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Planning for Instructional Improvement in Medical Education: A Case Study

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Abstract. The purpose of instructional improvement programs is to assist faculty members in identifying areas of personal strength and weakness in their teaching and, where needed, to develop strategies for change. Rather than utilizing formal coursework, workshops, or retreats, a model has been refined at Case Western Reserve University School of Medicine that emphasizes a working relationship between the interested faculty person and a member of the Division of Research in Medical Education, an educational research and instructional support unit at the school. The approach described comprises five steps in which a consultant relationship is formed, an agreement about the interaction process is reached, data on teaching behavior are gathered and analyzed, feedback is given, and plans for future action are developed. The paper also includes a discussion of the strengths and weaknesses of this model and implications for its use in medical education and elsewhere in higher education.

One of the most complex areas of curricular design in higher education exists in our medical schools. In this environment faculty-teaching contributions vary from informal contact with students on the clinical wards through very formalized didactic presentations in a traditional classroom setting. In addition, the curriculum is defined on a continuum from undergraduate medical education to specialty or graduate training to postgraduate or continuing medical education. In nearly all instances, faculty are not trained in techniques or strategies for effective teaching.

During the last two decades efforts have been undertaken to improve both instructional approaches and our understanding of the ways in which students optimally learn in these environments. The American Association of Medical Colleges instituted a faculty development program to help medical school faculty improve their teaching skills. Similarly, medical colleges and universities are attempting to sponsor workshops and conferences on various aspects of instruction (Poley, Smilansky, Bughman, & Sajid, 1976). Institutions across the country also have attempted to provide formal academic courses or programs that have a traditional educational format with credit provided (Vanek, Wile, & Kennedy, 1976). However, these efforts generally have failed to demonstrate success, either in terms of number of faculty participating or long-term changes in behavior (Centra, 1976; Gale, Tomlinson, & Anderson, 1976; Joorabchi & Chawan, 1975).

Among the contributing reasons for limited success is that members of the medical teaching faculty are, in nearly all instances, full-time physicians in clinical practice. Therefore, their time is valuable, and taking practice time to develop skills in education is difficult to arrange. Although other professionals, such as educators, can easily attend a course at their local college or university, physicians’ schedules simply do not permit this. Further, issues of time and money often have a direct influence on decisions to participate in instructional improvement activities.

Because medical students and faculty at Case Western Reserve want to improve teaching, the Division of Research in Medical Education (DORIM) developed a strategy for instructional improvement using a consultation approach. The plan was evolved to be reasonable in terms of faculty involvement, interest, and effort. In an attempt to create more personalized long-term interactions with faculty, the division has developed a mechanism whereby individual faculty receive feedback concerning their teaching behaviors while working cooperatively with educational specialists. The model described in this paper involves five steps that have proven valuable in documenting teacher behaviors through direct observation, in providing feedback to individual faculty members concerning these behaviors, and in developing strategies for improved approaches to teaching and student learning.

Background

The Curriculum

The undergraduate medical education program at CWRU is arranged in integrated, interdisciplinary, body-system committees of 4 to 8 weeks duration, i.e., mind committee and gastro-intestinal committee, rather than by traditional course disciplines, i.e., anatomy and biochemistry. Approximately 15 to 20 faculty members from many disciplines and clinical specialties teach in each committee. Classes usually are scheduled from 8 a.m. until noon in four 1-hour blocks of time. Any individual faculty member may teach from 1 to 6 hours during the course of a committee.

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Although a variety of teaching techniques is employed, the lecture method is the predominant mode of instruction. Small group conferences complement either the teaching committees or a separately delineated clinical education program. In these small group conferences clinical faculty members function as group leaders or resource personnel or provide the theme for prior and subsequent discussions.

Role of Educational Specialists

The DORIME was staffed with 11 educational specialists. Five had full-time faculty status and held doctorate degrees in education or a related field, three were full-time staff members with master's degrees in education, and three were graduate students in the health science education program (sponsored by this division).

The members of this group worked for several months to develop strategies to improve teaching in both the formal and informal aspects of the curriculum. Training sessions were held to provide these individuals opportunities to observe videotaped teaching activities, to use various evaluation instruments, and to practice providing feedback in role-playing situations. Since lecturing was the primary mode of instruction, the focus was on the organization and presentation style of the lecture and the effective use of audio- visuals. The emphasis was not placed upon making value judgments about specific teacher behavior, but rather to identify key elements and to examine whether the activity was observed to have occurred. These experiences formed the basis for developing the role of the consultant and for learning how to provide effective feedback.

Initial Contact

Faculty received an introductory letter, a brief description of the planned activity, observation forms for the instructional approaches, and a request to participate. In the event that faculty members failed to complete the initial contact form, a member of the DORIME staff would telephone and describe the project and, in most instances, would succeed in establishing a relationship. This procedure proved to be effective in securing faculty participation.

The Model

The model used in the instructional development approach is presented as a series of five steps that describe the teaching behaviors to be examined, the documentation efforts through direct observation, the feedback provided individual faculty members, and the strategies for behavioral change. The approach implies that formality can be developed to any level desired by the participating resource group and teaching faculty. The emphasis in this description is to categorize the key components of the process. However, in actual practice there is significant overlap from one step to another. For purposes of clarity they are presented as unique areas.

Step 1: Preteaching Interview

After a faculty member asked to participate in a teaching observation program, a conference was arranged between the instructor and the educational specialist. The purpose of this session was to help the faculty member identify with the instructor's perspective. This activity formed the basis for mutual trust and the establishment of a working relationship between the specialist and the instructor and also served as a conceptual rehearsal for the instructor. At this time, the instructor had the opportunity to revise the teaching presentation, if necessary.

In serving as a resource to faculty members regarding teaching methodology, the educational specialist assumed the role of a consultant (Rogers, 1971). Role definition was essential so that the faculty person had a clear understanding of the nature of the activity and the processes to be undertaken. In addition, the consultant learned the reason for the faculty member's interest in securing help and his or her expectations of the consultation. The entire instructional improvement activity was doomed to failure if the faculty member felt forced to participate, i.e., by a department chairman, or felt threatened by the process. Thus, this first critical step was to establish an atmosphere of openness.

The preteaching interview focused on the content of instruction, areas in which the faculty member felt comfortable or uncomfortable in terms of his or her presentation style, and a possible data-gathering instrument. The following questions often provided the framework for the consultant during a prelecture interview with the faculty member.

1. In order to help me (consultant) in

my observation, define your (faculty) purposes or goals for your lecture.

2. Is there a particular area in which you wish me to gather data? Discuss instrumentation (see Figure 1).

3. Can I be of service to you prior to or during the lecture in such areas as developing audiovisuals or writing examination questions?

4. Do you wish to have your lecture audiotaped or videotaped for your future viewing?

5. Will you complete the same or a similar data-gathering instrument so that we may explore our various perceptions/observations?

Figure 1

A checklist of selected criteria for observing lecture presentations.

![Figure 1](https://example.com)

**Figure 1.** Checklist of selected criteria for observing lecture presentations.
reached between the consultant and the faculty member to prevent making assumptions about what the faculty member wanted or needed. It was found that if such a contract was not made, subsequent interactions were misguided or ultimately fruitless. In addition, the contracting process provided the faculty member with a sense of ownership and control over the situation. He or she had the opportunity to identify areas for data gathering and to choose to collect information in areas where he or she felt moderately competent, thus opening the doors for a deeper involvement (Bergquist & Phillips, 1975b).

The process of contracting and the resultant relationship was viewed in terms of content and process issues. The content consisted of (1) what the faculty member expected to gain from the interaction, (2) the skills the consultant felt he or she could supply; (3) the plan of action, i.e., who did what, under what circumstances, and when; and (4) the desired observable outcomes. The process issues identified the interaction in terms of trust, openness, and ability to relate. Characteristics of a strong contract were a significant commitment from the faculty member, a clear understanding of the goals and objectives, realistic and meaningful action steps, and a positive feeling and openness between the two individuals. In a weak contract the consultant or faculty member generally had an uneasy feeling and other demands and stresses surfaced, thereby interfering with the productivity of the activity. For example, some faculty members said they had to spend more time on research and couldn’t afford the time needed to plan a lecture.

After the goals were established, methods for data collection were developed, and procedures for feedback to the faculty member were outlined.

Step 3: Data Collection

Data were collected by various methods from many sources including direct observations by consultants or peers, student interviews, consultant review of syllabi or teaching materials, and an analysis of a recorded teaching encounter by the instructor. This self-analysis was beneficial in pointing out the discrepancies between faculty and observer perceptions.

Step 4: Data Analysis and Feedback

The consultant analyzed all data sources including both peers and students, when possible. Then a meeting with the faculty member occurred to identify teaching strengths and weaknesses. It is important that the feedback be specific and descriptive in nature and based on behavior that is both observable and amenable to change (Bergquist & Phillips, 1975b). By presenting information in a descriptive manner, we have found that faculty identify with the critique and alter their lecture activities accordingly. As with all steps in this process, consistency of the feedback with previously agreed-upon goals was a key concern.

Feedback was given in both written and oral form. Written communication had the advantage of giving a faculty member the opportunity to privately analyze and synthesize the data and compare that information with his self-perceptions. In either case, it was important that the feedback occur as soon after the observation as possible.

Feedback ultimately should create a sharing of information and perception. The following questions illustrate those used during a feedback session and when planning for future interactions.

1. What did you (faculty) think of the lecture presentation I (consultant) observed?
2. Would you do anything differently another time?
3. Did our previous discussion change your teaching behavior?
4. Were your perceptions consistent with mine?
5. Would you like to work with me in the future?
6. What changes would you like to see made in a project of this nature?

Step 5: Postteaching Conferences

Following the written feedback report, a meeting was held to discuss the report and to develop plans for future action. In the case of an oral feedback session, the development of a plan for future action occurred at that time or within a few weeks of the session. Depending upon the length and depth of the relationship between the consultant and faculty member such “action planning” often included (a) a specific design for the next instructional activity, (b) a new contract based upon newly identified problems or areas for exploration, and/or (c) specific techniques for future self-assessment of teaching effectiveness for use by the faculty member.

Discussion

This model of instructional improvement can be implemented in a variety of ways. Faculty may elect to receive feedback on a single lecture or on an entire teaching unit. The feedback may be oral or written. This flexibility provides faculty who have less of a commitment to instructional improvement activities or have time constraints the opportunity to participate and receive meaningful feedback about their own skills.

This model encourages faculty, who may be insecure about their teaching abilities, to share their insecurities or problems concerning teaching and at the same time develop an organized approach to altering their teaching strategies. The ability to develop a trusting relationship is critical to the design of this model. The data belong to the faculty member and remain confidential.

Two-way communication is fostered during this feedback process through carefully planned pre- and postteaching conferences. Faculty can share their perspectives on medical education with individuals trained in instructional methodologies. Through this sharing and the ability of the educational specialist to act as a synthesizer of data from many sources, feedback can be more relevant to the faculty member. Evaluation of teaching by students, peers, or administrators via questionnaires, in the name of “instructional improvement” efforts, without two-way communication merely puts the faculty member on the defensive.

Although faculty report that feedback given in a formalized model of instructional improvement is useful, our data suggest that few faculty ask for it. When specifically asked whether they would like to receive feedback, however, most faculty answer positively. Clearly, instructional improvement activities are viewed as a “fringe benefit” of which few take advantage.

A critical component in the successful implementation of a formalized program is strong administrative support. In our experience, a committee chairman’s support and influence directly influenced participation, even though all personal data remained confidential.

Presently, many colleges of medicine are instituting mechanisms whereby educational contributions can be considered for promotion and tenure. Such is the case at Case Western Reserve University. For these endeavors to be
Integrating Learning Theory with Instructional Design

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EDITOR'S NOTE
This is the second of two articles IID is publishing on the implications of cognitive psychology for instructional development. For the first article, see the article by Low in IID, winter 1980-81, 4, 10-18.

Abstract. This paper examines the need for integrating assumptions about learning processes with the decisions typically made when designing instructional systems. Our concern is that the decisions made explicit in each of the commonly accepted components of instructional systems depend to varying degrees on implicit assumptions about the process by which people learn. Consequently, when instructional systems are designed without regard to learning theory, these decisions within components are often inconsistent, resulting in varying degrees of incompatibility among the components. The relationships between learning theory and instructional design are discussed, and suggestions are offered for improving the design process.

Instructional design methodologies have flourished academically in recent years because they have successfully “made sense” of the complex task environment facing teachers and instructional developers in public education, military, and industrial settings. Systems approaches to design of instruction (Briggs, 1970; Davies & Hartley, 1972; Dick & Carey, 1978; Gagné & Briggs, 1974; Glaser, 1967; Merrill & Tennyson, 1977; Skinner, 1988) have made possible a substantial degree of precision and control in handling traditional design tasks and have also created some relatively new tasks for designers and developers (review, for example, the recently expanded growth of need assessment, task analysis, and evaluation technologies). Moreover, the self-correcting nature of design procedures encourages planned systematic improvement of instructional practice, and the use of these procedures has obvious benefits in terms of accountability.

The advantages notwithstanding, the systems approach to the design of instruction has not had a major impact on education outside of the major materials development “shops” (most of which target nontraditional students). Systems approaches have seemed too mechanistic and too complex to receive serious consideration by many within the large and diverse population of public school educators. In fact, instructional designers have often highlighted the complexity and the mechanistic nature of “systems” approaches to their own detriment. It is rarely suggested in the educational technology literature that individual teachers and small teams of public school personnel can conduct, on their own, effective and inexpensive development projects (Gustafson, 1977).

A more serious problem confronting widespread utilization of instructional design principles, however, is that the existing models have very shallow (or nonexistent) theoretical foundations.

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Very little systematic work has been done in terms of describing the relationships between the assumptions that one makes about the learning process itself and the decisions made necessary by the individual components of instructional systems (Figure 1 gives one example of a systems model). The position taken in this discussion is that the decisions that are made explicit in each of the commonly accepted components of instructional systems depend to varying degrees on the implicit assumptions the designer makes about what, how, and why people learn. To the extent that instructional systems are designed without regard to a cohesive learning theory (or theories), the decisions within components risk being inconsistent (and arbitrary), resulting in varying degrees of incompatibility among the components. The major purpose of this paper, then, is to explore the possibilities (and problems) of integrating what is known about learning with what is known about designing instructional systems, as well as to offer some suggestions for avoiding potential mismatches between the science psychology and the technology of instructional design.

Learning: The Cognitive View

To simplify matters, we have selected one theoretical orientation to serve as an exemplar for unifying instructional decisions. For the complex types of learning that are of primary interest to current educators, the emerging cognitive or information processing orientation is most promising. It has influenced, with its recent maturity, practically all theoretical work in social science, including the traditionally conservative approaches to American education. To date, however, cognitive theories of learning have made only tentative contributions to instructional practice, in part because there is no linking schema for putting its constructs into operation. When instructional design models (e.g., Figure 1) are viewed within the context of such a learning orientation, however, we begin to approximate the required linkage.

Although we focus here on cognitive theory, others are equally available to instructional designers. Besides the several theoretical options that belong under the cognitive/information processing umbrella, the potential contributions of behavioral and humanistic psychology will also be briefly considered in our analyses. It is assumed, however, that any theory that has been applied to classroom learning from psychoanalytic theory to transpersonal (Roberts, 1975) to humanistic (Maslow, 1968) to behavioral (Skinner, 1968) could be adopted by the designer of instruction. Yet, because of the limitations each has in terms of explaining a wide range of complex behavior, we believe these additional theoretical approaches ultimately will serve primarily to augment, refine, and extend the application of cognitive theory.

Learning in the cognitive orientation is viewed as an active, generative process where meaning and understanding must be constructed from experiences (Neisser, 1967; Smith, 1975; Wittrock, 1978). The products of such learning are viewed not simply as single behaviors or classes of behaviors, but are described as organized memory "units" for which there are certain known characteristics. Some of these characteristics, for example, are described by Gagné and White (1978) in their recent review of the relationship between memory structures (e.g., networks of propositions, intellectual skills, images, and episodes) and learning outcomes (e.g., rule application and knowledge stating).

To facilitate our discussion of the relationship between learning theory and technology, several major points of cognitive theory are summarized in Figure 2. For substantial planning of instruction to occur, there are certain critical input, process, and output variables that must be considered under the cognitive orientation. There is consensus across many works (DiVesta, 1974; Frijda, 1978; Thorndike, 1978; Voss, 1978; Wittrock, 1978) that two input variables are critical: one is the existing cognitive structures that students bring to the learning situation; the other is the content structure that may be either contrived or inherent, but in either case, described explicitly for given disciplines. Although methodologies for detecting students' cognitive structures are only just beginning to emerge (Shavelson, 1972, 1975), it is recognized that meaning and comprehension (i.e., learning) is a function of the interaction between the organization of what is to be presented and the characteristics of individual students' own memory units (Ausubel, 1978; DiVesta, 1974; Johnson, 1975; Voss, 1978). Further, the fact that learning requires that students' cognitive structures become, over time, more like the structure inherent in the various content disciplines will have important implications for such instructional tasks as determining initial need and detecting the direction and sequencing of instruction, as well as for conducting final outcome evaluations.

