

INSTRUCTIONAL SYSTEMS DESIGN

Designing an instructional system requires an "objective analysis," which aids the specification of the instructional sequence, and a specification of the instructional conditions (Twelker, 1969). Twelker has outlined the steps which serve these functions.

The first major task, according to Twelker, is to analyze objectives to determine an instructional sequence.

A primary purpose of objective analysis is to discover what competencies that a learner is to discover a given course of instruction is to acquire during another and what competencies are independent from one another (Twelker, 1969, p.II-4).

Gagne (1965) discussed a few studies which also indicate the importance of objective analysis.

The results showed that the learning of "higher-level" principles was dependent on the mastery of prerequisite "lower-level" principles in a highly predictable fashion. For example, of the 72 students who performed correctly on principle IIA, only one did not perform correctly on principle IIAa. Of the 18 students who did Principle IIAa incorrectly, all 18 did principles IIAa incorrectly. The prediction that learning IIA depends on knowing IIAa was borne out, therefore, with a frequency of 99 percent. For all the other possible comparisons...the frequency of correspondence between predictions and findings ranged from 95 to 100 percent. The learning of organized knowledge, according to these results, appears to be predictable from the pattern of prerequisite principles that make up the hierarchy of knowledge to be acquired (Gagne, 1965, p.152).

Twelker believes the basic steps involved in objective analysis are:

- Step 1 Identify terminal objective
- Step 2 Identify learner entry level.
- Step 3 Starting at the terminal objective, ask the question, "What kind of capability would an individual have to possess to accomplish this objective?"
- Step 4 Repeat procedure for each competency that is determined.
- Step 5 As prerequisite competencies are determined, begin to arrange in hierarchical fashion.
- Step 6 Continually check efforts to assess relevance of competencies thus determined and to weed out competencies that are inappropriately stated, too detailed for the entry level of the learner, etc., asking the question, "Do I really need this competency?" (Twelker, 1969, pp.II-19-20).

Once objectives have been determined, instructional conditions need to be specified for achieving the objectives.

The main variables to be considered in specifying instructional conditions are: 1) characteristics of the learner and the system, 2) learning function, strategy, and response, 3) stimulus situation, feedback, and context, and 4) sequence (Twelker, 1969).

Twelker outlines twelve steps for specifying instructional conditions which can be sequenced under the headings given for the above variables.

Characteristics of the Learner and the system

Twelker's first step in specifying instructional conditions deals with the variable "learner characteristic."

- (1) Identify learner characteristics. This maximizes the adaption of instruction to the learner's personal needs, and reduces the chance of the system simply becoming a slick "Madison Avenue" package (Ibid. p.II-28).

The importance of this step is based on the assumption that students have different styles of learning and would benefit if the instructional system were adapted in some way to match, provide for, or at least take into account, each individual learning style.

...in their review of the studies dealing with aptitude measures, Tallmadge and Shearer (1967) concluded that no particular method or combination of methods have been shown to be most effective in instructing the students at various ability levels. Many of the results were conflicting, others were ambiguous or inconclusive, and those that seemed to be reliable did not fit into any recognizable pattern.

From a follow-up study, Tallmadge et al., (1968) obtained further data to substantiate the notion that a large number of variables exist that not only influence effectiveness but also interact with individual differences and each other in such complex ways that a thorough understanding of all of the interrelationships is impossible to achieve in any given study. However, their results strongly support the existence of learning styles and suggest that multi-track instruction based on learning styles is feasible. Incidentally, the individual differences which interacted with subject matter and instructional methods were all shown to be non-cognitive in nature (Ibid., p. II-34).

his lead Twelker to conclude:

- ...the instructor or designer of instructional systems is practically on his own in regard to the wedding of individual differences with instructional requirements. Indeed, the way open to the instructor for matching students with common attributes to appropriate curricula or units of instruction are very gross in nature.
- Tallmadge, et al., (1968) suggest several ways:
- (1) Classify students on the basis of administered aptitude and interest tests. Assign students to courses (or instructional systems) which differ in terms of intellectual demand and difficulty level.
 - (2) Classify students in regard to differential aptitude patterns and interest data. Assign students to courses (or instructional systems) encompassing the appropriate subject matter content.
 - (3) Classify students according to their learning style. Assign them to courses or instructional systems employing appropriate instructional methods (Twelker, 1969, p. II-34).

Hunt believes that individual differences can be accounted for in terms of four basic accessibility channels. These channels are: 1) cognitive, 2) motivational, 3) values, and 4) sensory (Hunt, 1971).

Hunt also sees students as progressing from a self centered unorganized phase, to learning ground rules, to learning how one is distinct from general standards, to relating on more empathetic understanding, to integrating a relationship of self and others.

He believes the optimum environment for students on level one is a clear consistent, well organized environment so that cultural expectation can be assimilated. If the environment is ambiguous or inconsistent and emphasizes autonomy, then there will be a mis-match and development will be restricted. Meanwhile, students on level two need an environment that permits a discovery approach. This leads Hunt to think that perhaps homogeneous grouping according to developmental stages might be beneficial (Hunt, 1971).

