A New Paradigm of ISD?

Charles M. Reigeluth
Contributing Editor

Do We Need a New Paradigm of ISD?

There is a lot of talk lately about new paradigms. The word "paradigm" is rapidly becoming one of the most used (if least understood) words in the current vocabulary. And now they want to apply it to ISD? What in the world for? ISD has been very successful the way it is—both parts of it: ISD process models (see, e.g., Gustafson, 1991) and ISD product models, better known as instructional-design strategies and theories (see, e.g., Reigeluth, 1983).

But ISD's middle name is "systems." We know that every system is a subsystem in a larger system. And we also know that, when the larger (super) system changes in significant ways, the system itself must change in equally significant ways for it to survive, because it must meet the needs of its supersystem in order for the supersystem to continue to support it (Hutchins, 1996). So if ISD's supersystem were undergoing a paradigm shift, then (and only then) would ISD need to search for a new paradigm or else risk becoming obsolete.

ISD's Supersystem

So, is ISD's supersystem changing dramatically? What is its supersystem, anyway? To oversimplify a bit, it is all those systems that we serve—every context for application of ISD, including K–12 schools, higher education, corporations, health agencies, the armed forces, museums, and other institutions in the private, public, and "third" (not-for-profit) sectors. So let's take a look at some of the ones to which we contribute (and on which we depend) the most.

Corporations are undergoing massive restructuring (Hammer & Champy, 1993) that certainly fits the definition of a paradigm shift. In the agrarian age, businesses were organized around the **family**: the family farm, the family bakery, and so forth. In the industrial age, the family was replaced by the **bureaucracy** as the predominant form of business organization. Now, as we evolve deeper into the information age, corporations are doing away with many of the mid levels of the bureaucracy and are reorganizing based on holistic processes rather than fragmented departments (Hammer & Champy, 1993). Hence, they are organizing as **teams** that are being given considerable autonomy to manage themselves within the purview of the corporate vision, rather than being directed from above.

Increasingly, other organizations in all three sectors (private, public, and nonprofit) are undergoing similar transformations (see, e.g., Osborne & Gaebler, 1992). Table 1 shows some of the "key markers" that characterize the differences between industrial-age organizations and information-age organizations.

Table 1. Key markers that distinguish industrial-age and information-age organizations.

Industrial Age	Information Age
Standardization	Customization
Bureaucratic organization	Team-based organization
Centralized control	Autonomy with accountability
Adversarial relationships	Cooperative relationships
Autocratic decision making	Shared decision making
Compliance	Initiative
Conformity	Diversity
One-way communication	Networking
Compartmentalization	Holism
Parts-oriented	Process-oriented
Planned obsolescence	Total quality
CEO as "king"	Customer as "king"

These fundamental changes in the supersystems we serve have important implications for ISD. Employees need to be able to think and solve problems, work in teams, communicate, take initiative, and bring diverse perspectives to their work. Also, "people need to learn more, yet they have less time available in which to learn it" (Lee & Zemke, 1995, p. 30), and they need to demonstrate impact on the organization's strategic objectives (Hequet, 1995). Can our systems of education and training meet those needs by merely changing the content—what we teach—or do we need to make more fundamental changes? To answer this question, we must take a closer look at our current paradigm of training and education.

The Current Paradigm of Education and Training

Table 1 indicates that our current paradigm in education and training is based on **standardization**,

Charles M. Reigeluth is a Professor in the Instructional Systems Technology Department at Indiana University, Bloomington, Indiana. The author is grateful to Michael Molenda and Laurie Nelson for their suggestions on an earlier draft of this article.

much like the mass-production of industrial-age manufacturing, which is now giving way to customized production in the information-age economy. We know that different learners learn at different rates and have different learning needs. Yet our current paradigm entails teaching a large group of learners the same content in the same amount of time. Why? Because this allows valid comparisons of students with each other, which met an important need of the industrial age: **sorting students**, separating the laborers from the managers. After all, you couldn't afford to—and didn't want to—educate the common laborers too much (or they wouldn't be content to do boring, repetitive tasks, nor to do what they were told to do without questions). This is why the current paradigm utilizes norm-based testing. When you really think about it, our current paradigm of training and education is not designed for learning, it is designed for sorting (Reigeluth, 1994). But assembly-line work is becoming an endangered species in the United States, and corporate restructuring is requiring ever-increasing numbers of employees who can think and solve problems. We now need a **focus on learning** instead of sorting. This means we need a focus on **customization**, not standardization. This is true in all contexts for ISD: corporations and other organizations, as well as K–12 schools and higher education. Merely changing the content will not meet this new need of ISD's supersystems.