Process variables are those constructs that are used to describe and explain the attainment of competence. Recent theoretical accounts of cognitive learning (Glaser, 1976; Neisser, 1976; Voss, 1978; Wittrock, 1978) have cautioned us that development of competence is a
complex process that involves more than simply breaking expert behavior into discrete tasks or steps that students subsequently reassemble in prescribed and clear-cut ways. Rather, it seems that successive inputs from instructional environments are initially transformed by students according to existing memory structures (or plans, sets, schemas, etc.) and that these structures in turn may be transformed later via generative processes that teachers can facilitate but never completely control. Norman (1978) gives an appealing account of three process variables that Rumelhart and he (Rumelhart & Norman, 1979) have used to describe the attainment of competence. We have used these variables to complete the process portion of the model shown in Figure 2. First, a great deal of learning requires students to simply add or subsume (Ausubel, 1968) new information into existing memory units. This process is relatively easy to understand and control given certain minimum information about students' entry characteristics. Ausubel, in fact, has described methods for putting appropriate structures or "organizers" in place as part of standard instructional practice.

At some point in the development of competence, however, existing memory units are restructured or replaced with more efficient and powerful units. It is these important restructuring operations that constitute insight into a body of content and that (depending on the power of the structure [Bruner, 1966]) allow knowledge to be used in a generative rather than prescriptive fashion. It is not well understood how such restructuring activities occur or what one can do to influence the process. Rumelhart and Norman (1979) have suggested that most new schemata are patterned on analogies from existing ones with perhaps some modifications included. They also consider inductive processes, however, and it is the detection or invention of new categories or structures from systematic observations of recurring data patterns that is the foundation of several inductive approaches to learning from instruction (Weil & Joyce, 1978).

Finally, performance improves systematically in the absence of either additional information or of new ways of organizing knowledge. Rumelhart and Norman have described this third process or type of learning as "tuning," which suggests that intact cognitive per-

formsances, with practice, become smooth and automatic in a manner similar to improvement of intact motor capabilities. Repeated use of cognitive capabilities is a logical requirement for "tuning" to occur, and the effectiveness of such training may be measured by tests involving accuracy, speed, breadth of generalization, smoothness, and the like.

Although each of the above processes may be occurring simultaneously during a given learning episode, Norman (1978) hypothesizes that attainment of knowledge within content areas involves rather distinct phases where, over time, humans alternate between the first two processes (adding new information and restructuring) with "tuning" activities becoming more important as the information structures begin to stabilize.

The educational importance of these notions is that appropriate instructional interventions must be available at the appropriate time to ensure optimum learning. Determining appropriate strategy at any point, however, will involve several options since there are a variety of instructional "models" that have appeared out of the general cognitive movement (see, for example, Ausubel, 1978; Bruner, 1966; Suchman, 1966; Taba, 1967). Because these approaches or "models" can vary from inductive to deductive in nature, one's particular choice(s) may have considerable impact on the design process.

The third category shown in Figure 2 involves those outcome variables that are expected, given a cognitive orientation to learning. As shown here, learning evaluations should yield evidence that students have personally "relicated" those knowledge structures that were established as input variables. Considerable research needs to be conducted to create testing technologies that detect learner outcome structures. Generally, we expect the best results might be obtained through evaluation devices that simultaneously assess the efficiency and generative power of one's memory structures.

**Integrating Learning Theory with Design Technology**

**Needs Assessment**

Needs assessment is a logical first step when planning any service program—educational or otherwise. Generally, the major goal of performing needs assessments on a routine basis is to ensure that more instructional time is available especially for those few "needs" that have been empirically validated and have survived a rigorous process whereby priorities among needs are identified.

In the educational technology literature, at least, the methodologies for conducting needs assessments are well known (Burton & Merrill, 1977; Kaufman, 1972). Typically, the procedure involves measuring empirically (for some target group) the discrepancy between existing conditions (e.g., skills, attitudes, achievement patterns) and some predetermined required conditions. These differences or discrepancies are subsequently restated in verbal form (i.e., as goals) and placed in some order of priority.

Our concern is that existing needs assessment methodologies are essentially independent of theory, with established procedures having only logical rather than psychological foundations. Since education is a tool of the general social order, we should reinforce those technologies that ensure
wide participation in determining "what ought to be." At one level then, need refers to social expectancies, and these may develop independently of particular theoretical orientations. Yet, even in this social context, participants in the needs assessment process respond to questions and instruments that could reflect certain "biases" of given conceptual notions about learning. We would expect a behaviorist, a humanist, or an information processing enthusiast to elicit different kinds of needs assessment data through the form and substance of their respective assessment tools. Given this possibility of theoretical "bias" we would prefer assessment methodologies that make those orientations explicit in much the same way that they should be made explicit within other design components. For example, needs assessments derived from cognitive theory should be designed to gather data from each of the major categories of variables shown in Figure 2. The major discrepancy data would involve differences between student information structures and the various content or discipline structures described by experts. Process information would also be highly valued under cognitive orientations and these data are also not generally available through current needs assessment methodology.

The humanistic movement in psychology and education has often harshly criticized both behavioral and cognitive approaches because they have allegedly ignored certain of the "higher level" characteristics of human nature, namely the ability to recognize and control one's own feelings, beliefs, and general growth toward self-fulfillment. Regardless of the accuracy of such criticisms, we tend to agree with Snell-becker (1974) that the humanistic approaches can at least have a corrective or "fine tuning" influence on instructional development. This influence might well begin by systematically including in needs assessment methodology (regardless of the major theoretical orientation) some collection of data concerning those growth needs that are consistent with humanistic psychology.

The basic generalization we want to propose here is that a needs assessment will be significantly affected by the theoretical orientation within which it is conducted. We see no way, for example, to perform a post hoc transformation of discrepancy data generated within a behavioral framework to make it serve design models based on cognitive learning theory. Theory and practice must initially merge at the needs assessment phase.

A major source of frustration for teachers (and students as well) is that learning activities and classroom tasks performed daily often do not "add up" to, or result in, the predicted final behavior or competency. Although many of these failures involve the technical quality of the activities themselves, of more concern here is the possibility that certain sequences of learning activities are not even potentially successful because designers and/or teachers do not understand the terminal outcome (or task) in terms of the logical relationship between/among component behaviors involved. For too long it has been incorrectly assumed that teachers' personal expertise in particular content areas is sufficient to allow one to make useful curriculum and teaching decisions regarding that content. Educators apparently fail to recognize that competent performance is qualitatively different from the behavior of novices and that the route between the two is complex. Our earlier discussion of Norman's hypotheses makes it clear, for example, that the learning act itself may vary over time depending on whether information is simply being added to existing structures, whether structures themselves are being transformed, or whether operations with structures are being redefined. Thus, even though educators may have specified (Rosnick, 1976) certain smaller steps that are the result of being competent, often there is little or no sensitivity to the operations required during novice, intermediate, or final learning phases. Lack of sensitivity often results in students being placed in learning activities that are not only technically inadequate, but are unrelated to the "mode" of learning (or dominant process) that is in operation. One major purpose of task analysis, then, is to suggest both the "route" and the processes students must use to progress from naive to competence.

More specifically, understanding the development of competency within disciplines (e.g., math, science, English) requires some specification of the structure of that discipline. Certainly, much of what is taught within any content area is amenable to some structural analysis that can be displayed in the form of hierarchies, taxonomies, or other framework. Yet, in spite of the fact that learning is increasingly described as the process of building or obtaining organized memory structures, we have not seen large-scale attempts to make these target structures known through either instructional materials or classroom practices. This is one reason why such importance is attached to the task analysis process: It is the component initially responsible for making explicit the major variables shown in Figure 2.

Once task structures have been outlined via the initial stage of task analysis, designers should proceed to describe, within levels of the structure, the precise operations that students must perform. These operations will depend on the mode of learning that might reasonably be in operation as well as the instructional model (e.g., deductive or inductive) that has been designed or selected to facilitate particular learning processes. Certainly, one serious problem with recently described task analysis procedures (Gagné, 1962, 1977) is that once a hierarchy has been created, designers and/or teachers still face, with insufficient information, the task of teaching facts, concepts, and rules that have been arrayed in some fashion via the analysis. Required student operations or processes at all levels need to be "discovered" and made explicit within the task analysis steps since most existing school materials are notoriously inefficient in concealing this critical information within complex and obscure prose statements too difficult to decipher. We are encouraged by the possibility of using Land's (1976) work to improve this aspect of task analysis methodology. His apparent success with the use of algorithms in learning and instruction gives a viable methodology for accomplishing at least three important things: detecting the critical attributes of concepts or rules, devising a correct and unambiguous statement of those attributes, and generating a procedure to follow that results in successful processing of learning tasks using those rules and concepts.

Task analysis essentially "gives birth" to cognitively based instructional methodology. During this process the goal statements that are typically derived through needs assessment procedures must be "transformed" into statements consistent with theory relevant variables such as those shown in Figure 2. We should mention here that only cognitive theory creates such a workload
for task analysis. Behavioral approaches are essentially satisfied with establishing learning hierarchies that Gagne (1962, 1968) has pioneered during recent years, and humanistic psychology is insufficiently mature to suggest clear functions for task analysis.

EntryBehaviors

As cognitive theory has evolved during recent years, our view of the learner as a passive recipient of information has changed to one where the learner is seen as an active processor of information. This change also recognizes the major responsibilities that students have for their own learning and, consequently, has forced us to consider more carefully the entry capabilities needed to engage a particular "chunk" of instruction. Several aspects or dimensions of entry characteristics now seem important. To begin, we know that where active processing is required, we need to look for a certain motivational state, a kind of tension, which in its elementary form simply may be a readiness to attend to the relevant attributes of some instructional problem. For most younger children this motivation, or tension, seems to be "built in" almost as if it were a natural drive. However, for older students at all levels, particularly those who have not done well in schooling, this motivation may be lacking, perhaps destroyed by long-term failure of schools to respond to and be sensitive to the natural curiosity found in young children. It also seems advisable, from a cognitive view, to eventually conduct analyses that measure the finer motivational determinants of student performance. These include dimensions such as locus of control, reflectivity, and anxiety as well as a host of variables identified as cognitive styles.

Additionally, routine learning episodes involve the ability or inclination to take risks, to work under conditions involving conceptual confusion, to propose and/or generate meaningful relationships and structures, and to evaluate one's own behavior. Students exhibit a great deal of variability across these dimensions and, to date, much of this variability is essentially meaningless. The recent book by Cronbach and Snow (1977), however, as well as other related aptitude, treatment, interaction (ATI) research, has demonstrated how to use variation within these and other dimensions to instructional advantage.

Developmental differences also are critical in terms of assessing students' entry characteristics, and these are specified both in cognitive and humanistic psychology. Clearly, as children move through preschool, elementary, and secondary levels we find tremendous quantitative and qualitative changes in terms of the cognitive technology that students bring to instructional situations. These changes are documented in the works of Piaget and Bruner and, in some cases, have been woven into instructional theory (Bruner, 1966; Case, 1978). Adult learners present a somewhat different situation. For them, we are not as concerned with the possibility of broad developmental changes. However, it will be important to determine, even for adult learners, exactly what processing capabilities are available. For example, certain students may have only poorly developed or practiced symbolic capability and/or may be unable to use certain complex logical operations. Instruction that requires these symbolic or logical competencies thus may be largely unsuccessful. Unfortunately, there is relatively little attention to adult developmental stages in the research literature (Fozard & Popkin, 1978; Kidd, 1973; Knowles, 1970; McClusky, 1971).

Gagne's work in developing the notion of learning hierarchies has had perhaps the greatest success in fully operationalizing the concept of examining entry capability prior to instruction. His idea is that the best way to determine suitability for instruction is to determine which of the required prerequisite skills have been mastered by each student. Although this work has been conducted essentially within the behaviorist tradition, the basic idea is easily transportable. Within the cognitive orientation, Gagne's work is extended to include specification of memory units or structures as well as skills hierarchies. Essentially, then, the work done in the prior task analysis phase provides the capability to conduct the appropriate entry assessment. The key question, of course, is whether students have cognitive structures (as opposed to cognitive styles) sufficiently similar to that of the instructor and/or the materials to ensure good communication.

Grouping and Sequencing

Learning Objectives

Since instructional programs are operationalized as series of events that occur over time, one practical design problem is to arrange some reasonable grouping and sequence of learning objectives. Historically, learning theory has contributed only minimally to this instructional task. In fact, it was only when Gagne (1962) applied the notion of learning hierarchies that any real conceptual advance was made regarding sequencing. This section describes briefly the additional requirements necessary if cognitive learning theory is applied to this aspect of the design process.

The prior analysis of discipline or content structure that was completed in the task analysis phase offers some initial help. However, a simple bottom-to-top sequencing, such as suggested in Gagne's learning hierarchy approach, is not sufficiently complete to serve all variations of cognitive methodology. For one thing, different teaching models within the cognitive framework will require somewhat divergent sequences of instructional activity (compare, for example, Ausubel, 1968; and Bruner, 1966). While Ausubel and Bruner both appreciate that meaningful learning involves attainment of organized memory structures, they each propose different sequences of events for attaining those goals. Ausubel's methodology essentially requires students to subsume or "chunk" information into structures that are initially presented (via advance organizers) as part of the instructional episode. Ausubel does not, however, describe these processes as purely deductive since the initial structures or propositions tend to acquire new meanings through a transformational process he calls progressive differentiation. Yet, these essentially top-down sequences are substantially different from the primarily inductive approaches (Well & Joyce, 1978) that involve students in collecting data, generating hypotheses, testing hypotheses, collecting additional data, etc. The primary point to be made here is that sequencing is intimately related to both general theoretical orientations and to variations within broad theoretical frameworks. We should also mention that decisions made here may require reexamination of entry behavior requirements. In fact, instructional design methodology probably will involve constant checks for compatibility among all components, hence the bidirectional linkages among components shown in Figure 1.

Long-term sequencing (i.e., a year or
more) will involve a somewhat more complex set of variables. On the one hand we need to consider developmental theory that suggests, for example, that humans progress through "stage-like" phases where information processing ability evolves from a very concrete and egocentric state to the point where the environment can be manipulated hypothetically using a variety of abstract symbol systems. In this regard, Bruner's spiral curriculum notions are relevant and can be used to sequence learning activities. We are also interested in the potential application of Rumelhart and Norman's (1979) "modes" of learning to the question of determining sequence. Again, there is at least some implicit understanding that humans tend to cycle through episodes involving (a) simple accumulation of information within structures, (b) re-structuring or "progressive differentiation" of structures, and (c) the fine tuning of intact and mature structures. It seems relevant, at least in the context of our model shown in Figure 2, to plan actively for this cycling or sequencing of learning behavior.

Delivery Systems

This component deals with the broad environmental framework within which instructional activities are presented. Within this single component, we are interested in at least two major decision categories: selecting and/or developing instructional materials and designing and/or selecting a teaching or delivery model. Again, it is important to remember that these categories are interrelated and that the entire component must be considered in terms of its relationship with other components.

With regard to materials selection, it should be apparent by this time that the time-honored strategy of letting textbooks and other materials dominate instructional decision making is completely inappropriate. Materials should be selected on the basis of decisions made within and among the various components of an instructional system. The task analysis procedure, for example, not the textbook, will determine the way content and process are organized. Likewise, texts and other commercial material cannot be allowed to dominate decisions concerning required student entry skills, sequencing of activities, evaluation procedures, and the like. These decisions are all a function of the complex design process.

We are particularly concerned that teachers become better consumers of both instructional materials and intact instructional programs. Improvement of commercial materials will happen only through widespread insistence by teachers who understand the powerful theoretical notions of cognitive and behavioral psychology that materials must conform with the relevant principles and constructs. The recent works of Hayes-Roth (1978) and Thorndyke (1978), for example, demonstrate the connection between text structure and the processing of studied material into memory. In many cases not only is inherent structure not made explicit within text, but the tendency of experts (i.e., authors) to produce good (artistic) writing may not be consistent with learner needs. We simply cannot afford to spend valuable resources on materials that need extensive reorganization and rewriting to be useful within a selected theoretical context.

Decisions concerning the actual delivery of instruction are clearly more involved than simply choosing a technique (e.g., lecture, lecture-discussion, discovery) that may have some particular appeal. Within the cognitive orientation there are a number of options, or models, that have been described in sufficient detail for practitioners to understand and implement (see, for example, Eggen, Kauchak, & Harder, 1979; Weil & Joyce, 1978). Both Weil and Joyce and Eggen et al. have provided an excellent service for teachers in making explicit and concrete the operation of both inductive (Bruner, 1966; Suchman, 1966; Taba, 1967) and deductive (Ausabel, 1968) systems of instructional delivery. Generally, these models are consistent with mainstream cognitive theory and have given sufficient attention to the tasks of explicating both student and teacher roles and of dealing with individual student characteristics. What they have not attended to, however, is the problem of integrating the models within a total instructional system such as we are describing in this paper. At this time the major point we want to make about delivery systems is that they should be consistent with the major theoretical framework employed (which the models we have referenced tend to be), and that they are compatible with the outcomes of other major components, viz., task analysis, student entry behaviors, individual learning activities, and evaluation procedures.

Learning Activities

It may seem awkward to place the specification of learning activities at the end of the design process. This placement makes a good deal of sense, however, when we consider the several advantages. Generally, the sequence shown in Figure 1 reduces considerably the risk of putting together a series of learning activities that fail to add up to desired outcomes. The results of task analyses and subsequent assessments of student entry behaviors, for example, allow designers and teachers to place students within appropriate learning activities and to move students through more efficient sequences of activities. Moreover, learning activities designed at this point in the design process are more likely to be consistent with already established evaluation procedures. Finally, our prior attention to selection/generation of appropriate materials and delivery mechanisms increases the probability that all learning activities will fit together and will receive needed support from the entire system.

