A Management Framework for Program Development Techniques

Symposium on ID Models—4

Castelle G. Gentry
Michigan State University
320 Erickson Hall
East Lansing, MI 48823

Abstract. Believing that most ID system approach models merely describe *what* should be done, but recognizing that ID techniques do provide operational directions for accomplishing tasks implied by those models, the author describes an ID approach model for organizing ID techniques. He categorizes a sampling of techniques according to the defined functions of the model, then identifies the techniques by name, purpose, and literature references.

The three instructional development system models described in papers by Diamond, Crilly, and Patton pointed out the differences *among* models. In this paper, a fourth model is used as a vehicle for looking *within* a model at the relationship between system components and the available techniques for accomplishing the functions of those components.

Most ID system models are descriptive rather than prescriptive; that is, they are more conceptual than operational. They provide an excellent overview and checklist of what should be done to accomplish an ID project, but they don't tell how to accomplish the actual tasks of the project. However, the techniques used by instructional developers are prescriptive, so it is appropriate for ID system models to tell us what must be done, while ID techniques tell us how to accomplish what must be done.

Jacque Ellul, in his major work *The Technological Society* (1967), defines "technique" as "any complex of standardized means for attaining a predetermined result." That meaning will be used here. It is contended here that many useful techniques have been designed to operationalize ID system models, but the techniques are scattered and difficult to find or assess. An appropriate framework for managing or organizing the wide range of techniques would be an ID system model! This would make it easier to search out the techniques for relevant purposes; such a systems view would reveal serious gaps in the array of available techniques.

This paper will present briefly an ID system model (developed over the years by the writer), recommended for organizing ID techniques and will categorize a sampling of techniques according to the functions served by the model. In addition, the techniques will be identified in terms of name, purpose, and literature reference.

The Systems Framework

The systems approach or management framework model (Figure 1), sometimes referred to as the "Dumbbell System," uses the boundary concept to demonstrate the relationship among its several components. This is particularly important for focusing ID students' attention on the exchange of essential information among the components (indicated by the arrows crossing component boundaries). In addition, the expanded support functions on the right reflect this writer's view of its importance in making operational the development functions on the left. Equally important, the model is responsive to organizational and faculty development concerns.

Component Functions

The 13 components of the model are defined below and keyed alphabetically to the schematic in Figure 1:

A. Needs analysis—The process of determining changes required in an educational system based on evaluation data.

B. Adoption—The process of obtaining agreement and support from legitimizers, decision-makers, and gatekeepers to incorporate an innovation into an educational system.

C. Design—The process of analyzing, planning, and drawing up appropriate strategies to accomplish a proposed change in an educational system.

D. Packaging—The process of developing, acquiring, and assembling the necessary skills, facilities, materials, and equipment for the prototype change; for testing the prototype; and for revising on the basis of test data.

E. Installation—The initial process of incorporating the change into an educational system.

F. Operation—The process of maintaining the change on a continuing basis.

G. Evaluation—The process of collecting data and providing confirming and corrective feedback on the relevancy, effectiveness, and efficiency of project elements.

H. Communication Network—The formal and informal procedures by which essential project information moves from the information generator to the information user.

I. Information Handling—The procedures for selecting, collecting, processing, transmitting, storing, retrieving, and assessing information relevant to an ID project.

J. Resource Acquisition and Allocation—The procedures for communicating ID project resource requirements, acquiring the resources, and distributing them among the elements of the project.

K. Personnel—Procedures for assigning personnel responsibilities and for handling internal personnel matters such as inservice training and discipline.

L. Facilities—Procedures for organizing and controlling spaces to serve

the purposes of an educational development project.

M. Management—The processes by which policies are determined, adopted, and enforced, and of coordinating and controlling the elements of the ID project in order to efficiently attain goals.

Range of Techniques

As indicated earlier, educational technologists deal not only with *instructional* development processes, but also with *organizational* and *faculty* development processes. Therefore, a sampling of techniques relevant to these three types of development is included here. Later in this paper, where techniques are matched with the components relevant to these three development types, significant gaps in the technique array are revealed. To make this organization of techniques really useful, additional techniques will have to be found or developed.

Among the many techniques identified and categorized, few of them are well researched, although testimonials to their value are relatively easy to find. It is important for researchers to realize the need for testing these techniques in actual use.

Categorization of Program Development Techniques

Space limitations prevent detailed description of individual techniques; however, each technique has been referenced so that any of interest can be pursued. This writer and a colleague have an extensive work in progress that will provide prescriptive detail. Publication is planned for 1981.