Table 1 indicates that our current paradigm of training and education is also based on **conformity** and **compliance**. Trainees and students alike are usually expected to sit down, be quiet, and do what they are told to do. Their learning is directed by the trainer or teacher. But employers now want people who will take **initiative** to solve problems and will bring **diversity**—especially diverse perspectives—to the work place. Both of these enhance the ability of a team to solve problems and keep ahead of the competition. Communities and families also need people who will take initiative and honor diversity. Changing the content is not sufficient to meet these new needs of the supersystems, for the very structure of our systems of training and education discourages initiative and diversity.

I could continue this process of analyzing how each of the key markers of our current paradigm of training and education (see Table 1) are counter-productive for meeting the emerging needs of the information age, but the message is already clear: **the paradigm itself needs to be changed.** This is the focus of the emerging field called Educational Systems Design (ESD) (see, e.g., Banathy, 1991; Reigeluth, 1995), which is concerned both with what kinds of changes are needed in education and training systems to better meet the needs of their supersystems and their learners (a product issue), and with how to go about making those changes (a process issue). So the next question is, does that mean ISD has to change?

To answer this question, it is helpful to distinguish between process and product, or means and ends, in ISD. The "product" issue is concerned with what the learning experiences should be like (after they have been designed and developed). **Instructional strategies and theories** are the knowledge base that addresses this issue (see, e.g., Reigeluth, 1983). The "process" issue is concerned with how we go about designing and developing those learning experiences. **ISD process models** are the knowledge base that addresses this issue (see, e.g., Gustafson, 1991). Since changes in the desired product will require changes in the process to create it, let's start by addressing the question as to whether the paradigm of instructional theory needs to change.

Implications for Instructional Theory

From the above discussion, we have seen that the current paradigm of **education** and **training** needs to change from one that is focused on sorting to one focused on learning—from the Darwinian notion of "advancement of the fittest" to the more spiritually and humanistically defensible one of "advancement of all." This means that the paradigm of **instruction** has to change from standardization to customization, from a focus on presenting material to a focus on making sure that learners' needs are met—a "Learning-Focused" paradigm. This, in turn, requires a shift from passive to active learning. It requires a shift from decontextualized learning to authentic tasks. And, most importantly, it requires a shift from holding time constant and allowing achievement to vary, to allowing each learner the time needed to reach the desired attainments.

But to do this, the teacher can't teach the same thing to a whole "class" at the same time. This means the teacher has to be more of a "guide on the side" rather than a "sage on the stage." So, if the teacher is a coach rather than the agent of most of the learning, what other agents are there? Well-designed resources are one, which is where instructional theory and instructional technology can play particularly large roles. But others include fellow learners (e.g., students or trainees), local real-world resources (e.g., practitioners), and remote resources (e.g., through the Internet). Instructional theories are needed to offer guidelines for the use of all these kinds of resources for the Learning-Focused paradigm of instruction. Furthermore, this paradigm requires that our definition of ***in***struction includes what many cognitive theorists refer to as "***con***struction" (see, e.g., Ferguson, 1992)—a process of helping learners to build their own knowledge, as opposed to a process of merely conveying information to the learner. Instruction must be defined more broadly as anything that is done to facilitate purposeful learning.

To help educators and trainers to design this new type of instruction, we need a truly new paradigm of

instructional theory, through which flexible guidelines are offered for instruction in which learners take initiative and work in teams on authentic, real-world tasks, choosing from a diversity of methods, utilizing advanced technologies, and being allowed to persevere until they reach appropriate standards. The Learning-Focused instructional theory must offer guidelines for the design of learning environments that provide appropriate combinations of challenge and guidance, empowerment and support, self-direction and structure. And the Learning-Focused theory must include guidelines for an area that has been largely overlooked in instructional design: deciding among different "approaches" to instruction, including problem-based learning, project-based learning, simulations, tutorials, and team-based learning. Tables 2 and 3 show some of the kinds of approaches that Learning-Focused theory might encompass. And we need flexible guidelines for the design of each of those approaches to instruction.