Within the present framework a designer is given considerable direction in terms of constructing and selecting activities that are consistent with the dominant theoretical position. Yet, the complexity of the cognitive approach suggests that a great variety of different activities might be planned to run concurrently across students. We will expect, for example, to find individual students who require, within a small time frame, a variety of activities that correspond to one or more modes of learning (i.e., subsuming, transforming, tuning) that occur simultaneously across different content areas. A task of considerable importance is simply to manage and keep track of the varied activities across students. Success here is largely a function of the data made available through the program evaluation system. One possibility is to develop and maintain a cumulative record for each student that, instead of simply tracking discrete behaviors, will track growth and modification of memory structures. Such a record would be used both as a formative record of progress and as a management technique to cue designers/teachers to needed modifications within or transitions among learning activities.

In addition to the mainstream activities actually designed into instructional programs, we also expect to see de-
TABLE 1. Examples of key questions or issues that arise when instructional design occurs under theoretically different conceptualizations of human learning.

<table>
<thead>
<tr>
<th>Conducting Needs Assessments</th>
<th>Performing Task Analysis</th>
<th>Assessing Student Entry Behaviors</th>
<th>Grouping and Sequencing of Learning Objectives</th>
<th>Designing Delivery Systems</th>
<th>Designing Learning Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are discrepancy analysis presented in behavioral terms?</td>
<td>Can terminal outcomes be subdivided into appropriate enabling or prerequisite behaviors?</td>
<td>Can existing levels of behavior be pinpointed and charted?</td>
<td>Does sequencing follow established rules of shaping and chaining?</td>
<td>General questions in delivery include the following:</td>
<td>Do activities meet standard behavioral requirements (i.e., small steps, active responding, frequent feedback)?</td>
</tr>
<tr>
<td>Are routine needs assessment techniques generally followed?</td>
<td>Has the task analysis product been verified empirically?</td>
<td>Is reinforcement history known?</td>
<td>Do sequencing patterns follow from task analysis?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are needs assessments routinely updated?</td>
<td>Does assessment procedure express desired and existing conditions in terms of cognitive structure characteristics?</td>
<td>Can structural aspects of memory be identified?</td>
<td>Is sequencing consistent with targeted theoretical variation (i.e., inductive vs. deductive)?</td>
<td>Has conscious choice been made from among the several cognitively based instructional options currently available?</td>
<td>Are specific activities consistent with theoretical option chosen?</td>
</tr>
<tr>
<td>Does assessment procedure seek information processing needs?</td>
<td>Does analysis yield a task or information structure?</td>
<td>Have processing skills required for relevant variations of cognitively based instruction been assessed?</td>
<td>Are grouping and sequencing decisions sensitive to hypothesized periodic variations in learning behavior (such as shown in figure 2)?</td>
<td>Has above choice been made in context of decisions made within previous components?</td>
<td>Are specific activities consistent with all decisions made within previously considered components?</td>
</tr>
<tr>
<td>Does assessment procedure stress “learning how to learn” skills?</td>
<td>Assessing how information is used?</td>
<td>What prerequisite intellectual skills and information are present?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are needs assessments routinely updated?</td>
<td></td>
<td>Have developmental concerns (such as the mode in which material is represented) been considered?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Signers systematically using supportive teaching/learning activities. Good behavioral techniques, for example, will obviously continue to play a significant role within any instructional framework. During the tutoring phase described earlier, it seems likely that the process of stimulus control could be used to refine, focus, and make automatic already acquired performance patterns. In fact, a great deal of the social behavior associated with all learning activities in classrooms might well occur in the context of either reinforcement theory or humanistic theory, or both.

Summary

To summarize briefly, we have generated one additional display (Table 1), which gives at a glance some examples of questions and issues that arise when theory interacts with instructional design procedures. The questions associated with cognitive theory have not been treated extensively here but are generally well known to designers. As can be seen from Table 1 and from the above discussion, cognitive theory places demands of greater breadth and complexity on the designer than does the more familiar behavioral orientation. Yet, however broad and complex, these and other issues not included in Table 1 (such as the particular questions that arise within variations of cognitive theory) must be taken up by designers. Designers, no doubt, will satisfactorily answer some of these questions as well as discover others of interest to theorists. Progress in education is thus seen as a cooperative venture between theory and design technology.

Theory and Design: Additional Caveats for the Designer

The task of matching all the available theoretical approaches to learning with the many permutations of instructional design sequences is beyond our time, knowledge, and inclination. We have described the integration of cognitive theory with a general design model. The larger task could probably be accomplished in a general manner, but to the extent that each teacher, designer, etc. chooses a single theory and adapts it to his or her own phenomenological needs and beliefs, such an “accomplishment” may be overprescriptive. It is appropriate, therefore, to mention some general principles or strategies we believe should guide the process of integrating design and theory.

First, the process of planning the instructional enterprise can begin only after the planner meets the dual requirements of understanding both the systematic nature of the design process as well as particular theoretical orientations that explain how learners do learn, might learn, can be motivated to learn, etc. Without these prerequisite under-
standings, it is difficult to "plan" or "design" effective instruction to meet the individual needs of the client. Obviously, in team enterprises this requirement will have to be articulated in a rather formal manner such that all those involved have an understanding from the outset what the basis of their efforts will be. A classroom teacher, on the other hand, would probably not need to do more than outline the requirements. In either event, these understandings will probably have to be committed to paper.

Second, the instructional design situation should be approached as one of a hypothesis testing. Although space has not allowed discussion of any specific formative or summative evaluation strategies, the entire design enterprise should be viewed as amenable to change based on feedback. This would include not only specific design steps or theoretical concepts, constructs, etc., but also the entire design model or learning theory. Treating the process as an hypothesis-testing exercise further delineates the need for stable design technology and learning theory. To the extent that this need is not met, the ability to test becomes meaningless as random decisions and variables intrude on the process.

Third, we agree with Snellbacher (1974) that a single learning theory should be selected as the starting point for entering the planning process. After it is used in some consistent fashion and testing reveals it to be inadequate for certain needs, then it is appropriate to modify and refine by adding, subtracting, or supplementing with additional theories. Related to this line of reasoning, it is suggested that the simplest model of a given theory be utilized initially. This simplifies decision making and testing and allows for elaborations to be made easily as experience progresses. Within this paper the cognitive model outlined (see Figure 2) may be considered to be the theoretical "bare bones," yet it easily permitted the generation of some rather complex design questions.

Fourth, allow the design model to ask the questions and allow the learning theory to answer. When the theory selected cannot answer questions, modification is necessary; if the theory cannot answer a majority of the questions, it is inadequate and should be replaced. This may be a particularly troublesome aspect of integrating design and theory—losing a "pet" learning approach (similar to what Abramowitz, 1978, has labeled "heart-poseses" as opposed to hypotheses). If a theory cannot answer the questions required in instructional planning, however, it is not useful, no matter how intuitively appealing.

Finally, it should always be remembered that the system must be internally consistent. Use of a theory will not always guarantee that a decision in step 4 of the design model will be consistent with a decision made in step 2. Thus, a certain amount of checking back and forth is essential to ensure that the parts "add up" in a holistic manner. Naturally, the more internally consistent one's learning theory or framework is, the less of a problem this becomes.

Conclusions/Recommendations

We have approached this work essentially because of our frustration with the absence of a paradigm or framework for linking learning theory with instructional practice. In daily work with teachers, teacher trainees, and doctoral students, we have seen the difficulties of trying to comprehend instructional practice without theory, and theory without clear conceptual understanding of practice. The literature in education and psychology is sometimes sensitive to these conditions, but little is done to remove them. We have taken a preliminary step in what we hope is a fruitful direction.

The field of educational psychology, particularly, needs to engage in work of this nature. It seems to us that too much time and effort have been spent on systems approaches to the design of instruction without knowing whether these approaches can have widespread utility in the public education sector, or whether they have utility as a device for transforming theoretical statements into practical applications. Tentatively, we believe the answer is yes in both instances, but this has not been demonstrated.

Instructional technologists need to be more honest and open in the promotion and dissemination of instructional design (ID) products and processes. Reiser (1978) has appropriately cued us to a major problem of instructional design: The users of ID products often do not understand the product, how it was developed, or how it should be used. We suspect this problem lies more with designers (who should know better) than with clients who (a) have little or no formal training in instructional design and (b) have not been given adequate directions from designers. We also believe that designers and practitioners should reach some common understanding of the major theoretical notions about learning (if any) that underlie design products. These principles should be made explicit in much the same manner that consumers of other products (e.g., food and clothing) are now given details concerning ingredients and appropriate care and use instructions. It may be that those who design and market ID products have avoided such explicit details to avoid "scaring off" potential customers who react negatively to certain theoretical positions. By not stating theoretical frameworks, a more "mass appeal" of the product is guaranteed.

Finally, there needs to be more emphasis on external evaluation of what has already been developed in educational technology and in learning theory. The tendency to produce increasingly refined paradigms has taken on, in both areas, the aura of an exercise in logic rather than research. It is hoped that future efforts will be directed, not just toward research but towards cooperative research between technologists and theorists.

References


Redesign of a Graduate Program in Instructional Design, Development, and Evaluation (IDDE)

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Introduction
Program and instructional developers do not, as a rule, publicly document their efforts. In most cases, the clients of successful developers, rather than the developers themselves, prepare and disseminate manuals, reports, or articles for use in a defined field or context.

This article, however, is not written by a developer's client. It was prepared by representatives of two groups of instructional development-oriented professionals—a graduate academic program and a university academic service support center. It details the evolution of a new instructional design curriculum at Syracuse University. Briefly, the article serves the following purposes:

Supplement to Required Reports—Both the graduate program and the academic support center are required to submit annual reports of activities to various deans and vice chancellors. This article will supplement both reports.

Program Development Justification—Careful description of faculty contri-

Symposium on Training Instructional Developers

To meet the professional criterion of a specified training program, the field of ID must undertake systematic data-based analyses to determine (a) the characteristics of good instructional developers, (b) the skills and competencies they need to be good, and (c) the kind of training/educational program that can best help people gain those skills and competencies.

The symposium "Training Instructional Developers-Five Approaches" held at the American Educational Research Association convention in April 1980 addressed these three objectives. Papers presented at the symposium by Doughty, Bratton, Markle, Wallington, and Silber appear in this issue of JID.

Doughty describes an approach that produced a research/theory, design, development, and evaluation curriculum component.

Bratton discusses the addition of skills related to content, organization, and values of the profession in which one will work as a developer as an essential curriculum component.

Markle focuses on training developers to think, so that they, in turn, can include such "thinking-level" objectives in what they develop.

Wallington argues that an underlying set of generic skills—applicable to most situations—is more important to success in ID than the specific ID skills. He describes these skills and a curriculum based on them.

Silber carries this argument further, focusing on the underlying intellectual abilities of good developers and suggesting a curriculum based on these abilities.

—K.H.S., Editor
butions to the graduate program is required so that well-informed decisions can be made about promotions, tenure, and salaries. In addition, top-level academic administrators for both groups represented in this report can be kept aware of the support center's contributions to university program development. Moreover, the University Senate Finance Committee is always searching for sources of faculty salary money—particularly from those without substantial justification for existing.

Documentation for External Audiences—Growing numbers of requests for description and justification of the academic program suggest that state education department doctoral review committees, as well as ACET accreditation and certification efforts, will continue. This article provides the opportunity to describe the current status of one program to colleagues in similar programs, perhaps generating communication that will result in further improvements.

Reimbursement for Services and Resources—Rare is the occasion when instructional developers receive public credit for accomplishing impossible missions. One would hope that the acknowledgment herein of the superb services the support center offers will lead to additional backing. This article also provides a vehicle for thanking other academic programs for sharing their graduate survey data, internship procedures, and other types of program guidance.

Overview

How does a graduate program that purports to prepare professionals as instructional improvement researchers and practitioners decide what to teach and how to teach it? The Instructional Design, Development, and Evaluation (IDDE) program at Syracuse University is now completing a 24-month self-assessment that includes reviews of training and instructional needs, curriculum analysis, and critiques by graduates in the field. The University's Center for Instructional Development has been heavily involved as an "external" development agency in designing and guiding the assessment program.

The immediate result of the assessment has been a redesigning of the graduate curriculum. Issues such as the academic and scholarly requirements for doctoral studies have been balanced with requirements for fieldwork necessary to prepare the graduates to practice professionally. Special consideration has been given to theory, research, and inquiry skills and their relationships to applied design, development, and evaluation experiences. The result, to date, is a program that attempts to integrate the varied skills and interests of the faculty, the curriculum design requirements, the field experiences available to students, the projected job market, and the student applicant pool.

This report will outline the rationale behind designing a new curriculum. A major aim of the discussion will be to address the question of why increasingly scarce resources have been invested in revising the curriculum, improving support systems, and developing new courses. By describing the procedures employed in effecting changes not yet completed, this article will attempt to photograph verbally a moving object that is finally slowing to a comfortable jogging tempo.

The rationale for making a change in both program goals and procedures is presented in the following section. Significant internal and external factors currently influencing the program and the field are next described so that readers can judge the wisdom of faculty and developer decisions. The fourth section presents a brief portrayal of the program's general focus and goals, with subsequent sections outlining procedures and results. The final section includes comments about inter- and intra-institutional relationships that serve to promote or hinder the advancement of the field.

Rationale for Change

Of the many factors that influence graduate instructional development programs, several have been discussed but not clearly articulated issues predominate. The concerns to which faculty respond most strongly are especially important because they constitute the bulk of the "constraints and capabilities" considerations that drive program redesign. For convenience, the issues have been separated into those common to most instructional technology (IT) programs in the country and those relatively idiosyncratic to the Syracuse program.

Factors Common to Many IT Programs.

Issues that currently influence many graduate programs in the field include those two demons, inflation and declining conventional student populations. Even well-endowed institutions are feeling the pinch, for they, too, must raise tuition to keep salaries competitive, thus risking further declines in the student population. At Syracuse, for example, a 5% faculty salary raise requires a 7½% tuition increase, and tuition already is at an all-time high. Immediate solutions to such dilemmas, if identified, have not been widely publicized. One short-term solution for some university programs appears to be a policy of severely limiting the number of courses students can take outside the home program. If IT programs ever adopt this strategy, it will suggest that we have exceeded our useful and productive life as the great integrator of skills, concepts, and perspectives.

Additional concerns facing IT programs include the rather dramatic changes in job prospects and skill requirements. Combined with general declines in conventional student populations, these changes create challenges—and opportunities—for us all. An increasing diversity of students appears to be common, including a higher percentage of females, more mid-career or second-career students, and more international students, of whom much is expected when they return home. Perhaps of even greater importance to the future of all IT programs is the dramatically shifting job market. Where once the typical graduate looked to media professional positions in secondary or postsecondary settings, the range of jobs available now resembles a high-caliber smorgasbord. In addition to a still healthy demand for instructional researchers and teachers in academic and research and development (R & D) centers, as well as for professors of educational technology, the new market includes openings for (a) trainers and training developers in business and industry; (b) instructional designers, developers, and evaluators in higher education, government, health, and international settings; and (c) project and program managers for various types of instruction and training.

Idiosyncratic Influences

The current description for the IDDE program in the Syracuse University graduate catalog offers a formal state-
ment of the program's purpose and scope:

The academic program in IDD&E focuses on the systematic research, evaluation, design, and development of educational materials and programs. Courses are offered in the areas of instructional development, educational research design and methodology, message design, media production, evaluation of materials and programs, and theories of instruction and learning. Students are encouraged to prepare themselves with development and management skills for use in educational settings such as instructional development or training centers. All students receive training in research and evaluation skills for use either in the design of instruction, program management, or in postsecondary research and teaching.

How did this program, which in many ways reflects the changes in the field nationally, evolve at Syracuse University? Instructional technology came to Syracuse in 1937 with the establishment of an educational film library. In 1943, an audiovisual service was established at the University. The graduate instructional technology program, one of the first in the United States, was instituted in 1948, with the first doctoral degree awarded in 1951. Meanwhile, both the academic program and campus support services were housed within the Center for Instructional Communications.

During the 1950s, educational film making and audiovisual production were emphasized in the graduate program. As the repertoire of tools available to the instructional technologist expanded during the 1960s, the Syracuse program also expanded, along with collaborative IT programs in a consortium consisting of Indiana University, Michigan State University, University of Southern California, and the Teaching Research Division of the Oregon State System of Higher Education. Applied learning theory and programmed instruction spurred the trend to examine in depth the inherent problems of particular educational settings. Systematic design of instruction incorporated the media as teaching tools. Reflecting these developments, the official title of the academic program at Syracuse was changed during the sixties from Instructional Communications to Instructional Technology. At the same time, the much-expanded campus services program was formally placed under the purview of the vice chancellor for academic affairs and given the title of Center for Instructional Development (CID).

The field of instructional technology and development has expanded into one of the primary articulators of ends and means for instruction. The Syracuse program, like many others, reflects the growing emphasis upon design, motivation, diffusion, evaluation, management, and cost-effectiveness. Currently, the academic program, renamed Instructional Design, Development, and Evaluation, in 1978, stresses the study of analytical tools and procedures applied in an ever-expanding range of settings. These changes in emphasis were made despite the fact that no comprehensive plan for the program had been completed during the previous 10 years because both the field and program leadership had changed so frequently. However, a combination of the local issues and national concerns facing IT programs convinced faculty and administrators 2 years ago that comprehensive program redesign was in order. Several of those issues merit brief discussion.

Maturing Faculty—New faculty joined the Syracuse program in the past decade, and their strong and substantive areas of expertise needed to be blended into the overall curriculum.

Curriculum Influences—Individual faculty members increasingly felt the importance and utility of instructional science, management science, and systems theory as program components, in addition to the traditionally important areas of educational research, media production, and instructional delivery systems.

Discrepancy Between Theory and Practice—Academic requirements for meeting doctoral degree criteria always have been of some concern for those planning careers as field-based professionals. With the growing demand for designers, developers, and evaluators to work in nonacademic settings, even greater discrepancies were possible between academic requirements and nonacademic professional practice.