As a convenience to the reader, the sampling of techniques in this work is presented alphabetically by title. The technique's purpose, the system component function(s) served, and a reference to further information are provided.

The reader may know a technique by a name other than the one presented here. When a technique has more than one name, the one most frequently found in the literature is used. The letters before each of the system component functions are used as the means for keying each of the techniques to the Management Framework Model in Figure 1. A second key is provided at the end of the paper to permit a user to start from the Model components in order to find an appropriate technique without having to search the alphabetic listing.

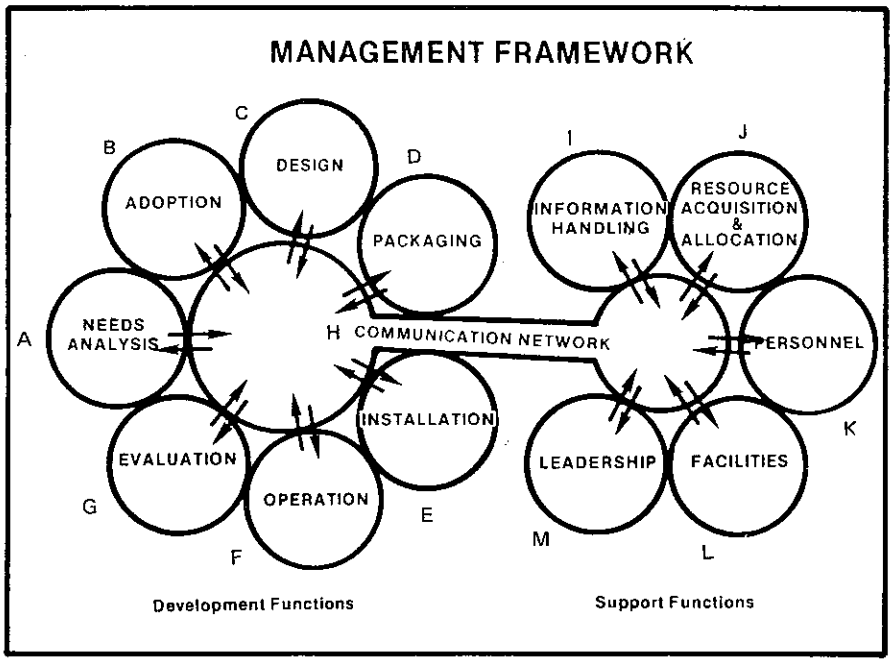

FIGURE 1. Management framework model.

Alphabetical List of Techniques

1. *Brainstorming (A, B, C):* Helps small groups generate a large number of ideas about a given subject or problem in a short time. (Osborn, 1963)

2. *Broken Squares (K, M):* Game designed to sensitize group members to some of their own behaviors that may obstruct the solving of problems in the organization. (Pfeiffer & Jones, 1969)

3. *Content Analysis (H, M):* A method of analyzing communications in a systematic, objective, and quantitative manner. May be used to analyze instructional messages. (Pool, 1959)

4. *Contract Plan (C):* A written agreement between student and teacher listing the goals, skills, and activities to be completed by the student within a specified time. (Haddock, 1967)

5. *Cost Benefit Analysis (C, J):* An analytic method designed to help a developer identify the most appropriate strategy among several alternatives, given cost constraints. (Goldman, 1967)

6. *Criteria for Rejecting Clients (A):* A checklist of eight items that help instructional developers determine whether to accept or reject a potential client. (Gentry, 1979)

7. *Critical Path Method (C, E, H, M):* Used for planning, scheduling, expediting, or monitoring tasks in a project. (Priluch & Hourihan, 1968)

8. *Decision Tables (I, M):* A decision-making structure for logically and consistently identifying the alternatives, conditions relevant to a problem, and their consequences. It has several advantages over flowcharting. (Hussain, 1973)

9. *Delphi Method (A, B, H, M):* Efficiently derives maximum judgmental input from a group of experts (anonymous to each other) on future events as they relate to some specific problem. (Helmer, 1966)

10. *Discovery Method (C):* A structured method giving students a wide range of choice in manipulating variables to solve a problem. (Taba, 1963).

