional design models provide a framework for organizing and guiding the instructional process. They help educators make informed decisions about how to present information, structure learning activities, and facilitate student learning.

**FIGURE 1. Basic cybernetic model (Pratt, 1978, p. 5).**

The feedback loop in the diagram represents the continuous evaluation and adjustment of the instructional process based on student feedback and performance data. This cyclic process ensures that the instructional design is responsive to the learner's needs and adjusts accordingly.

Instructional design models vary in complexity and focus, ranging from simple frameworks to comprehensive theories. Each model offers unique insights and principles that can guide instructional practice. Understanding these models can help educators enhance the effectiveness of their teaching strategies and improve student learning outcomes.

While instructional design models provide valuable frameworks for instructional planning, it is essential to consider the unique characteristics of each learner and adapt the models to fit specific contexts. This approach ensures that instructional design remains responsive to the diverse needs and preferences of students.
means of the monitoring and control functions of the systematic approach.

3. Improving evaluation processes by means of the designated components and sequence of events, including the feedback and revision events, inherent in models of systematic instructional design.

4. Testing or building learning or instructional theory by means of theory-based design within a model of systematic instructional design.

"The educator who ultimately uses an instructional design model should know how and why the developer arrived at the model so the designer can determine the suitability of the model for the desired goals."

As suggested in the review by Smith and Murray (1975), the procedures in models may be based more on the monitoring and control functions associated with general systems than with any clearly stated instructional purpose. Lowe and Schwen (1975) note that most instructional development is "a systematic process focused on improving the effectiveness and efficiency of learning and instruction in various educational environments" (p. 43). Vance (1976) and Waldron (1973) present a similar purpose statement, while Davis and McCallon (1974) modify this purpose in stating their intent to "translate social science learning theory for practical use in a variety of instructional settings" (p. xi) to serve as a guide "to the theory and practice of adult education" (p. 6). Even (1977) does not refer to theory, but retains the purpose statement presented by Lowe and Schwen (1975), focusing on classroom activities as the specific environmental context.

According to Gagné and Briggs (1974), the purpose of the systematic approach (or a statement of its usefulness) is that "it encourages the setting of a design objective, and it provides a way to know when that objective has been met" (p. 228). In view of this purpose, Gagné and Briggs observe that the systematic approach is useful in designing lessons and modules as well as instructional systems (p. 227). Other developers and reviewers have referred to the value of the systematic approach as a planning, organizational, and/or managerial tool for effective design and development (Brannon, 1978; Kelly, 1976; Shoemaker & Parks, 1976; Smith & Murray, 1975; Teague & Faulkner, 1978).

Educators generally and instructional designers specifically often use a model of instructional design as a kind of game plan for their development efforts. This plan assures the educator that every piece of instruction that is used will, regardless of content, have recognizable elements. This sameness aids educators in a variety of ways: Formative evaluations and revisions are more systematic and congruent; the sequence of developmental and evaluation events is planned in a procedural context; media development is more efficient; and evaluation systems can be developed with quality as a key criterion. This sameness also allows standardization of a project's design efforts so that design becomes task specific. This enables increased communication and coordination among the members of a development project. For instance, the phrase "assessing learner needs" should be defined similarly by all project members. Major misunderstandings usually can be resolved by consulting the definitions and explanations provided with a model. The sequencing of events in a model also provides a management framework conducive to use of FERT techniques and other management strategies for ensuring the availability of human and material resources at required times. In this way project events can be scheduled to make efficient use of time, materials, and other resources (cf. Briggs, 1977).

Another useful purpose of a model of instructional design is to allow testing of the theory from which the model was constructed. Adair and Foster (1972, p. 231) suggest this purpose for pedagogical models when the specific theoretical constructs can be identified. However, a model of instructional design may also be the result of a component-testing or theory-building process, in which case the construction of the model is built on weak theory or no theory at all, as suggested by Roberts (1978, p. 7) in his review of program planning models. The difficulty in deciding which theory-related purpose is being used is expressed by Kaplan (1964), who warns that propositions may be tautologically presented so that they become "mistaken for genuine theory, and a program is accepted for its own fulfillment" (p. 273). Most models, however, as noted by Smith and Murray (1975), seem to be "exemplars of desirable or commendable operating procedures" (p. 13) instead of theory-based models, (cf. Barson, 1965) That is, the assumptions and the interrelationship of factors are not revealed by the model. Instead, the model may be a frame of reference for only one setting in which it has been used.

The various purposes and advantages cited here are consistent with Banathy's (1968) preface statement about a major advantage of the systematic (systems) approach, which is that it enables us "to develop and manage complex entities" (p. iii). Throughout his book, Banathy also stresses that the defined outcomes determine the particular system purpose.

The use of a model will not ensure that any or all of the four suggested purposes are accomplished. There is, for example, the effect of human variation in interpreting and implementing available models. Also, Lowe and Schwen (1975) found that the documentation of instructional design models often omits detailed accounts of how the development process works in various settings. (An exception to this generalization is the detailed explication provided by Teague and Faulkner, 1978.) Nonetheless, the documentation serving as the basis for this report has provided a means by which the origins, purposes, and uses of instructional design models can be described and analyzed. The next section presents two categorization schemas for fulfilling this purpose.

Categorization and Analysis

The categorization of components of models is a difficult task. Some references explicate theoretical considerations directly; others require inferences of theory. This study is not intended as a definitive statement about the status of any model. Instead, it is an analytical
review of models as they are represented
in available literature.

Models Reviewed
As the result of an extensive examination
of books, journal articles, bibliographies,
ERIC documents, and procedural manuals, over 60 possible target
models were identified. To provide
comprehensive (although nonrandom)
sampling, the authors deliberately
selected models applied in nonformal as
well as formal settings and models ap-
piled for modular or course develop-
ment as well as for large-scale curricu-
um or program development. To ap-
propriately represent nonformal settings
and large-scale development in this
review, it was necessary to include pro-
gram development as well as instruc-
tional development models, some of
which represent the application of a
prior model to a particular setting and
purpose rather than a new model. Some
of the models often cited in the literature
are not reported here due to unavail-
ability of the necessary references. A
few models are reported because they
are familiar to the authors through local
use. However, the authors intend to
provide representativeness in this study
for the purpose of analytical organiza-
tion, review, and synthesis, and in no
way intend to suggest any inadequacy
in those models not contained in this
review. In fact, the models cited in this
review represent an unevenness in
amount and quality of information re-
ported in the references.

Description of the First Schema
All of the models reviewed are com-
pared to Gropper's (1977) list of 10
common tasks (Table 1). This list is used as a
refferent in this paper because, although
Gropper does not state which models
provide the basis for his list, he does in-
dicate that the list represents a synthesis
of the best models. Also, it is a more
recent source than others presenting
"generally agreed upon" steps. For ex-
ample, Merrill and Boutwell (1973) offer
5 basic components; Atkins (1975) offers
12; Gagné and Briggs (1994, p.
215) offer another 12.

During the review of the models, the
authors found four additional com-
ponents addressed separately by a number
of models. These additional compo-
nents are also shown in Table 2, which
is coded according to the list in Table 1,
with Tasks 1 to 10 representing Gropper's
(1977) list and Tasks 11 to 14 rep-
### TABLE 2. Tasks included in instructional design models.

<table>
<thead>
<tr>
<th>Reference for Model</th>
<th>Outcomes</th>
<th>Tests</th>
<th>Analysis</th>
<th>Sequencing</th>
<th>Learner attributes</th>
<th>Strategy</th>
<th>Media</th>
<th>Development</th>
<th>Tryout/revision</th>
<th>Install/maintain</th>
<th>Need</th>
<th>Alternatives</th>
<th>Constraints</th>
<th>Cost</th>
<th>Total</th>
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</table>

In recognizing the nature of needs assessment, it is important to realize that the analysis of the learner population (Task 5) is the type of needs assessment that identifies gaps between "current and prerequisite goals" (Gropper, 1977, p. 8) for the learner (cf. Maher, 1978, p. 26) based on the analysis conducted in Task 3—a task sometimes omitted in the design process. The needs assessment represented by Task 11 is more global, focusing on such issues as problem identification or occupational analysis, which provide the basis for the goal statements in Task 1.

Some authors, instead of completing a needs assessment, proceed from the assumption that a broadly defined or stated learner need has been identified and therefore consider no other alternatives apart from the creation of an instructional solution. Others proceed as if the nature of the problem may require an alternative other than the acquisition of learning capabilities or the development of an instructional product. Some recognize that even when the problem pivots on learning capabilities of some sort, the solution may be another alternative such as management of a system or management of resources instead of creation of a new product or program.

Briggs and Wager (1979) present a systems schematic of a model for the design of instruction (p. 10) which starts with stating the objectives and performance...
<table>
<thead>
<tr>
<th>Reference for Model</th>
<th>Outcomes</th>
<th>Tests</th>
<th>Analysis</th>
<th>Sequencing</th>
<th>Learner attributes</th>
<th>Strategy</th>
<th>Media</th>
<th>Development</th>
<th>Tryout/revision</th>
<th>Install/maintain</th>
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<th>Alternatives</th>
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<td>21. Ledford (1973)</td>
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<td>23. Mager &amp; Ripe (1978)</td>
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<td>24. Maher (1978)</td>
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<td>25. Merrill (1973); Merrill &amp; Boutwell (1973)</td>
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<td>26. Michigan State University; Barson (1965)</td>
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<td>27. Pennington &amp; Green (1976)</td>
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<td>28. Ponta (1973)</td>
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<td>29. Roberts (1978)</td>
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<td>31. Sherman (1975)</td>
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<td>32. Shoemaker &amp; Parks (1976)</td>
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<td>33. Teague &amp; Faulkner (1978)</td>
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<td>34. Tennyson &amp; Bourwell (1971)</td>
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<td>35. Tosti &amp; Ball (1989)</td>
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<td>37. Vance (1976)</td>
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<td>38. Waldron (1973)</td>
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<td>39. Watten (1973)</td>
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<td>40. Waters, et al. (1978)</td>
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<table>
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<tr>
<th>Frequency</th>
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<th>28</th>
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<th>34</th>
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<tr>
<td>Percentage</td>
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<td>70</td>
<td>73</td>
<td>58</td>
<td>68</td>
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<td>70</td>
<td>68</td>
<td>35</td>
<td>63</td>
<td>35</td>
</tr>
</tbody>
</table>

**Note:** The models are listed alphabetically, because a chronological sequence reveals no definite evolutionary patterns for those models contained in this review. When examining the models chronologically, it appears only that tasks 3 to 4 and 10 to 14 are reported somewhat more frequently after 1972, but not consistently. A bullet (*) is used to denote the presence of a task in the particular model reviewed, as indicated by the reference for the model.

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standards. But their explication of the model starts with determining needs, goals, and priorities (pp. 19-40) and resources, constraints, and delivery systems (pp. 42-59).

Although Table 2 shows that the tasks outlined by Cropper are included in the models in this review, the differences made in analyzing models according to the first matrix were sometimes generous in light of the amount of information or the outline of model components presented in the reference. The reader should refer to the results of the second categorization schema for information about the origin, theoretical basis, purposes and uses, and documentation associated with these models.