State Doctoral Program Review—As part of its academic program monitoring responsibility, the New York State Education Department schedules infrequent reviews of graduate programs. When it became apparent that some members of the state bureaucracy had difficulty differentiating among instructional technology, audiovisual aids, and driver education, the Syracuse program decided that a relatively careful and articulate self-study was in order.

Development of a Joint School Media Specialist Master's Degree Program—In addition to conducting substantive and thorough reviews of doctoral programs, the state also requires all programs leading to public school certification to be competency-based. One option at Syracuse was to develop separate master's programs for school librarians and audiovisual specialists. Since the audiovisual positions available in the schools require combined skills and experience, the already uncommonly positive relationship with the School of Information Studies was tapped to obtain external funding to create a joint, competency-based program for school media specialists. This project required careful analysis of the skills, knowledge, and experience required by media specialists, as well as extensive consideration of alternative assessment strategies.

Center for Instructional Development Priorities—Changing roles and priorities of the center and several of its new key staff had marked influences on both the course offerings and the faculty requirements for the academic program. Formalization of financial policies and policies governing the appointment of professional associates created greatly expanded opportunities for IDE students, CID staff/professional associates, and full-time faculty to teach, create practica and internships, and conduct meaningful research, development, and evaluation studies on campus. It also relieved the academic program of several important academic responsibilities, thus freeing up salary resources for investment in other high-priority areas.

Integration of Recruitment, Admissions, Financial Aid and Placement—New kinds of students, new restrictions on entrance testing by the state, high tuition rates, and many new kinds of prospective employers for graduates contributed additional noise to a system already well endowed with static. While redesigning the curriculum, it seemed sensible at the same time to redevelop catalogs, forms, and review
Support and Modeling from ERIC—
The ERIC Clearinghouse Center for Information Resources, an externally funded national project, is an integral part of the academic program and provides continuing impetus for change. In addition to offering support to students, it furnishes state-of-the-art information and techniques that serve as models, and as inspiration, for many programs. This is particularly true in the center’s growing number of computer-related management and communications applications.

Program Focus

It is likely that most of the 159 institutions currently being surveyed by AECT’s International Division for its annual report will be able to supply information on courses and programs in educational communications and technology. What may not be revealed by this (or perhaps any written) survey are the values and priorities imbedded within a program in our field. Numbers of courses in a particular area or special expertise of individual faculty members may imply curricular orientations but not underlying program goals. Because the long-range career aims of the graduates of a program are difficult to formulate and are not likely to be well communicated, the chief responsibility for articulating the values of a program falls upon the faculty. Several program characteristics of particular importance to the faculty at Syracuse had a powerful influence on the redesign planning efforts and are fairly evident in the operation of the current program.

Since the focus of the field has historically been on the practical, to stress the “how, when, where, and how well” of the profession is commonplace. The challenge for us has been to emphasize an equal or even greater concern for the “why.” Perhaps the best illustration is our expanding emphasis on instructional design or instructional science. A prescriptive approach to the design of learning and training programs requires sound rationale and a conceptual base for making decisions. Without these, it is difficult to entertain or to answer the “why” questions.

The development of leadership is the second major characteristic judged to be of particular importance to our program. Our literature and course work related to interpersonal communications, coordination, articulation, scheduling, needs assessment, problem solving, and change suggest that a responsive service posture for our future professionals will hinder rather than foster the development of leadership qualities. Proactive management and leadership perspectives require not only clear explanations of purposes and outcomes but good models as well. In this context, good modeling encompasses the inclusion of the student in decisions on admissions, financial aid, and faculty selection, as well as in work on consulting teams for practice as developers.

A final concern is professional “income,” as measured not in economic terms but in important proxies such as satisfaction, pride, and sense of mission, feelings often translated into a general concern for the quality of life—for client and society, as well as for self. The development of all the above characteristics is the underlying focus of our program—thus the concern for these items during our redesign efforts.

Redesign Process

Rather than present a narrative description of the procedures employed and decisions reached during the redesign phase, a series of component diagrams will be used as the primary vehicle of communication, with comments added where necessary. Figure 1 shows the schedule for program redesign. Each box represents an important event or series of activities that illustrates the process of redesign. Comments or component diagrams for each box follow.

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Box A. Initial Meetings with Planning Team. A planning group, consisting of IDDE faculty and students as well as CID representatives, began the project by setting meeting dates and locations, together with prescribed tasks. The ongoing state doctoral program review and the school media specialist program development endeavor contributed considerable information to the planning team, including the survey of IDDE graduates, refined competency lists, reviews of previous and current placement opportunities, and critiques of internal operating procedures. Particularly useful sets of information and procedure guides were solicited from other graduate programs. These included admissions and graduate survey data and competency lists from Florida State University, internship policies and procedures from Michigan State University, and several reported surveys of graduate IT programs conducted by AECT divisions and members. All served to inform the team members about potential components of an ideal program before they considered operational constraints.

Once the preliminary plans and general specifications for the project were completed and reviewed, additional faculty and students were recruited to assist in detailed planning (Box B) and content/skill analysis (Box C). This allowed all faculty to make meaningful contributions in areas of special interest and to consider major issues related to curriculum sequences, assessment strategies, and overall instructional strategies.

Box B. Continued Planning Team Meetings. The expanded team sessions reluctantly moved away from outlining the ideal program into considerations of prerequisites, prior course work and experience, admissions, and advising. One primary purpose of these sessions was to foster open, involved dialogue and teamwork on well-specified tasks, with time frames fixed and maintained by CID developers. Healthy conflicts surfaced during these sessions when decisions were made about such issues as the relative importance of design compared to that of development and the role of evaluation in the curriculum.

Box C. Functional Specialty Groups. In order to make the best use of the surveys, competency reviews, and information shared by other programs, groups were organized around functional specialty areas. These groups concentrated on areas such as instructional research and theory, instructional development, and media production and utilization. Initial tasks included clustering of content, goals, skills, values, and contexts so that meaningful blocks of instruction and learning outcomes could be defined. Dubbed "clump analysis" by developers concerned about the mixing of unlike commodities, the clustering nevertheless greatly aided the later content and learner task analysis conducted by the functional specialty groups. Emphasis within specialties were determined by each small group, but relative emphases across specialties were decided in later full planning team sessions (Box E).

Box D. Community Meeting. The first progress report was presented at an open meeting of the IDDE community. Although scheduled during spring semester finals week, topics such as new core courses for all degree programs, required course sequences, and a revised instructional science arrangement drew an attentive, supportive audience,
Selected student involvement from the beginning, including the use of CID development interns, helped ensure consumer input on the adequacy, sufficiency, and fairness of the changes under discussion. It also helped recruit additional student enrollees for the following fall semester's practicum courses, which created actual course outlines, syllabi, assessment schemes, and, in some instances, study guides (Box F).

**Box E. IDDE/CID Planning Workshop.** A final 2-day marathon meeting was held to finalize agreements, resolve remaining conflicts about arbitrary curriculum sequence and content emphasis, and develop the first of many component outline drafts. This initial draft included several of the key assumptions about the ideal program but did not yet differentiate between such issues as master's versus doctoral requirements or relative curriculum weighting across or within functional areas.

**Box F. Fall 1979.** The results of the spring planning workshop allowed a small team to continue working during the summer so that an expanded second component outline could be ready for review in the early fall. Credit hour estimates were included as indicators of student time and energy requirements. This outline allowed several practicum groups to analyze quickly the functional specialty "chump analysis" results and begin to detail content outlines, define quasi-behavioral student outcomes, and specify evaluation and assessment criteria and procedures.

**Box G. Finalize Core Experiences and Define Curriculum Sequences.** By the beginning of the second semester, approximately one year after the initial planning meetings, a detailed three-phase curriculum overview (Figure 2) had been prepared. This outline identified in detail the basic components of the doctoral program, which included most of the elements required for defining the master's and specialist programs. Not all sequences, prerequisites, and credit hour weighting had been specified, but the basic blueprint was now ready for the specialists to flesh out.

**Figure 2.** Several of the components identified in Phase I, for example, were inquiry, research, and foundational experiences currently being offered or developed in programs outside of IDDE. Once identified, these programs were offered suggestions about appropriate scheduling of courses, since IDDE students could, at times, comprise a significant portion of course enrollments.

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Additional results of this process are discussed briefly in the following section.

Results

Although the redesign process is not yet completed, major program curriculum decisions and agreements have been made. Course outlines and instructional components such as modules and lesson guides have been completed and tested for many of the core courses. Advanced seminar courses and several of the courses identified in Phase II (Advanced Study) sections of Figure 2 always will require considerable revision in content and delivery since the topic areas are less stable than others in the field.

Relationships with professional associate faculty (primarily CID professionals) and external academic programs have been improved considerably now that defensible program goals and sequences are public knowledge. Moreover, joint master's and doctoral programs, dual faculty appointments, team teaching, and joint recruiting ventures have been facilitated. Our response to the twin demons of inflation and declining enrollment thus has been to press for integration of curricula with collegial programs such as higher and adult education and to have data supporting the instructional productivity of individual faculty and the program as a whole. Although it is increasingly difficult to present any data as powerful as those describing student credit hours generated, evidence of quality instruction and a substantive curriculum helps argue the case for new faculty, for salary increments, and for improved facilities. (Syracuse visitors can identify easily which of the three has not yet been accomplished.)

Implications

There is growing evidence that, at long last, education and training no longer will be justified by arguments for socialization, entertainment, and work place queuing. For example, as a labor and cost intensive activity, the press for evidence of the productivity of training requires skilled professionals capable of assessing the efficiency and effectiveness of well-designed and implemented interventions. Who better to provide this service and leadership than knowledgeable developers or instructional technologists? This is especially true when developers can use evaluation or assessment as the entry for development.

The evidence at Syracuse suggests that other schools and programs are realizing the relevance of our field for their graduates. In several instances, the reverse also is true, and IDDE students are enrolling in international development and policy analysis courses (Maxwell School of Citizenship and Public Affairs) or in strategic planning and institutional research courses (higher and adult education) as part of their programs. Cross program enrollments existed prior to redesign, but rarely were these experiences well integrated or supported. Now there is growing support for cross enrollment, not simply because it makes sense economically, but because it is a necessary component of well-designed graduate programs.

To suggest that all is now well under that blanket of Syracuse snow would be misleading. There always will exist a healthy tension between the academic and the practical. If ever the IDDE program, the Center for Instructional Development, and the graduate school agree without reservation about the relative emphasis to be placed upon theory, inquiry, development, production, and interpersonal skills, then we will have failed as academics and developers. There never will be enough time or other resources for master's or doctoral candidates to learn all that is necessary to become accomplished professionals. The compromises made during redesign forced us to consider what was absolutely necessary, what was important for many, and what was important for particular faculty members and their doctoral students. The promise made to all was that we would not have to do this again at least until 1984. But then over lunch we started discussing the best way to help future developers practice their interpersonal skills, and that suggested a new practicum arrangement and . . .

Particularly Useful and Obtainable References Employed in IDDE Program Redesign


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BACK ISSUES

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Training the Instructional Development Specialist to Work in Unfamiliar Content Areas

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EDITOR'S NOTE
This article deals with only one general approach (the interview): We recognize that sometimes the ID must rely only on printed sources of information. Readers are asked to submit articles that explore how best to train ID students to learn new disciplines from printed materials.

Abstract: Most ID practitioners face the challenge of designing instruction in a content area about which they have little personal knowledge. To obtain a rudimentary understanding of the content, some peruse texts and journals and others interview experts in the field. But little is known (or at least published) about the specific techniques developers employ to gain an understanding of unfamiliar content or ways to teach such skills to ID graduate students. This article explores the ID skill of comprehending unfamiliar, specialized, and sophisticated subject matter by first noting the nature and characteristics of disciplines and knowledge. Second, self-reports of experienced developers are presented, particularly from those who employ the interview approach to gather information. Finally, the relatively new field of ethnography is examined for heuristics that may be helpful to developers who interview clients for information about content areas.

An instructional development specialist (IDS) engages in several intellectual tasks. During the first several meetings with the subject-matter expert (SME) or client, the IDS may be trying to (a) understand the nature of the instructional/training situation being presented, (b) establish and maintain a professional consultation relationship with the SME, and (c) grasp some understanding of the subject matter if the content area is unfamiliar.

In a recent national presentation, Silber (Note 1) delineated these three broad activities into six specific “thinking processes” that developers use:
1. The developer is presented with some problem related to learning and/or performance.
2. The developer must gather information about the problem, analyze it, synthesize it into a coherent statement, and evaluate the statement in terms of reality.
3. The developer is presented with a body of content to learn.
4. The developer must analyze the body of content and restructure (or synthesize) it into a form that takes into account both the integrity of the content and the learning and instructional principles to be applied to it.
5. The developer must evaluate the accuracy and adequacy of this restructuring and restructure again if the original attempt is not successful.
6. The developer must translate the verbal written form of the content into other communication formats, such as visual and oral media.

It is the experience of the authors that much time is required at the beginning of any instructional development project for the instructional designer to become familiar with, and well enough versed in, the subject matter to be taught. In order to be an effective participant in the instructional development effort. The requirement of being expert in the subject matter is slightly tempered when an instructional development team is developing materials for the K-12 curriculum. In this case, the instructional designer already has an idea of the subject matter that is taught in these grades because he has, more than likely, studied the subject matter in public school. It is in the design of highly specialized subject matter in post-secondary education where the lack of sophistication in that subject matter inhibits the contributions of the instructional designer. (p. 13)

It is the author’s experience, as a teacher and as a developer, that working with unfamiliar subject matter is a real concern to ID students and to practitioners. Graduate students question their ability to work in content areas other than those with which they are familiar, and practicing developers note the added effort required when they must learn a new content area in order to help a client.

The purpose of this paper is twofold: to attempt to describe how practicing developers might grasp unfamiliar subject matter from content experts and to suggest some implications for the training of students for the ID profession.

Author's Note. The author wishes to thank Donald Langstaff and Patricia Weger, ID graduate students at the University of Iowa, for their literature reviews that contributed to the preparation of this paper.
When a cursory review of prominent ID texts and periodicals produced no information about how developers grasp an understanding of unknown content or how to prepare ID graduate students for the task, three different approaches were taken to uncover clues that might be helpful in understanding the situation. One examined the nature of disciplines and organized knowledge. The second investigated how experienced developers deal with the task. And the third looked at another professional role that faces a similar problem.

Two questions were posed for the research on disciplines and knowledge: Are all disciplines structured to permit logical ordering and analysis of the subject matter regardless of the particular content area? Is there a master structure or general theme across the various fields of knowledge that, if mastered by an IDS, would enable him/her to quickly understand the subject?

Unfortunately, a review of the literature (Brobeck, 1962; Elam, 1964; Ford and Pugno, 1964; King and Brownell, 1966; Lewis, 1972; Pheris, 1962; Schwab, 1962; Tyler, 1964) produced negative responses to the questions. Bruner (1955) put it succinctly, “Disciplines do not lend themselves to simple classification. There is no single organizational principle” (p. 56). There appears to be little information here that will help prepare ID trainees for the problem at hand (Note 2).

The second avenue of investigation asked, “How do experienced developers work in unfamiliar fields?” This question was put to ID practitioners at six higher education institutions in the United States (Alabama, Indiana, Iowa, Kansas, and New York). The impromptu telephone inquiry surprised some of them; they acknowledged the importance of the question and the issue behind it but admitted that they had not given it serious consideration in terms of their own ID work. Most suggested that when embarking on a new project in an unknown area they read texts and/or discussed the content area with the SME. The most frequently cited approach was to interview the SME in order to learn about an unfamiliar topic.

The IDS practitioners who were more introspective about their style of work suggested that the interviewing strategy was a critical factor in learning about a new field from the SME. They reported interviewing the client with specific goals in mind; they used inductive, deductive, and inferential questioning strategies. They offered analogies and presented tentative conclusions to the SME during the discussion as a means of clarifying their own understanding of the content.

These same insightful practitioners noted they were not specifically trained during their professional preparation for this task. Opinions varied on how best to provide such training, but role modeling was most often suggested; that is, allowing for trainees to observe practitioners in interviews with clients.

Is there another profession in which the practitioners must learn about a content area through interactions with clients? Several similarities exist between the developer’s task to comprehend unfamiliar subject matter and the ethnographer’s attempt to understand an unfamiliar human culture. Ethnography, the study of human cultures, often involves fieldwork within the culture being examined, as a “participant-observer” the ethnographer tries to uncover explicit and tacit knowledge about the culture from its members. Both developers and ethnographers are “outsiders” to the area of interest—the IDS seldom is an expert or scholar in the specific content area to be developed, and the ethnographer usually is not a member of the society or culture under study. Both rely on personal interviews as a primary means of gaining understanding. These interviews include two distinct but complementary processes: establishing rapport and eliciting information.

Spradley’s (1979) description of ethnographic interviewing techniques may be useful to instructional developers. He describes in detail three major types of questions for eliciting ethnographic information: descriptive, structured, and contrast.

Descriptive questions are global in nature and are designed to encourage the respondent to talk about a particular topic. They are open-ended and used by the interviewer to discover relevant follow-up questions. Asking a descriptive question, in Spradley’s words, “is like offering the person a frame and a canvas and asking him to paint a word-picture” (p. 85). An example of a descriptive question asked by an IDS might be, “Can you (the SME) describe the major topics in your course?” An important heuristic for ethnographic interviewers is that expanding the length of the question tends to expand the length of the response. The example above might be expanded to the following: “Your field is new to me, and it sounds very interesting. Can you describe the major points you cover in this course? If I were a student what would I learn?” Spradley says expanded questions not only give clients time to think but also communicate your interest in learning as much as possible from them.

