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Briggs, Leslie and Dodl, Norman. "Module 5.3: Taxonomies/Instructional."

CENTER FOR EDUCATIONAL TECHNOLOGY

MODEL

Instructional Module 5.3

"Taxonomy/Instructional
Gagne/Briggs"

College of Education/Florida State University

1973

INSTRUCTIONAL
MODULE 5.3:

TAXONOMY/INSTRUCTIONAL GAGNE/BRIGGS

by

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series editors

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First Field Test Version 6/10/73
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1973

Note: This is a revised and expanded version of this module; the 6/10/73 version was only the introductory part.

Note to Student: Some of the modules in this series utilize three type styles.

If you have <u>not previously encountered</u> the explanation for the three styles, please go on to the next page for an explanation.

If you have encountered the three styles before, skip the next two pages, and begin the module.

Note to Student:

Explanation of Types Styles

In this module, three type styles are used to help you be aware of the different functions of each part of the module. These functions are next summarized, in the type style used for each in the module.

1. *This type style is used to give directions to you, and to explain the purposes of the module -- in short to make clear what you need to do. So this type style helps you answer the questions: "Where am I going in this module? What am I to learn? What am I to do?".*

2. This type style is used for the instructional materials which are designed to show you how to get to where you are going in the module, e.g. to enable you to get to where you are going. This tells you "How will I get there?".

3. This type style is used for self-tests or practice exercises. While these self-tests are to help you decide whether you think you have mastered the objective of the module, other tests will enable the instructor to verify that you have indeed arrived. Both kinds of tests help you answer the question: "How will I know when I'm

arrived?" (Mastered the objective.)

To Summarize:

This type style is used for	-- answering this question:
1. This type style	-- "*Where am I going?*"
2. This type style	-- "How will I get there?"
3. This type style	-- "How will I know I've arrived?"

Generalizing suggestion: In planning your own teaching, you might find the above three questions useful to keep in mind. Any lesson, like any module, should involve all three.

Introduction

Module 5.3: Taxonomy: Instructional-Gagne/Briggs

Differences Among Taxonomies

The introductory module for this cluster (Module 5.1) listed the various purposes and uses of taxonomies. Some of the purposes for taxonomies discussed there, were:

1. To sort objectives into clusters, under domains or types of learning in taxonomies, in order to group together those objectives that are similar in nature (type of learning), although varying in specific content and pupil actions.

2. To check the planned objectives for desired distribution across a range of domains of learning.

3. To aid in the approach to teaching.

4. To aid in the approach to evaluation.

5. To consider the sequencing of instruction.

Different taxonomies now in use vary among themselves in several ways. Notable among such variations are the following:

1. Some taxonomies appear useful for classifying objectives and evaluating outcomes of instruction (Bloom; Krathwohl).

2. Most taxonomies pertain to pupil learning and performance, but one pertains to performance of the teacher (Dodl *et al*).

3. Some taxonomies represent only one "domain" of learning and performance:

a. Cognitive domain - Bloom

b. Affective domain - Krathwohl

4. One taxonomy:

a. Cuts across several domains, and

b. Focuses particularly upon the design of instruction (Gagne/Briggs).

The present module deals with the last named taxonomy. This taxonomy is treated in the greatest detail in a book by Gagne and Briggs (1974). This module is to some degree a highly condensed account of this particular taxonomy. Both documents deal with several rather distinct, but closely correlated, aspects of that taxonomy:

a. Identification of various domains and types of learning.

b. Describing the performances that would typify the objectives and the outcomes of each category of learning.

c. Describing the conditions of learning that can be utilized in the "instructional events" (teaching steps) which would facilitate each type of learning.

Of distinctive importance is the consideration that the taxonomy by Gagne and Briggs is designed especially to provide guidelines for the <u>design of instruction</u>. These

authors attempt to show how to teach each domain and sub-domain of learning they identify. They do this by two main classes of information. They provide:

1. A list of instructional events that are common to all domains, and thus should be considered in the planning of all instruction, regardless of domains.

2. A list of the conditions of learning that are different from one domain to another. These distinctive conditions of learning are woven into the way the generally useful instructional events are planned.

While the above comments clearly justify the classification of the Gagne/Briggs taxonomy as an instructional taxonomy, this does not restrict its use for all the other purposes served by taxonomies, as summarized above, and in Module 5.1. So a teacher might want to use this taxonomy for all the purposes served by taxonomies, or he may find occasion to use different taxonomies for different purposes, although this would involve trying to translate one taxonomy in terms of another. This is not easy to do, even for taxonomies covering or including a single domain (e.g., both Bloom and Gagne/Briggs cover the "cognitive domain.") It would be even more difficult if not entirely wrong, to try to translate Bloom's taxonomy into Krathwohl's, because they address themselves to

different domains.