**Description of the Second Schema**

Table 3 defines the coding dimensions. Table 4 is coded according to the numbers and letters assigned to the set of dimensions in Table 3. For example,
TABLE 3. Dimensions used in model schemata.

<table>
<thead>
<tr>
<th>Code</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Origin</td>
</tr>
<tr>
<td>1.1</td>
<td>Theoretical</td>
</tr>
<tr>
<td>1.1a</td>
<td>Total model (includes general systems theory or other total approach)</td>
</tr>
<tr>
<td>1.1b</td>
<td>One or some of the components (includes adult learning theory and other learning theories)</td>
</tr>
<tr>
<td>1.2</td>
<td>Empirical (includes reports of experience or research of viable processes)</td>
</tr>
<tr>
<td>2.0</td>
<td>Theoretical underpinnings</td>
</tr>
<tr>
<td>2.1</td>
<td>Emphasis on learning or instructional theory (includes constructs about adult learning requirements)</td>
</tr>
<tr>
<td>2.2</td>
<td>Emphasis on control/management/monitoring functions of systems theory</td>
</tr>
<tr>
<td>2.3</td>
<td>Emphasis on analysis function (includes content, task, and learning analysis of systems theory)</td>
</tr>
<tr>
<td>3.0</td>
<td>Purposes and uses</td>
</tr>
<tr>
<td>3.1</td>
<td>Teach instructional design</td>
</tr>
<tr>
<td>3.2</td>
<td>Produce viable instructional product(s) or activity(ies)</td>
</tr>
<tr>
<td>3.2a</td>
<td>Nonformal (includes military, industrial, governmental, vocational, nonformal adult education)</td>
</tr>
<tr>
<td>3.2b</td>
<td>Formal (includes public, higher, and professional education)</td>
</tr>
<tr>
<td>3.2c</td>
<td>Small-scale lesson/course/module development</td>
</tr>
<tr>
<td>3.2d</td>
<td>Large-scale curriculum/system/program development</td>
</tr>
<tr>
<td>3.3</td>
<td>Reduce costs of training/education</td>
</tr>
<tr>
<td>4.0</td>
<td>Documentation</td>
</tr>
<tr>
<td>4.1</td>
<td>Documentation, application, or validation data relating to use of the total model</td>
</tr>
<tr>
<td>4.2</td>
<td>Documentation, application, or validation data relating to part of the model (the more outline and description of a model being insufficient to qualify as documentation)</td>
</tr>
</tbody>
</table>

1.1a means that there appears to be a theoretical basis for the total model, while 1.1b means that there appears to be a theoretical basis for only part of the model. Each of these dimensions is explained later in more detail. Figure 2 summarizes the results of Table 4.

Origin. Knowledge of the origin of a model can help the educator use a particular model in the most appropriate manner. There are two main discernible sources of origin: theoretical and empirical. Of course, logical inference and combinations of theory and experience also are used to create or modify models of instructional design.

Theoretical models have as their origin a particular theory-based rationale, such as Bandura's (1968) approach based on general systems theory or Gagné's (1977) approach to the conditions of learning. As this paper is based on a sampling of systematic approaches to instructional design, it is not surprising that most models reflect this source.

In order to qualify as having an origin in general systems theory, the description of a model should contain specific reference to general systems theory or describe the systematic approach with emphasis on interaction of the components of the model as they relate to accomplishment of the intended outcomes in the intended environment. For example, Bishop (1976), Kaufman (1972), and Roberts (1978) reference in detail the ways of identifying and describing the total system objectives, the performance measures for the whole system, the effect of constraints and resources of the target system, and the management of the system, as well as specific interactive processes for accomplishing the defined outcomes through checking and rechecking in the feedback and revision processes.

Merrill and Boutwell (1972), however, refer to some of the same components as found in Bishop and Roberts, but stress learning theory and give no explanation of the system components that they briefly list. Similarly, Evert's (1977) and Vance's (1976) approach to instructional design strongly emphasizes learning theory, as does the approach of Davis and McCallon (1974), who stress adult learning theory in particular. Thus, when learning theory, such as that constructed by Bruner (1966), Gagné (1977), or Houle (1972) provides the main basis for a model, with little or no reference to general systems theory, the model is judged to have a theoretical basis for only some of the components. This is the nature of the systematic approach, which logically makes use of learning theories in the direct design of instruction after outcomes are specified and before evaluation occurs. An exception to this generalization is Glaser's (1966) model, which is wholly grounded in learning theory. Although Glaser mentions feedback and revision along with psychological activities, the origin of the total model is clearly learning theory rather than general systems theory.
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<tr>
<th>Reference for Model</th>
<th>Origins</th>
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<th>Purposes and Uses</th>
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<td>7. Burkmann (1975-1978); Laugen (1979)</td>
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<td>25. Merrill &amp; Boulware (1973)</td>
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<td>36. Tuckman &amp; Edwards (1973); (cf. Davis, 1977)</td>
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It would seem that theories related to organizational development might have a place in the classification of some models. That is, the strategies, targets, tactics, and management activities required to effectively implement an instructional project based on any model selected would also have an impact on the workability of some models in different settings. Such concepts are not included in this particular review, though it would probably benefit the user to consider theories of organizational development when selecting a model to use. (Some models have no discernible theory base.)

Many models have their origin in the developer's or user's particular experiences with instructional design, as in the case of the Individualized Science Instructional System (ISIS) model, described by Burkman (1976-1978) and Laugen (1979), and in the Center for Studies in Vocational Education (CSVE) model described by Crittendon and Massey (1978). The descriptive model of a certain set of procedures in these cases produced good results and is an example of a description that may become a prescription for other users.

Developers may also borrow heavily from a previously existing model and add their own special modifications. For example, J. Davis (1977) presents a model adapted from Tuckman and Edwards (1973) (cited in Davis, p. 36; cf. Tuckman, 1969). Sherman (1978) bases his model on Hayman (1974), but lays out the type of learning capabilities and conditions required to master each of the systems process components in order to teach the systems approach. Brien and Tawle (1977) did not present their own model, but instead referred their readers to Boutwell and Tennyson, Tuckman and Edwards, and Briggs. In this instance a more recent model described by Gagné and Briggs (1974) and Briggs (1975) is listed in place of the 1970 reference to Briggs given by Brien and Tawle. (Also see Briggs & Wager, 1979.) Of course, some models appear to be based on other models, but without specific reference to the particular source of origin.

Finally, a few models have either stated or implied origins that are both theoretical and empirical. This would seem to be the ideal set of origins, but few models fall into both categories.

Of the models reviewed, about 65% reported some source of theoretical origin, about 50% for the total model (such as general systems theory) and about 20% for only some of the components of the model. About 50% reported an empirical origin. (The reader is cautioned to remember that the categories are not mutually exclusive. Subsequently, the sums across dimensions of a category may equal more than 100%.)

Theoretical underpinnings. This portion of the categorization schema displays three main divisions to show which models emphasize learning or in-
structural theory and which emphasize subdivisions (functions) of general systems theory.

Those models based on learning theory usually indicate this status early in the model's description and/or in the discussion about the model's purposes and uses. In a few instances, the authors of this paper made inferences about the probable theoretical basis for a given model. Sometimes this was done by analyzing the reference section of the source to identify the probable foundation of the model.

The two subdivisions of the general systems approach are: (a) the control/management/monitoring function, and (b) the analysis function. The first function allows the educator to make sure that all portions of the instructional system behave in the prescribed manner. This is sometimes very difficult to accomplish with a large curriculum project. Special steps are often added to the model to assure the developer that every component will flow smoothly.

The second function allows the systems user to have confidence that the analysis of a task will proceed in a logical, orderly manner. Most of the models use this analysis function in order to simplify the complex concepts involved in a learning process.

Finally, some models seem to have no discernible theoretical basis as reported in the reference citation. These models usually appear to be based on one or more previous models and are concerned more with the addition of a new component or application than with building on the theoretical basis of the original model.

About 50% of the models emphasized an underpinning in learning theory, 50% in the control/management/monitoring function of general systems theory (either explicitly or implicitly), and about 50% in the analysis function. Together about 70% emphasized either the control or analysis function of the general systems model. This means that about 30% of the references reported in Table 2 focused no discernible attention on two of the basic functional advantages of general systems theory. Of those who focused on learning theory, about 70% (11 of 15) also cited the general systems theory advantages. (About 30% did not do so.) Of those who focused on the general systems theory advantages, only about 40% (11 of 27) also cited a learning theory basis.

**Purposes and Uses.** The purposes and uses of a model center around one of three main categories: (a) teaching of the instructional design process, (b) production of viable instructional products, and (c) reduction in cost of education. Although almost every model could be
used to teach the instructional design process, models placed in this category were limited to those expressly stating this as their purpose. The production of an effective product tends to take second place for models having this classification.

Many models are constructed to yield instructional products for the purpose of improving the training or education function of an organization. Two main settings are conceived within this category: (a) formal, and (b) nonformal education. A distinction between these settings is offered by Ingle (cited in Roberts, 1978, p. 4), who defines nonformal education as "any organized activity, outside of the established framework of the formal school and university system, which aims to communicate specific ideas, knowledge, skills, attitudes and practices in response to a predetermined need." Thus, the nonformal setting includes military, industrial, governmental, vocational, and other nonformal adult education activities. The formal setting is primarily limited to public, higher, and professional education activities. Except for activities unique to a specific setting, such as occupational analysis, many of the models could be used in either setting, although the reference may have named one type of organization as the focus of the model.

The models reviewed have two main uses: (a) the development of instruction on a small scale (lessons and modules), and (b) the development of instruction on a large scale (courses, curriculums, and programs). Generally, the source for the models cited herein indicates the intended use, although some inferences are made about uses based upon the particular products associated with the model, such as a module versus a program plan.

Few of the reviewed models mention any costs associated with the model. Those that do, however, make the point that economy of scale would enable educators using a particular model to reduce the per unit expenditure in their special setting. However, while Glasgow (1976) observes that the cost effectiveness of systematic development has no empirical basis, Carey and Briggs (1977) discuss cost-benefit approaches to the use of a system approach to instruction. Goodson and Roberts (1979) also present a two-by-two matrix of instructional quality versus product impact (p. 25) as an evaluation schema that can be used for cost-benefit analysis of instructional products within the staff training program of a human services agency.

Of the models reviewed in this study, about 40% reported the teaching of instructional design (or equivalent) as the primary purpose, 90% emphasized the production of an instructional product, and less than 10% reported cost reduction as a basic purpose. The setting category (nonformal and formal) was evenly split as was the scale of production (large and small).

Documentation. Unless an educator knows whether or not a particular model has been tried out in an actual instructional setting, it will be difficult to make a decision about that model's chance of success in the planned setting. Few of the models reviewed supply any data concerning their effectiveness. Some assert that the particular model works well, although no supporting data or descriptions of applications are provided. Since most of the models' sources are journal articles, it may be argued that too little space is available for the reporting of this type of data or information. However, the longer sources that were reviewed (books and ERIC documents) would seem to have little excuse for not revealing this data. (A pertinent question might be raised about the usefulness of publishing a model without having its efficacy established beforehand by means of a firm theory base and/or empirical base.)