Structural questions are more specific than descriptive ones and are used to gather detailed information about a particular topic. Spradley gives this example from an ethnographic interview, but it could have occurred in an IDS-SME discussion:

Interviewer: We’ve been talking about your ballet classes and you’ve mentioned some of the different exercises you do in class. Now, I want to ask you a slightly different kind of question. I’m interested in getting a list of all the different kinds of exercises done in class. . . . This might take a little time, but I’d like to know all the different types, what you call them. (p. 122)

Structural questions also can be used to confirm the interviewer’s understanding of the content. Two forms of structural questions relevant for developers are inquiries with yes/no answers (“Is a sodium-restricted diet used only with renal patients?”) and with examples (“Let me see if I understand—/a movement to down center left on stage puts the actor in a more powerful position?”).

The contrast question is a still more specific type of interview question. It is directed at discovering the meaning of discrete facts and concepts and the relationship among them. Spradley warns that it usually is fruitless to ask an interviewer to give a definition of a fact or concept; the response probably will be filled with more deeply embedded facts and phrases! Instead, the interviewer should ask how a concept is related to another or how it is different from another or ask the interviewee to provide an example. For example, the IDS might suggest that a volleyball instructor explain and demonstrate the difference between a “bump” and a “dig” rather than ask for a definition of the terms.
While the ethnographic inquiry sequence appears to move from opening descriptive questions to structural questions to contrast questions, Spradley indicates that actual interviews seldom follow this pattern; in reality, descriptive and structural questions are asked early and throughout the interview, and contrast questions are eventually interspersed. The goal of the interview is to elicit as much relevant information as possible without boring or grilling the client with repetitious questions.

The following ideas are presented for the training of instructional developers who will come in contact with unfamiliar, specialized, and sophisticated subject matter. They are offered to spur further discussion and inquiry on this topic.

Factors taken into consideration for the initial admission of applicants into ID professional preparation programs should include their experiences and intellectual capabilities. For example, applicants with a strong liberal arts undergraduate degree or with work experience in several fields may be familiar with the structure and content of a number of disciplines and subject areas. Applicants, too, might be screened for their intellectual capability, i.e., the perspicacity to retain, understand, and relate abstract concepts and principles—an ability often required of the developer in the early stages of an ID project.

Once admitted to the training program, the students might be exposed to the following training opportunities:

1. Formal study in academic fields outside the area of ID and the College of Education. This study will provide the student with a firsthand opportunity to observe how different fields conduct inquiry, hold values, communicate internally, and view the teaching/learning process. (ID doctoral students at the University of Iowa, as well as at several other major higher education institutions, are required to pursue a minor area of specialization outside the College of Education.)

2. Formal study and discussion of the task of working with unfamiliar content. A class that included selected readings focusing on interviewing techniques, reviews, and critiques of recorded examples of actual ID-SME interviews and discussions led by an experienced ID practitioner might at least reduce student anxiety. A class in ethnographic interviewing offered by the anthropology department could prove useful.

3. Formal practice in questioning and interviewing. First in highly structured simulated settings with SMEs representing various disciplines and later in more realistic complex situations. In all instances, students should receive feedback about their performance. Courses and practicums in counseling on consulting, particularly ones employing interpersonal process recall techniques, would be helpful.

4. Internship experiences to observe ID practitioners on the job in SME interviews followed by meetings where the student and the developer discuss the interaction and interview techniques employed by the IDS. Later, students should carry out SME interviews in the presence of an experienced IDS followed by a debriefing and feedback session.

In the area of continuing professional education, practicing developers continually should seek opportunities to improve their skills by attending professional meetings, sharing their experiences and successful techniques with colleagues, and engaging in self-diagnosis and self-initiated study.

Reference Notes


2. The disciplines, however, do seem to share some interesting common characteristics. Each has its objects of study and unique processes of investigation. Each possesses schools of thought, particularly about the nature of man, the nature of knowledge, and how one becomes a member of the scholarly community. Teachers and scholars in a particular discipline use common jargon and modes of communication, and they typically share similar attitudes about how best to present the field to students and how students learn. Interested readers are referred to Elam (1964) and King and Brownell (1966).

References


Training Designers to Think About Thinking

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Abstract. Instructional products can be characterized as reaching three different levels of achievement: (1) students remember the information presented; (2) students can apply conceptual classification schemes, can apply rules, or can follow procedures; (3) students can discover how conceptual and rule-governed structures work. While memory is often a useful outcome, it does not imply the ability to use the knowledge. Ability to think at an adult level is an increasingly called-for outcome, especially among science educators, an outcome that calls for new ways of designing instruction. Designs that enable students to apply conceptual schemes and rules do not foster thinking skill development. The pursuit of efficiency and content coverage in instructional products will have to be sacrificed in some cases in order to train students in thinking skills.

In the beginning was the Word. The Word was given and the Word was received. In the mid-fifties, the most popular design for instruction required the programmer to construct a sequence of not more than 30 words in such a way that at least one of them occurred twice. The second coming of the important Word required student activity, namely filling in a blank. If the designer had artistic talent, the student could be assisted in this challenging task by all sorts of attention-getting devices, e.g., italics and underlining. If this did not suffice to ensure correct blank-filling behaviors, one could also manipulate the characteristics of the blank itself by providing initial letters or the correct number of spaces or by some other similar prompt. The subsequent instructional design problem was to provide enough practice—an empirically based concept—so that, given the beginning of the sentence on the posttest, most students could fill in the blank without all that prompting.

It was a simple design. It required no thought whatsoever from the student and very little thought from the designer, provided the designer could read a good textbook on the subject and identify important technical terms and statements of principles from less important ones. And, in spite of all the evidence damning it (Anderson & Faust, 1967), it is a design that is still very much with us. Sometimes, as you can discover easily by checking the “programmed” section in some of the student workbooks that accompany mass market textbooks these days, it is still used in its antique unadulterated form. There are also variations on the design. The medium of presentation is one of its variable attributes. I recall a friend objecting to “taking dictation from a tape recorder,” often with the assistance of a slide. You can use video if you have it. And, of course, a lecturer can write on a blackboard or overhead projector for students to copy into their notebooks. Other variable attributes render the design a little more subtle but nevertheless present. One can increase the amount of verbiage to be reproduced, moving from a fill-in test item to a whole essay. One can increase the interval between the presentation of the word and the request that the student reproduce the word. One can even provide an example or two of what is being talked about without overstepping the bounds, provided that the student is not required to decide whether the example is indeed one (Markle, 1978). The critical attributes of the model are that the student is told and then the student repeats back. Because the requirements that the student must meet are to remember and reproduce what was said, the error signals coming back to the designer during formative evaluation are relatively simple to handle. If the student forgets, give more practice.

Memorization is a distinguishable category in almost everyone’s taxonomy, inside instructional development (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956; Gagné, 1965; Merrill, 1971) and outside. What Skinner (1957) called “intraverbals,” Gagné (1972) “verbal information,” or Tjumann and Markle (1978) “verbal repertoires” may be relatively complex behaviors involving organized knowledge and even paraphrasing of the original words, requiring instructional designs far more complicated than the filling-in-the-blank design. But these outcomes are still manipulations of words in ways that do not necessarily involve real understanding.

In a charmingly simple diagram, Faust (1977) recently suggested that design principles could be organized according to a 2 x 4 scheme for classifying objectives. Four basic kinds of content—facts, concepts, rules, and procedures—map onto two different kinds of behavior—remember and use. I am going to add one level to Faust’s model, giving it an equally simple name in keeping with the others. The third level is “create,” a rather ambiguous term that would include the wildest level of creativity as well as construction or discovery, under any level of guidance, of what others already know.

The model in Figure 1 is much simpler than elaborate models such as Guilford’s

three-dimensional structure of intellect (1967) or Bloom's taxonomy, both of which had more categories of contents and behaviors. This model also differs from some of the taxonomies mentioned earlier because it provides a slot for remembering with respect to concepts and rules while others would restrict conceptual behavior to the "use" level. But it will do as an organizer to enable me to place instruction targeted toward thinking skills on its own separate level. The three levels have a certain degree of independence. I think we all agree that students may learn verbal information at the bottom level without being able to use it, and they may be able to use classification schemes without being able to verbalize the critical attributes or behave in rule-governed ways without being conscious of (i.e., verbalizing) the rules they follow. I'm not clear on how one could invent or discover a rule, however, without being about to use it, so the third level may imply the second level.

A bit of relevant ancient history is the 1960 paper by Evans, Homme, and Glaser (published 1962), describing their RULEG system for designing instruction in verbal subjects. It put instructional development squarely on the second level of Faust's diagram and constituted a significant improvement over the tell-them-and-have-them-fill-in-the-blank designs. The authors provided a clue to why we are primarily fixated on the second level: "Rather than run the risk of having the student induce an incorrect RU, it seems preferable to state the RU for him explicitly." In the past 20 years, most of the highly effective instructional products fall in this category. The sophistication of the appropriate designs is far beyond the simplistic RULEG formulas (Markle, 1978), but the learner's behavior remains equivalent to the outcomes implied in the early paper. Given a definition, the student classifies; given a rule, the student applies it; given a description or demonstration of a procedure, the student follows it.

Subject-matter experts at the forefront of their disciplines are operating at the "create" level. It strikes me that our real progress in instructional design has been in the increasing sophistication of the analysis processes required of designers. Designers also are operating squarely in the top row, even when the instruction they are to design is not at the forefront of the discipline. There is a reason for this. The RULEG authors may have believed that the rules were known and that it was, therefore, possible to state them explicitly for the students to apply. Most of us have discovered otherwise. The concept analysis procedure, for instance, sprang from the frustrations of attempting to get students to use conventional definitions to classify examples and nonexamples (Markle & Tiemann, 1969). When you ask students to remember the definition of a concept or to recall the correct classification of given examples (back to the bottom row), the feedback from trials with students provides no error signal about the adequacy of the definition. But ask students to classify wide ranging new examples, and the feedback often will indicate how bad most of the definitions are. The same can be said for rules and procedures. The breakthrough in analysis led to the development of algorithms and decision tables (Lewis & Horabin, 1977) that made explicit the underlying logic of the applications. The secrets and unstated assumptions that students gradually stumbled on through trial-and-error practice are now clarified by analysis. Similar creativity has been applied to cognitive tasks in the familiar design documents that show hierarchical task structures, associated with Gagné (White & Gagné, 1974) and with Resnick (Resnick, Wang, & Kaplan, 1973).

Landa's work (1976) falls in the same category of discovery. I'd like to use his amusing chapter title "He couldn't figure it out because he couldn't figure it out" as a motto for instructional developers. Landa coined that title to express the frustration of a geometry teacher who couldn't teach a student to prove theorems because the underlying thinking strategies were unknown to the teacher. We can presume the teacher could do them, but doing them does not mean that the doer can communicate what is going on inside the head. To restructure Landa's phrase, he—the student—couldn't solve the problem because he—the teacher—couldn't verbalize or demonstrate the cognitive procedures involved.

It is fashionable to call for more research, and certainly we don't know all there is to know about teaching problem solving skills. However there are some useful ideas floating around. Both in research and in practical applications, there is an emphasis on developing protocols of thinking processes—blow-by-
blow descriptions of how the thinker is proceeding through the problem (Lochhead 
& Clement, 1979). Problems in college-level disciplines require a heavy component of knowledge along with the 
procedural skills required to think like a subject-matter expert. Also, for my 
particular students, who are experts in their disciplines, it is very hard to get the feel of the tentativeness of the thinking 
processes involved when they attempt to analyze problems they already 
know how to solve. So protocol practice begins on a wide variety of so-called "simple" problems where the prerequisite knowledge may be as simple as knowing the alphabet or knowing basic arithmetic facts, but the cognitive processes can be as complex as any in chemistry or physics. There are several rich lodes to be mined for anyone who wants to think about thinking, among them the Piagetian exercises from Renner's 
group (Renner, Stafford, Lawson, McKinnon, Priot, & Kellogg, 1976), the Guilford-based series by Samson (1975), 
the eclectic course materials from Whimbey and Lochhead (1979), and the creativity exercises of Parnes (1967), as well as brain twisters that research psychologists have been using for years.

A good example of the latter is the conservative focusing strategy from Bruner's classic research on concept formation (Bruner, Goodnow, & Austin, 1956). Recast into the analytic documentation modeled by Resnick and her associates (1973), the procedure for solving these problems is shown in Figure 2.

Data abound in the concept formation literature demonstrating that college students confronted with such problems do not exhibit such an organized attack on solving them. Although the domain of problems used in research studies may be of minimal interest to most science educators, it is not difficult to demonstrate that the steps in the strategy are basic to many problem solving procedures in many disciplines and to comprehension of many disciplines. With a few changes in the steps, the focusing strategy is directly parallel to the two different approaches to concept analysis of Markle and Tiemann (1969) and Becker, Engelmann, and Thomas (1975). With very few changes, the diagram can be reconstructed as a flowchart of the major Piagetian formal operation "manipulation and control of variables" tested (and found wanting in many students) by Renner and his associates (1976). A similar strategy is employed by a subject-matter expert in attempting to build a rational classification scheme in a not-yet-organized area of a discipline, where the attributes that will result in well-defined coordinate and superordinate relations are not the simple ones of color, shape, and numerosity of Bruner's early experiments.

One of the demonstrable generalizations of this family of strategies is its applicability to "discovery" exercises of the sort shown in Figure 3. The exercise shown there was an erroneous design generated by one of my students that the present generation of students is required to repair (Markle, 1978, p. 151). To solve the problem correctly, learners must go through steps very similar to those in Figure 2. The error made by the designer lies in providing insufficient information for learners to complete the third step in the hypothesis-testing strategy, leading to a 50% error rate on the exercise.

The design for the "function" exercise, when done correctly, falls into the top level of Figure 1. The learner is required to generate hypotheses about potential attributes, test these against the information given, construct the correct rule, and apply it to the choices given. There is some evidence (cf. Egan & Greeno, 1973) that forcing the student to think through the classification scheme, as this design does, results in some deeper level of comprehension than do designs that verbalize the scheme and ask the student to apply it, in other words, designs at the "Use" level. Further research to tease out what else it might be that students learn when forced to construct rather than to re-
receiver knowledge certainly is needed. But, if the results hold up, the wisdom of many science educators who now exhort us to get the students to think through the subject matter rather than digest it will be vindicated.

At the moment, I would have to admit to a very qualified success in attempting to change the behavior of teachers towards greater emphasis on training students to think. In classroom exercises, my students can discriminate between exercises (or objectives) that fall at the third versus the second level of the content/behavior matrix. They can repair faulty exercises such as Figure 3 in simple subject matters, given data indicating that learners fall flat in trying to solve the problem. They can take a design in which the rule is stated and the learner is to apply it and turn the design into one in which the learner is to discover the regularity involved. But, if they can do all these things, will they? At the end of the course, each designer creates a product of whatever type would be most useful in his or her ongoing teaching situation. To date, almost none of these products has applied the design principles at the third level. Why?

I think there are two reasons for this. One is habit, "Instruction" conventionally involves a great deal of teacher talk. As the old timers in RULEG noted, human verbal behavior is so efficient that telling the student gets you there fast—if what you tell is true. All design students have had many years of experience with instruction as learners, and most of my students are experienced as instructors too. They know how it's done. Glad as they are to escape the memory level, the second level is comfortable and satisfying.

The second reason is the press of time, not just time to do the requisite analysis and design at the highest level, but the press to cover the discipline. For most instructional designers working within conventional colleges and universities, freedom to teach what one wishes in the way one wishes is not possible. Few young teachers have the political clout to throw out the department syllabus and the fat respectable textbook and to reorient their courses to where the students are in their cognitive development. No one has presented the case with more passion than Arons (1973) talking to his colleagues in physics: "If we are serious about cultivating some measure of . . . understanding . . . we must give the students time to learn; the pace must be slow enough to let them confront the evidence, to think and contemplate, to relive some of the steps by which the human mind first achieved these insights . . . . When I urge, as I do here . . . that we back off, slow up, "cover less, give students a chance to think and understand, some- one invariably demurs: 'But if we stop way back here, if we do not cover our subject, students will never know about this . . . .' To this I can only respond that the demurrer constitutes a terrible prostitution of the word 'know.'"

There is a small but increasingly volatile chorus across the country opposing the viselike grip of content coverage and calling for cognitive development—i.e., thinking—as the valuable outcome of liberal arts education. When we become the majority, instructional designers will have to be ready with the skills and models for reaching these important new objectives.

References


Generic Skills of an Instructional Developer

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While a strong case could be made that instructional development has been around for some time under various guises with other names, another view is that instructional development is simply a refinement and logical extension of the work of W. W. Charters and other educational engineering pioneers. But instructional development is new—new not only because of a new name, but new (or renewed) with vigor and a new concern about who and what make up this field.

Instructional development, in attempting to become a profession, is beginning to examine itself more closely. Because a profession emerges from and reflects the activities of practitioners within the field, this self-examination must include the abilities of those practitioners. However, investigation of developers' abilities has yet to be done in any large-scale, organized fashion.

Previous Studies

In 1974, AECE did publish a list of basic tasks of the technician and specialist levels in the area of instructional program development. While a percentage of the task list was gathered through field observations and on-site task analyses, the final list was compiled by committee and, thus, became a mix of both what an instructional program developer did and should do. The task list was not developed further into a list of more general abilities nor was the list field-tested by further analysis.