Of course, learner characteristics could also be classified according to other paradigms of development like Kohlberg's or Piaget's.

For moral development Kohlberg postulates six stages of moral judgement.

Level I-Premoral

- Stage 1-Punishment and obedience orientation.
(obey rules to avoid punishment.)
- Stage 2-Naive instrumental hedonism
(Conform to obtain rewards, have favors returned, and so on.)

Finally, in the stage of formal operations

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Level II-Morality of Conventional Role-Conformity
 Stage 3-"Good-boy" morality of maintaining good relations, approval of others.
 (Conform to avoid disapproval, dislike by others.)

Stage 4-Authority maintaining morality.
 (Conform to avoid censure by legitimate authorities and resultant guilt.)

Level III-Morality of Self-Accepted Moral Principles
 Stage 5-Morality of contract, of individual rights, and of democratically accepted law.
 (Conform to maintain the respect of the impartial spectator judging in terms of community welfare.)

Stage 6-Morality of individual principles of conscience. (Conform to avoid self-condemnation.) (Kohlberg, 1964, p.400).

Piaget presents several stages of cognitive development. These are: 1) sensory motor stage, 2) preoperational stage,

3) stage of concrete operations, and 4) formal operations. In the sensory motor stage

Children...encounter objects through random physical movement, without thought. (Dryll, 1972, p.6).

The muscular reflexes by constant exercise, become modified and the child's physical movements in space get coordinated. He acquires notions of objects and their permanency... (Raman, 1973, p.7).

the preoperational stage the child approaches problems through trial and error.

...the child does not use logical operations in his thinking. ...the child is perceptually oriented, i.e. he makes judgements on the basis of how things look to him... He is aware of only one variable or property since it stands out visually. He lacks the ability to coordinate variables...The development of logical process, though not stagnant, is very slow...(ibid. p.8)

the stage of concrete operations

...the child...begins to think logically, but this thought is concrete rather than abstract. In other words, while he can now perform simple logical operations, the child can do more advanced thinking if given physical objects to manipulate than he can if he is expected to do the same problems symbolically (Dryll, 1972, p.12).

The individual in the stage of formal operations learns to manipulate symbols and deal with ideas verbally without the necessity for always working directly with the physical objects. In other words, he becomes able to think in increasingly abstract terms.

The individual in this stage also learns to hypothesize before doing something. He can suggest for example "What might happen if I put an ice cube in a glass of cooking oil," and can then perform the operations necessary to either prove or disprove his suppositions (Ibid. p.23).

Another way to characterize students is by the degree of structure they require. Mosston (1972) believes that teaching style should be adapted according to how ready students are emotionally to make the different kinds of decisions required in learning. (see appendix).

As can be seen, there are a multiplicity of learner characteristics that could be identified. Which characteristics need to be identified will depend upon the purpose at hand.

The teacher should first clarify a purpose and then identify those characteristics relevant to the accomplishment of the aim.

Of course, once the learner characteristics have been identified, the next question is what implications do they have for setting up the instructional system.

(2) Identify tentatively the general characteristics of the instructional system to be used to achieve the terminal objective(s). That is, attempt to look at the whole system and outline its characteristics (Twelker, 1969, p.II-28).

For example, if students can be categorized according to a characteristic should they be grouped? Grouping would be an important characteristic of the instructional system. The effect of such a decision will have great influence. The consequences should be projected carefully. For instance,

Behavior, attitudes, beliefs, and values of the individual are all firmly grounded in the groups to which he belongs. How aggressive or cooperative a person is, how much self respect and self confidence he has, how energetic and productive his work is, what he aspires to, what he believes to be true and good, whom he loves or hates, and what beliefs and prejudices he holds--all these characteristics are highly determined by the individuals of groups and of the relationships between people. Whether they change or resist, change will, therefore, be greatly influenced by the nature of these groups. Attempts to change them must be concerned with the dynamics of groups (Cartwright, 1971, p.209).

Bany and Johnson point out that ability grouping can cause negative, resistant, apathetic reactions in a low group. "The group will lack unity, be anxious, dependent, and easily distracted. Average groups may resist the teacher because they are dissatisfied. And, high groups must retain their status and will therefore react negatively to individuals they feel aren't as adequate. The high group will resist the teacher's attempt to establish standards. Because they are cohesive, they will establish their own norms (Bany and Johnson, 1970, p.60).

Thelen believes students can be grouped according to certain learner characteristics while avoiding the problems that often arise with grouping. He suggests letting students serve different teachers and pick the one whose natural style suits their taste. He thinks that students would naturally select the instructional style most appropriate to their own particular learning style. Thelen calls this grouping by teachability." He believes this match between learning style and instructional style can also be predicted by an assessment battery (see appendix). This system supposedly allows a teacher to select an instructional style on the basis of how comfortable

he, the teacher, is with it rather than on the basis of learner characteristics. This assumes teachers will select differing styles so that students will have a range of choices.