11. *Ethnography (C, G):* Observational technique for collecting data and describing in analytical and multilayered fashion what is happening in a given instructional situation. (Schatzman & Strauss, 1973)

12. *Fault Tree Analysis (A, E, M):* Used for predicting the most probable ways by which a system or part of it might fail. It provides information for the redesign or monitoring of the system to prevent those failures from occurring. (Witkin & Stephens, 1968)

13. *Field Testing (C, D):* A process for developing, refining, and validating educational products to meet their intended objectives (Klausmeirer, 1968)

14. *Flowcharting (M):* Graphically conveys relevant facts, ideas, and relationships in a comprehensive and understandable form. Permits analysis of the processes and decision points relevant to the solution of problems in program processes. (Schriber, 1969)

15. *Force-Field Analysis (A, B, G):* A graphic means for identifying and contrasting forces facilitating and inhibiting a desired operation or change. (Judson, 1966)

16. *Formative Evaluation (D, G):* Means for collecting appropriate evidence during the construction and trial of instructional modules in such a way that revisions can be made during these activities. (Bloom, Hastings, & Madaus, 1971)

17. *Function Analysis (C):* A process for determining requirements and subfunctions for accomplishing all program objectives. Concerned with "what" is to be accomplished rather than "how." (Kaufman, 1972)

18. *Futures Wheel (A, C):* Helps learners or clients visualize the impact of one set of events on other events. It demonstrates how developments in one area lead to developments (both positive and negative) in other areas. (Gunn & Guy, 1974).

19. *Goal-Rating Procedure (A, B, C):* Procedure for ranking goals for importance and setting instructional development priorities. (Witkin, 1977).

20. *Information Mapping (F, H, I, M):* Highly structured presentational form for reducing ambiguity in communications. (Horn, 1976).

21. *Interaction Matrix Method of Sequencing Objectives (C):* Method for determining the sequence of objectives, based on the principle of student moving from the known to unknown. (Jones, 1972).

22. *Interactive Television (C, L):* Means of communicating over a distance on a face-to-face basis by means of a two-way audio and video signal. (Wittson & Benschoter, 1972).

23. *Latent Image (G):* Uses chemically treated response sheets to provide immediate feedback to subjects answering test questions. (A. B. Dick, 1980).

24. *Learners Verification and Revision—LVR (G):* Process for monitoring a learner during trial of new instructional materials for effectiveness and revision data. (Stolovitch, 1978).

25. *Management by Objectives (J, M):* Systems approach for developing and managing projects. (Koontz & O'Donnel, 1972).

26. *Managerial Grid (K, M):* Helps to establish the relationship between organizational demands (concern for results) and human demands (concerns for people). Used to reveal organizational problems. (Dessler, 1977).

27. *Merit Rating Chart (K, M):* Determines employee progress and value to the organization. (Doohes & Marquis, 1950).

28. *Microteaching (C):* Provides feedback to student on the basis of a videotape of performance on a teaching task. (Allen & Pyan, 1967).

29. *Needs Assessment (A):* Provides data for decision-making, planning, and development. (*Educational Technology.* November 1977 issue dedicated to needs assessment).

30. *Network Analysis (B, H):* Process which enables a developer to quickly determine significant communicative groups, links, and liaisons in an educational organization. (Farace, Monge, & Russel, 1977).

31. *Nominal Group Process (A, C, M):* Generates the maximum amount of judgmental data from a group in a minimum amount of time and gains agreement on the ranking of that data. (Delbecq, Van de Ven, & Gustafson, 1975).

32. *PPBS—Planning, Programing, Budgeting Systems (F, J):* A means of providing program justification for acquisition and allocation of resources in a cost-effective manner. (Magaro, 1975).

33. *Peer Tutoring (C):* A learning process in which one learner teaches another. (Klaus, 1975).

34. *Personal Inverted Filing System—PIFS (F, J, M):* Provides an expansive, simple, reliable, and efficient manual information filing system. (Holmes & Gentry, 1979).

35. *Program Evaluation and Review Technique—PERT (M):* Management technique for minimizing development delays by providing a timed and priced sequence of project tasks. (Ahauja, 1976).

36. *Relevance Trees (M):* A process of working backwards from a goal to the present, generating a hierarchy of events that must occur to accomplish the goal, to determine the most relevant path. (Yates & Henchey, 1974)

37. *Scenario Writing (A, C):* A process for generating the most probable chain of events, given a random selection of events and trends. (Duperrin & Godet, 1975).

38. *Sequencing and Clustering Large Numbers of Objectives (C):* A procedure for helping faculty systematically to sequence and cluster program objectives, based on faculty judgment. (Gentry, 1976).

39. *Sequencing Content (C):* Provides a rationale and process for sequencing instructional content. (Posner & Strike, 1976).

40. *Simulation (C):* An instructional process allowing students to respond very much as they would in the real situation. (Greenblat & Duke, 1975).