More recently (1978), the American Society for Training and Development (ASTD) conducted a national survey of its membership to determine the activities of “training and development” practitioners in business, industry, government, and public institutions. The survey itself was a self-report based on a task list generated by a committee and reviewed by selected ASTD chapters. The survey findings were reviewed by a committee and, like the earlier AECE work, the tasks were grouped by a committee. Because of the difference in conceptual models used to group tasks, ASTD had no grouping for instructional systems development (the AECE term) although a grouping probably could be constructed by combining ASTD task categories. 

Generic and Specific Skills

At this juncture, some commentary on generic skills is needed. Most task analyses directly reveal tasks performed, not skills involved. The relationship between task and skill is that the task is one of many possible performances stemming from an underlying skill or skills. External conditions surrounding and cueing the performance shape the specific task performed. The performer's current condition, underlying attitudes, and other worker traits also shape the actual task performance.

From a number of performances under similar external conditions, using a number of different performers, the underlying skill can be inferred. The skills may be relatively narrow or may involve complex performances with a

1In the 1950's and the early 1960's, when much of the foundation of instructional development was being laid, the term itself was largely unused, if not unknown. In the late sixties and the early seventies, the term received special impetus from the federally funded National Special Media Institutes. These evolved into the Instructional Development Institutes. The term now is used primarily in postsecondary education and professional schools. In the elementary-secondary world, instructional development is confused with curriculum development and media services. In government, business, and industry, it runs head-on onto the more encompassing term, human resources development.

2The term abilities is used here to include knowledge, attitudes, belief, and skills—skills being the application of knowledge as shaped by attitudes.

3Keep in mind that in most cases, the publication date of material minimally reflects work that ended at least 6 months—more likely 12-18 months—before. And, that is the end date of the work. When the article or report is written, data may have been gathered 6-18 months prior to that. Thus, the information and data base from which the article or report was developed is likely to be about 2 years old. This is true of the AECE report.

4The term government includes all levels of government, and public institutions are herein defined as institutions open to the general public even though privately owned or operated.

5Kerr (1978) outlines the role of a developer-like person but uses the term "educational communications consultant" and seems to be addressing only the K-12 area. One problem that arises is that the social, organizational, and legal problems related to instructional development in K-12 institutions are often different from those in postsecondary education or in business/industry, or in government. There also may be major differences in institutions that are similar in mission but are in the public and private sectors. There is, then, any number of reasons why little seems to have been addressed to the general abilities expected of instructional developers.
number of abstract variables having no inherently correct solution. A real problem lies in the scope of generic. How generic is generic? In a hierarchical taxonomy of skills, each higher skill must be regarded as generic to skills directly subordinate to it on the hierarchy. Thus, generic becomes solely an operational term deriving its meaning from the context in which it is used. To put the rest of this article in perspective, remember that the context is that of the overall training of instructional developers in a graduate-level program in formal education. The context of formal education is important because the approach to training instructional developers in other contexts, especially business and industry, is quite different. The generic skills we will look at are for the most part rooted in specific instructional development performances and skills but not so general as to be unteachable over a 2 to 3 year period or genetically innate. These skills, however, do relate directly to some traits or prerequisite without which the skill may be impossible (or highly improbable) to learn. For example, it may be impossible to teach the skills of developing a learning task hierarchy to a learner who does not have the ability to manipulate abstract information. Similarly, teaching the androgynist interpersonal skills may not be possible.

A second view of generic skills in this article will be that we are looking for a magic number of seven, plus or minus two. In all honesty, this is done for the sake of convenience to establish a generic skill level from someplace between the procedural skills in instructional development (e.g., conducting a needs assessment, choosing an instructional strategy) and an innate skill such as general intelligence (however measured). In the following pages, we will consider five generic skills, some fairly specific to instructional development, others less directly related but still applicable to instructional development concepts and procedures.

In the order of their appearance, the five are:

- Interpersonal communications skills;
- Extracting and assimilating chunks of information and working them into a logical (as defined by the subject-matter expert) framework;
- Solving problems, mostly in instructional development;
- Applying principles of the behavioral sciences;
- Systematically searching for related information.

There is a sixth that is less generic—learning, keeping up with, using, adapting, and creating instructional development procedures. This includes using instructional development terms in conversation. After all, if you can't speak the language of instructional development, your I.D. colleagues won't recognize you as an instructional developer, even though your clients will.

Level of Skills and Practice

Perhaps this difference between the first five generic skills and the sixth less generic skill has to do with the level of practice with the field. In Jobs in Instructional Media Study, Hyer, et al. (1971) used worker instructions to set three general levels of performer, aide, technician, and specialist—a concept later used by Grady (1974) and Frigge (1974) in AECT certification studies.

Reigeluth, Bunderson, and Merrill (1978) differentiate among “scientists, who discover principles, technologists, who use those principles to develop procedures, and technicians, who use those procedures to produce instructional products.” (Italics as in original.) Scientists, according to Reigeluth et al., are more concerned with general principles than with the actual development of a specific piece of instruction. Technologists and technicians may equate with the practicing instructional developer. This reaffirms the two-role “instructional developer.” One role emphasizes the theoretical side of instructional development and the second stresses the actual development of an “instructional product.” This sixth less generic skill rests more heavily than the rest on what the field actually involves.

The Scope of Instructional Development

In dealing with the generic skills of the developer, some limits to the field of instructional development must be set beforehand. There are an abundant number of definitions of instructional development—at least one or two per author in the field. According to the recent AECT glossary (1979), instructional development is:

A systematic approach to the design, production, evaluation, and utilization of complete systems of instruction, including all appropriate components and a management pattern for using them; instructional development is larger than instructional product development, which is concerned only with isolated products, and is larger than instructional design, which is only one phase of instructional development. (Italics as in original) (p. 20)

This "systematic approach," which includes "... a management pattern for using them (all appropriate components of a complete system of instruction)," also implies a direct and strong interaction between the instructional developer and managers within the total organization or institution. This interaction usually occurs in order to secure the cooperation and appropriate support for the development and installation of the aforementioned instructional system.

Deriving Skills from the General Literature

In the absence of a large body of information on the skills of an instructional developer, it is only natural to turn then to the general literature of the field for support. The main body of instructional development literature, however, is largely dichotomous. It either deals with specific systems, models, and techniques of instructional development or it is made up of case studies of instructional development projects. While the information in both areas is undoubtedly needed, the skills must be inferred from the information presented. The different types of literature often lead to different inferences.

Interpersonal Skills

The systems and models approach places emphasis mostly upon the cognitive skills of the developer. The case studies, whether directly or by infer-

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*See the article by Tim Bentley in the February 1980 issue of the newsletter of the Industrial Training and Education Division (ITED) of AECT and a description of some differences.
ence, often stress the importance of interpersonal communications skills—an ability often lacking in training programs. Diamond et al. (1973), in a chapter entitled “Some Lessons Learned,” is particularly to the point.9

Since the development process is highly personal, the relationship between the development staff and the faculty is highly important . . . .

Occasionally there will be disagreements in the development process between the faculty member and the developer. Sometimes these disputes must be skipped temporarily and dealt with later on . . . .

The people responsible for design and implementation, evaluation, and production must work closely not only with the faculty but also with each other. There must be mutual understanding and the various responsibilities in the total process and respect for one another as professionals and as people . . . . Development is actually the sum total of a complex series of human interrelationships—a fact that cannot be overlooked by those responsible for the process. (pp. 239–240)

Few studies within the literature of instructional development currently respond to this apparent need. Savage (1975) is one of the few examples of studies concerned with training in the interpersonal communications area. Kerr (1978, p. 159) calls for “. . . training in empathy, human relations, and/or counseling in order to overcome the natural hesitancy of teachers to enter discussions of instructional problems.” Goldberg and Grimes (1978) in discussing the needs of practitioners in instructional development heavily emphasize the areas related to “human needs.” Consider their list of topics for research and development and note the high proportion of those that require interpersonal skills:10

consultative skill building;
dissemination and diffusion techniques;
user-needs studies;
understanding the politics of change and innovation;
leadership and management training;
development of effective linkages with research and development agencies, colleges, universities, and so forth;
problem identification and solution;
effective staff development;
organizational development, analysis, renewal;
interdisciplinary team building;
improvement of data collection and presentation;
cost/benefit, cost/analysis and improvement of interpersonal communication. (p. 191)

Thingarajan (1973) was eloquent when he spoke of his personal role as part of an instructional development team.

But nobody warned me about the problems of working with all those insecure and paranoid colleagues. None of the programming workshops, courses, or other textbooks seem to have as an objective the improvement of interpersonal communication skills so vital for an SME (subject matter expert) and an ID (instructional developer) to work together.

Information Structuring

For the instructional developer, the situational context of interpersonal communications skills is often that of working with a subject-matter expert to determine the structure of the content. This procedure mixes the interpersonal skill with a high level cognitive skill. In many cases, the structure of the content, according to the subject-matter expert, is not the same as that found in the

standard text or reference. This implies that the developer, through personal interaction with an individual or with a committee of content specialists, can formulate a working content structure within which the information and skills to be taught can be formed into a sequence and hierarchy. Such a structure is necessary if interrelated sequences of instruction are to be developed.

Not only must the developer work with the subject-matter expert to maintain a good interpersonal relationship, but the developer must also quickly master new content areas. This ability to assimilate large quantities of new and relatively unstructured (at least to the developer) information and then to create an intellectual structure for it is little discussed in the literature of the field. The developer must not only take in large complex chunks of information quickly but he or she must create a theoretical framework in which to manipulate the information. The developer must question the subject-matter expert to check both the validity of additional incoming information and the framework in which it fits. In this mode, information begets information and if the developer has truly established a strong rapport with the subject-matter expert, this expert may offer unlimited quantities of information simply as a sign of good faith.

The total process—receive, classify, and store information, build/rebuild structure, request new data and recyle—usually occurs at a rate too fast and too complex to carefully define what is happening. If one adds in the fact that the developer is actually performing the process for two sets of data, one dealing with the actual content material and another dealing with maintaining the personal rapport between developer and client, the whole process becomes a bit mind-boggling. Yet, instructional developers do perform such activities as part of their routine work. The secret of successful performance (another way of saying the underlying generic skill) is probably an ability to “go with the flow” of the questioning and information. Bratton relates the skill to that of anthropologists acquiring information about a new culture. It is probably also related to the ability to take a standardized test (any subject) and do well, and/or to easily learn a new language, and/or to quickly learn a role or part (become a “quick study”). Somehow it is more than

9The term interpersonal communications is used to denote these skills that primarily have to do with dealing with people rather than data. For example, the instructional developer and the content expert may not agree on the correct definition of a certain term. The developer may be technically correct and “win” the argument but do it in such a manner that the developer/content expert relationship is destroyed. The developer could be said to have exhibited good cognitive or “intellectual skills” while failing in the area of interpersonal communications.

10Although Diamond speaks of higher education, his words have relevance in any situation where the faculty member, teacher, or subject-matter expert is “in place” before the instructional development process begins. His observations may not apply when the curriculum is developed before the teacher or trainer is hired.

11Contrast Kerr and Goldberg and Grimes with articles on instructional development by Morgan (1978), Kaufman (1978), and Brandon (1978) in the same issue of ECT for a concrete example of the cognitive-interpersonal skills dichotomy.
simply information processing. Whatever the skill components may be, the existence of the skill itself should be sufficient evidence that instructional development is more than a technical process and its practitioners more than technicians—at least in this instance.

Problem Solving

The instructional developer must operate in the context of the total instructional problem and find organization-wide solutions to problems as well as solving specific instructional problems.

While Reigeluth's scientist-technologist classification makes it seem as though only the scientist can indulge in creative problem solving, most practicing instructional developers would gainsay this idea. They would point to the number and diversity of elements involved in the development of even a simple module—elements that make problem solving the order of the day. These include, at a minimum, factors in production, distribution, system maintenance, and both formative and summative evaluation. The number of variables taxes even the accomplished developer, although developers, not unlike chess players, soon reduce the almost endless permutations down to a manageable number of viable lines of attack. Unlike the previously mentioned skill of forming the structure of a new content area, this skill draws more on previously learned information and procedures in instructional technology and instructional development.

Problem solving is mentioned frequently in the literature but usually without specifics of the exact nature of the skill. When specifics are given, they usually take the form of some process model based on the scientific approach rather than a taxonomic model of problem solving skills from specific to generic. Few models ever integrate both the process and the taxonomy—perhaps because the former is regarded as a continuous flow making it difficult to measure without disrupting the flow. For purposes of the actual training of instructional developers, the process model seems most appropriate, while for the development of an understanding of the elements of problem solving and their interrelationships, the taxonomic approach would seem more viable.

Applying Behavioral Sciences

As is the case with any applied science, instructional development draws heavily on other disciplines but has its own set of specialized information and protocols. The would-be instructional developer must learn both the specifics of the field and large measure of those disciplines that support it. Of those supporting disciplines and fields, the one most heavily drawn upon is psychology—particularly the psychology of learning and instruction. The instructional developer is, in effect, an applied behavioral scientist whose mission is, in general, to apply the relevant principles of learning in the creation of ways to instruct the learner. The case could be made that applied behavioral science is a generic skill—rather than a field-specific skill—for the instructional developer. The argument is moot. Whether field-specific or general (as it relates to instructional development) few would contest the fact that the instructional developer must be fully conversant with behavioral psychology and be able to apply it in practical situations involving instruction. The behavioral sciences, as Saettler (1968) points out are the heart of instructional technology.

Information Searching

The scope of the instructional development field and the way in which it draws on so many other fields mean that—for all practical purposes—the instructional developer can never totally master all those disciplines and fields that form the basis for instructional development. This range poses another skill tacitly expected of instructional developers—the ability to locate needed information not only within the field of instructional development but within the broad range of related fields.

This information-searching skill has as its basis the ability to conduct a complex search for information from a number of different sources in different disciplines—each discipline with its own internal structure and logic.11 Practiced instructional developers seem to be able to locate needed information both through formal information searches and by linking together information from a number of sources each with only a portion of the information sought by the developer. While the information relates specifically to the different fields and disciplines, the searching skill is more or less generic because it relates to all while using specifics of each when appropriate.

Summary

The mix of field-specific and generic skills so far mentioned includes:

- interpersonal communications skills.
- comfortably receiving and assimilating large amounts of new information;
- creating a logical structure for that information;
- testing the information against that structure so that additional information can be assimilated;
- and seeking new information that will help to further develop structure of the information—all of the foregoing done in conjunction with other persons as the source of information.

- creative problem solving of practical problems. We need far more study to precisely how the first five skills are applied within the field. If they are truly generic skills, they should be applicable in a variety of situations in instructional development. By analyzing those applications, a series of protocols can be developed to offer guidance for the practicing instructional developer and to offer some sort of curriculum model(s) for trainers of instructional developers.
- the application of the behavioral sciences to instruction.
- seeking and locating information from data bases and developing appropriate search strategies for each source of information—the foregoing done with information previously stored, usually in printed or text format.
- more specific instructional development skills.

There may, however, be a lot more to generic skills than there seems to be on the surface. Generic skills may involve a completely different approach to the handling of information.

A Further Look at the Generic Skill

To explain generic skills any further,
we must look to a framework broader in scope than instructional development. A number of such frameworks do currently exist. Some are derived from the job analysis field where field-specific skills are derived from the observation, compilation, and classification of tasks.12

The Labor Department, for example, uses an extensive task classification system to develop the Dictionary of Occupational Titles. Many of the task descriptions therein border on a list of generic skills, depending on the specific skills chosen as benchmarks.13 The fields of instructional development and learning psychology also offer some models and taxonomies for classifying tasks and, by implication, skills. The venerable Bloom/Krathwohl domains have somewhat given way to Briggs and Gagné's hierarchy but while Bloom and Krathwohl developed all domains, the Gagné approach rests heavily in the cognitive domain, offering little help when it comes to interpersonal skills and manual skills.

A third, and perhaps the most fruitful, approach is to use a general psychology model that incorporates features of the other models listed. One such model is Guilford's (1967) structure of intellect. In this model of human intelligence, Guilford (1966) accounts for a broad range of skills—including creative problem solving—and places intelligence "...within the mainstream of general psychological theory." The terms intelligence and structure of intellect are often misconstrued because they bring to mind an association with Gagné's intellectual skills hierarchy and Bloom's cognitive domain.

In actuality, Guilford comfortably accommodates the affective domain and the "people skills." The structure of intellect does this by including "behavioral content," which Guilford defines as "...information where awareness of attention, perceptions, thoughts, desires, feelings, moods, emotions, intentions, and actions of other persons and of ourselves is important." (For more about Guilford's structure of intellect, see Silber's article on p. 33 of this issue.) The structure of intellect is not offered as "the" model of intellect. Rather, it offers a relatively convenient and reliable way of classifying the mental processes of skills in any field—including instructional development.

Another model that can be applied to generic skills is Piaget's stages of intellectual development. This model (discussed in Silber's article on p. 33 of this issue) offers some guidelines for training instructional developers.

Teaching Generic Skills

In Piaget's construct, persons would have to be proficient in formal operations (manipulation of information with highly symbolic content) before being able to demonstrate many of the generic skills mentioned in this article. Persons at the concrete operations level could not, then, by definition, acquire the generic skills at the formal operations level. Thus, by implication and logic, they could not become successful instructional developers unless they had moved up to formal operations. Formal operations learning requires learners to be put into learning situations in which they (with appropriate guidance) must perform formal operations. It behooves us to examine our training methods to ensure we are offering instruction not only in the prescribed content but also at the formal operations level.