If one wishes to select a taxonomy for a single purpose, such as checking to see if a variety of types of learning are reflected in the objectives to be taught, one might choose either Bloom or Gagne/Briggs if all the objectives are in the cognitive domain. If the objectives cut across the cognitive and affective domains, one might choose Bloom plus Krathwohl, or Gagne/Briggs.

Where more than one taxonomy could serve the same purpose, one could choose whichever he finds most convenient to use. Systematic studies are lacking as to whether Bloom or Gagne/Briggs would be most difficult to learn how to use, for example, for the cognitive domain. No doubt prior exposure to either would incline the person to use the one already familiar to him. But for the purpose of instructional design, it bears repeating, the Gagne/Briggs taxonomy has no actual parallel.

Overview of the Gagne/Briggs Taxonomy

Actually, four basic sources external to this module would need to be consulted if one wishes to both understand the scope of types of learning covered by this taxonomy, and to utilize it systematically for the detailed design of instruction. To understand why this is so, we present, in historical sequence, an overview of the content of the four basic documents.

1. The Conditions of Learning, by Gagne (1965, first edition; 1970, second edition), outlined the domain of intellectual skills, listing eight types of learning which comprize this domain, as Gagne defined it. This book also presented the list of instructional events common to the different types of learning, and the conditions of learning which are different among the types of learning.

The eight types of learning Gagne identified as the intellectual skills domain were:

1. Signal learning
2. Stimulus-Response learning
3. Chaining
4. Verbal Association
5. Discrimination learning
6. Concept learning
7. Rule learning
8. Problem solving

2. Handbook of Procedures for the Design of Instruction, by Briggs (1970), represents a more prescriptive or proceduralized account of instructional design, relating closely to the same intellectual skill domain treated by Gagne. This Handbook contains not only step-by-step instructions for application purposes, but also samples of how this is done, and exercises and self-tests for the

specialized designer.

3. A Student's Guide to Handbook of Procedures for the Design of Instruction (1972) gives added directions for an individualized study approach to mastery of design skills in the same domain as discussed in the earlier two works. In addition, complete examples of how such designs can be worked out are reproduced from the work of three former students who had taken Briggs's course, which employed the above two volumes as course materials.

4. Principles of Instructional Design, by Gagne and Briggs (1974), extends the coverage of instructional design to the following domains and sub-domains of learning and performance:

1. Intellectual Skills (including the eight types identified above.)
2. Information learning
    a. Facts
    b. Verbal sequences
    c. Learning the "substance" of printed passages
3. Motor Skills (Subsuming motor chains)
4. Cognitive Strategies
5. Attitudes

Thus the current taxonomy, as described by Gagne and Briggs, covers five domains, and twelve sub-domains, or types of learning.

In the 1974 volume Gagne and Briggs also attempt to extend the coverage to include identification of the Conditions of learning for all domains and sub-domains; these conditions are to be employed in the detailed management of the events of instruction, applicable to all domains.

Cross-Indexing with Other Taxonomies

Broadly speaking, the domains of intellectual skills and cognitive strategies, taken together, appear to be broader in scope than is Bloom's cognitive domain. Within the total scope, many near-equivalencies with Bloom may be discerned.

The information learning domain as treated by Gagne and Briggs, overlaps in some degree with work of Ausubel in what he calls "reception" learning.

The attitude domain, as treated by Gagne and Briggs, will hardly please anybody. It does not represent what Krathwohl covers as the affective domain, nor does it deal with emotions or personal value formation. Rather it defines attitude operationally as internal pre-dispositions

which make themselves apparent in the way people choose to behave. So choice behavior and how it is developed is a near equivalent of attitude, as defined in the 1974 book.

You have now had an extremely condensed overview of the Gagne/Briggs taxonomy. As you have seen, you would have to read all four books mentioned above to have the entire story of this taxonomy in all of its details. It takes more time to learn to use this taxonomy because it is intended to serve all the purposes of a taxonomy discussed in module 5.1 and at the beginning of this module.

Of the several purposes of a taxonomy, the use of the Gagne/Briggs taxonomy for the purpose of the design of instruction is what makes it so complex to learn to understand and put to use. In a sense, using the Gagne/Briggs (G/B) taxonomy for its full range of purposes, would encompass the following aspects, say, of planning a year of instruction.