Furthermore, as the world becomes more complex, learners need more skills for complex cognitive tasks, such as solving problems in ill-structured domains. Instructional theories to date have focused largely on simpler procedural tasks in well structured domains. Only recently have researchers begun exploring instruction for complex cognitive tasks (see, e.g., Spiro, Feltovich, Jacobson, & Coulson, 1992; Leshin, Pollock, & Reigeluth, 1994, pp. 82–100, 230–244), and much work remains to develop powerful guidelines for designing instruction for this important type of learning.

For ISD to remain a vibrant and growing field that will help meet the changing needs of our systems of education and training, we desperately need more theorists and researchers working collaboratively to develop and refine this new paradigm of instructional theories. Formative research (Roma & Reigeluth, 1995) represents one possible methodology for developing such theories, because it focuses on how to improve existing theories, rather than on comparing one theory with another (as experimental research does) or on describing what happens when a theory is used (as naturalistic qualitative research does).

Clearly we do need fundamental changes in instructional theory. But does this mean we also need fundamental changes in the ISD process?

Implications for the ISD Process

The ISD process is basically a process for making decisions about the nature of instruction—the nature of ways to facilitate learning. To make good decisions, three activities are useful: analysis, synthesis, and evaluation. You should **analyze** the needs, the content, the learners, and the constraints to get the information necessary to make good decisions. Then you should **synthesize** that information to design and develop the instructional system. Then, you should **evaluate** that synthesis to find weaknesses in it and ways of improving it, and also evaluate your activities (analysis, synthesis, evaluation, and change), as any good reflective practitioner would do. Finally, throughout your analysis, synthesis, and evaluation activities, you should pay attention to issues of **change** (including implementation, organizational change, and management) needed to support the instructional system, because performance problems almost always require organizational changes as well as changes in the knowledge and skills of individuals. The typical ISD model characterizes these as successive phases of analysis, design, development, evaluation, and implementation/change (Gustafson, 1991).

So, won't these five basic activities also be useful, if not necessary, for designing the new paradigm of Learning-Focused instruction? I believe they will, but that some significant changes will also be necessary.

The first significant change, in my view, is that the ISD process should be viewed as (and is, in fact, even now intuitively performed by ISD experts as) a **series of decisions**, each of which is preceded by its own appropriate types of analysis. It is not useful to think in terms of completing all the analysis activities before doing any design activities. I like to think of this change as "**just-in-time analysis**." Much of the rationale for this is that each decision you make is likely to change the nature of subsequent options, such that it is often impossible to know ahead of time what type of analysis to do (what types of information to collect) for making all your later decisions.

For example, there are many different ways to sequence instruction: historical sequence, procedural sequence, hierarchical sequence, and so forth. Each type of sequence is based on a different type of relationship within the content. Therefore, each requires a different type of content/task analysis to design the sequence, such as a chronological analysis for the historical sequence, a procedural-prerequisite analysis for the procedural sequence, and a learning-prerequisite analysis for the hierarchical sequence. Until you have made the decision as to what kind of sequence to use, it is senseless to conduct a content/task analysis.

Furthermore, each decision can and should be **evaluated** as soon as possible after it is made ("zero-delay evaluation"), and organizational **change** concerns (including implementation) should be dealt with in conjunction with each decision ("ongoing change"). Consequently, I believe the new paradigm of ISD models will view the ISD process as an **iterative series of ASEC cycles** (Analysis–Synthesis–Evaluation–Change) for progressive sets of design decisions.

The second significant change I foresee is that the ISD process will be broadened to include greater attention to **impact on the instructional system's supersystems**. In the case of corporate training systems, greater attention will be paid to corporate performance

Table 2. Mid-level Strategies (from Dorsey, Olson, & Reigeluth, 1988).