If, for example, formal operations must be taught by solving new problems that cannot be solved with concrete referents, to move from a concrete to a formal operational level "...involves overcoming inconsistencies and contradictions that are generated when a student seeks to apply her (sic) current repertoire of problem solving strategies to tasks for which they are insufficient. Thus, to encourage a level change, developmentists design situations that confuse the student. For a Piagetian, this confusion is a necessary part of a process by which a student reorganizes her basic cognitive structures to better deal with the demands of the tasks she is confronting" (Harmon & King, 1979, p. 19).

Applying this information, then, to an instructional development program means that:

- Over a period of time, the courses should be structured so there is a progression from concrete operations to formal operations.
- The skills learned in the courses should be arranged so that even if the content varies from cognitive to affective or from fact to concept to problem solving, every higher level course should have some problem solving built into it.

- A program must have more to it than the learning of facts and procedures because the cumulative effect of a number of concrete operations is not necessarily a move up to formal operations.

- A program must have more to it than the learning of facts and procedures because the cumulative effect of a number of concrete operations is not necessarily a move up to formal operations.

- Students making the move from concrete to formal operations levels must be given special care, and their confusion must be resolved if such resolution is possible for them. If it is not possible to move them from concrete to formal operations, even more care and counseling is needed, and it is the ethical obligation of the program to provide the student with such counseling.

- All courses should be broken down into skills to be acquired14 and these should be examined as to the type and level of skill (by someone's consistent classification scheme) and then sequenced accordingly—this has special implications for courses outside the regular program.

The ideal program, of course, has done a careful needs assessment for skills needed by instructional developers, developed a skill list and classified it by both type and level of skills, and then built its curriculum—courses and means of measurement—on those bases. It then uses the finest of methods to bring its students to the levels of both specific and generic skills (whatever levels) specified in the program. If this is not happening, then instructional development as a field and we, as practitioners, are in trouble. This is especially true of instructional development training programs.

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12Looking at tasks in the field was the basic premise at the beginning of the article. We are what we do, not what we say.

13Tasks with higher complexity levels, especially Data and People, are almost always more generic than lower level tasks.

14We call these "terminal behaviors." and all of us, as a matter of standard practice, describe our courses in these terms.
Applying Piaget's Stages of Intellectual Development and Guilford's Structure of Intellect Model to Training Instructional Developers

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Abstract. This article states and gives evidence that (1) there is a set of underlying skills required by the instructional developer to enable him or her to learn and apply specific ID skills; (2) these underlying skills take the form of a cognitive strategy—an internal thought and control process; (3) this cognitive strategy underlying ID is an internal problem solving process; (4) the components of this internal problem solving thought and control process underlying ID can be identified based on the theoretical frameworks of (a) Piaget’s formal operational thought and (b) Guilford’s structure of intellect model. In addition, this article reports the results of a preliminary study that indicate a strong relationship between formal operational thought and the ability to do ID. This article concludes that: There is little evidence that the cognitive strategy underlying ID can be taught to adult learners at all, and, if it can be taught, it can only be done (a) indirectly, by providing favorable conditions through instructional strategies and (b) over a long period of learning and practice. Consequently (1) more research is necessary; (2) we should use instructional strategies that create “favorable conditions” for developing cognitive strategy in our students; and (3) if we cannot teach the internal problem solving cognitive strategy that underlies ID, then we must use it as a screening device when selecting students for graduate ID programs.

The Problem

The prevailing approach to training instructional developers is based on the notion that performing instructional development is a process that requires a specific set of ID skills. Examples of such skills include conducting a needs assessment, analyzing a task, writing behavioral objectives, selecting media, conducting a formative evaluation, etc. Lists of such specific ID skills or competencies have been generated by Hendrix and Tiemann (1971), AECT (1974), and DID (1980).

The assumption in training instructional developers, based on this approach, seems to be that if one can competently perform these specific ID skills, then one will be a “good” developer. Based on this assumption, the small amount of discussion about training instructional developers that does occur (and there is precious little of such discussion) centers around what courses and learning resources are best suited to provide developers with these skills. The review of nine ID programs by Patridge and Tennyson (1978-79) and the article by Dougherty and Durzo in this issue of JID reflect this approach.

The problem with the specific ID skills approach to training instructional developers is that those skills are not all it takes to make a “good” instructional developer. Bratton (see this issue of JID) suggests that the ability to understand the content, organization, values, and way of thinking of the discipline for which instruction is being developed is a critical skill for the developer to possess. Markle (see this issue of JID) argues that most instructional products do not require higher cognitive skills on the part of students—and that this may be the result of the lack of such skills by the developers. Wallington (1980 and this issue of JID) argues that there is a set of generic skills underlying the specific ID process: interpersonal communications skills, extracting and assimilating chunks of information and working them into a logical framework, solving problems, applying principles of the behavioral sciences, and systematically searching for related information.

Thesis 1

These positions suggest the beginning point for this article:

There is a basic set of underlying skills required of the instructional developer—skills that enable him or her to learn the specific ID skills in the first place and to apply them successfully on the job.

Next Steps

Merely suggesting this thesis is not enough. If it is to be useful in changing the way instructional developers are trained, it must be made more specific and practical by answering three questions:

(1) What is the nature of the underlying skills?
(2) What is the theoretical basis for identifying and categorizing these skills?
(3) Can these skills be taught to instructional developers? If so, how?

Wallington’s article (see this issue) takes one step toward answering question 1, but does not do so completely; it does not address questions 2 and 3 at all. This article will attempt to expand upon Wallington’s list of generic skills, indicate two theoretical bases for identifying and categorizing the underlying skills, and draw some implications for the training of instructional developers.

Delimitations

This article will not concern itself with all possible underlying skills. It will limit itself to those skills underlying a major portion of the ID process—the cognitive processing of information in written and verbal forms. This delimitation means the article will not discuss
two areas that are also an important part of the instructional developer's repertoire.

What will and will not be included can best be understood by reference to the four types of content identified by Guilford (1967). These are:

Semantic—"Semantic information is in the form of meaning to which words commonly become attached; hence it is most notable in verbal thinking and verbal communication" (p. 227).

Symbolic—"Symbolic information is in the form of signs, materials, the elements having no significance in and of themselves, such as letters, numbers, musical notations, and other 'code' elements" (p. 227, italics as in original).

Figural—"Figural information is in concrete form, as perceived or as recalled in the form of images" (p. 227, italics as in original).

Behavioral—"Behavioral content is defined as information, essentially nonverbal, involved in human interactions, where awareness of attention, perceptions, thoughts, desires, feelings, moods, emotions, intentions, and actions of other persons and of ourselves are important" (p. 77, italics as in original).

This article will address itself to the cognitive processing of semantic and symbolic content. It will not address the figural and behavior content areas. This is done because although there is sufficient theoretical and research information regarding the former types, there has been little or no work done on the latter two.

The omission of behavioral content is important because it is that type that the developer uses in interacting with subject-matter experts and others on a development team. The omission of figural content is important because it is that content type that is used by the developer in any media production.

When sufficient research and theory about these two types become available, an analysis comparable to the one done here for semantic and symbolic content ought to be attempted.

Nature of the Underlying Skills

In addition to Wallington's generic skills cited earlier, indications of the nature of the underlying skills can be found in three different sources: (1) a common sense analysis of the process of thinking while performing ID, (2) the types of capabilities identified by Gagné and Briggs, and (3) an operational model of problem solving.

A common thread runs through all three—they relate to the internal thinking processes that an instructional developer uses to perform the specific ID skills.

Thinking During ID. If we carefully analyze what happens to and within the developer during the ID process, something like the following pattern emerges:

(a) The developer is presented with some problem related to learning and/or performance.
(b) The developer must gather information about the problem, analyze it, synthesize it into some coherent statement, and evaluate the statement in terms of reality.
(c) The developer is presented with a body of content, usually in verbal written form, that he or she must learn or develop a cognitive structure for.
(d) The developer must analyze that body of content and restructure (or synthesize) it into a form that takes into account both the integrity of the content and the learning and instructional principles to be applied to it.
(e) The developer must evaluate the accuracy and adequacy of this restructuring and restructure again if the original attempt is not successful.
(f) The developer must translate the verbal written form of the content into other communication formats, such as visual and oral media.

The thinking processes underlying the specific ID skills, according to this analysis, are: gathering information, analyzing information, learning information, synthesizing information, evaluating solutions and information, restructuring information, re-structuring information, and translating information into another format.

Types of Capabilities. Another more theoretically based way of looking at the thinking processes underlying ID skills is based on the notion of types of capabilities (Gagné & Briggs, 1979).

If one looks at the specific ID skills as separate entities, they can be seen as intellectual skills:

- Intellectual skills are the capabilities that make the human individual competent. They enable him to respond to conceptualizations of his environment.

Learning an intellectual skill means learning how to do something of an intellectual sort. (Gagné & Briggs, 1979, p. 49, italics as in original)

More specifically, applying the specific ID skills can be seen as either rule using or problem-solving-level intellectual skills:

A rule has been learned when it is possible to say with confidence that the learner's performance has a kind of "regularity" over a variety of specific situations. In other words, the learner shows he is able to respond with a class of relationships among classes of objects and events. (Gagné & Briggs, 1979, p. 67, italics as in original)

Sometimes, the rules which human beings learn are complex combinations of simpler rules. Moreover, it is often the case that these more complex, or "higher order" rules are invented for the purpose of solving a practical problem or class of problems. In attaining a workable solution to a problem students also learn something which can be generalized to other problems having similar formal characteristics (Gagné & Briggs, 1979, p. 69)

For example, the specific ID skill of writing behavioral objectives in Magerian form following Gagné's types of capabilities is rule using; one applies the relationships that make up a "correct" behavioral objective to the relationships in the content to write behavioral objectives. The specific ID skills of developing the relationships within the content itself, by selecting among the information processing approach, the task classification approach, the learning task analysis approach, the content analyses approach, or some combination of these, and then applying the selected approach to the content, is an example of problem solving.

It is the view of this paper, however, that more important insights about the internal thinking processes used by a person doing ID can be gained by viewing the entire ID process as a cognitive strategy:

- A cognitive strategy is a control process, an internal process by means of which learners select and modify
their ways of attending, learning, remembering, and thinking. A cognitive strategy is an internally organized skill that selects and guides the internal processes involved in defining and solving novel problems. Cognitive strategies have as their objects the learner’s own thought processes. (Gagné & Briggs, 1979, pp. 71-72, italics as in original)

The capability of cognitive strategy fits more closely than does intellectual skill, the internal thought processes (described earlier) that underlie and control the specific ID skills, and the generic skills identified by Wallington.

For example, if one were faced with a problem, and one’s internally organized thought processes automatically began to attend to and think about that problem as an ID-related one, and one’s internal control process automatically began to call upon, select, and utilize the specific ID skills to define and solve the problem, then one would be employing a cognitive strategy.

We can conclude, therefore, that cognitive strategy is the internal control process for the specific intellectual skills of ID and the internal thought process that underlies and guides the use of the specific ID skills.

Further, viewing the use of the total ID process as a cognitive strategy has implications for explaining differences in effectiveness and efficiency of developers. Gagné and Briggs (1979) assert that:

The efficacy of an individual’s cognitive strategies exerts a crucial effect upon the quality of his thought. They may determine, for example, how creatively he thinks, how fluently he thinks, and how critically he thinks. (p. 72)

Thus, it is possible for a developer to possess the specific ID skills, but not bring them to bear on a problem at the right time, in the right manner, with the right results because he or she does not possess the internal control and thought process—the cognitive strategy—to select and utilize those specific skills in an appropriate manner.

Problem Solving. As was noted earlier, the developer’s thought processes begin when he or she is presented with a problem and end when that problem is solved. The internal thought process underlying ID can, therefore, be viewed as a specific case of a general problem solving model.

Guilford (1967) suggests that Rossman’s (1931) set of problem solving steps contains all the steps of classical problem solving models, as well as more recent models emphasizing information processing. Rossman’s steps are: (1) need or difficulty observed, (2) problem formulated, (3) available information surveyed, (4) solutions formulated, (5) solutions critically examined, (6) new ideas formulated, and (7) new ideas tested and accepted (Rossman, quoted in Guilford, 1967, p. 313).

Viewing the internal thought process underlying ID as a problem solving process as defined by this model has several advantages: (a) it links the “common-sense-generated” list of “thought processes during ID” identified above to a theoretical model; (b) it links Wallington’s generic skills identified above to a theoretical model; and (c) it supports the notion that the thought process underlying ID is a cognitive strategy as discussed above, and, further, delineates specific components of that strategy in terms of two theoretical models.

Thesis 2
We can summarize the discussion of the nature of the skills underlying ID by stating that:
There is an internal thought and control process—a cognitive strategy—that underlies the use of specific ID skills.

Thesis 3
We can even go one step further and make a general statement that:
The cognitive strategy underlying ID is an internal, problem solving thought and control process.

Delineation of the Cognitive Strategy
If we accept Thesis 3, then we are faced with the task of delineating the component parts of the cognitive strategy based on some theoretical framework. According to Gagné and Briggs, this is a difficult task:

Internally organized strategies that govern the learner’s behavior come in several varieties. At present, it is not possible to identify them singly with any degree of confidence, much less name them. (Gagné & Briggs, 1979, p. 52)

The identification of the cognitive strategy involved here as a problem solving one, and the description of that problem solving process by both steps and an operational model, as was done earlier, indicate that the task is not as impossible as Gagné and Briggs would have us believe.

Fortunately there are two theoretical frameworks that provide a basis for doing this. The first is Piaget’s stages of intellectual development, the second is Guilford’s structure of intellect model.

The next two sections will describe how these theoretical frameworks can help identify the components, or subordinate skills, of the problem solving cognitive strategy underlying ID.

Piaget’s Stages of Intellectual Development
It is not within the scope of this paper to review all of Piagetian theory, nor to discuss all of the developmental stages Piaget identifies. (See Inhelder & Piaget, 1958.)

The stages that might be relevant to the cognitive strategy being addressed here are the concrete operational and the formal operational stages. An analysis of the characteristics of these two stages points out some important, theoretically based characteristics of that strategy. Some characteristics of the concrete and formal operational stages are shown in Table 1 (Harmon & King, 1979, p. 17). Based on these characteristics, and how they operate in each stage, it seems clear that the internal problem solving thought and control process, the cognitive strategy, underlying instructional development consists of formal operations.

If we match the steps or operations of the problem solving process with the characteristics of formal operations, it becomes clear that formal operations are required for, and are the components of, this cognitive strategy.

Components of the strategy identified in the table include: use of models; use of relationships between two or more variables; generation of hypotheses; thinking in terms of abstract patterns, concepts, properties; awareness of own reasoning; and checking on validity of conclusions.

In addition Harmon and King elaborate on some of the processes formal operators use—and, again, these are clearly components of the cognitive
strategy we have been analyzing:

- "Identify and abstract a pattern and use their knowledge of that pattern to be systematic in solving some problem."
- "Adapt a systematic method."
- "Begin by recognizing that a particular instance is an example of some class of similar situations."
- "Use what they know about the class in general to predict a number of different possibilities relative to the given situation."
- "(Recognize) the abstract model or pattern that the particular problem only typifies or concretizes."
- "Begin with an abstract model or set of variables."
- "Consider both what actually exists at the moment and what other possibilities are latent in the particular situation."
- "Coordinate two or more disparate referential systems" (Harmon & King, 1979, pp. 14 & 15).

**Thesis 4**

The incredible parallel between the characteristics of formal operational thought and the cognitive strategy we have said underlies ID leads to Thesis 4 of this paper:

The characteristics of Piaget's formal operational thought provide a theoretically based identification of the components of the internal problem solving thought and control cognitive strategy underlying ID.

**Guilford's Structure of Intellect Model**

Again, it is beyond the scope of this paper to explain completely the structure of intellect model. The model itself is shown in Figure 1 (Guilford, 1967; inside cover).

The internal problem solving thought and control cognitive strategy that has been discussed in this paper was studied extensively by Merrifield, Guilford, Christensen, and Frick (1962).

Based on simplified versions of the problem solving steps and the operational problem solving model described earlier, the authors hypothesized six abilities that make up problem solving: (1) think rapidly of several attributes or characteristics of a given object, (2) classify objects or ideas, (3) find different relationships, (4) think of alternative outcomes, (5) think of attributes of a desired goal, and (6) educe logically sufficient antecedents. For each ability, they hypothesized which SI cells would make up that ability.

The results of the study supported the notion that problem solving is too broad to be explained by a simple ability:

There is no evidence whatever that problem solving as measured by these criterion tests is a unitary ability. (Merrifield, et al., 1962, p. 19)

Further, the study showed that the six problem solving abilities hypothesized and tested in this study can be explained in terms of factor dimensions that have logical positions in the structure of intellect. (Merrifield, et al., 1962, p. 19)

The most important result of the study was the identification of the 12 structure of intellect factors that make up problem solving. These specific factors are given below, using both the SI cell indicator and the common name for the represented ability as designed by Guilford:

- CML-verbal comprehension
- CMC-conceptual classification
- CMR-awareness of conceptual relations
- CMS-general reasoning
- CMI-conceptual foresight
- DMU-ideational fluency
- DMR-associational fluency
- DMT-originality/spontaneous flexibility
- NMC-production of categories of meaning
- NMR-production of conceptual correlates/relations
- NMI-deduction, and
- EMI-sensitivity to problems.