Often, because this approach is not feasible, teachers are left having to determine what the most appropriate instructional style would be for the different specific conditions they confront. There is a wide range of choices for the teacher to choose from. For example:

...from the analysis of the instructional problem and the thinking about the proposed solutions to the problem, he might want to investigate the use of a simulation exercise or programmed instruction or some type of independent study or the audio-tutorial approach (Twelker, 1969, p.II-36).

However,

Unfortunately, there exists no manual or set of guidelines that would allow an individual designer to choose between one or another type of instructional system (Ibid. p.II-37).

Hudgins (1971) supports this statement.

There have been many research investigations conducted into the nature and operation of instructional materials, especially since the advent of educational films and radio in the 1930's, followed by educational television a generation later. Unfortunately, most of that research has been highly empirical in the sense that studies have been individual rather than part of an overall research program, and frequently the questions asked by the researcher have been highly specific to a given film, etc., thus negating any generalized use. Only rarely have investigations of instructional media been guided by an overarching theory or conceptual structure about the nature of communication, teaching, or learning (Hudgins, 1971, p.176,177).

This indicates that, at best, this review will be a patchwork of theories and findings.

One set of findings indicates the importance of considering the degree and nature of human interactions inherent in an instructional system under review.

way they had been at the beginning of the experiment. This radical change was expected to have a tremendous negative psychological impact on the girls and reduce their output. Instead, their output jumped to a new all-time high. Why?

The answers to this question were not found in the production aspects of the experiment (i.e., changes in plan and physical working conditions), but in the human aspects. As a result of the attention lavished upon them by experimenters, the girls were made to feel they were an important part of the company. They no longer viewed themselves as isolated individuals, working together only in the sense that they were physically close to each other. Instead they became participating members of a congenial, cohesive work group. The relationships that developed elicited feelings of affiliation, competence, and achievement. These needs, which had long gone unsatisfied at work, were now being fulfilled. The girls worked harder and more effectively than they had worked previously (Ibid., p.44).

Obviously, the same human aspects studied at the Hawthorne plant are important in the classroom also. Bany and Johnson (1970) state that when interaction is restricted open and natural development of the classroom group is inhibited. In such cases, when something interrupts class work there will be a lot of interaction to make up for lost time. Also, some groups will unite and resist teacher efforts to prevent talking. Furthermore, since disruption allows for interaction, the group may allow individuals to misbehave. A class group will resort to multiple mechanisms to maintain itself (Bany and Johnson, 1970, p.61).

In creating an instructional system it should be kept in mind that in effectively functioning classroom systems the forces determining individual behavior are not solely dependent upon the teacher or any single individual for motivation (Ibid. p. 59).

Bany and Johnson also point out that Team Teaching may cause problems of adjustment to multiple group membership because

First of all, for example, teaching machines can't provide for everything.

...Instructional objectives that involve the attainment of factual knowledge are amenable to automated instruction while objectives which involve patterns of behavior occurring at unpredictable intervals and reflecting "mediational" processes will be more readily attained through human instruction (Twelker, 1969, p.II-38).

Secondly, children need a certain amount of human interaction for its own sake.

...Investigators have reported interesting examples of the importance of the human instructor in an instructional system. Silber (1968) reports that in an experiment where children were isolated from each other and from the teacher in a dimly lit room and instruction was presented by a computerized system, the children would reach out to touch the experimenter as he walked about the room (Ibid., p.II-40).

Educators constructing such instructional programs need to account for the human factors found to be so important in the Hawthorne studies.

In 1924 efficiency experts at the Hawthorne, Illinois, plant of the Western Electric Company designed a research program to study the effects of illumination on productivity. At first, nothing about this program seemed exceptional enough to arouse any unusual interest. After all, efficiency experts had long been trying to find the ideal mix of physical conditions, working hours, and working methods which stimulate workers to produce at maximum capacity. Yet, by the time these studies were completed (over a decade later), there was little doubt that the work at Hawthorne would stand the test of time as one of the most exciting and important research projects ever done in an industrial setting. For it was at Western Electric's Hawthorne plant that the Human Relations Movement began to gather momentum, and one of its early advocates, Elton Mayo...gained recognition.

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Mayo and his team started their experiments with a group of girls who assembled telephone relays,...For over a year and a half during this experiment, Mayo's researchers improved the working conditions of the girls by implementing such innovations as scheduled rest periods, company lunches, and shorter work weeks. Baffled by the results, the researchers suddenly decided to take everything away from the girls, returning the working conditions to the exact

not only curriculum organization may be different, but also, grouping practices employed by the teacher. Thus, with subject matter specialists and different groupings, it is difficult for children to identify with any particular grouping. Yet, it is in their first organized work groups that children conform their perceptions of their own worth and identity in comparison with others. The more closely knit the group the less likely there will be interactional conflict and continued necessity of redefinition of individual performance. Loosely knit groupings impede communications, present unclear situations, give few cues to test perceptions by, fail to provide stable ties with social world of work, and provide little means for knowing the evaluation placed on behavior by others in the same setting (Ibid.).