Apprenticeship: an experiential learning strategy in which the learner acquires knowledge and skills through direct participation in learning under immediate personal supervision in a situation that approximates the conditions under which the knowledge will be used.

Debate: a formally structured discussion with two teams arguing opposing sides of a topic.

Demonstration: a carefully prepared presentation that shows how to perform an act or use a procedure; accompanied by appropriate oral and visual explanations and illustrations; frequently accompanied by questions.

Field trip: a carefully planned educational tour in which a group visits an object or place of interest for first-hand observation or study.

Game: an instructional activity in which participants follow prescribed rules that differ from those of reality as they strive to attain a challenging goal; is usually competitive.

Group discussion, guided: a purposeful conversation and deliberation about a topic of mutual interest among 6–20 participants under the guidance of a leader.

Group discussion, free/open: a free group discussion of a topic selected by the teacher, who acts only as chairman; learning occurs only through the interchange among group members.

Ancient symposium: a group of 5–29 persons who meet in the home or private room to enjoy good food, entertainment, fellowship, and with the desire to discuss informally a topic of mutual interest.

Interview: a 5- to 30-minute presentation conducted before an audience in which a resource person(s) responds to systematic questioning by the audience about a previously determined topic.

Laboratory: a learning experience in which students interact with raw materials.

Guided laboratory: an instructor-guided learning experience in which students interact with raw materials.

Lecture/Speech: a carefully prepared oral presentation of a subject by a qualified person.

Lecture, guided discovery: a group learning strategy in which the audience responds to questions posed by the instructor selected to guide them toward discovery (also called recitation class).

Panel discussion: a group of 3–6 persons having a purposeful conversation on an assigned topic before an audience of learners; members are selected on the basis of previously demonstrated interests and competency in the subject to be discussed and their ability to verbalize.

Project: an organized task performance or problem solving activity.

Team project: a small group of learners working cooperatively to perform a task or solve a problem.

Seminar: a strategy in which one or several group members carry out a study/project on a topic (usually selected by the teacher) and present their findings to the rest of the group, followed by discussion (usually teacher-led) of the findings to reach a general conclusion.

Quiet meeting: a 15- to 60-minute period of meditation and limited verbal expression by a group of five or more persons; requires a group of people who are not strangers to each other; is used at a point when the leaders or members feel that reflection and contemplation are desirable.

Simulation: an abstraction or simplification of some specific real-life situation, process, or task.

Case study: a type of simulation aimed at giving learners experience in the sort of decision making required later.

Role play: a dramatized case study; a spontaneous portrayal (acting out) of a situation, condition, or circumstance by elected members of a learning group.

Think Tank/Brainstorm: a group effort to generate new ideas for creative problem solving; thoughts of one participant stimulate new direction and thoughts in another.

Tutorial, programmed: one-to-one method of instruction in which decisions to be made by the tutor (live, text, computer, or expert system) are programmed in advance by means of carefully selected, structured instructions; is individually paced, requires active learner response, and provides immediate feedback.

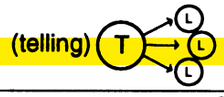
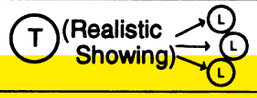
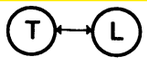
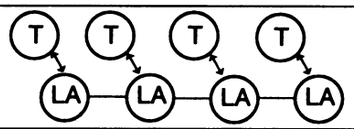
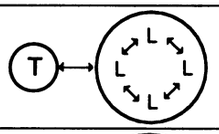
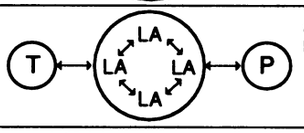
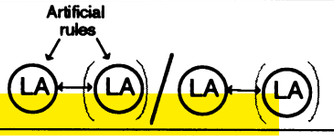
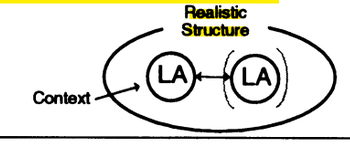
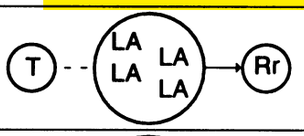
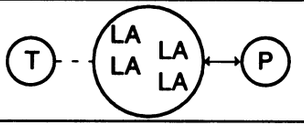
Tutorial, conversational: one-to-one method of instruction in which the tutor presents instruction in an adaptive mode; is individually paced, requires active learner response, and feedback is provided.