An analysis of Table 4 shows that even at the grossest categorization level, there was not one model which addressed all of the categories. In addition, the "purposes and uses" category was addressed by all of the models. As the categorization became more specific, the percentages of models matched to categories continued to decrease.

Of the models reviewed in this study, about 50% reported documentation of some sort on the application of the total model, and about 35% offered some limited documentation. Finally, of those reporting some theoretical origin, about 70% (19 of 27) cited some form of documentation; but of those citing documentation, only 55% (19 of 34) cited any theoretical origin.

Analysis of Models. The analysis of the 40 models selected for this study using the two schemata described above is presented in Tables 2 and 4. Table 2 shows the tasks included in Instructional design models according to the first schema. Table 4 shows the categorization of ID models by origin, theoretical underpinnings, purposes and uses, and documentation (second schema).

Possible Reasons for Model Proliferation

There are a number of possible reasons for the large variety of models of instructional design. One of the most obvious reasons seems to be that many educational endeavors are afflicted with the "not-invented-here" syndrome. Much effort seems to be duplicated because educators do not seek out existing models of instructional design or available materials before they endeavor to develop their own. The symptoms of this malady usually take the form of an attitude that says, in effect, "We have our own special circumstances and problems here and any innovation (design model) which comes from outside our organization boundaries will very likely fall in our unique situation." This attitude is certainly not restricted to the educational field; industry, military, government, and many other types of organizations seem to fall prey to it just as easily. Molnar (1971) points out the tremendous inefficiency resulting from such an attitude.

The large amount of uncoordinated research activities and the lack of preplanned linkages between research and practice has led to the existence of an expensive cottage industry in educational technology which tends to
retool every academic year. Researchers and educators frequently demonstrate a strong resistance to the use of someone else's innovation. It has been said that if there was a Nobel prize for educational research, we would nominate an entire generation of researchers for their co-discovery of the wheel. (p. 7)

Another reason for the great number of models seems to be related to the degree of documentation that the models have. As stated by Logan (1976):

"Instructional systems development assumes more or less the previous reputations of other innovations. This delays acceptance of ISD, for as with other innovations, promised performance could not be met and, if met, could not be maintained. Developers of innovations often leave the customers with inadequate supporting documentation if they left any at all. (p. 17)"

Since many models are never tried out, educators may be skeptical about the model being reviewed and thus decide to develop their own.

Merely examining a model tells one very little about its efficacy. Unless performance data are available from tryout situations, the educator interested in choosing a model will have few objective criteria on which to base a decision. Because few available models actually exhibit tryout data, it is little wonder that designers are reticent about adopting or adapting even a well-known model. The risk of sinking a project's resources into a model which is, in effect, an unknown quantity must be disconcerting to a project director.

Yet another reason is linked to Alexander's (1964) observation about the nature of design: "What does make design a problem in real world cases is that we are trying to make a diagram for forces whose field we do not understand" (p. 21). This effort appears to be a problem within the context of learning within a particular educational environment as well as within the context of learning in general.

The major learning theorists, including Ausubel (1968), Bruner (1966), Gagné (1977), Piaget (1954), Skinner (1954), and others, present different propositions regarding the conditions for learning. These differences may have the greatest impact on the development of materials, but they may also cause individual educators to reject certain steps in available system approach models. For example, a strong advocate of discovery learning might reject the specification of objectives and corresponding direct match of instructional events to these objectives.

More often, however, the major steps of models are adapted to particular differences in the learning environment.

Conclusions

The review of models reported here provides an approximation of the state of the art regarding models of instructional design. Categorizing the models as shown in Tables 2 and 4 may do injustice to some models and give undue credit to others. Even with these possible inequities, however, several substantial generalizations can be made with some confidence.

1. The components of the general systems approach applied to instruction have proliferated in varied forms with varied origins, purposes, uses, and documentation.

2. Learning theory bases are not explicitly prescribed in many of the models using a systematic approach to instructional design.

3. Documentation of the systematic application of the models for specific purposes and uses is generally inadequate for assessing the effectiveness of particular models.

4. Although the "systems" approach is "an inquiry and a discipline, complete with theoretical underpinnings and a developed methodology" (Hayman, 1974, p. 495), many of the systematic instructional design models, as described in the literature, represent a series of mechanical or linear steps rather than the complex and rigorous analytical and cybernetic process required for effective application of the general systems approach to instructional design.

5. The general tasks constituting a model of instructional design, though differing in sequence, are generic in that they may be applied across differing purposes, emphases, origins, uses, and settings. This attests to the robust qual-
ility of the systemic or systematic approach to instructional design.

6. Little concern or documentation is reported to demonstrate the cost-utility of using different models of instructional design.

7. Models such as those reported by Bishop (1976), Briggs (1975), Briggs and Wager (1979), Gagné and Briggs (1974), Robert (1978), Scantland (1974), and Teague and Faulkner (1978) appear to provide enough explicat to enable users to apply the reported models as intended. The reader is advised, however, to consider a model that matches the dimensions of the user's context and to make judgments about the adequacy of documentation and theory base before selecting a model to use. To begin patterning instruction after the first model encountered might very well be a mistake for two reasons: (a) the model may have been developed for a completely different setting for a completely different purpose, and (b) the model may not have been validated. A model may work well when finally used, but not many educators or project directors can afford the luxury of trying the model out with their own resources.

8. A few of the models reported are not models at all in that they fail to describe, explain, or predict elements in their referent system. Instead, they represent the use of jargon in a nearly tautological manner and possibly mechanical prescriptions inappropriate to the intended users. These models will be unnamed but the buyer should beware.

9. Instead of model proliferation, it would be more useful to engage in model evolution. That is, by examining the two schemata presented in this paper, it should be possible not only to select the most appropriate model for given purposes and uses but also to identify at least the general type of theory basic for a given model. The results of the categorization and analysis schemata presented here indicate gaps in documentation or validation of models as well as in the theoretical bases of some models. Based on these results, the educator should consider describing particular theoretical bases and providing thorough documentation of the implementation of a given model. In this way, there could be more theory development and testing by means of model implementation.

In view of these generalizations and the comparisons provided in this analytic review of models of instructional de-

sign, it would be ill advised to recommend that one, and only one, grand pattern be used for all design efforts. However, a strong argument can be made that the large number of extant models is not only confusing, but also often wasteful of the resources over which educators and project directors have command.

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Designing Effective Computer-Based Education to Teach Reading to Nonliterate Adults

Robert M. Caldwell, Associate Professor
Division of Educational Studies
Southern Methodist University
Dallas, TX 75275

Abstract. The basic skills learning system is a modularized network of computer-assisted tutorials, drills, tests, printed materials, and videotaped presentations directed at improving the basic reading, math, and language skills of adults who have mastered these skills at a level above third grade but below the eighth. Performance data from demonstration projects in Maryland, Texas, and Minnesota indicate that adult and adolescent learners made significant grade-level gains in reading and math and that dropout rates were reduced from 40% to less than 5% in some adult basic learning centers. These dramatic gains seem directly attributable to computer technology which utilizes effective instructional strategies. The purpose of this paper is to present the instructional rationale used in the design of this learning system and to define some of the teaching strategies which seem to directly impact reading achievement gains.

Teaching Strategies and Computer Courseware

Programs of adult basic education have the educational goal of expanding employment opportunities for participants. Learning experiences are planned so that learners will (Wilson, 1978):

1. Develop a degree of self-confidence that will enable them to respond positively to employment opportunities and to adapt to the demands of jobs or training.

2. Develop a command of necessary life skills, with particular emphasis on literacy and numeration.

3. Discover the type of work they like; identify and begin to develop those skills associated with this work.

4. Improve their ability to learn and adapt to changing situations.

The Basic Skills Learning System (BSLS) described by Caldwell and Rizza (Note 1), like many other programs, has these goals within its planned curriculum but is unique because it seeks to develop these goals through a modular network of computer-assisted lessons, drills, tests, printed materials, and videotaped presentations. As a total package, these strategies are directed at helping adults whose skills are above the third-grade level but below the eighth-grade level improve their competency in reading, math, and language arts. Because of its modular nature, the instructional system is capable of responding to wide differences in age levels, achievement, and interest by using individualized instructional techniques that locate and apply these instructional methods that will enhance learning motivation, reinforce student achievement, and develop an improved model of management for student learning.

Evaluation studies conducted at three sites between January and June of 1978 have yielded encouraging results about how well the BSLS achieves the goals of adult basic education cited at the beginning of this article. Rizza and Walker-Hunter (1976) report dramatic gains in reading and math achievement as well as improved learner motivation, attitude, and self-concept development.

These results are encouraging because they demonstrate that effective curriculum models using well-designed instructional paradigms can offer high-quality instruction in the basic skills through computer-based delivery systems. Other studies also have demonstrated the effectiveness of computers for teaching the basic skills, but unfortunately few of them have discussed the nature of
the instructional models used in the curriculums. Instead, these reports imply that the results obtained are largely due to the uniqueness of the computer system through which instruction is delivered rather than the effective use of the teaching strategies within the computer courseware. The purpose of this paper, therefore, is to explain the instructional rationale that is used in the design of the BSLS and to define some of the teaching strategies that seem to be responsible for the dramatic gains achieved at test sites across the country.

Field tests of the BSLS at sites in Minnesota and Maryland, for example, have demonstrated significant gains in reading achievement among adult learners. These learners upon entering the system are diagnosed using criterion-referenced inventory tests that establish an achievement profile for each student. Progress is then monitored through lessons arranged hierarchically in five strands. Each strand (structural analysis, vocabulary development, literal comprehension, interpretive comprehension, and evaluative comprehension) contains lessons ordered in difficulty levels ranging from the third through the eighth grade. Instruction is based upon the progressive mastery of reading skills that emphasize the successful accomplishment of the instructional objectives particular to each lesson before the learner proceeds to more difficult content. Tables 1 and 2 summarize the results of using such a system with a variety of adult learners. (Caldwell & Rizza, Note 2). Table 1 presents data collected between February and June 1978 from the Adult Learning Center in Baltimore, Maryland.

Two projects in Minnesota (see Table 2) compared the computer-based BSLS with traditional educational programs used at each site. Each site used approximately 20 students. Data were collected between February and June of 1978.

In summary, adult learners using the BSLS to improve reading skills averaged a 1.12 grade-level gain in reading achievement after an average instructional time of 13.0 hours. Further analysis of the data reveals that an average learning time required to generate a 1.0 grade-level gain would require 18.34 hours of computer-based reading instruction. A more detailed analysis of these data is offered by Rizza and Walker-Hunter (1978).

These preliminary results are encouraging. The motivational acceptance of the learning system is a result of extensive use of an interactive computer-based configuration integrated with a multimedia support package. This multisensory approach is often successful with students who have difficulty achieving in text-oriented, passive-learning environments and carries with it a compelling novelty effect that most learners find extremely motivating. This effect has been sustained quite often across long periods of instruction.