Therefore, the influences affecting children are not only from teacher-pupil interactions, but also result from interaction between pupils and classroom group organization (Ibid.) The result is that if children find it necessary to devote time to developing unity, they will lose time from instructional tasks (Ibid. p.62).

Certainly, then, in planning an instructional system, it is important to plan for management of interaction. Classroom management is coordinating and integrating activities of the classroom system and minimizing difficulties arising from interaction patterns in classroom organization. It is not doing something to individuals which will develop self discipline in each child. Instead, it is stabilizing work conditions. It does not mean coercion, appeal, or persuasion. It means

creating highly satisfactory conditions in the classroom system so that group needs are met (Ibid. p.63).

The processes, or managerial patterns of activities, include (1) developing unified cooperative system of relationships (2) establishing standards and coordinating work procedures, (3) improving conditions in the system and solving operational problems by using problem solving techniques, and, (4) changing group properties which limit individual and group performance. As can be seen, these practices use skill rather than power to handle problems (Ibid.).

The following findings are helpful for establishing effective instructional groups and systems.

1. In organizing small groups, those containing up to seven members usually have everyone participating while having eight or more usually has someone who doesn't participate (Henry, 1960, p.198).

2. Possible socio-psychological relationships among class members are:

- 1) problem-solving and work relationships,
- 2) authority relationships for decision making,
- 3) social influences or power relations,
- 4) social acceptance relationships,
- 5) sex relationships,
- 6) informal, private, or friendship relationships (Ibid.)

3. Four major types of conflict can arise from personality conflicts, role conflicts, differences in role expectations and personality-dispositions, and differences in values and expectations. This indicates that if a teacher perceives his role differently then the students perceive his role there will be trouble (Ibid.). Therefore, in planning an instructional system, perceptions and expectations need to be taken into account.

4. To sustain motivation and learning:

- 1) most energy of students and teachers should be channeled into problem solving and work,
- 2) decision-making must develop from need to have well directed group work,
- 3) social acceptance must relate to problem solving in a way that supports members in work and problem solving participation,
- 4) social influence should be used to release direct problem solving and goals, and
- 5) friendships can develop to share perceptions and feelings about problem solving and work (Ibid. p.113, 114).

5. A supportive and interdependent environment should be strived for. Shared problem solving, acceptance, empathy, and good listening help create a supportive climate while advice giving, censoring, defence, persuasion, controlling, and punishing contribute to a defensive atmosphere (Ibid. p. 122-123).

6. The barriers to goal attainment are:

- 1) imposition of goals from external source,
- 2) improper manner of goal setting,
- 3) overabstraction in goal setting,
- 4) guilt of students over unacceptability of the "real goal" of the room (such as working to relieve boredom etc.). (Ibid. p.128)

Ideally, goals should be integrated and unified. A group would be working toward a task which maintains group morale and satisfies individual needs (Ibid.).

7. A growing group begins by being dependent, uncritical, and accepting of teacher remarks. As growth starts, the group may resist information from the teacher as part of a counter-pendence move. Time will also begin to be taken to work on group process problems instead of task (Ibid. p.131).

8. Social structure can be viewed by looking at 1) structure authority, 2) structure of goal orientation, 3) structure social access (Ibid. p.191).

9. Two important judgments a teacher must make are 1) What is the clarity with which students perceive learning goals, and 2) What is the existing level of dependence (Ibid. p. 212).

- 1) When goals are ambiguous, direct influence will establish more desirable attitudes and superior patterns of work.
- 2) When goals are ambiguous, indirect influence by teacher increases independence by decentralizing authority structure and/or freeing social access.
- 3) When goals are clear and attractive, direct influence will tend to increase dependence and indirect influence will tend to decrease dependence, but only to the extent that the students cannot see the relationships between teacher comments and the clear goals.
- 4) When goals are clear and unattractive, direct teacher influence is necessary to sustain work by restricting social access and centralizing authority, through a system of rewards and punishments, producing high dependency (Ibid. p.207).

So, teacher behavior can be

- 1) indirect or 2) direct, while learning goals can be 1) clear or 2) ambiguous, creating pupil responses that are either 1) dependent or 2) independent (Flanders, 1971, p. 185).

In addition to the above, in looking over a potential instructional system to determine characteristics, it may be helpful to think of four broad categories of principles of learning.

A teacher should look at the principles of learning 1) affecting motivation, 2) affecting rate and degree of learning; 3) affecting retention, and 4) affecting transfer of learning to any appropriate situation (Allen, 1971, p.151).

Furthermore, a teacher should consider three general teaching traits:

- 1) support v.s. demand (degree of support offered by the teacher-v.s. amount of demand for independent learner performance, 2) predictability v.s. ambiguity, 3) small steps v.s. large steps (Ibid. p. 153).