Socratic dialogue: a type of conversational tutorial in which the tutor guides the learner to discovery through a series of questions.

Note: There are many variations of these approaches, and different approaches are often used in combination.

(often called "performance technology") and societal impact (see, e.g., the "Business Impact ISD Model" proposed by Molenda, Pershing and Reigeluth (in press). For K–12 and higher education, greater attention will be paid to the needs of the broader community or society (and its various organizations) that the educational institution serves, as well as to the learners' needs; and greater attention will be paid to organizational changes that will help the institution and its instructional system to meet those needs. The concern for systemic change in education, or Educational Systems Design (ESD), is a reflection of the

Table 3. Alternative Methods for Instruction (from Molenda, 1995).

Methods:		Strengths:
Lecture/Presentation		Efficient Standardized Structured
Demonstration/Modeling		Eases Application
Tutorial		Customized Learner Responsible
Drill & Practice		Automatized Mastery
Independent/Learner Control		Flexible implementation
Discussion, Seminar		Meaningful, realism, owned, customized to learner
Cooperative Group Learning		Ownership Team-building
Games (artificial rules)		High Transfer High Motivation
Simulations		
Discovery • Individual		
• Group		
Problem Solving/Lab		High Level Thinking in ill-structured problems

T = Teacher (Live or Automated) L = Learner Ri = Resource (instructional) - - - = Indirect Involvement

P = Problem LA = Learning Activity Rr = Resource (raw) ⟩ = Direction of Control

need for this change in ISD (see, e.g., Reigeluth, 1995).

The third significant change I see flows out of the second: the ISD process should **include all "stakeholder" groups**, so that their interests, values, and perspectives can be accounted for in the instructional design and organizational changes. The stakeholders are all those people who have a stake in the instructional system under design. In a corporation, it might include the trainers, trainees, their managers, higher-level managers, stockholders, and customers. In a school system, it might include the teachers, students, administrators, parents, local businesses, and social service agencies. There are many times and ways the stakeholders should be involved during the process (see, e.g., the next paragraph), but the net result should be not only valuable **input** from these groups, but also the "output" of a sense of **ownership** over the resulting instructional system, which is an important aspect of the implementation/change dimension of ISD.

The fourth significant change I foresee is that the ISD process should have a **visioning activity** shortly after the needs analysis. This activity should entail having all the stakeholders for the instructional system under design come to consensus on a fuzzy image of what the instruction will be like, both in terms of **ends** (how the learners will be different as a result of it) and **means** (how those changes in the learners will be fostered). This is an opportunity for all the stakeholders to share their values about both ends and means and to reach some consensus, so that there will be no major disappointments, misunderstandings, or resistance when it comes time for implementation. And this vision should be continually revisited, revised, and elaborated throughout the design process. This kind of visioning activity was advocated by Diamond (1980), whose ID model included the step of "imagining the ideal" immediately after completing the needs analysis. Diamond found a number of practical benefits of this approach, not the least of which is that it gets the design team excited about a solution.

The fifth significant change I foresee is that the ISD process will make much greater use of the notion of **"user-designers"** (Banathy, 1991). This is a natural progression beyond Burkman's (1987) notion of "user-oriented ID" in that it goes beyond measuring and incorporating relevant potential user perceptions—it entails having the users play a major role in designing their instruction. Users are primarily the learners and the facilitators of learning (which should not be confused with the current concepts of students/trainees and teachers/trainers). Rather than viewing this role through the lens of the current paradigm, as students and teachers working on our current design teams, we could imagine several scenarios.