The presentation of reading instruction through the computer-based learning system offers illiterate adults a number of advantages that compensate for many earlier learning problems. The curriculum is individualized so that it adjusts learner progress in reading skills by teaching to points of weakness and it provides for more opportunities for interaction and feedback than would be expected in a traditional classroom. Teaching for mastery ensures large measures of success and builds student confidence and feelings of self-worth as they progress through individual clusters. A multisensory learning environment provides a rich experience in which to learn new concepts and ideas. Finally, the modular organization allows for flexible adaptation to a wide variety of learning needs and situations (Caldwell & Rizza, Note 3).

The instructional rationale for establishing and developing teaching strategies for the reading component of the BSLS is derived from a recognition of certain conditions that seem to enhance verbal learning (Dececco, 1968). These conditions include meaningfulness, reinforcement, instructions to learn, and practice.

### Meaningfulness

Noble (1952) defines meaningfulness as the number of different associations elicited by a verbal unit. A learner's ability to make associations will strongly influence his or her rapidity of learning. The more frequently a word or phrase appears in a child's environment the more familiar it becomes and consequently the greater the probability that meaning for the new word will be associated with other familiar words.

The sophisticated capabilities of the modern computer system allow language instruction to take into account each student's response. Materials are designed to adapt the amount and extent of instruction to the individual needs of each student. Common techniques such as self-paced and individualized branching usually employed in programs of individualized instruction are augmented by the ability of the learning system to handle student controlled selection of instructional techniques while providing for a tailoring of teaching to individual performance. In this way, learners are helped to select the most appropriate pathway through the material and are given both regular and distributed practice in language skills. Instruction presented through such a

### TABLE 1. Results from Baltimore study

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<thead>
<tr>
<th>Number of students</th>
<th>Average time on PLATO per student</th>
<th>Average grade level gain</th>
<th>Expected school time for similar growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>15 hours</td>
<td>0.8 grades</td>
<td>120 hours</td>
</tr>
</tbody>
</table>

### TABLE 2. Results from Minnesota study

<table>
<thead>
<tr>
<th>Site</th>
<th>BSLS</th>
<th>Traditional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stillwater Prison</td>
<td>1.62(^a)grade level gain/ 15 hours of instruction</td>
<td>0.0 grade level gain/ 15 hours of instruction</td>
</tr>
<tr>
<td>Stillwater, Minnesota</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair Break (Adult Education Center)</td>
<td>1.00(^a)grade level gain/ 11 hours of instruction</td>
<td>0.0 grade level gain/ 11 hours of instruction</td>
</tr>
<tr>
<td>Saint Paul, Minnesota</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)Statistically significant gain
learning system provides the learner with a rich and varied language experience and provides immediate and frequent feedback to responses.

In the BLS this important condition of verbal learning has been incorporated in several different ways:

1. Great care has been taken to match reading content to student achievement levels. Syntactic structures and vocabulary levels in reading selections are appropriately designed for the learner's grade placement. For example, reading content presented on the display panel never exceeds 25 words at the fourth-, 50 words at the sixth- or 75 words at the eighth-grade level. Similarly, vocabulary increases in difficulty and syntax becomes more complex. As students progress through the curriculum, therefore, they are continually challenged with more complex material that has been carefully correlated with concepts that were mastered earlier in the curriculum sequence.

2. Subskills are sequenced in a hierarchical arrangement so that they are reinforced across strands in the following manner: (a) Comprehension is made a part of each lesson, and (b) Vocabulary development is introduced at every opportunity, although no more than five new words are introduced in a single lesson.

3. Reading material is presented in very small segments to ensure concept mastery.

4. Students are allowed control over the learning sequence whenever possible. They are free to choose from many options within lessons. These include opportunities for reviews, remedial sequences, diagnosis, and choice of reading content.

5. Feedback is made more meaningful by making it personalized and specific to student response sequences (e.g., "You did well, Allen, but would you like to review prefixes before going to the next lesson?")

6. Graphic and animation capabilities are used extensively to help create cognitive structures necessary for comprehension of key ideas and concepts.

Reinforcement

This is possibly the most important condition of verbal learning. Reinforcement is a confirmation of the learner's correct use of language within various contexts. Language assumes meaning within the context in which it is used.

This context has been called the "semantic environment" (Postman, 1976). If communication is to occur, it requires not just a recognition of language but an ordered situation in which language assumes meaning. The semantic environment defines the meaning of words and, therefore, the nature of the communication. Reinforcement is critical in helping learners confirm whether or not their attempts at using language communication within the semantic environment are effective and it helps the learner derive meaning from other new contexts.

In the BLS reinforcement patterns have been constructed to shape reading behaviors in a manner that will reduce student frustration levels and increase the probability of student success. A typical reinforcement pattern is shown in Figure 1. This type of reinforcement pattern contributes to meaningfulness because it:

1. Provides specific information that helps to correct student behavior and achieve the desired outcome.

2. Reduces the frustration often experienced by learners in computer-assisted instruction (CAI) programs that simply provide a "no" response to an incorrect answer. This type of reinforce-

ment is unsatisfactory because it provides no specific feedback to enable the learner to discover correct responses. Instead, learners are forced to guess until the correct answer is found.

Instructions to Learn

Associations that contribute to the meaningfulness of verbal stimuli can be achieved more quickly if the learner develops a state of readiness induced by directions or verbal organizers within the environment. This verbal "set" helps focus the learner's attention on specific stimuli within an environment bombarded with verbal stimuli. The BLS provides instructions that aid student learning in various ways:

1. In many CAI lessons students often make mistakes on practice exercises because they do not understand directions. Exercises that require typed responses seem particularly prone to this problem (Caldwell, Note 4). This system has taken great care to provide sample exercises before each practice to reduce this type of mistake. In this way, responses can be judged on the basis of concept mastery rather than on a lack of understanding of the response mechanism.

Exercise: Change the following word by adding "ing."
(Student must type the correct response.)

Come __________________________

(A correct response on the first try warrants positive reinforcement such as "great," "super," "well done," or "excellent." These and other reinforcing statements are generated randomly from a list of 20 or 30 possible statements. Incorrect responses follow a pattern of shaping and cuing that leads the student to the correct answer.)

After the first incorrect response, the student sees:

Come __________________________ (drop the "e")

(The student is cued by being reminded of the rule under examination.)

After the second incorrect response, the student sees:

Come __________________________ (come + ing)

(In this second prompt, the computer system animates the "e" in "come" and drops it from the equation.)

After the third incorrect response, the student sees:

Come, Coming

(if on the third try the student still has not typed the correct response, the correct answer is given and the student moves on to the next problem.)

FIGURE 1. Typical BLS reinforcement pattern.

Continued on page 23.
An Objective Approach to Scoring Essays

Robert A. Reiser
Assistant Professor and Research Associate
Center for Educational Technology
Florida State University
Tallahassee, FL 32306

Introduction
Do you like essay questions? When I was a student, I always hated them. I preferred true-false questions. I even liked matching questions with 10 items in Column A and 12 items in Column B more than I liked essay questions.

Now I am an instructional designer. Now I design tests instead of taking them. And now I like essay questions.

The reason my attitude toward essay questions has changed has nothing to do with my change in roles. During the first few years that I designed instruction, I still hated essay questions. My change in attitude has come about because I have persuaded some instructors to adopt a different method for scoring essays. This ID training module is designed to enable you to employ that scoring method.

After completing this module, you should be able to:
1. Design a checklist that can be used to score objectively a set of answers to a given essay question.
2. Identify a sequence in which essays can be read so as to increase the likelihood that the essays will be scored objectively.
3. Identify problems that may arise when an objective method for scoring essays is employed. Several practice exercises are included in this module to help you acquire these skills.

An Analytical Approach
Many instructors employ a method for scoring essays that is known as the global approach. This approach entails reading an answer to an essay question, forming a general opinion about it, and scoring it based on that general opinion. There are no explicit criteria for judging the worth of the answer.

The problem with the global approach is that it is highly subjective. Instructors using the global approach must rely primarily on their subjective judgment to determine the quality of a student's work.

Whereas the global approach involves much subjectivity, another approach, called the analytical approach, is fairly objective. The analytical approach has been used by many instructors and is discussed in many measurement textbooks. There are a number of variations to the approach, but it consists basically of the following four steps:
- Specify the features the answer to the essay question should contain.
- Specify criteria for judging the adequacy of each feature.
- Assign point values to each of the criteria.
- Read each student's answer, using the criteria to help determine the student's score.

Using the Analytical Approach to Grade an Essay
Let's examine the steps in this approach, using the following essay question taken from a social studies unit on the government of the United States:

Describe how the checks-and-balances system operates. Also indicate whether you think the checks-and-balances system was effective in 1979, describing how two major events during 1979 support your point of view.

Here is how the analytical approach might be used to score students' answers to this essay question:
STEP 1: Specify the features the answer to the essay question should contain.

Features:
1. Description of how the checks-and-balances system operates.
2. Statement indicating whether the student thinks the checks-and-balances system was effective in 1979.
3. Description of two major 1979 events that support the student’s point of view.

STEP 2: Specify criteria for judging the adequacy of each feature.

Feature: Description of how the checks-and-balances system operates.
Criteria: Was the description accurate?
Was the description well stated?

Feature: Statement indicating whether the student thinks the checks-and-balances system was effective in 1979.
Criteria: Was the statement clear?

Feature: Description of two 1979 events that support the student’s point of view.
Criteria: Are two events cited?
For each event cited:
Is the event described accurately?
Is the event described clearly?
Does the student clearly indicate how the event supports his or her point of view?

STEP 3: Assign point values to each of the criteria.

To assign point values to each of the criteria, the instructor should consider the relative importance of the various criteria. For example, the instructor might decide that a student’s ability to describe accurately how the checks-and-balances system operates is more important than the student’s ability to indicate how a particular event supports his or her point of view about the system. Thus, the instructor would assign a greater number of points to the criterion that assesses a student’s ability to describe the system.

Table 1 contains a checklist indicating the number of points that might be assigned to each of the criteria identified during step 2. The point values appear in parentheses following each of the criteria. A checklist of this type can be used to score a student’s answer to an essay question.

When assigning point values for an essay question, the instructor should consider the total number of points that can be earned on the question in relation to the points that can be earned on other questions on the same test. The total points that can be earned on a particular question should reflect the relative importance of that question. If it is decided to revise the total number of points a student can earn on an essay question, the point values for each of the criteria should be adjusted, keeping the relative importance of each of the criteria in mind.

Before going on to the fourth step in the analytical approach, see if you can correctly apply the first three steps by responding to practice exercise 1.