41. *Stake Model (G):* Provides relevant evaluation of what was intended versus what educational programs accomplished. (Stake, 1975).

42. *Storyboarding (C):* A process for designing and sequencing visual and auditory events for nonprint media. (Kemp, 1963).

43. *Summative Evaluation (D, F, G):* Assesses the impact of a finished product or program. (Fitz-Gibbon & Morris, 1978)

44. *Task Analysis (C, M):* The process of breaking down a task into basic components or subtasks which must be accomplished in order to accomplish the larger task. (Gagné, 1974)

45. *Task Description (M):* A process for identifying and defining program development and learning tasks in terms of explicit behavioral performance. (DeCecco, 1968).

46. *Team Teaching (C, M):* Two or more teachers cooperatively plan, instruct, and evaluate one or more student groups in a common instructional space. (Shaplin & Olds, 1964).

47. *Telelecture (C, L):* Used to permit two-way audio communication between a lecturer and a group in another location. Uses telephone lines and equipment. (Goldman, 1978).

48. *Time Study (D, F, M):* Procedure for determining the amount of time required to accomplish a series of tasks necessary to a project. (Mundal, 1960).

49. *Trigger Film (C):* An instructional strategy used to elicit an emotional response in viewers, and to "trigger" meaningful group discussions of the issues portrayed. (Fisch, 1970).

Listing of Techniques by Component

Each of the component names listed below is keyed to the numbers of the techniques:

A. Needs Analysis: 1, 6, 9, 12, 15, 18, 29, 31, 37

B. Adoption: 1, 9, 15, 19, 30

C. Design: 4, 5, 7, 10, 11, 17, 18, 19, 21, 22, 28, 31, 33, 37, 38, 39, 40, 42, 44, 46, 47, 49

D. Packaging: 13, 16, 43, 48

E. Installation: 7, 12

F. Operation: 20, 32, 34, 43, 48

G. Evaluation: 13, 15, 16, 23, 24, 41, 43

H. Communication Network: 3, 7, 9, 20, 30

I. Information Handling: 8, 20, 34

J. Resource Acquisition and Allocation: 5, 25, 32

K. Personnel: 2, 26, 27

L. Facilities: 22, 47

M. Leadership: 1, 2, 3, 7, 8, 9, 12, 14, 20, 25, 26, 27, 31, 34, 35, 36, 44, 45, 46, 48

Summary

The list of techniques provides only a sample of valuable means for accomplishing our daily tasks. The purpose here was not to formulate an exhaustive list, but to provide a framework for systematically organizing techniques. Such a model not only provides ready access for program developers but also provides a framework for adding and deleting techniques. Finally, such an organization alerts developers to the need for additional techniques, and to the need for objective research on the effectiveness, relevancy, and efficiency of existing techniques. The writer would be pleased to hear of additional techniques with their references.

References

A. B. Dick. *Creative use of invisible printing.* (A. B. Dick, 5700 W. Touhy Ave., Chicago, 60648) 1980.

Ahauja, H. N. *Constructor performance control by network.* New York: John Wiley, 1976.

Allen, D. W., & Pyan, K. A. *Microteaching.* Reading, Mass.: Addison-Wesley, 1967.

Bloom, B. S., Hastings, J. T., & Madaus, G. F. *Handbook on formative and summative evaluation of student learning.* New York: McGraw Hill, 1971.

DeCecco, J. *The psychology of learning and instruction: Educational psychology.* Englewood Cliffs, N. J.: Prentice-Hall, 1968.

Delbecq, A. L., Van de Ven, A. H., & Gustafson, D. H. *Group techniques for program planning.* Glenview, Ill.: Scott, Foresman, 1975.

Dessler, G. *Management fundamentals: A framework.* Reston, Va.: Reston Publishing, 1977.

Doohes, M. J., & Marquis, V. *Rating employee and supervising performance.* New York: American Management Association, 1950.

Duperrin, J. C., & Godet, M. SMIC 74: A method for constructing and ranking scenarios. *Futures,* 1975, *7*(4), 30-312.

Ellul, J. *The technological society.* New York: Vintage Books, 1967.

Farace, R. V., Monge, P. R., & Russel, H. M. *Communicating and organizing.* Reading, Mass.: Addison-Wesley, 1977.

Fisch, A. L. The trigger film techniques. *Improving College and University Teaching,* 1970, *20*(4), 286-289.

Fitz-Gibbon, C. T., & Morris, L. L. *How to design a program evaluation.* Beverly Hills, Calif.: Sage, 1978.