Also, it might be helpful to keep in mind that

To involve the students in the formulation of management rules and procedures is a goal; to establish rules immediately is a requirement. As teachers read the recommendations of various authorities, it is well for them to remember that it is authoritarian to be told not to be authoritarian (Ibid. p. 182).

In addition to considering grouping and classroom interaction, while planning the overall instructional design of a system, O'Reilly, Gorth, and Allan (1972) state that other important aspects of instructional development to consider are: 1) student management, 2) course content, 3) who chooses course content, and 4) instructional technique (O'Reilly et al, 1972).

Student Management - This relates to how and where decisions are made on guiding students through the course content. Are the students managed as a large group (entire class), a small group (2-10 students) or as individuals? Do students all proceed at the same pace, or are they self paced? Do they have a choice of which objectives they learn next? These are all management decisions...

Course Content - The information to be learned by the students upon completion is known as the course content. This course content is usually delineated by teacher outlines, lesson plans or behavioral type objectives. Most developers of instruction are now turning to behavioral objectives as the clearest indication of what students will learn in a course of instruction. Who Chooses Course Content - The decision maker who has control over what course content is to be learned has traditionally been the teacher in consortium with the textbook author and administration. Many newer instructional models are allowing students to choose their own content.

Instructional Technique - The instructional technique comprises the method or mode used to impart the course content to students. Alternatives consist of lectures, tapes, slides, simulations, programmed instructional materials, field trips, individual or group projects and many more (Ibid. book 1400, pp. 5-6).

A student management model may be "group-paced," "re-grouped," or "individualized." In a group paced model

"The students are guided through the course content together as a group (Ibid.)." In a regrouping model, "Students are still guided through the instruction in groups. However, instead of one group there may be many groups (Ibid.)." In an individualized model, "The students are guided through the course content based on their individual success and abilities (Ibid.)."

The first major dimension of student management is "Who Makes Decisions About Management?" Usually, the teacher is the decision maker deciding to review, move on, determine the criteria for success, etc. However, personnel specialists like librarians, and reading specialists can also make decisions. Furthermore, decisions may be made by group consensus or individual students may be the decision makers. Sometimes, the instructional materials developer becomes the decision maker by dictating sequence and follow-up activities in different media (Ibid.).

A second major dimension of student management focuses on "About whom are the decisions made." Decisions can be made not only about the entire group of students and individual students, but also students may decide that "the teacher is moving at too rapid a pace and should slow down or the presentation is unclear and should be made in some other manner (Ibid.)."

Another dimension is pacing. Pacing can be based either on the calendar or on learning rates.

As these things are being considered, the teacher needs

also to decide how many options, and what kinds of decisions, about subject matter the instructional system is going to permit students to be involved in.

The two options to be considered are linear or branched. In a linear sequence the group, or individual student, has limited options. If the objective is accomplished, then, the next objective in a preset sequence is tackled. If the objective is not accomplished, then the objective missed is reviewed. In a branching situation more options are available. If an objective is accomplished, the student(s) have a choice of which objectives to try next. These options could range from a limited choice of two objectives to any objective in the course. Similar branching options could also be built in if the objective is missed (Ibid.).

This involves a question of structure. A central characteristic of any instructional system that cannot be ignored is the degree to which learning activity is controlled. The power of decision making may be placed in the hands of students, may be inherent in the materials, or may be held by the teacher. One of the central distinguishing characteristics of open education is that students are given a wide latitude for decision making. Montessori provides structure through the arrangement environment. Various other models of teaching provide different methods for structuring (see Appendix).

Research indicates some guidelines for the handling of structuring in a classroom. First of all, the teacher is a leader responsible for seeing that appropriate structuring takes place. The Bureau of Research at Ohio State University describes this leader behavior along two dimensions: Initiating Structure and Consideration (Halpin, 1959, p. 4). William J. Reddin, in his "Tri-Dimensional Management Style Theory" describes initiation structure as task behavior and considera-

tion as relationships behavior (Hersey, Blanchard, 1972, p. 81). Paul Hersey and Ken Blanchard define these two dimensions as follows:

Task Behavior - The extent to which a leader is likely to organize and define the roles of the members of his group (followers), to explain what activities each is to do and when, where, and how tasks are to be accomplished; characterized by endeavoring to establish well-defined patterns or organization, channels of communication, and ways of getting jobs accomplished.

Relationships Behavior - The extent to which a leader is likely to maintain personal relationships between himself and the members of his group (followers) by opening up channels of communication, delegating responsibility, giving subordinates an opportunity to use their potential; characterized by socio-emotional support, friendship, and mutual trust (Ibid. p. 82-83).

Hersey and Blanchard (1972) summarize the findings of the work at Ohio State in this way:

In studying leader behavior the Ohio State staff found that Initiating Structure and Consideration were separate and distinct dimensions. High on one dimension does not necessitate being low on the other. The behavior of a leader could be described as any mix of both dimensions (Ibid. p. 74).

This means that four quadrants can be used to show various combinations of these two dimensions as illustrated below.