<table>
<thead>
<tr>
<th>TABLE 1. Essay scoring checklist</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Feature:</strong> Description of how the checks-and-balances system operates.</td>
</tr>
<tr>
<td>Was the description accurate? (4)</td>
</tr>
<tr>
<td>Was the description well-stated? (2)</td>
</tr>
<tr>
<td><strong>Feature:</strong> Statement indicating whether the checks-and-balances system was effective in 1979.</td>
</tr>
<tr>
<td>Was the statement clear? (1)</td>
</tr>
<tr>
<td><strong>Feature:</strong> Description of two 1979 events.</td>
</tr>
<tr>
<td>Are two events cited? (2)</td>
</tr>
<tr>
<td>Is the first event described accurately? (1)</td>
</tr>
<tr>
<td>Is the first event described clearly? (1)</td>
</tr>
<tr>
<td>Is there a clear indication of how the first event supports the stated viewpoint? (2)</td>
</tr>
<tr>
<td>Is the second event described accurately? (1)</td>
</tr>
<tr>
<td>Is the second event described clearly? (1)</td>
</tr>
<tr>
<td>Is there a clear indication of how the second event supports the stated viewpoint? (2)</td>
</tr>
<tr>
<td><strong>Total Points</strong> (17)</td>
</tr>
</tbody>
</table>

PRACTICE EXERCISE 1

Assume you are teaching a course in a graduate program in instructional development and you have recently developed a test that includes the following essay question:

Describe three frequently stated arguments against the use of behavioral objectives and, in each case, provide an appropriate counter-argument.

You have decided already that another question on this test is worth 20 points and you consider this question to be of approximately equal importance. Employ the first three steps in the analytical approach in order to design a checklist that can be used to objectively score student answers to this essay question. (After you finish, compare your response with the answer at the end of the module.)

Applying the Checklist

STEP 4: Read each student’s answer, using the criteria to help determine each student’s score.

As a student’s answer is being read, the instructor should determine how well the answer meets each of the specified criteria. If the instructor determines that the answer fully meets a particular criterion, the student should be awarded
Several Cautions

If an instructor decides to use the analytical approach to scoring essays, the instructor should be aware of two problems often associated with it. First, it is often difficult to specify the basis upon which an essay should be judged. Trivial criteria might be focused upon because they are often easiest to specify. After criteria are specified, they should be reviewed carefully to ensure that this problem has been avoided.

A second problem associated with the analytical approach is that an instructor, in looking for specific features in an essay, may fail to examine the ways in which those features are related. To overcome this problem, the instructor may wish to include a criterion item such as "Are the ideas in the essay clearly related?" (See practice exercise 3.)

PRACTICE EXERCISE 3

Examine the criteria listed in the answer to practice exercise 1, and answer the following questions:

1. Do you consider any of the criteria to be trivial? If so, which?

2. Do you think it is necessary to add another criterion item that focuses attention on the way in which ideas in the essay are related?

   Yes
   No

Compare your responses with the answers at the end of the module.

PRACTICE EXERCISE 2

Assume you recently have given your class a test consisting of two essay questions and you are now ready to score your students' essays. You have in front of you three test booklets (A, B, and C), one for each student in your class (you have a very small class). Each booklet contains two essays (essay 1 and essay 2). According to the principles described in this article, which of the following lists the most appropriate sequence in which you should read the essays—X, Y, or Z?

   X
   Y
   Z

   essay 1, booklet A
   essay 1, booklet A
   essay 1, booklet A
   essay 2, booklet A
   essay 1, booklet A
   essay 1, booklet B
   essay 1, booklet C
   essay 2, booklet C
   essay 2, booklet C

After you have made your decision, check your response with the answer at the end of the module.

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Additional Readings


ANSWERS TO PRACTICE EXERCISES

Exercise 1

Listed here is one example of how you might have performed the first three steps in the analytical approach in order to develop your checklist.

STEP 1: Specify the features the answer to the essay question should contain.

Features: 1) Description of three frequently stated arguments against the use of behavioral objectives. 2) Description of three appropriate counter-arguments.

STEP 2: Specify criteria for judging the adequacy of each feature.

Feature: Description of three frequently stated arguments against the use of behavioral objectives.

Criteria: Is each argument one that is frequently used? Is each argument clearly described?

Feature: Description of three appropriate counter-arguments.

Criteria: Is each counter-argument an appropriate response to the argument it is used against? Is each counter-argument clearly described?

STEP 3: Assign point values to each of the criteria.

In performing this step, you should have decided upon the relative importance of each of the criteria, noted the approximate number of points you wanted to assign to the essay question, and then divided the points among the criteria, using your decision regarding the relative importance of the criteria as a guide. In following this strategy, I decided that describing arguments against the use of behavioral objectives was not as important as describing appropriate counter-arguments, therefore I decided to assign more points to the criteria related to the counter-arguments. Because each criterion pertained to three arguments (or counter-arguments), I also decided that the point value assigned to each criterion would be a multiple of three. Taking into account these decisions, and the fact that I wanted to assign approximately 20 points to the essay question, I was able to determine the number of points to assign to each criterion. These point values are indicated on this checklist.

Feature: Description of three frequently stated arguments against the use of behavioral objectives.

Is each argument one that is frequently used? (3)

Is each argument clearly described? (3)

Feature: Description of three appropriate counter-arguments.

Is each counter-argument an appropriate response to the argument it is used against? (6)

Is each counter-argument clearly described? (6)

Total Points (18)

Exercise 2

The correct answer is Z. The sequence listed under Z incorporates two of the principles described in this training module: a) score each student's answer to one question before scoring any student's answer to the next question, and b) change the order in which you rate students' answers as you move from one essay question to the next. Choice X violates principle (a) and choice Y violates principle (b).

Exercise 3

Because both of the questions listed ask for an opinion, there are no wrong answers to either question. Nonetheless, in order to provide you with some feedback, I asked three instructional designers to read this module and respond to both questions. A summary of their responses to the two questions is: 1) All three designers indicated that the criteria listed in Practice Exercise 1 are not trivial. 2) One designer felt it would be desirable to include a criterion item that focused attention on the way in which ideas were related. The other two designers, however, felt that an additional criterion item was not necessary.

WRITE A TRAINING MODULE

JID is interested in publishing short self-instructional materials as ID Training Modules. Each module should teach or improve the readers' skills in ID and be written in an instructional format. Authors may address the skill needs of beginning or advanced instructional developers, but must limit the length of each module to fit within 8 pages when published.
2. Each lesson states the performance objectives to be mastered in that lesson in terms each student can comprehend. Students, then, have a clear idea about the learning behaviors expected of them.

3. Throughout each lesson students are presented with checkpoints and summaries of what they have learned and what they will be learning in future segments of the lesson. This helps develop for the learner a structure that we believe helps organize the concepts presented for study.

4. All directions are written in simple language and illustrated with examples as stated above.

Practice

Research on skill learning has documented well the effects of practice: The longer the learner works at learning the more he or she will learn (Underwood, 1964). Research on verbal learning, however, has not resulted in the same degree of certainty about this effect. Essentially, the value of practice, particularly in verbal learning, depends less upon the amount than on the nature of the practice. More research is needed to discover which types of practice (e.g., massed vs. distributed) are appropriate to various types of learners, what are the effects of overlearning, and whether the whole or part method of presentation is most effective at various levels and with various materials. One form of practice in the BSLS that significantly enhances the development of reading skills was the typed response. When students were allowed to type their responses rather than simply choose from alternatives, it seemed to produce these advantages:

1. Students seemed to express more favorable attitudes toward writing.
2. Spelling skills and the ability to generate language improved.
3. Personalized feedback was made possible.

The typed response did have its negative features as well. For example, typing very often became time consuming because students made many errors typing. This had the effect of distracting students from the concept under consideration and focusing their attention on the typing task. A related problem was that many errors in typing were judged by the computer to be incorrect responses and routed students into remedial sequences when they in fact knew the concept being studied. Also, if typed responses are not carefully cued, learners are often forced into an "open loop," i.e. they have little idea about what is expected of them and become frustrated trying to type a correct response that will ultimately advance them to the next frame. This is a common error made by instructional designers and has an extremely negative effect on learners.

The instructional considerations mentioned above are important ingredients in the recipe for success in teaching basic skills. In the BSLS these conventions have been incorporated into a series of tutorial and drill-practice strategies that are set into strand and cluster configurations.

Strand

A set of concepts and skills which have been ordered hierarchically according to common and expected outcomes is called a strand. In reading, these strands are structural analysis, vocabulary development, literal comprehension, interpretive comprehension, and evaluative comprehension.

Cluster

Within strands content is further divided into subskills. Related subskills expressed in behavioral terms are grouped in a meaningful way in clusters. Each cluster contains tutorial, drill and practice, review help sequence, offline activity, and mastery test.

Tutorial. Tutorial is a presentation of new material to the learner on the objectives within a cluster. It is characterized by concept explanation, demonstration, explanation, and/or inquiry, as well as student assessment, branching, and feedback.

Drill and practice. A series of drill examples of similar form on each objective in the cluster is presented in drill skills when they are away from the terminal.

Mastery test. Mastery test presents a series of test items designed to evaluate the student's achievement across competencies addressed by the cluster.

The Future of CAI

Summarizing, then, the BSLS assesses each learner for placement and diagnostic purposes by a series of inventory assessment instruments that accompany each strand in the system. Progress, retention, and achievement are measured by the mastery and retention tests that accompany each cluster throughout the instructional system.

In short, computer-based systems can be designed on a large scale to provide basic skills instruction over a wide range of abilities and grade levels. Further development and use of these systems offer great potential for individualizing instruction in ways not possible before interactive computer systems became available for wide use. Careful attention to the organization of curriculum materials within these systems and using effective teaching strategies can improve the effectiveness of these systems further and maximize the benefits for potential users—at present and in the immediate future.

Reference Notes

1. Caldwell, R. M., & Rizza, P. I. The development and implementation of a computer based system of reading
Designing, Producing, and Evaluating an Instructional Telecourse: A Model for Involving the Adult Learner

Marietta Lynn Baba  
Assistant Professor, College of Lifelong Learning  
Wayne State University  
Detroit, MI 48202

Joy Schermer  
Research Associate, School of Medicine  
Wayne State University  
Detroit, MI 48202

Norma Shifrin  
Associate Professor  
University Studies/Weekend College Program  
Wayne State University  
Detroit, MI 48202

"You took a giant step forward. No doubt about it," said a male voice from the back of the room. "Sure did," said a woman, amid nods from other students. These were the closing minutes of a product evaluation session of the new telecourse Changing Life on Earth. Perhaps the previous months of planning and working to develop a creative and innovative approach to an instructional telecourse had, at last, achieved a successful educational experience for the student. The data had now to be tabulated and analyzed.

Introduction

A large array of instructional materials has been developed in recent years but only a small percentage of these products has been subjected to evaluation (Kornoski, 1974). Experts in the fields of educational technology and instructional design (Cavert, 1974; Gagne & Briggs, 1977) have formulated models that include evaluation as a necessary step in the development of an instructional product. The efforts of the Children’s Television Workshop (CTW) in the creation of Sesame Street (Schramm, 1972) are outstanding and have provided concrete guidelines for the developmental processes used by the State University of Nebraska and the University of Mid-America (Carl, 1976; McBride, 1976). This paper describes a reality-based developmental process whereby a team

References


of content experts, producers, television professionals, evaluators, and adult learners combined their efforts to create an instructional teleseries.

