

# Instructional Design and the Curriculum Development Process

For curriculum designed for numerous presentations by a variety of instructors, a systems approach offers schools a cost-effective, integrated process already used by the military, corporations, and third-world nations.

A process for improving student achievement through the systematic design, development, and evaluation of instruction is currently available but not widely used by the public schools. The process is referred to as the *systems approach*, and those who use it are usually referred to as *instructional designers*.

## The Instructional Design Process

The "systems approach" label indicates that a set of interrelated procedures is used to achieve a predetermined outcome. The process includes a feedback loop that indicates the extent to which the instruction has been effective and how it might be revised. There is no single systems approach. Andrews and Goodson (1980) have indicated that at least 40 different models have been documented in the literature. However, the models have a striking degree of similarity. Figure 1 is based primarily on the common elements identified by Andrews and Goodson.

## Historical Perspective

The general systems approach first became well known to the public when it was applied to the development of large weapons systems by military contractors in the 1950s. However, the term was not used in education until 10 to 20 years later. The '60s

saw the emergence of the components that eventually would be combined to become the instructional design systems approach. Interestingly enough, a number of these components were the direct result of work done on various curriculum development projects.

Robert Glaser and researchers at the University of Pittsburgh were among the first to develop individualized instructional packages for elementary children. As they developed instructional objectives, Glaser became aware of the necessity of including test items that directly measured the behaviors described in the objectives. This process of matching test items to objectives became known as criterion-referenced testing and is a key component of the systems approach.

Robert Gagne was a consultant to the Maryland Mathematics Project when he developed his procedures for identifying learning hierarchies. Rather than accepting a list of skills that might have been identified by a subject-matter specialist, for each stated instructional goal Gagne asked the question, "What does the student have to know or be able to do in order to learn to perform the instructional goal?" The answer was the identification of several subordinate skills that, when combined with additional instruction, would lead the student to the instructional goal. This process is

repeated for each subordinate skill until basic knowledge and skills are identified. The result is a learning hierarchy that indicates the skills that should be included in the instruction and the sequence in which they should be presented. The hierarchical analysis is one of several analytic techniques that designers use to identify what should be included in an instructional package.

Another basic component of the systems approach is the use of formative evaluation to collect data from students to find out what types of revisions should be made in the instruction. A number of educational researchers became concerned while evaluating the effectiveness of the multimillion dollar science curriculums produced by universities and research and development centers in the early 1960s. Lee Cronbach, Michael Scriven, and others found that many of these products were only effective with the most capable students. They asked why the effects of the instruction were not determined before the materials had been published and used in the classroom. Couldn't there be some earlier form of evaluation that would identify these problems and suggest alternative solutions that could be tested? The answer to this query was the concept of *formative evaluation*—a continuing revision process that is em-

ployed as curriculum is being developed. This process is used not to judge the effectiveness of the instruction but rather to provide information to the developers as to how they can make the instruction more effective.

### Applications of the Systems Approach

Although many components of the systems approach to the design of instruction were developed in conjunction with public school curriculum efforts, the largest users of the approach today are undoubtedly the military, business, and industry. There appear to be several reasons for its use by these groups.

- Behaviorally stated instructional goals can be identified and agreed upon.

- It is critical that all learners master whatever tasks they must perform. Our country's defense or a company's profits depend on people who can do their jobs.

- Business, industry, and the military can afford the large start-up costs that frequently are required when the systems approach is used. (*Any* curriculum development process is expensive, however, if the resulting curriculum is ineffective.)

- Public schools typically have not employed persons who are trained to develop curriculum materials. Likewise, teachers typically have not had either the time or the training to engage in large-scale curriculum development efforts.

Given these factors, it is still enlightening to examine several situations in which instructional designers have been involved in developing instruction for public schools. At the most elementary level are those efforts I see each semester when I teach graduate classes in instructional design. The students, who usually include practicing classroom teachers, are required to develop a one-hour self-instructional module. They proceed through the entire process, from identifying an instructional goal to developing tests and instructional materials to trying out the instruction with students. They revise their package, try it out with a larger group, and write a report documenting procedures and outcomes.