In one scenario, design teams (including all stakeholders) create flexible, computer-based, learning tools, like intelligent tutoring systems, that learners can use—while they are learning—to create or modify their own instruction. This concept is like adaptive instruction, except that the learners have the capability to request the computer system to use some instructional strategies, as well as the computer deciding on some strategies based on learner input. As Winn (1989) put it:

> This means that the role of instructional designers will involve less direct instructional decision making and more concentration on the mechanisms by means of which decisions are made (Winn, 1987). ... It follows that the only viable way to make decisions about instructional strategies that meshes with cognitive theory is to do so during instruction using a system that is in constant dialogue with the student and is capable of continuously updating information about the student's progress, attitude, expectations, and so on. (pp. 39–41)

Learners are able to make decisions (with varying degrees of guidance) about both content (what to learn) and strategy (how to learn it) while the instruction is in progress. The work of Dave Merrill and associates on "transaction shells" (Li & Merrill, 1990; Merrill, Li, & Jones, 1992) could well lead to this type of tool and has shown that such a tool is feasible to create.

A major shift in the paradigm of ISD that this scenario of the concept of user-designers represents is the notion that much of the analysis that is now done by a designer for a whole "batch" of learners well ahead of the actual instruction will soon be done during the instruction as the computer system continuously collects information from an individual learner and/or a small team of learners and uses that information to present an array of sound alternatives to the learner(s), both about what to learn next and how to learn it. Also, the teacher or trainer is afforded the opportunity to modify the system in ways s/he thinks are important. The systems concept of "equifinality" reflects the reality that there are usually several acceptable ways to accomplish the same end. The new paradigm of ISD will, I believe, allow for such diversity of means, as well as a diversity of ends, for learners.

In another scenario of the concept of user-designers, computers play a relatively minor role in some instructional situations, so the users must—ahead of time—design the framework or support system within which the instruction will occur. Rather than this being done in a designer-based team, in which an instructional designer plays the leading role, Nelson (1995) has developed a promising alternative in which it is done in a user-based team in which the designer plays a facilitating role and the users (teachers and students) play the leading role. I believe the new paradigm of ISD will empower the users to play a greater role in designing their instruction than our current conception of ISD allows.

All of these significant changes in the ISD process add up to more than a bunch of piecemeal changes

because they are systemically interrelated. They reflect a consistent set of values and a fundamentally different view of how instruction should be designed, including primarily the importance of making the design process more inclusive and less rigidly fixed in time. Because of its centrality to those values, I refer to this emerging paradigm of the ISD process as the "User-Designer Approach." Regarding **inclusivity**, the User-Designer Approach pays greater attention to the instructional system's supersystems, to all its stakeholder groups, and especially to its users. Regarding **time**, the ASEC cycles reflect the value of just-in-time analysis, zero-delay evaluation, and ongoing change, as well as the "yin and yang" of design:

- the contingent relationships among design decisions (one decision can only be made after another), and
- the iterative nature of the design process (similar activities are engaged in over and over, and earlier decisions are frequently revisited and revised).

Both inclusivity and time converge in the visioning activity that occurs with all the stakeholders early in the process and is continually revisited, revised, and elaborated as the process proceeds.

Conclusion

The first question posed in this article was, "Do we need a new paradigm of ISD?" We have looked at ISD's supersystems and seen some dramatic changes taking place—changes that have profound implications for what systems of training and education must do to meet the needs of their supersystems. Foremost among those implications is the need for a paradigm of training and education based on learning instead of sorting students. Other implications include the need to develop initiative, teamwork, thinking skills, and diversity. To help all learners reach their potential, we need to customize, not standardize, the learning process.

We have also seen that this new paradigm of education and training has important implications for ISD. Indeed, the health of the field (if not its survival) depends on the ability of its theorists and researchers to generate and refine a **new breed of Learning-Focused instructional theories** that help education and training to meet those needs—i.e., that focus on learning and foster the development of initiative, teamwork, thinking skills, and diversity. The health of ISD also depends on the ability of its practitioners and researchers to develop a **User-Designer Approach** to the ISD process, which ...

- conceives of the ISD process as a **series of design decisions**, each of which requires a cycle of analysis, synthesis, evaluation, and change (ASEC);
- attends more to the needs of, and ISD's impact on, its **supersystems**;
- includes **all stakeholder groups** in the ISD process; and
- envisions a **fuzzy image** of the instruction early in the ISD process.