1. State the entire range of goals for the year.
2. Break the goals down into major unit objectives, each, perhaps, covering 4 to 8 weeks of instruction.
3. Break each unit objective down to its specific objectives.
4. Analize each objective into its subordinate competencies (enabling objectives).
5. Classify each enabling objective as to its type or domain of learning, according to the G/B taxonomy.
6. List the instructional events to be used to teach

each enabling objective, planning to supplement them or implement them in the way specified in the appropriate set of conditions of learning for the type of learning represented by the enabling objective.

7. Plan and conduct the instruction to utilize the instructional events (I.E.) and the conditions of learning (C.L.) specified in the plan.

8. Do a formative evaluation of each objective or unit of instruction.

9. Review the entire goals and objectives for the year for desired spread over the several domains and sub-domains (types) of learning.

10. Revise the year's instruction, and conduct it again.

11. Conduct a summative evaluation to see if the design objective has been met, and to summarize any observed but uplanned outcomes of instruction.

Rather than going into detail now on how to do each of the above steps in use of the G/B taxonomy for the design and evaluation of instruction, we will by-pass the "how to do it", for now, in favor of giving you <u>one example</u> of planning instruction for a single lesson.

Then we will come back to an acc unt of how one goes

about the use of the G/B taxonomy.

An Example of the use of the G/B Taxonomy for Designing a Single Lesson

The example of lesson design given here is a greatly condensed version of a plan by Carol Robb, which is presented in full detail elsewhere (Briggs, 1972, pages 140-177).

This lesson is a part of a high school course called " "Introduction to Jornalism", which is a prerequisite for students who wish to work on the school newspaper. A required entering competency is the ability to type accurately but speed is not essential.

The course objective is as follows: "The student will be able to gather news, write it in an acceptable form, and edit the copy for publication. He will employ standard practices in newspaper layout and placement of stories according to their 'newsworthiness'. He will be able to differentiate between news and feature stories. He will be able to write headlines; to avoid libel; and to formulate a philosphic position of a newspaper in our society. He can identify the duties of each position in a standard newspaper organization."

As might be expected from the above, an early unit of instruction deals with the following objectives: "The student will be able to view an event, decide whether it

is newsworthy, record the pertinent facts, write an acceptable news story based on the 'who, what, when, where, why?' criteria, and edit his copy and type it for setting into type." Components of this unit are expressed in performance terms as specific objectives, including:

1. Observing and taking notes on an actual event or a simulated event (motion picture or videotape)

2. Deciding newsworthiness, and if such criteria are met, recording necessary facts and checking their accuracy

3. Using the notes to write a news story

4. Editing in a form to be sent in for type setting.

For the specific objective no. 3, above, a learning hierarchy was constructed (See Gagne, 1970; Gagne and Briggs, 1974), which contained, among others, the following enabling objectives. (Subordinate competencies; lessons):

a. Given notes on a newsworthy event, demonstrates the writing of a good lead.

b. Given notes and a lead, demonstrates the organization of the story in "pyramid" form.

c. Given (a) and (b), generates the story, using standards of brevity and reader interest.

It is evident that learning to write a good lead (competency a, above) might be approached by first learning to identify a "lead", when one is seen, and to

distinguish if from the remainder of the story. So the designer planned an introductory lesson for this purpose: "given a news story, the student identifies the 'lead' by underlining." In other words, this particular lesson was designed for the learning of the defined concept "lead". (After this lesson, rules would be learned to enable the student to write a lead.) Keeping in mind the events of instruction, and the conditions of learning appropriate to such a lesson objective (Gagne and Briggs, 1970), the following events of the lesson were arranged:

(1) State the objective of the lesson	(1) The teacher explains that the class will learn what a "lead" is. The ultimate goal is to write leads; but for now the students need only to recognize leads.
(2) Inform the learner of the objective by providing a model of performance	(2) The teacher projects a slide containing a short news story. The sentences which are underlined constitute the lead. Students are told that at the end of the lesson they will be asked to underline the lead in other news stories.
(3) Learning guidance	(3) The teacher asks the class to try to explain why the underlined part of the slide is the "lead". They speculate on what lead means in this context; some attempt to define "lead".
(4) Learning guidance: providing a verbal definition.	(4) The teacher now defines the lead as the first part of a news story which gives a skeleton

	outline of the entire story in the fewest possible words.
(5) Learning guidance: providing a variety of examples.	(5) The teacher next projects several other slides and hands out some one-page news stories.
(6) Present the stimulus, and elicit performance.	(6) The teacher asks the students to identify leads to "practice" stories. The students respond by pointing on the screen or by underlining on paper.
(7) Provide feedback.	(7) The teacher provides confirmation and corrective feedback as needed.
(8) Assess attainment of objective	(8) A group of three short news stories is given. Students underline the lead as a performance test over the lesson.