Two results of this effort are highly predictable. First, the teacher-designers almost always report large learning gains by students on their criterion-referenced post-tests. Often student

performance far exceeds what the teachers had been able to accomplish in the past with other approaches. The other result is the inevitable statement "I'll never be the same teacher again!" Even experienced teachers often gain insights into their students' abilities and the learning process that they had not realized through their normal teaching.

In complete contrast to the one-hour modules constructed by novice designers is the application of systems techniques to large projects, such as the redesign of the Republic of Korea's public school system (Morgan 1981). A team of educators was funded by the Agency for International Development to work with their South Korean counterparts to analyze the educational system and its impact on other aspects of society. A sector analysis identified the need for changes especially at the elementary and middle school levels. The systems approach was used to design schooling that would not cost more in resources and would serve the postwar technological needs of the country by making effective instruction more widely available.

The Korean government established a new organization to implement the country's educational reform, the Korean Educational Development Institute, which was responsible for developing an entirely new curriculum and for training teachers in its use. In a ten-year follow-up study of this extensive

project, the Agency for International Development found that even though the student population had grown, student performance had increased from 20 to 40 percent on the various content tests. The Agency considers this to be one of its most successful educational projects and has funded a consortium led by Bob Morgan, director of the Korean project, to implement the same approach in a number of third-world nations.

The projects I have described exemplify the range of applications of the systems approach. A teacher can develop a small package to meet a specific instructional need, or a group of specialists can analyze and develop a new system for an entire country. Most applications today fall somewhere between these two extremes.

### The Systems Approach Applied to Curriculum Development

The instructional design process is beginning to make an impact on the curriculum of public schools in the United States. Over a decade ago, Ernest Burkman employed the process to create the Individualized Science Instructional System textbooks that are used in many high schools throughout the U.S. Many of the major components of the systems approach process were used in this project, sponsored by the National Science Foundation, as they were in a number

1. **Needs assessment.** Identifies needs to which instructional solutions may respond.
2. **Instructional analysis.** Identifies content goals and requisite skills learners must achieve to reach instructional goals; sets objectives and standards for meeting them.
3. **Learner analysis.** Identifies learner instructional needs and learner characteristics; develops test instruments to determine if learners can begin instruction.
4. **Instructional setting.** Identifies modes through which instruction will be delivered, such as lecture or self-instruction; develops instructor and student guides and other materials.
5. **Instructional strategy.** Develops strategies to (a) assess learner entry skills, (b) develop and sustain learner motivation, (c) inform learners of informational and behavioral requirements for each objective; provides practice and feedback activities; develops testing plan: pretest, embedded tests, post-test, attitude questionnaire; provides strategies for remediation and enrichment.
6. **Materials development.** Drafts and refines instructional materials through processes of formative evaluation.
7. **Formative evaluation.** Tries instruction in various settings to identify problems and revise materials.
8. **User training.** Provides procedures for use of materials and training of instructors.

To be cost-effective, the instructional design process must meet two critical prerequisites. The first is the establishment of an instructional goal that describes what learners will be able to do when they complete the instruction. Second, the total process is of greatest benefit when a number of instructors offer the instruction numerous times. The systems approach is usually not cost-effective for instruction that will be presented only once to a small group of students.

Fig. 1. The Instructional Design Process

of other federally funded curriculum projects at that time.

Several state legislatures have required textbook publishers to adopt at least one component of the systems approach—formative evaluation. The state requires publishers to demonstrate that they have formatively evaluated a text before it is offered for adoption.

Each year textbook publishers in Florida submit Learner Verification and Revisions Reports (as the formative evaluation process is referred to in the Florida legislation) to the Department of Education. An analysis of some of these reports (Dick 1986) indicates that few publishers are using a systems approach to develop texts, and that many do not even gather data from student tryouts to revise the texts prior to their publication. In public meetings, publishers' representatives offer various reasons for the quality of reports they submit. However, state textbook councils have begun to reject any texts that are not accompanied by satisfactory formative evaluation reports. Other states are watching with interest the publishers' reactions to the Florida requirements.