Perhaps most important of all implications is that much of the designing should be done by the learners (**user-designers**) while they are learning, with help from a computer system that generates options based on information collected from the learners.

But with all this talk of a new paradigm of ISD, it is important not to completely reject and discard the old paradigm. In fact, the new paradigm needs to incorporate most of the knowledge our field has generated about both instructional theory and the ISD process—only that knowledge needs to be restructured into substantially different configurations to meet the new needs of those whom we serve.

Whether or not the field of ISD makes this transformation to a new paradigm will depend in great measure on the willingness of those of us in academe to develop the necessary theories and ISD processes and to provide the necessary professional development for the next generation of ISDers. □

References

Banathy, B. H. (1991). *Systems design of education: A journey to create the future.* Englewood Cliffs, NJ: Educational Technology Publications.

Burkman, E. (1987). Factors affecting utilization. In R.M. Gagné (Ed.), *Instructional technology: Foundations.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Diamond, R. M. (1980). The Syracuse model for course and curriculum design, implementation, and evaluation. *Journal of Instructional Development, 4*(2), 19–23.

Ferguson, D. L. (1992). Computers in teaching and learning: An interpretation of current practices and suggestions for future directions. In E. Scanlon & T. O'Shea (Eds.), *New directions in educational technology.* Berlin: Springer-Verlag.

Gustafson, K. L. (1991). *Survey of instructional development models* (2nd ed.). Syracuse, NY: ERIC Clearinghouse on Information Resources, Syracuse University.

Hammer & Champy. (1993). *Reengineering the corporation: A manifesto for business revolution.* New York: Harper Collins.

Hequet, M. (Nov. 1995). Not paid enough? You're not alone. *Training, 32*(11), 44–55.

Hutchins, C. L. (1996). *Systemic thinking: Solving complex problems.* Aurora, CO: Professional Development Systems.

Lee, C., & Zemke, R. (Nov. 1995). No time to train. *Training, 32*(11), 29–37.

Leshin, C. B., Pollock, J., & Reigeluth, C. M. (1994). *Instructional design strategies and tactics.* Englewood Cliffs, NJ: Educational Technology Publications.

Li, Z., & Merrill, M. D. (1990). Transaction shells: A new approach to courseware authoring. *Journal of Research on Computing in Education, 23*(1), 72–86.

Merrill, M. D., Li, Z., & Jones, M. K. (1992). Instructional transaction shells: Responsibilities, methods, and parameters. *Educational Technology, 32*(2), 5–26.

Molenda, M. (1995). Personal communication.

Molenda, M., Pershing, J., Reigeluth, C. M. (in press). Designing instructional systems. In R. Craig (Ed.), *Training and development handbook (4th Ed.)*. New York: McGraw-Hill.

Nelson, L. M. (1995). Personal communication.

Olson, J., Dorsey, L., & Reigeluth, C. M. (1988). Unpublished manuscript.

Osborne, D., & Gaebler, T. (1992). *Reinventing government: How the entrepreneurial spirit is transforming the public sector.* New York: Penguin.

Reigeluth, C. M. (Ed.) (1983). *Instructional-design theories and models: An overview of their current status.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Reigeluth, C. M. (1994). The imperative for systemic change. In C. M. Reigeluth & R. J. Garfinkle (Eds.), *Systemic change in education.* Englewood Cliffs, NJ: Educational Technology Publications.

Reigeluth, C. M. (1995). Educational systems development and its relationship to ISD. In G. Anglin (Ed.), *Instructional technology: Past, present, and future* (2nd ed.). Englewood, CO: Libraries Unlimited.

Roma, C. M., & Reigeluth, C. M. (1995). A study of formative research as a methodology to improve prescriptive theory. Manuscript submitted for publication.

Spiro, R. J., Feltovich, P. J., Jacobson, M. J., & Coulson, R. L. (1992). Cognitive flexibility, constructivism, and hypertext: Random access instruction for advanced knowledge acquisition in ill-structured domains. In T. Duffy & D. Jonassen (Eds.), *Constructivism and the technology of instruction: A conversation.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Winn, W. (1989). Toward a rational and theoretical basis for educational technology. *Educational Technology Research & Development, 37* (1), 35–46.