Consideration (High)		Initiating Structure (High)	
(Low)	HIGH CONSIDERATION and LOW STRUCTURE	HIGH STRUCTURE and HIGH CONSIDERATION	HIGH STRUCTURE and LOW CONSIDERATION
	LOW STRUCTURE and LOW CONSIDERATION		

Blanchard has suggested that, in general, a traditional school's instructional approach can be characterized as falling into the lower right hand quadrant. He said that any school that wants students to sit in rows, be quiet, and do as they are told, will fall into the high in structure and low in consideration quadrant. On the other hand, an alternative school which feels that it is important for students to select their own goals and methods for learning while teachers perform a supportive and reinforcing role will fall into the opposite category of high consideration and low structure (which is the upper left quadrant in the illustration).

Actually, both research and logic point to the conclusion that there are times when both of the above leadership styles are appropriate and times when neither style is appropriate. For example, in a study done in an industrial setting in Nigeria the results indicated that supervisors using high considerations and low structure got low production while high producing sections were directed by a high structure and low consideration style (Hersey, 1965). However, from studies in the United States, Rensis Likert concluded that the ideal productive leader behavior in industry is employee-centered (Likert, 1961, p. 9.) Obviously, these two findings conflict. Thus, Blanchard concludes,

A single normative leadership style does not take into consideration cultural differences, particularly customs and traditions as well as the level of education and the standard of living (Blanchard, 1972, p. 79).

Of course, it's only logical that no single leadership style is appropriate for all situations. For example, in an emergency, like a fire, people can't sit around discussing how to proceed (high consideration and low structure).

On the other hand, in an university setting, professors might rebel if told exactly how to teach (high structure and low consideration). The professors would probably prefer to be left on their own (low structure and low consideration).

With this in mind, Reddin states that a useful theoretical model "...must allow that a variety of styles may be effective or ineffective depending on the situation (Reddin, 1967, p. 13).

Consequently, it might be best to try adaptive leader behavior.

The manager must be much like the musician who changes his techniques and approaches to obtain the shadings of total performance desired (Koontz and O'Donnell, 1959).

The more a manager adapts his style of leader behavior to meet the particular situation and the needs of his followers, the more effective he will tend to be in reaching personal and organizational goals (Hersey, 1967, p. 15).

This means that teachers should be flexible and adapt their teaching style and the instructional system to meet the needs of the individual learners. Such flexibility requires learning to discriminate between environments, learning to discriminate between behaviors, between persons, being able to radiate different environments, being able to move students from one environment developmentally to another, and being

able to give appropriate types of feedback that will be effective for each type of person (Hunt, 1971, p. 54).

Mosston (1972) see appendix) has analyzed the basic teaching styles (alternative ways of structuring instruction). He lists the basic styles as 1) command, 2) task, 3) reciprocal, 4) individual program, teacher design, 5) guided discovery, 6) problem solving, and 7) individual program, student design.

In the command style the teacher makes all the decisions. He makes the planning (pre-impact) decisions, the implementation (impact) decisions, and the evaluation (post-impact) decisions. The student simply does what is prescribed.

In the task style the teacher makes all the planning and evaluation decisions while the student makes time and place decisions (where and how long to work).

In the reciprocal style, planning and implementation is like the task style. This style is different in the evaluation stage, however. After the teacher sets the criteria for evaluation the students actually do the evaluating.

In the individual program - teacher's design, the teacher makes the planning decisions while the student makes the implementation and evaluation decisions adhering, however, to the teacher's content decisions.

In guided discovery the student makes some content decisions during implementation.

The teacher guides the student through small, sequential discoveries until the student discovers the focus, the goal, that the teacher has selected. The student is presented with a sequence of questions (or clues) so meticulously arranged that the student always discovers the correct response until the target is reached. This represents convergent thinking (Mosston, 1972).

The sequence of discoveries by the student are the subject matter details which represent the content decisions the student makes during implementation.

The problem solving style differs from guided discovery in that problem solving calls for divergent thinking. The teacher still makes decisions about what problems are to be tackled but the students are called upon to make decisions about alternatives in solutions. The process is open ended. Problems can produce new realizations, new insights, new solutions, new ideas, new knowledge--

...all done by individual students who have learned to make decision independent of the teacher's preconceived solutions and decisions (Ibid.).

Finally, in the individual program - student design, the student makes all decisions in a condition of independence. He designs the problems and asks all the questions.

Mosston believes both teachers and students need to become flexible in the use of all these styles. He believes a natural progression is from command to individual student designed program. This means that Mosston has identified the specific styles that would represent movement through Blanchard's four quadrants. Certainly, each of these styles would be an important characteristic to consider in designing an instructional system.

In review, this first part of the chapter on instructional systems design has focused on characteristics of the learner and the system. Since there are many learner characteristics upon which a teacher could focus, it is best to center on a purpose and the characteristics directly relevant to its attainment. About the relationship between learner characteristics and the characteristics of the instructional system Twelker has said,

There are not any empirical data that lend themselves to the formulation of an unified theory regarding interaction training methods and learner characteristics (Twelker, 1969, p. 11-35).