Compared with the procedure publishers normally use to develop a text, the systems approach brings more people into the process and costs more money—a cost that would presumably be passed on to the schools. Most texts are written by one or more subject-matter specialists who work with the editorial staff of the publishing company. Publishers assume that the writers are familiar with the characteristics of the learners who will use the text. They assume, in fact, that as the authors are writing they are trying out the materials with the learners. In some situations this is a fair assumption. However, most writers do not have access to the support staff or the range of students needed to effectively try out and revise instruction.

It may be argued that it is not the publishers' responsibility to produce texts that teach but rather only to assemble factually correct information. It is important to distinguish between the ways publishers and instructional designers work. An instructional designer creates a total instructional system that produces certain specified learning outcomes. This system considers the instructor, students, instructional materials, and the learning environment. Publishers, in contrast, claim

that they do not produce instructional systems, but only one component, the text, and should not be accountable for the learning taking place. They claim that ensuring learning is the teacher's responsibility.

### Instructional Design and the Teacher

An examination of the curriculums of most teacher education programs suggests that, at best, an evolution, not a revolution, is occurring. Most preservice teachers are not being prepared to use the instructional design process. They are now learning, however, to use objectives in the instructional process and to link specific types of instructional strategies to particular learning outcomes. They are not being taught to think about instruction as a systematic process, nor are they provided with the full range of instructional design skills. It appears that it can be useful to the teachers in at least three situations.

• Every year states and local school districts ask teachers to participate in textbook evaluation and selection. Because teachers seldom receive any training for this task, they rely on their knowledge of the content area and their previous experience with the use of textbooks. To prepare more skillful teachers, Florida now requires all members of both state- and district-level textbook selection committees to be trained. The state's training program includes a substantial section on identifying important instructional design characteristics of textbooks. Committee members are encouraged to assess the instructional design characteristics of a text as critically as they would its content.

• As more and more districts engage in their own curriculum development efforts, it can be argued that the teachers involved in such efforts should receive some training in instructional design. Good teachers, who are usually selected to serve on such teams, do not necessarily make good curriculum developers. But with a short period of training, the probability that team members will produce usable materials is substantially increased. Teachers can use texts, such as those by Sullivan and Higgins (1983) and Dick and Carey (1985), to learn the basic instructional design competencies and to apply them to their curriculum development. The time spent in training at the beginning

of the project can result in large pay-offs in the end.

• A third possible introduction of the systems approach is through general inservice training programs. Anyone interested in viewing teaching as a replicable, systematic process could be shown how to apply instructional design procedures in their classrooms and how to adapt particular components of the process for their own use. Teachers interested in the approach could do follow-up work on their own or in conjunction with other teachers and instructors from nearby colleges and universities.

### The Systems Approach and Public Education

Evidence is accumulating that the use of instructional design results in more effective and efficient instruction. However, instructional designers have not found a direct role to play in public education. Rarely are they employed by publishing companies that prepare the textbooks or by the public schools that use the texts within an overall curriculum plan. The positive results of using a systematic design process are such that publishers should add instructional designers to work with teachers on curriculum development projects and to provide inservice training to teachers. □

#### References

- Andrews, D. H., and L. A. Goodson. "A Comparative Analysis of Models of Instructional Design." *Journal of Instructional Development* 3 (April 1980): 2-16.
- Dick, W. "An Analysis of a Sample of the Learner Verification and Revision Reports Submitted to the Florida Department of Education in 1985-86." Paper presented at the annual meeting of the American Educational Research Association, San Francisco, April 1986.
- Dick, W., and L. Carey. *The Systematic Design of Instruction*. 2d ed. Glenview, Ill.: Scott Foresman and Co., 1985.
- Morgan, R. M. *Korea Elementary-Middle School Project: Project Impact Evaluation*. Washington, D.C.: U.S. Agency for International Development, 1981.
- Sullivan, H., and N. Higgins. *Teaching for Competence*. New York: Teachers College Press, 1983.

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