Gagné, R. M. *Task analysis—Its relationship to context analysis.* Paper presented at AERA, Chicago, April 1974. (ERIC Document Reproduction Service No. ED 092 588).

Gentry, C. *Criteria for rejecting clients.* Unpublished paper, January 1979.

Gentry, C. G. *Outline for sequencing and clustering of objectives.* Unpublished paper used in ID classes, 1976.

Goldman, R. M. Uses for the conference telephone in classroom instruction. *Educational Technology,* 1978, *18,* 42-43.

Goldman, T. A. *Cost-effectiveness.* New York: Praeger, 1967.

Greenblat, C. S., & Duke, R. *Gaming—Simulation: Rationale, design and application.* New York: Halsted Press, 1975.

Gunn, J., & Guy, C. Easy ways to help children think about the future. *The Futurist,* 1974, *8*(4), 186-188.

Haddock, T. Individualized instruction through student contracts. *Arizona Teacher,* 1967, *55,* 10-11.

Helmer, O. *The use of the Delphi technique in problems of educational innovation.* Santa Monica, Calif.: Rand Corporation, 1966.

Holmes, T. F., & Gentry, C. G. A foolproof personal filing system. *Audiovisual Instruction,* 1979, *24*(5), 40-42.

Horn, R. E. *How to write information mapping.* Lexington, Mass.: Information Resources, 1976.

Hussain, K. M. *Development of information systems for education.* Englewood Cliffs, N. J.: Prentice-Hall, 1973.

Jones, J. C. *Design methods: Seeds of human future.* London: Wiley Interscience, 1972.

Judson, A. J. *A manager's guide to making changes.* New York: Wiley, 1966.

Kaufman, R. A. *Educational system planning.* Englewood Cliffs, N. J.: Prentice-Hall, 1972.

Kemp, J. E. *Planning and producing audiovisual materials.* San Francisco: Chandler, 1963.

Klaus, D. J. *Patterns of peer tutoring: Final report.* Washington, D. C.: American Institute for Research in Behavioral Sciences, 1975. (ERIC Document Reproduction Service No. ED 117 695)

Klausmeirer, H. Research and development toward the improvement of education. *Journal of Experimental Education, 37*(1), 1968, 1-163.

Koontz, H., & O'Donnel, C. *Management: A book of readings.* New York: McGraw Hill, 1972.

Magaro, J. D. PPBS: A means towards accountability. *Audiovisual Instruction,* 1975, *20*(10), 10-12.

Mundal, M. E. *Motion and time study: Principles and practices.* Englewood Cliffs, N. J.: Prentice-Hall, 1960.

Osborn, A. F. *Applied imagination: Principles and procedures of creative problem solving.* New York: Scribner's, 1963.

Pfeiffer, W. J., & Jones, J. E. *A handbook of structured experiences for human relations training* (Vol. 1). Iowa City: University Associated Press, 1969.

Pool, I. de Sola. *Trends in content analysis.* Urbana: University of Illinois Press, 1959.

Posner, G. J., & Strike, K. A. A categorization scheme for principles of sequencing content. *Review of Educational Research,* 1976, *46*(9), 665-689.

Priluch, H. M., & Hourihan, P. M. *Practical CPM for construction.* Duxbury, Mass.: Means Company, 1968.

Schatzman, L., & Strauss, A. L. *Field research.* Englewood Cliffs, N. J.: Prentice-Hall, 1973.

Schriber, T. J. *Fundamentals of flowcharting*. New York: John Wiley, 1969.

Shaplin, J. T., & Olds, H. F. *Team Teaching*. New York: Harper and Row, 1964.

Stake, R. E. *Evaluating the arts in education: A responsive approach*. Columbus: Charles Merrill, 1975.

Stolovitch, H. D. The intermediate technology of learner verification and revision. *Educational Technology*, 1978, *28*(2), 13-17.

Taba, H. Learning by discovery. *Elementary School Journal*, 1963, *63* (6), 308-316.

Witkin, B. R. Needs assessment kits, models and tools. *Educational Technology*, 1977, *17*(11), 5-18.

Witkin, B. R., & Stephens, K. G. Fault-tree analysis: A research tool for educational planning. *Technical Report 1*. Hayward, Calif.: Alameda County PACE Center, October 1968. (ERIC Document Reproduction Service No. ED 029 379)

Wittson, C. L., & Benschoter, R. Two-way television: Helping the medical center reach out. *American Journal of Psychiatry*, 1972, *129*(5), 624-677.

Yates, J. R., & Henchey, S. P. *Futurism in education*. New York: Macmillan, 1974.