The University Studies/Weekend College (US/WC) Program at Wayne State University (WSU) in Detroit is an experimental program designed to provide lifelong learning to working adults in the metropolitan area. The curriculum design requires instructional telecourses as a core component of each year's study. Each quarter's course offerings include a teleseries that students view on their home television sets during several alternate time periods each week.

The teleseries have been used as a basic part of the curriculum since the inception of the Weekend College Program in 1974. The first teleseries were produced rapidly and inexpensively by faculty members who had little or no training in instructional television. As a result, most of the early teleseries relied on the "talking heads" method of content delivery and had few visuals and graphics.

In the questionnaires submitted to students in 1977 to determine the courses' effectiveness, Woodyard and Anderson found that: (a) content of the programs was delivered at too high a level (29%); (b) there was too much material in each program (41%); (c) teleseries were too difficult to understand (25%); another 26% were undecided on this question; (d) programs were not interesting (they were boring or "so-so") (39%). When asked what changes in the teleseries would make the content material more effective, students favored: (a) more "lively" productions (71%); (b) more discussion of the applicability of the content to their everyday lives (73%); (c) more review of important points (68%).

Indeed, Juskevic (1978) found that the students' comments about "boring" programs did not mean the programs were too simple; rather, it meant they were too complex; many of the programs were so advanced and so poorly organized that students could not follow them.

Although Wardwell (1976) reported that student attitude does not seem to affect learning, Juskevic found that programs that were boring because they were too complex alienated students who frequently tuned out the rest of the program content. Also, there are dis-

Because the students' attitude toward the teleseries had a great deal to do with the learning process, the television format was designed to appeal to students and keep them watching."

The course committee, with the instructional designer, began curriculum planning by determining the overall goals of the new TV series, including major scientific questions that would be presented; the sociocultural contexts that would be explored in presenting data; and other broad pedagogical concerns, such as the demystification of the scientific method.

With goals clarified, each committee member developed a course outline with primary themes clearly stated. Careful study of each outline and much debate on the relative merits of the various ap-

approaches finally resulted in a consensus. The committee chairperson prepared a 50-title outline for the series which covered the content areas. The chairperson's outline was reviewed and revised by the committee.

The next step in content development was the writing of content outlines for each of the 50 programs. Members of the committee wrote outlines in their areas of specialization. Each outline included program objectives and a detailed description of the subject matter to be covered. Once an outline was approved, it was assigned to a committee member, or to another member of the faculty at WSU to expand into a rough draft. When completed, these drafts went through a complex process of review and modification. That process can be outlined as follows:

Step 1. Review by the instructional designer and editor to ensure that programs met the stated objectives, were clearly and sequentially organized, and had an appropriate vocabulary level with visual support of terms and concepts.

Step 2. Review by the content committee for theoretical bias, factual accuracy, and clarity of examples.

Step 3. Modification according to suggestions of the writer (faculty member).

Step 4. Final reading and approval by the course committee.

The flowchart in Figure 1 outlines the initial stages of the instructional design process. The course committee attempted to combine peer review and consensus with a division of labor and expert input in an effort to balance and integrate course content. Each draft thus had the benefit of expert treatment, yet the individual drafts were integrated into a whole that met the overall goals set by the faculty course committee.

These initial stages took several months, because 50 drafts had to be reviewed and modified. Completion of this process meant that drafts were ready to go to the graphic designer but it did not mean that they were complete.

Each draft was submitted to three additional review procedures. These procedures included review and modification by television professionals who added visual and sound components, studio directions and blocking, review and modification by a seminar of students who were studying instructional television, and a final review by a second group of students who evaluated
pilot videotapes and made suggestions for improving final studio scripts.

**Use of Television Professionals**

In the past, faculty members in the program had attempted to plan, design, and produce telecourses on their own. Fortunately, the committee was now in a position to expend its energy on curriculum development and to hire a team of specialists to help design the final product and produce the series.

The professionals who were hired included: a **visual consultant** to locate and secure slides and films to illustrate the content appropriately; several **graphic designers** to create graphics (e.g., charts, diagrams) designed by the faculty; a **director** to put the raw materials together in the studio; an **associate producer** to ensure that all materials arrived on time, to take care of all legal problems, to handle the details of the budget, and to act as general liaison between the technical members of the team and the faculty committee; an **evaluator** to carry out formative evaluation of the series; and a **moderator** to host the series and serve as the TV instructor.

The difficult problem of getting the large, diverse team coordinated and working together was solved by establishing a "triumvirate" of directors: a faculty person in charge of curriculum development, a television director responsible for in-studio activities, and an associate producer responsible for locating and obtaining material resources originating outside the studio. The three directors coordinated the activities of their particular groups of professionals. They met to decide on major issues, but directors had final authority in their areas of expertise. They were in the television studio during all production sessions. As a result of the team approach, each of the groups of professionals had to compromise on some things because of considerations raised by other members of the team. For example, at times faculty members had to make adjustments in the scripts due to time constraints. They handled this problem by deciding that all script additions were to consist of an expansion of the review or summary portion of the program.

The team approach constantly generated new problems of coordination. A flowchart was developed to route each script through the maze of people working on the series. Figure 2 represents a somewhat idealized summary of each script's movements.

**New Approach to Telecourse Format**

Because the students' attitude toward the teleseries had a great deal to do with the learning process, the television format was designed to appeal to students and keep them watching. "**Format**" includes the noncurricular elements affecting delivery of content—elements such as visuals, moderator, and style of delivery. The course committee discussed alternative formats and approaches with the instructional designer and several professional instructional technologists. The decisions made about format became an integral part of the rest of the preproduction planning and of the production itself. The following is a description of the most important format considerations and decisions.

**The Professional Moderator.** Although there is disagreement concerning the relationship between student appeal, use of trained presenters, and student achievement (Juskevicia, 1978; Kanter, 1958; Myers, 1961; Wardwell, 1976), the course committee decided that a professional moderator would improve student appeal. The use of a nonscientist as moderator did require the preparation of verbatim scripts, a laborious process with the advantage of allowing review, modification, and planning of detailed visualization. Although the moderator chosen was effective, her lack of scientific training meant that she had difficulty interpreting some of the
material and thus was often unable to impart the correct emphasis.

Maximum Use of Visuals. A small staff of visual consultants searched the art departments of local libraries and the Encyclopaedia Britannica for visual materials. Faculty members encouraged the staff’s criticisms and suggestions about scripts. When pictures were lacking, a cartoonist drew what was needed.

The editor reviewed all scripts and listed and ordered necessary slides. The faculty director designed and ordered graphics for each script. Visual consultants were able to criticize and change the original decisions because script writers made a number of errors: requesting too many visuals for a short segment of copy; requesting slides over copy better handled as straight lecture; requesting slides when copy could be more effectively explained by a graphic; failing to key copy to visual materials so viewers could clearly see the relationship between visuals and script.

Organization, Redundancy, and Review. The pedagogical literature (Gagne, 1977; Schramm, 1972) shows that a certain amount of carefully planned redundancy in instructional materials enhances the learning process. The following methods were developed to incorporate redundancy and review into the series: immediate repetition of complex concepts or graphics, review of major points at end of programs, and summary programs throughout the series.

Student Contributions

The faculty committee responsible for Changing Life on Earth devised a two-stage process of formative evaluation using student participation which doubled as a learning experience for faculty and students.

Formative evaluation with student participation increased the complexity of the instructional design process because it occurred simultaneously with review and modification of script drafts by television professionals. The flowchart in Figure 2 shows the complete process of instructional design including the formative evaluation components where student contributions were sought. The following sections of the paper describe the two-stage process of student input which included a student seminar and a product evaluation.

Content Development

In the first stage, the course committee designed a multiquarter seminar for 10 senior students. During the course of the seminar, students received a basic education in instructional technology, an education that gave them the tools to review, criticize, and suggest improvements in the new TV programs. Because none of the programs were in studio production during the seminar, it was possible to use student suggestions to modify and improve scripts, visuals, and format.

During the first quarter of the seminar, a weekly workshop was held to review the theory and method of instructional television. Each week the workshop featured a guest lecturer speaking on various instructional television topics. Students learned that instructional telecourses should include clearly stated objectives, correspondence of objectives and content, logical organization, concise and interesting copy, visual materials clearly supporting content, and appropriate content level and amount of material. The class reviewed programs from different types of videotaped telecourses, including early US/WCP telecourses. Everyone participated in a critical analysis of the tapes viewed.

Students applied the knowledge they had gained in a minipracticum at the end of the first quarter, in which they were randomly assigned one scientific concept that was to be used in the first
unit of the new series. They conducted research on the concept and wrote a content outline explaining how they would treat this concept in a TV program. Each content outline included objectives, format, and visual suggestions. After content outlines were reviewed and approved by the seminar instructor, students implemented their ideas by writing a script and developing a storyboard to go with it. Probably the most useful aspect of the first quarter's work was the fact that faculty members involved in the seminar received a thorough, basic education in instructional television. This basic education proved invaluable as faculty members worked to organize concepts, write scripts, and design graphics. The close interaction between students and faculty during the first quarter and the long critique sessions at the end of each workshop also provided the course committee with an opportunity to understand students' interests and perspectives in a way that had not been possible through the use of questionnaires.

The second quarter, or 10-week session of the seminar, consisted of a practicum, the heart of student contribution to the series. In the practicum, students worked in teams of two or three. Each team's objective was the thorough review and improvement of two or three of the programs in the new telecourse. The teamwork approach provided a greater range of student involvement in each of the programs reviewed. Each team was provided with scripts, visual suggestions, and graphics for the assigned programs. The team prepared a thorough critique of the program, basing its evaluation on the criteria outlined during the first quarter. Where necessary, teams rewrote or reorganized scripts, called for clearer definitions or alternate examples, designed new graphics, or submitted pictures other than those suggested by faculty members. The students' critiques and modifications were submitted to the faculty committee and the faculty director carefully went over each team's comments.

Although students found the scripts to be well organized and to contain clear objectives and well-defined terms and concepts, they noted that the new programs were still boring. This time, however, boring had a different meaning than in earlier evaluations. Students had previously called a program boring when they had difficulty following the content and had felt it was not interesting. Now, though students could understand the content, they felt that programs were still not applicable to their everyday needs and interests and did not spark their desire to learn. The programs lacked the ability to capture viewers' imaginations and motivate them to learn new material.

After lengthy discussion, the faculty committee decided that every script should be reviewed and modified to capture student interest early in each program. The most important suggestion made by the students was that each program, regardless of content, should begin with a clear statement of the relationship of the topic to the human condition. Each program was modified to introduce content in an interesting manner through a series of statements or questions that focused the planned content on the students' lives or problems of interest to students. Scripts were also edited to focus content on the human condition at several points throughout the program and at the conclusion of each program.

Product Evaluation

A faculty committee member met with the instructional designer to plan, design, and develop the evaluation of the first draft of the study guide, and of the completed telecourse program. The purpose of the evaluation was to confirm or deny the suggestions of content experts and to give the faculty committee the opportunity to obtain descriptive and judgmental information directly from students about the value of the instructional components.