These 12 factors are similar to the abilities suggested by Piaget's formal operational thought described earlier, meet the definition of components of a

<table>
<thead>
<tr>
<th>CONCRETE OPERATIONS</th>
<th>FORMAL OPERATIONS</th>
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<tr>
<td>Must use models whose components are real things.</td>
<td>Can use models that have abstract or symbol components.</td>
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<tr>
<td>Can not use explanations that involve two or more independent variables or that depend on the control of one variable while another is being examined.</td>
<td>Can use explanations that involve two or more independent variables and/or that depend on control of variables as part of the analysis.</td>
</tr>
<tr>
<td>Can not expect student to generate hypotheses, or think in terms of abstract patterns.</td>
<td>Can expect the student to generate hypotheses and to think in terms of abstract patterns.</td>
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<tr>
<td>Student is aware and critical of his/her own reasoning, inconsistencies among various statements he makes, or contradictions with other known facts.</td>
<td></td>
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<tr>
<td>Needs reference to familiar objects, actions, and observable properties.</td>
<td>Can reason with concepts, relationships, abstract properties, axioms and theories; uses symbols to express ideas.</td>
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<tr>
<td>Nedd step-by-step instructions for complex procedures; should use successive approximations and emphasize practice.</td>
<td>Emphasize theory and/or overview.</td>
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**TABLE 1. A comparison of concrete and formal operations. From "Operant Learning, Cognitive Development, and Job Aids," Improving Human Performance Quarterly, 1979, 8, 1, 17. Reprinted by permission.**
cognitive strategy, and match the "common sense" analysis of what thought processes a developer uses.

**Thesis 5**

Because of this similarity, we can state that:

Guilford's structure of intellect model provides a theoretically based identification of the 12 factors that make up the internal problem solving thought and control cognitive strategy underlying ID.

**Testing the Two Theoretical Frameworks**

Despite the logical soundness and theoretical bases of the five theses presented thus far, the theses are, at present, unproven hypotheses. There is no evidence, at present, to suggest either a positive or negative relationship between possession of Piaget's formal operational thought or Guilford's problem solving SI factors and the ability to do instructional development.

Such a relationship must be shown to exist before any changes in the training of instructional developers are made based on the theses suggested here.

The author has just completed a pilot study that addresses the relationship between possession of formal operational thought and success in an instructional development course at Governors State University (Woodward, Silber, & Jahn, 1981). At the beginning of the course, students were given the Test of Level of Thinking (TOLT) (Tobin & Capie, 1980a, 1980b). This 10-item test contains two items that measure each of five elements of formal operational thought: (1) proportional reasoning, (2) controlling variables, (3) probabilistic reasoning, (4) correlational reasoning, and (5) combinatorial reasoning.

A score of 4 or more indicates the person is operating at the formal operational level. The test has been shown to be both valid and reliable (Tobin & Capie, 1980a, 1980b). Test scores were correlated with: (a) course grade, (b) number of times an ID project had to be redone, (c) conceptual grasp (vs. mere performance) of the ID process, and (d) the instructor's subjective judgment of the student's performance as a developer.

Results showed that the score on total TOLT and on the question measuring control of variables and combinatorial reasoning correlated .70 with course grade, conceptual grasp of the ID process, and the subjective rating.

These results indicate a strong relationship between the possession of formal operational thought and both the ability to do instructional development well and the ability to understand what the ID process is and how and why it works.

They support Theeses 1-4—that is, there is an internal, problem solving thought and control cognitive strategy underlying ID that is based on the components of Piaget's formal operational thought. Further, they suggest that possession of this cognitive strategy is necessary to apply the specific ID skills well.

The author is currently conducting more extensive and better controlled studies at eight ID training programs, using both the TOLT and tests for Guilford's 12 factors, to try to (a) further prove the existence of the underlying cognitive strategy, (b) show its importance in being able to apply the specific ID skills, and (c) test and compare Piaget's components of formal operational thought and Guilford's problem-solving factors as theoretically based delineations of the components of the cognitive strategy underlying ID.

**Review**

Thus far, we have stated and given evidence that:

1. there is a set of underlying skills required by the instructional developer to enable him or her to learn and apply specific ID skills;
2. these underlying skills take the form of a cognitive strategy—an internal thought and control process;
3. this cognitive strategy underlying ID is an internal problem solving process;
4. the components of this internal problem solving thought and control process underlying ID can be identified based on the theoretical frameworks of: (a) Piaget's formal operational thought, and (b) Guilford's structure of intellect model.

In addition, we have reported the results of a preliminary study that indicate a strong relationship between the possession of formal operational thought and the ability to do ID.
Thesis 6

Based on what has been shown in this article, it is clear that any listing of "ID Competencies" that includes only "Specific ID" skills is incomplete. Both Gagné and Briggs' theoretical assertion (cited earlier) that the quality of an individual's cognitive strategy affects his or her ability to apply intellectual skills, and the results of the preliminary study (cited earlier), which show that possession of formal operational thought is related to the ability to do ID, we can conclude that:

A competent instructional developer should possess the internal problem solving thought and control cognitive strategy underlying ID, with the component elements as identified by Piaget or Guilford.

The next logical question then, is the final one this article will address: Can this cognitive strategy be taught to instructional developers, and if so, how?

Training Instructional Developers

The logical conclusion from what has been said so far is that we ought to add—either in our content or our methodology—learning activities that teach the cognitive strategy underlying ID to the courses we already teach dealing with the specific ID skills.

Unfortunately, the situation is not as simple as this. There is considerable debate about (a) whether the cognitive strategy can be taught at all and, (b) if it can be taught, how best to do it.

Can it be taught? Many ID trainers will see this as a moot question. They would argue that since, according to Piaget, one reaches formal operational thought at the age of 15, and since their students are older than that, there is no need to teach the cognitive strategy at all—ID students already possess it.

Studies cited by Harmon and King (1979) indicate that this is not the case:

- From 40 to 60% of sampled college students function at the concrete operational level.
- Many adults function at the concrete level when they interact with tasks with which they are not familiar (Harmon & King, 1979, p. 13).

This conclusion was born out by the preliminary study (Woodward, Silber, & Jahn, 1981) where only 65.7% of the students, with a mean age of 35, functioned at the formal operational level. Thus most ID trainers will need to think about teaching their students the cognitive strategy underlying ID. Guilford believes that this can be done.

From numerous investigations on the question concerning training aimed at the improvement of creative potential we have considerable reason for guarded optimism. The writer shares the view... [that] thinking abilities as intellectual skills... are trainable.... They have been developed largely by informal practice, and should be improvable by virtue of formal practice. (Guilford, 1967, p. 336)

There are, however, two problems with Guilford's assertion. First, all the studies Guilford cites deal with the improvement of creativity, not with the improvement of the 12 factors the Merriam study showed to be the elements of the problem solving cognitive strategy. Second, and perhaps more important, all the studies Guilford cites were done with elementary and high school students, not with college students and adults.

Harmon and King reach a different conclusion. Though they admit that the research on teaching formal operational thought is complex, and that no easy conclusion can be reached, they conclude—after reviewing seven studies:

Insofar as we can teach formal operational thought, suffice it to say that it takes a lot of time and effort and is only partially successful. (Harmon & King, 1979, p. 18, italics as in original)

Of the two reasons Harmon and King give for their negative conclusion, the former—time and effort—is a pragmatic concern, while the latter—partially successful—is a more fundamental, theoretical concern.

Gagné (1977) expresses the same theoretical and pragmatic concerns. He begins by citing the positive results of studies using the Productive Thinking Program to teach students such cognitive strategies as generating new and unusual ideas, breaking mental sets to look at problems differently, attending to relevant facts and conditions of the problem, etc., and states that "there is some evidence, then, that cognitive strategies applicable to thinking and problem solving can be learned" (Gagné, 1977, p. 176): He switches positions, however, in his conclusion on the matter:

At the same time, it has apparently not been easy to show that deliberate attempts to teach cognitive strategies result in consistent and substantial learning and transfer of learning. Regardless of the nearly universal agreement on the educational goal of "teaching students to think," the evidence that this goal can be successfully accomplished when deliberately undertaken is actually quite meager at the present time. (Gagné, 1977, p. 176)

Gagné also addresses the pragmatic concern when he discusses how long it takes to learn cognitive strategies. While again citing one study in which "children seemed to acquire new strategies after only a small amount of instruction," (Gagné, 1977, p. 177) he notes that many adults have been convinced by their own experiences that strategies of thinking are seldom acquired quickly, but may require years of practice to reach the stage of refinement at which they are transferable to novel problem solving situations. (Gagné, 1977, p. 177)

From the positive and negative statements of these three sources, we can draw the following theoretical and pragmatic conclusions about whether the cognitive strategy underlying ID can be taught to college students:

- There is a little evidence that cognitive strategies can be taught to children;
- There is very little evidence at all that cognitive strategies can be taught to adults;
- If they can be taught to adults, it may require years of practice for them to learn and use a cognitive strategy.

How can they be taught? There is even less evidence about how to teach cognitive strategies than there is about whether they can be taught. Harmon and King (1979) provide an approach to teaching formal content to concrete operational students—but this is not the same as teaching formal operational thought—or a cognitive strategy—"itself. The literature cited by Guilford (1967) related to teaching creativity and problem solving is not relevant bu-
cause it treats problem solving as an intellectual skill applied to external problems, rather than problem solving as we have been discussing it here—
a cognitive strategy that controls internal thought processes.

Gagné and Briggs (1979) clearly identify the difficulty of teaching cognitive strategies:

In the case of other types of intellectual skills, one can plan a sequence of learning events external to the learner which will insure the learning of those skills. But cognitive strategies require a more indirect control; one has to organize external events so as to increase the probability of certain internal events; and these in turn determine the learning of the cognitive strategy. Accordingly, the design of instruction for cognitive strategies has to be done in terms of “favorable conditions,” and cannot be accomplished by specifying the “sufficient conditions.” (Gagné & Briggs, 1979, p. 72)

The most definitive statement Gagné and Briggs can make about teaching cognitive strategies is: “Generally, the favorable conditions are those which provide opportunities for development and use of cognitive strategies” (Gagné & Briggs, 1979, p. 73, italics as in original).

Thus, if we are to attempt to teach cognitive strategies, it should be not with a course on creative problem solving, but rather by incorporating instructional strategies into all courses we teach that demand that the student develop and use the problem solving cognitive strategy underlying ID. Gagné (1977) notes, however, that such an approach can take away from the learning of other kinds of capabilities.

From this literature, we can conclude: It is extremely difficult to teach cognitive strategies; the best we can do is to provide favorable (as opposed to sufficient) conditions for their development; the way to provide favorable conditions is through instructional strategies that call for the student to develop and constantly use the cognitive strategy; and the emphasis on teaching cognitive strategies can take away from the learning of other kinds of capabilities.

**Thesis 7**

Based on the discussions of whether the cognitive strategy underlying ID can be taught and, if so, how, we can state that:

There is little evidence that the cognitive strategy underlying ID can be taught to adult learners at all, and, if it can be taught, it can only be done (a) indirectly, by providing favorable conditions through instructional strategies, and (b) over a long period of learning and practice.

**Implications for ID Trainers**

It is most disconcerting for this writer (and, surely, for the reader) to come this far and discover that; There is an internal problem solving thought and control cognitive strategy underlying ID, its nature and elements can be delineated by two theoretical models, and it is essential for instructional developers to possess this strategy since it can affect their ability to perform specific ID skills. At the same time: There is little evidence that the cognitive strategy can be taught to adults, and if it can it can only be taught indirectly and over a long period of time.

From this unfortunate situation, the author can draw three implications—two fairly straightforward, but not promising any immediate results, and one controversial, which will have the effect of immediately improving the quality of instructional developers we train.

1. **More Research.** It is clear that more research needs to be done in two areas. First, we must do more studies that validate the nature of the cognitive strategy underlying ID and confirm its importance. Second, we must begin to do extensive research on instructional methodologies for teaching cognitive strategies to adults. With this research, we will confirm the correctness of Theses 1-6 and begin to eliminate the problems created by Thesis 7.

2. **Instructional Strategies.** We must begin immediately to use instructional strategies that create favorable conditions for the development of the cognitive strategy in our students. We must use techniques that help students learn and practice the elements of formal operational thought and the problem solving factors of the structure of intellect model. Our instructional strategies must require students to: identify and abstract patterns, adapt a systematic method, use models, use relationships between two or more variables, generate and test hypotheses, check on the validity of their own reasoning, produce categories of meaning, be sensitive to problems, be spontaneously flexible, be fluent both ideationally and associationally, etc.

3. **Screening.** If we cannot teach the internal problem solving cognitive strategy that underlies ID, then we must use it as a screening device. We must only allow into graduate ID programs those students who already use formal operational thought and who possess the SI problem solving abilities—the cognitive strategy.

This conclusion may be an unpopular one. But consider the alternatives for the profession of instructional development. If some of the graduates of ID training programs are not effective developers because they do not possess the thought processes and abilities to implement the internal problem solving instructional strategy that underlies ID and thus to use specific ID skills effectvively, then those who use our services will begin to wonder even more than they do now—only this time with justification—what good we are, and how we can help them improve instruction.

This is a sad conclusion to reach after such an extensive analysis of what the basis of ID is, but I submit it is better to use this analysis to be realistic than to continue kidding ourselves that we can train effective developers by teaching only “specific ID skills.”

**References**


ID Project Abstracts

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PROJECT TOPIC: 
Nursing Inservice: Blood Component Administration
Indiana University Hospitals

Background

As part of inservice education for staff nurses, Indiana University Hospitals, specifically the blood bank, had been providing large-group lecture format instruction on the procedures for administering blood and blood components. This type of instruction created several problems:

1. It was very time consuming for the instructor to present the material to nurses on every shift and to all newly hired staff.
2. Attendance was low because many nurses would have to attend either on their own time or leave their units understaffed.
3. The lectures were 50 minutes long and many nurses could only leave their units for 30-minute periods.

The Medical Educational Resources Program was asked to develop an effective inservice program that eliminated the logistical problems.

The Blood Bank Task Force committed itself to a systems approach to the development of the project. The instructional designers conducted an extensive needs assessment to ascertain what the nurses really needed to know about transfusions, what they didn't learn in nursing school, what their experience and educational background was, and how much time they had available for inservice training.

With this information in hand, the Task Force (nurses and instructional developer) initiated the development of a series of slide/tape programs with handouts that would run about 10 to 20 minutes each. The first three in the series would be viewed individually or in small orientation groups by all staff nurses and newly hired nurses. These programs include an overview of blood banking (Unit 1), the forms and procedures required to obtain blood or components from the I.U. Hospitals' blood bank (Unit 2), and the general procedures for administering blood (Unit 3). Subsequent programs in the series present specific details on particular products, i.e., fresh frozen plasma, platelets, while reinforcing the general procedures delineated in Unit 3. These units will be reviewed only by those nurses who need to know about a particular product. Viewing will occur during breaks on an individual basis. Handouts with specific information on each component can be used by the nurses for reference.

Project Evaluation

To date, four units have been developed. They have all undergone formative evaluation through each stage of design. After the Blood Bank Task Force agrees on the content, objectives, script, handout, and test items, the package goes to the Staff Development Committee for suggestions since they ultimately will administer the program. After the prototype slide/tape program is complete, it is viewed by both the task force and the committee. Any corrections and revisions are incorporated into the final product.

Small-group tryouts are planned and data will be collected on the results of the pre-and posttests. Evaluations of the effectiveness of the programs also will be solicited.

For more information about the project contact: Barry Lein, Medical Educational Resources Program, Indiana University School of Medicine, 1100 W. Michigan St., UH A-116, Indianapolis, IN 46223.
ERI Reports on ID

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This annotated bibliography lists instructional development resources relevant to the Interservice Procedures for Instructional Systems Development Model (ISD), a standardized model providing for the assessment of training needs and instructional quality, as well as the design, development, and implementation of instruction. Following a literature search, relevant documents were classified according to the ISD model, and summaries were written to identify documents on authoring aids, procedures, or techniques. The purpose of each block in this model is defined, and documents are listed alphabetically within blocks. A status section for each block indicates the availability ofauthoring aids sufficient to guide an individual through all activities specified by the block, as well as the availability of relevant procedures and techniques that could be developed into authoring aids. Directions for future research, based on the lack ofauthoring aids available, are identified.

Microfiche 914, paper copy $5.30 plus shipping as document ED 186 023.


This publication brings together seven papers exemplifying the systems approach to educational decision making. The first discusses the need for inclusion of constituent values in educational decision-making strategies to properly apply systems theory concepts. Recommendations presented in the second, which addresses systems design for problem solving in schools, are intended to help the school staff cope more effectively with change and the change process. The third discusses a model of seven functions in the passage and implementation of school law to facilitate special education legislation. A dissemination model known as MOD, designed to determine the process by which an intermediate state agency could act as a linking agent between developers and classroom users of educational products, is described in the fourth paper. The fifth presents a systems view of learning focused education, defines LFE, develops a systems model, and presents a learner system. In the sixth, the three major elements of a career education delivery system are defined and the relationships among the planning, implementing, and evaluating activities are developed. The final paper discusses educational program evaluation and shows the value of system design in method selection and the analysis and interpretation of data.

Microfiche 914, paper copy $6.95 plus shipping as document ED 188 602.


This discussion of the use of various delivery systems and models of instruction for technical training in the field of measurement and control includes a review of the basic requirements of a learning system. Several aspects of such a system are considered, i.e., the design of a learning system through the use of computer-assisted instruction, the development of physical models to facilitate learning, and the use of simulation in the delivery of instruction.

Microfiche 914, paper copy $2.00 plus shipping as document ED 188 598.


This review of the experimental literature on certain components of printed instructional materials commonly used in early childhood education for normal, at-risk, and handicapped children focuses on the use of color, instances of concepts, language style, number of answer options, the use of pictures and drawings, preferences of children, response-mode requirements, and successive versus simultaneous stimulus presentations. Issues regarding educational practice and research are discussed. Microfiche 914, paper copy $3.65 plus shipping as document ED 187 472.