However, questions arise about grouping, group process, teaching style and structure. Theory and some research indicate that teachers need to be careful about grouping. The human aspects of a system need to be considered carefully. There are various models of teaching which can be grouped as to a general style which provide a certain level of teacher structure vs. student structure. Ideally, the style and structure of an instructional system should match the maturity of the students. Both the teacher and the students should learn how to work effectively using all the styles.

Once the general relationship between learner characteristics and the general system have been established, the teacher can then:

- (3) Identify tentatively the relationship between, and general characteristics of, the way in which enroute objectives in the instructional system will be taught. This lets the designer match his tentative overall specifications for the system with each objective in the system (Twelker, 1969, p. 11-28).

Twelker presents a simplified example to illustrate what he means.

Let's suppose that a designer, upon review of his terminal objectives, decides to incorporate four general characteristics into his instructional system. (We could name many more, but these will do for now.) They are:

- (1) Learners will be responding actively during instruction.
 - (2) Immediate feedback will be given through peers, and not the teacher.
 - (3) Learners will receive a positive effective experience through interacting with each other.
 - (4) Due to cost, media will not be used.
- (Any similarity between this list of characteristics of the system and a simulation game are definitely not coincidental).

Now in Step Three, the designer takes a look at each enabling objective to determine the "fit" between the manner in which it might be best taught and the previously specified list of characteristics. This analysis might show, for instance, that one particular objective cannot be taught adequately in a simulation game. Perhaps media might be required. In this way, Step Three serves as a check against faults in characteristics specified in Step Two.

Another point should be made. The relationship between objectives and the components of the instructional system should be examined. For example, in an instructional simulation system, at least five general phases of instruction may be identified:

- (1) Pre-simulation system activities
- (2) Briefing
- (3) Conduct of the simulation exercise itself
- (4) Debriefing
- (5) Follow-up activities

In this case, the simulation designer should ask himself where a particular objective best fits in terms of these five phases (Ibid. p. 11-43-44).

Now, having analyzed the characteristics of the learner and the system and examined the match between the overall system and each of its separate parts, the teacher is ready to specify learning function, strategy and response.

Learning Function, Strategy, and Response

- (4) Identify the type of learning function represented.
Is it problem-solving or multiple discrimination
or something else (Ibid. p. 11-30)?

For identifying type of learning function it would be helpful to have a taxonomy such that

...each objective could be classified into a category which is homogeneous with respect to the conditions fostering learning of that type,...(Ibid. p. 11-45-46).

Twelker indicates that "Several attempts have been made in specifying this learning taxonomy (e.g., Cotterman, 1959; Gagne, 1965; Miller, 1963; Altman, 1966) (Ibid.)."

He suggests a taxonomy adapted from Altman (1966).

Briefly, the taxonomy is as follows:

- (1) Chaining or rote sequencing
- (2) Discriminating or identifying
- (3) Coding
- (4) Classifying
- (5) Discrete estimating
- (6) Continuous estimating
- (7) Logical manipulation
- (8) Rule-using
- (9) Decision-making
- (10) Problem-solving (Ibid.)

There are a variety of models and taxonomies that could be used for identifying learning function. One fairly simple model is the S.P.C.P. Model. This model suggests that learning begins with

...sensations, the products of stimulation of the sense organs, that is, any responses registered by the senses. The more the learner uses and combines his senses, the more the sensations are improved. Sensations are the "stuff" from which perceptions or impressions of experience with objects, events, qualities, or relationships are formed. That is, perceptions result from a

synthesis of separate sensory elements. It is important to note that many factors influence a learner's perceptions. Sometimes he perceives only what he has learned to perceive or only when his observations fit into a meaningful pattern. The perceptions of others might also influence him. As the learner gathers more perceptions, he begins to form concepts or abstractions of particular impressions organized into categories.... When the learner is able to organize or chain relationships among concepts, he can formulate principles or generalizations (Weigand, 1972, p.142).

Therefore, the model presents the following learning sequence.

Sensations -- Perceptions -- Concepts -- Principles
It predicts that

If the learner has been deprived of sufficient stimuli, that is, if his interaction with the learning environment has been limited so that he has experienced few sensations, his perceptions will be restricted and probably inaccurate. This, in turn, will have detrimental effects on his concept and principle formation. (Ibid.)

Another classification system has been developed by Bloom and his associates (1956 & 1964). Their taxonomy

...is divided into three domains - cognitive, affective, and psychomotor, with each domain including several classes of behavior that suggest how information might be used. Here is a list of these categories in the cognitive domain, along with a definition of the thought processes involved in each.

Knowledge: Knowledge simply involves the recalling of specific items of information.

Comprehension: Comprehension involves more than knowledge.

For example, a person who comprehends something cannot only recall it, but can paraphrase it, review it, define it, or discuss it to some extent.