Evaluation objectives were:

1. To determine the effectiveness of the program and obtain opinions and preferences of the students.
2. To determine whether the study guide was adequate as a supplement to the television program, i.e., that it con-
tained sufficient information and direction for the student, was well organized, written at appropriate vocabulary level, and so forth.

3. To obtain suggestions for activities to be conducted in the weekly workshop.

In addition, it was necessary to determine how much viewers had learned. To obtain this information, an objective reference test was developed as part of the experimental situation.

"The most important suggestion . . . was that each program . . . should begin with a clear statement of the relationship of the topic to the human condition."

Before the evaluation, four programs had been produced. Features of the Living Systems: Metabolism was chosen by the faculty committee for evaluation because the production elements and content were considered satisfactory.

The study guide that was to accompany the programs was drafted. Its components were:

1. Introduction to the course
2. Introduction to the study guide
3. Program objectives and outline
4. Study questions
5. Supplementary materials

The subjects were students enrolled in the University Studies/Weekend College. Gagne and Briggs (1977) state that in a formative evaluation, only 8 to 24 students are needed. In order to avoid the problems of selection and to obtain as much feedback as possible, it was decided to use two classes: a morning class of 12 students and an evening class of 19. The evaluation was to be conducted at the first class meeting of the quarter, so that it would not interrupt the regular course schedule. A demographic profile of the subjects was obtained by means of a questionnaire.

An evaluation tool developed by Forrester and Zakia (1974) provided a model for the format of evaluation to be used. Written as well as oral responses were desired.

At the beginning of the evaluation session, each student (evaluator) received a packet of printed materials. It included the questionnaire, the introductory and outline portions of the study guide, and corresponding response sheets, as well as response sheets for the TV program and workshop. To maintain student anonymity and provide a means of cross-checking data, each packet was assigned a code number.

The faculty person in charge of curriculum development was interested in knowing what the students learned from this exposure to the television program and print materials. An objection was made to testing the students because the time allotted would not permit them to use the learning materials as if in the actual learning situation, where they would have reviewed the study guide, used the study questions to advantage, and read the supplementary materials.

In spite of the questionable validity of the results, an objective-referenced test was developed. This test was administered as a pre- and posttest to the morning class and as a posttest only to the evening group. Campbell and Stanley (1966) have shown that students learn from taking a test. If a test is administered both as a pretest and posttest, there is doubt about whether the difference in scores results from exposure to the instructional package or to the pretest itself. Administration of a posttest only and a comparison of the two posttests can help determine whether learning has occurred from the instructional package.

Thus, evaluation sessions would include response sheets, study guide, pre- and posttests, and a television program viewing. Prior to each session, the in-class teacher briefly explained the evaluation, and students were allowed to withdraw if they wished. An audiocassette recorder and two 60-minute tapes were on hand to capture oral comments.

Two persons conducted each evaluation session. One, a member of the faculty committee who was familiar to the students, described the evaluation process. It was stressed that the instructional sequence was being evaluated, not the students. The second person timed each sequence, compared it to the trial run, curtailed the time being taken for each part when necessary, and provided additional copies of materials if students found anything missing. The entire evaluation session, including viewing of the 26-minute videotape, took approximately 3 hours.

Results

Thirty-one students participated in the evaluation. The demographic profile showed that the majority of students were employed young adults who had previously received course material by television in biology and other subjects. This experience with instructional television enabled them to make comparisons with the materials under study and, therefore, valuable recommendations. In addition, the questionnaires revealed that most of the students held favorable attitudes toward the use of television in education. Therefore, they were not negatively biased in their responses.

Tabulation of all closed responses revealed that at least 23 students responded to each question. This high yield of responses suggested that the responses were representative of the opinions of the students as a whole. Therefore, conclusions are recommendations, and actions taken to modify the components were considered valid.

Objective 1: To determine the effectiveness of the television programs. The forced closed responses on "Content" and "Form" (see Table 1) indicated a high level of effectiveness in all areas. The question, "Did you take notes? if no, why not?", received no response from the students; thus, it was unclear why notes were not taken. However, the predominance of level four and five responses indicated support of the television program in its existing form.

The middle range (level three) responses in the area of "level of difficulty" indicated a need to look at not only the level of content but choice of words; words that needed to be simplified or explained. However, the response to the question, "Did you understand the words used?" would seem to negate this as a problem for the students.

Analysis of the students' responses to seven open questions showed that the students approved the on-camera narrator, found her devoid of any annoying speech or personal mannerisms, and gave support to her continued participation in the series. Because 19 students found the program interesting and not
TABLE 1. Closed responses to the televised program.

<table>
<thead>
<tr>
<th>Content</th>
<th>Not well 1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Very well 5</th>
<th>Total responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>How well did the objectives for the program agree with what was taught?</td>
<td>5</td>
<td>10</td>
<td>13</td>
<td></td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>How well did the level of difficulty match your level?</td>
<td>1</td>
<td>7</td>
<td>12</td>
<td>7</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>Did you understand the words used?</td>
<td>2</td>
<td>3</td>
<td>11</td>
<td>12</td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>How well did the examples help clarify the material?</td>
<td>1</td>
<td>12</td>
<td>15</td>
<td></td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>Was the program organized?</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>10</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Did the material encourage you to think?</td>
<td>2</td>
<td>2</td>
<td>9</td>
<td>14</td>
<td></td>
<td>29</td>
</tr>
<tr>
<td>How well did the study guide work with the TV program?</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>13</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>How would you rate the overall value of the program?</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>16</td>
<td></td>
<td>28</td>
</tr>
</tbody>
</table>

Amount of Information Given
Not enough: 0  Enough: 28  Too much: 1

Form

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Were the visuals (pictures, films, graphics) effective?</td>
<td>24</td>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>Were enough visuals used?</td>
<td>22</td>
<td>6</td>
<td>27</td>
</tr>
<tr>
<td>Were the graphics easily read?</td>
<td>23</td>
<td>4</td>
<td>27</td>
</tr>
<tr>
<td>Did you take notes?</td>
<td>10</td>
<td>14</td>
<td>24</td>
</tr>
<tr>
<td>If no, why not?</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Would you feel it necessary to view the tape again in order to understand the material?</td>
<td>6</td>
<td>17</td>
<td>23</td>
</tr>
</tbody>
</table>

confusing, the developers felt encouraged.
From the “Additional Comments” section of the questionnaire came two valuable points: a request for repeat of important elements in the program and a plea for “same wording” of the narrator’s script and the study guide.
The oral comments that followed often repeated what had been written on the closed responses.

Objective 2: To determine whether the study guide was adequate as a supplement to the television program. In the Introduction to the Course the explanation of the goals and the importance of the course did not receive high ratings. Here was an area where the goals and rationale of the course should be strengthened and more clearly defined.

Open written comments on the Intro-

duction to the Course offered few suggestions. Some were related to administration of the course, instructors’ names, grading, course requirements, and so forth. Comments reinforced a need for a more clearly stated rationale for the course. Some students expressed concern about the amount of previous knowledge or experience necessary to understand the subject matter covered in this course. This concern suggests the need for a statement of prerequisites. The Introduction to the Study Guide rated adequate to high in content and form.

Open written comments revealed acceptance of the study guide as it was presented. Oral comments substantiated this. It was suggested that the glossary be enlarged and placed at the beginning of each unit.

Objective 3: To elicit suggestions for activities to be conducted in the weekly workshop. In their closed responses, students favored a close relationship between the workshop and the content of the week’s programs. They also agreed that their own participation in the workshop was important.

Open comments reiterated a feeling that the workshop should center on elements in the TV programs not understood by the students. There was disagreement about the use of additional materials.

Response to the idea of a textbook was unanimously negative. Comments about the supplementary readings indicated a willingness to read them but not to have them on hand.

Pretest and Posttest Results
In considering the results of the objective-referenced pretest and posttest, two factors should be kept in mind. The main thrust of this product evaluation was to seek student opinions and preferences about the print and nonprint components of the television course. In addition, the evaluation session as planned, and as limited by time, would not allow the students to use the learning materials in the same way as if they had been studying.

Pre- and posttests were administered to the morning group of 12 students. The pretest was given after the students had read the Introduction to the Course and Introduction to the Study Guide. The posttest was administered following response to the videotape.
Of the 12 students present, two were not considered in the final tabulation because they did not complete both tests. No follow-up was made to determine why they did not complete the tests. In the second group of 19, three students did not take the posttest.

For Group 1, the mean score increased from 31.4 for the pretest to 41.1 for the posttest. For Group 2, the mean for the posttest was 38. The variance for Group 1 (10 students) pretest was 400.8 and films was included to ensure that students would grasp the main points of the visual material. In response to recommendations, pertinent graphics were repeated during the programs, at the end of each program if time permitted a substantial review, and in the summary programs. As students had suggested, the moderator was coached to move more frequently, to wear clothes in contrast to the background, and to assume a more relaxed conversational approach and facial expression.

There was some concern that because the study guide (Objective 2) was written in outline form, students might find it too terse. They overwhelmingly approved of the form but asked that sentences be written when the use of phrases could not clearly convey the meanings intended. This procedure was incorporated into the construction of the study guide examples. Other suggestions subsequently included in the study guide were listing the guest speakers and contributors to each program and introducing new vocabulary before each program. Each unit introduction included a list of the technical words in the unit programs, and these were defined in the glossary at the end of the study guide.

Students' suggestions for activities to be conducted in the weekly workshop (Objective 3) resulted in the decision to make available for the workshop demonstration copies of many of the slides appearing on the television programs, and to design projects involving students with the material.

In addition, an instructor's guide, listing selected program slides and recommended projects, was to be provided for all teachers in the course.

Summary and Recommendations

What has been gained by this experience? The developers learned the value of having students react to the learning components while these components were still in the developmental stage, and films was included to ensure that students would grasp the main points of the visual material. In response to recommendations, pertinent graphics were repeated during the programs, at the end of each program if time permitted a substantial review, and in the summary programs. As students had suggested, the moderator was coached to move more frequently, to wear clothes in contrast to the background, and to assume a more relaxed conversational approach and facial expression.

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Faculty members had the valuable experience of developing a course in conjunction with students, and of observing students' responses to the learning components they developed.

Use of Evaluation Results

The written and oral comments of the students about the television program were summarized and presented to the faculty member in charge of curriculum development who shared the information with the television director and associate producer. The comments concerning the study guide were directed to the faculty member responsible for writing the study guide.

In response to the student evaluation (Objective 1), the television production staff reviewed all graphics for clarity. Additional graphics were ordered to introduce objectives and to summarize conclusions. Two methods of emphasizing points on graphics—use of highlights and pointers—were increased because of student requests for such aids. Attempts were made to keep superimpositions on the screen long enough for reinforcement and to make the background of sufficient contrast for the words to stand out clearly. More use of voice-over as accompaniment to slides and films was included to ensure that students would grasp the main points of the visual material. In response to recommendations, pertinent graphics were repeated during the programs, at the end of each program if time permitted a substantial review, and in the summary programs. As students had suggested, the moderator was coached to move more frequently, to wear clothes in contrast to the background, and to assume a more relaxed conversational approach and facial expression.

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References


Wardwell, D. Which is the better presenter, an ITV instructor or a trained communicator? Educational and Industrial Television, May, 1976.


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ERIC Reports on ID

Barbara B. Minor
ERIC Reports on ID Editor
School of Education
Syracuse University
Syracuse, NY 13210


The structural strategy diagnostic profile project developed the elaboration model of instruction as a superior alternative to standard instructional sequencing based on hierarchical task analysis. The theory construction phase, the first of two phases, identified the instructional variables, postulated cause-effect relationships, and proposed optimal configurations of instructional conditions and methods through the construction of a model (or theory). The second phase included the application of the instructional model to the design of a course in a subject-matter area and the development of procedures for implementing this model in the design of new instruction. Four major products of the project are described: (a) an instructional model for sequencing, synthesizing, and summarizing related parts of a subject matter; (b) a taxonomy of the variables that are included in the model; (c) a set of procedures for designing instruction based on the instructional model; and (d) a “blueprint” illustrating the application of these procedures for the redesign of the Navy’s basic electricity and electronics course. —Microfiche 83¢, paper copy $10.82 plus postage as document ED 175 426.


This summary of the final report reviewed above includes descriptions of the four major products.—Microfiche 83¢, paper copy $1.82 plus postage as document ED 175 427.


Recognizing the difficulty of representing faculty interests as diverse as those at Utah State University, planners sought relevant information from both faculty and administrators in an assessment of the needs of the university for this 5-year period. Some conclusions about needs were drawn from existing data: (a) enrollment can be expected to remain steady or to experience a slight decline; (b) the emphasis on quality teaching will increase; (c) students are dissatisfied with survey courses; (d) critical skills areas include communications, problem solving, and managerial practices; and (e) graduate teaching assistants have little preparation for teaching other than their specific academic training. The objectives of the Instructional Development Office are reviewed in the context of these needs and the areas of staffing and financing of instructional development activities are addressed. An implementation flowchart of activities scheduled in the ID office over the next 5 years is provided, as well as a list of references and the tabulated data from a survey of undergraduate students in survey courses. —Microfiche 83¢, paper copy $3.32 plus postage as document ED 175 439.

Individualizing Instruction in Quantitative Subject-Matters: Capitalizing on Aptitude by Treatment Interaction,
This review of the literature on aptitude by treatment interaction concentrates on studies that investigated two or more instructional treatments in a quantitative subject area—primarily mathematics—with different populations of students on whom measures of individual differences in aptitude were available. Designed to formulate some tentative recommendations for matching instructional methods to individual differences between students, the review examines 61 studies investigating logical vs. scrambled sequences in programmed instruction, linear vs. branching programmed instruction, overt vs. covert responding in programmed instruction, deductive vs. inductive sequencing mastery vs. conventional instruction, verbal vs. visual/spatial instruction, and conventional instruction vs. new math. A brief summary of the results with recommendations is followed by six tables summarizing the major findings of the reports in each of the areas studied.—Microfiche 834, paper copy $4.82 plus postage as document ED 175 455.


This paper describes the instructional components of the bilingual access program (BAP), a federally funded 5-year project established at Elgin Illinois Community College to supplement regular vocational programs with language training for limited English-speaking adults, to provide them with additional employable skills related to the employment opportunities in the nearby and Chicago metropolitan areas. Detailed descriptions are provided of BAP's instructional delivery system, instructional materials, an instructional design model for developing bilingual access support materials, an instructional design model for developing instructional components, techniques for teaching the vocational class in an ESL context, and a sequence of milestones within the BAP instructional design process. It is concluded that BAP is a very useful, cost-effective program with self-contained outputs that can be used at any time utilizing available human and other resources. Appendices include a list of regular vocational objectives, an instructional analysis sheet, a list of Spanish instructional aids, a language skills assessment form, and material for vocabulary study.—Microfiche 834, paper copy $3.32 plus postage as document ED 175 462.


This outline indicates some of the special problems of deaf learners in the context of instructional design variables in eight areas: learner variables, language and communication, content, evaluation, teaching-learning strategies, instructional materials, pilot testing, and future trends. Included are recommendations, alternatives designed to meet the special needs, and a list of six organizations useful as resources for materials and services.—Microfiche 834, paper copy $1.82 plus postage as document ED 172 771.


Intended to assist in the development of instructional products that can be used without direction or assistance from the developer, this guide identifies and describes steps in the product development process in a systematic, yet flexible, approach. These steps, called phases, serve as chapter headings: Phase I—clarifying the need; Phase II—creating the prototype; Phase III—critiquing the product; Phase IV—changing the product; and Phase V—disseminating the product. Checklists showing the options the developer has in deciding who will do what part of the master copy are included, and sample worksheets and charts are provided in the appendices. The techniques described have been field-tested and refined by the authors.—Microfiche 834 plus postage as document ED 175 429; paper copy available from the NETWORK, 290 South Main Street, Andover, MA 01810 ($3.50 prepaid).


This description of the marketing process as a practical way to manage the function of instructional development emphasizes the importance of the identification and evaluation of customer needs before developing objectives. To assist the instructional development agency in focusing on this aspect of planning, a checklist of possible marketing elements is provided for assessing the nature and structure of the market, services desired, and distribution channels, as well as developing appropriate advertising and pricing policies. The application of these marketing procedures to a hypothetical development agency is described to illustrate the process.—Microfiche 834, paper copy $1.82 plus postage as document ED 175 431.


Two projects conducted at the Center for Research on Learning and Teaching at the University of Michigan investigated factors involved in the adoption and dissemination of classroom innovations by college instructors. The first investigated the use of various instructional technologies among faculty members who were given released time and financial support for the development and implementation of innovations in their courses, and a random sample of faculty members who received no support. Results showed that the former group significantly increased their use of innovations whereas the latter showed no such increases. The second project focused on a random sample of faculty members and examined four factors used to predict the use of instructional innovations: (a) formal network—the extent to which respondents used vari-

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Kent Gustafson, ID Project Abstracts
Editor
Educational Systems Development
Michigan State University
East Lansing, MI 48823

PROJECT TOPIC: Communication

Background

Effective communication skills are needed by all individuals in their everyday lives in a social and career context. Representatives from three program areas—arts and sciences, business, and education—formed a task force to identify communication skills generic to courses of study for careers within the three program areas represented. These identified generic competencies were used to design undergraduate and graduate core courses in communication.

Project Descriptions

A total learning system in communication (undergraduate and graduate) was developed as core courses based on determined generic communication competencies. The elements of the core courses are: (a) an evaluation of the students' entry skills and cognitive and communicator styles; (b) an orientation session; (c) individual learning modules; (d) scheduled lecture/seminar sessions; (e) independent learning materials; (f) student/faculty conferences; (g) Independent Learning Center schedule; (h) evaluations of modules, instructional materials (commercial and locally produced); and (i) instructors' materials.

Topics of specific modules for the undergraduate course are: (a) Introduction to Communicating Effectively, (b) Persuasive and Oral Communication, (c) Nonverbal Communication, and (d) Decision-Making and the Communication Act. Module topics for the graduate course are: (a) Semantics: An Overview of the Communications Process, (b) Nonverbal Communication, (c) Letter Writing, (d) Listening, (e) Informative Communication, and (f) Persuasive Communication.

Lecture/discussion sessions allowed for practice of skills related to concepts learned through independent study. Faculty conferences allow for individualization of specific elements and afford individual corrective feedback to students.

Project Evaluation

Evaluation of modules, courses, instructional and delivery systems, and materials provided by student feedback make provisions for a data base on which to ground revisions of segments of the total instructional system.

This abstract was prepared and submitted by Dr. Jaquita Cranfill, Curriculum Design and Development. For further information about each of the core courses contact the following task team leaders: Dr. Tom Gandy, Director for Graduate Communication Core, and Dr. Ron Sprinchorn, Director for Undergraduate Communication Core, East Texas State University, Texarkana, TX 75670.
evaluating, and revising for final dissemination self-instructional modules for dental assisting and dental hygiene programs in Kentucky and adjoining states.

Project Description

The primary goals of this project are to: (a) develop, field test, and prepare for final distribution dental auxiliary modules that will increase educational flexibility in dental auxiliary programs, and (b) design a prototype for the development, field testing, evaluation, and dissemination of self-instructional materials in other health disciplines.

Tasks accomplished by the project include:
- The generation and presentation of workshops on the utilization of self-instructional materials and teaching strategies in selected sites throughout the United States;
- Construction of a curriculum study and subsequent analysis of results to assess the effects of self-instructional materials use on teaching/learning patterns;
- Development of continuing education packages for practicing dental auxiliaries.

In the Colleges of Dentistry and Allied Health Professions these materials are currently being used in course development and instruction and used as a basis for new program development within the Department of Dental Auxiliary Education and Research.

The staff for this project consists of the following full-time personnel: coordinator and director (instructional development specialist), content specialist (dental auxiliary educator), media development specialist, and secretary.

Project Evaluation

Approximately 150 modules have been summatively field tested in three selected program sites. Initial or formative field testing has been conducted in 15 dental auxiliary programs in the United States and Canada. The grant ends June 30, 1980; however, a continuation grant and Kellogg proposal will be submitted to continue developmental activities.

For more information on the project contact: Judith B. Kirkhorn, Ph.D., Project Director, Self-Instructional Materials Development Project, College of Allied Health Professions, Medical Center Annex #2, Room 109A, University of Kentucky, Lexington, Kentucky 40536, phone (606) 233-3762.

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PROJECT TOPIC:
Dental Hygiene Development
Project
University of Washington

Background

In January of 1977, the Kellogg Foundation awarded a 5-year grant to the University of Washington to develop and validate instructional materials for dental assisting and dental hygiene curricula and to implement the curricula with accompanying instructional materials in 10 accredited dental auxiliary education programs in Washington State. The grant followed the completion of a project funded by the same foundation that enabled the University of Washington to complete a task analysis of 89 skills considered essential to dental auxiliary curricula in Washington State.

Project Description

To date, over 45 learning units have been completed in such diverse content areas as clinical examination skills, patient education, restorative procedures, and radiography. Several have been revised based upon trials in participating programs. The modules average over 100 pages; some are supplemented by sound-slide programs. The design of the modules approximates the Information Mapping™ format. Each module includes a guide for instructors and students, self-tests to assess student progress, three posttests, and a final clinical examination and checklist.

Nine dental assisting and hygiene programs are currently implementing or planning to implement the model curriculum. In these programs clinical and basic science instruction by the faculty is an integral part of the curriculum.

Project Evaluation

The model curriculums have been implemented fully to date in one dental hygiene and one dental assisting program. Student performance data from scores on module posttests indicate students learn well from the module. Faculty and student opinion is positive and will be helpful in revising the modules. The evaluation staff is continuing to collect student performance data at five additional programs where the modules are being used this year.

Other activities of the project, including module development, have been the subject of a report written by an external evaluation team led by Barry Bratton, University of Iowa, May 1979.

For further information on the project, contact: Franklin Furlong, Dental Auxiliary Education Project, E-312 Health Sciences Building, SC-45, Office of Research in Medical Education, University of Washington, Seattle, Washington 98195.
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