Application: The person who can use this thought process can do everything in categories (1) and (2) above. He can also demonstrate his ability to take information of an abstract nature and use it in concrete situations. It is this ability to apply information to new problems that makes the process unique.

Analysis: The essential ingredients of analysis include the breaking down of a communication into its

constituent parts, and revealing the relationships of those parts.

Synthesis: Synthesis is a word used to describe the process of pulling together many disorganized elements or parts so as to form a whole. It is the arranging, combining, and relating parts that makes this process unique.

Evaluation: Judgments about the value of materials or methods are evaluative judgments. This thought process requires many of the abilities of categories 1 through 5, as well as some abilities unique to category 6 (Fraenkel, 1973, p. 30).

For the affective domain the processes are:

1. Receiving. Receiving refers to the student's willingness to attend to particular phenomena or stimuli....
2. Responding. Responding refers to active participation on the part of the student. At this level he not only attends to a particular phenomenon but also reacts to it in some way...
3. Valuing. Valuing is concerned with the worth or value a student attaches to a particular object, phenomenon, or behavior...
4. Organization. Organization is concerned with bringing together different values, resolving conflicts between them, and beginning the building of an internally consistent value system.
5. Characterization by a Value or Value Complex. At this level of the affective domain, the individual has a value system that has controlled his behavior for a sufficiently long time for him to have developed a characteristic "life style." Thus the behavior is pervasive, consistent, and predictable (Ibid. pp. 34, 35).

As of yet, a taxonomy for the psychomotor domain has not been developed by Bloom. Simpson (1966) and Harrow (1972) have attempted to create a taxonomy of the psychomotor domain. However, these taxonomies have not gained wide acceptance.

The ANISA model is based on the identification of basic learning processes in the psychomotor, perceptual, cognitive, affective, and volitional domains. A listing of these processes can be found in the appendix.

Another approach to classifying types of learning is presented by Gagne (1971). These are listed as follows:

Problem Solving	Solving a novel problem to achieve a goal by applying one or more rules
Rule Using (Principle Formation)	Relating two or more concepts; performing an action based on a rule or chain of concepts
Classifying (Concept Formation)	Responding to things or events in terms of some common abstract properties to form a class; ability to generalize
Multiple Discrimination	Recognizing physical differences among stimuli and making different responses accordingly to them
Verbal Chaining	Combining words to form verbal responses
Motor Chaining	Demonstrating a series of related actions; learning motor skills
Stimulus - Response Learning	Giving a certain specific response to a specified stimulus (Weigand, 1972, p. 156).

As can be seen, there are many classification systems which can be used for identifying types of learning. A system should be selected which 1) suggests a developmental

sequence, and 2) is specific enough in description to enable observers to clearly identify the type of learning.

Once the type of learning has been identified the next step is to:

- (5) Identify the instructional strategies that provide general conditions of learning. If general principles govern learning of one type or another, they must be identified (Ibid. p. II-30).

Generally, this means that once a teacher has identified the type of learning represented by each objective, he needs to identify the instructional strategy to be used by the teacher to help the learning take place. (Ibid., II-50). Gagne, in his book, The Conditions of Learning (1965) explains:

The requirements for instruction of principles whether practiced by a teacher, a film, or a textbook

Step One: Inform the learner about the form of the performance to be expected when learning is completed.

Step Two: Question the learner in a way that requires the reinstatement (recall) of the previously learned concepts that make up the principle.

Step Three: Use verbal statements (cues) that will lead the learner to put the principle together as a chain of concepts in the proper order.

Step Four: By means of a question, ask the learner to "demonstrate" one or more concrete instances in the principle.

Step Five: (Optional, but useful for later instruction) By suitable question require the learner to make a verbal statement of the principle (Gagne, 1965, p. 149).

Various teaching models have been developed which present strategies for providing conditions for learning. These are summarized in the appendix.

The next step listed by Twelker is:

- (6) Specify the learner response(s). What is the learner supposed to do? What is the form of the response? What media are required? (Twelker, 1969, p. II-30)

In specifying learner responses a teacher must note (1) content, and (2) operation. Obviously, content refers to what information is to be learned. In addition to the content of a response a designer should state the form of the response. Twelker suggests that if a practice of knowledge is desired, the designer is free to use any of the following forms:

Overt (An observable response) Button pushing, Verbal response, etc.	Covert (An unobservable response) Mental response
Selective Making a multiple-choice response on an answer sheet	Motor Pushing a button.

Vocal
Saying or writing
(Ibid., p. II-54)

On the other hand, if practice of performance (application) is desired, a designer must also consider:

- (1) A real-life response to real-life stimuli (doing the task in the operational setting);
- (2) An enacted response (doing the task in a non-real life setting);
- (3) An iconic response (drawing what would be done in a real-life setting);
- (4) An analogue response (giving a non-corresponding response in a non-real life setting); or
- (5) A symbolic response (saying, writing, or choosing among given alternatives what would be done in non-real life setting) (Ibid., p. II-54-55).

In addition, the designer should consider what strategy might be used in the operation. For example,