Discussion of the Example

It is clear that this sample lesson could have been planned somewhat differently, without departing from its objective. Some teachers might spend much time on step 3, expecting that the students will "discover" the definition of a lead. This plan permits such an approach. It provides, however, that in case the student discussion is not adequate, the teacher next gives the verbal definition as a time-economical step in the lesson. Different teachers might use more of fewer examples, or employ an overhead projector rather than a slide projector, etc. Some might choose to write the first example on the chalkboard.

In any case, use of a variety of examples is important

for such a lesson, in which one wishes to insure that the concept is well enough learned so as to apply it to new situations. It is conceivable, of course, that the verbal definition alone might be enough to enable some students to recognize leads consistently.

An alternate version of the lesson was also prepared. It is somewhat more prescriptive, depending upon applying formal criteria for identifying an acceptable lead. In this case, there is more emphasis upon recall of the six criteria: "who, what, when, where, why, and how." The teacher would suggest that a good lead must contain most of these or all of them. Formal criteria for a lead are listed in the designer's plan for this form of the lesson (Briggs, 1972, p.173).

It may be noted that since the objective of this lesson is to identify leads in stories, the student is not asked for a verbal definition of a lead. Such a definition could be merely memorized, and would not meet the objective of the lesson.

Classifying Goals and Objectives

In the 11-step procedure mentioned earlier for a full use of the G/B taxonomy for the design and evaluation of instruction, it was suggested that planning begin with major end-of-year goals, then working back from that to more

specific objectives.

While nobody can say with confidence how many such levels of goals and objectives should be derived for an entire year of instruction, Briggs (1970) suggested that at least these levels are useful:

1. End-of-year goals
2. Unit objectives
3. Specific objectives for each unit
4. Enabling objectives for each specific objective
5. Single lesson objectives

Arranging such a "network" to span and link lesson objectives to end-of-year goals is a challenging and by no means easy intellectual task. But it can be done, as the work of students in Briggs' classes have demonstrated (Briggs, 1972).

The process of working from more general to increasingly specific levels of objectives requires a process of logical analysis in which one asks himself: For this (general or unit) objective, what would the pupil have to learn earlier before he can do this? Answering this question at each level of the objectives results in a logical network of objectives in which more detailed objectives are defended only as they are needed to reach a more general objective. Otherwise, dead wood creeps into the planning.

For an experienced teacher, it is tempting to reverse this process, because the teacher can think most concretely about the various individual lessons he has taught in the past. But this temptation must be resisted resolutely. Otherwise, rather foolish general objectives are concocted to justify the lessons the teacher has previously taught.

Probably nobody has ever really completely worked out the entire network of objectives for an entire K-12 curriculum. But different people have often dealt with objectives at different levels. A curriculum committee might work out a "Scope and sequence" for, say, a K-6 curriculum. Then sub-groups representing specialty areas could block out the objectives for each year, in science, mathematics, social studies, etc. Then individual teachers might take each year of work in each subject in order to work down to the unit or lesson level.

While we cannot deal here with the even broader task of forecasting the nature of our society in the future in order to derive new national goals for education, every teacher should watch trends in society to try to determine how the present curriculum might be improved.

When one does work out a network from year-long goals to objectives of specific lessons, and after these are written down, one should then consider two questions:

1. Do I need to express the goals and objectives at

all levels in performance terms?

2. Do I need to classify all levels of goals and objectives according to a taxonomy?

While opinions would differ on these two questions, we pause to comment on each.

Performance Terms

Must all goals and objectives be expressed in behavioral terms, as taught in the module on how to write performance objectives?

One way of answering this is to suggest that objectives should be in performance terms for all levels at which evaluation of pupil performance is desired. Objective-referenced tests are possible only when there are objectives which define the pupil performance desired.

Another suggestion is that the more the total objectives are expressed in performance terms (what the learner can do, not "topics" or "subject matter presented"), the more levels at which formative evaluation of the instruction can be undertaken.

Another suggestion is that is is hard to defend the inclusion of a "specific" or "lesson" objective, if no higher objective is there, in performance terms. That is if a unit objective in history is simply "The Revolutionary War", there is no way to defend a specific objective such

as "the learner will show how taxation helped lead to war". But if the unit objective specified "being able to explain the economic, social, and military factors leading to war", one could defend the specific objective mentioned.

Finally, to plan the lessson there needs to be a performance objective.

Classifying Objectives

Should all levels of goals and objectives be classified according to a taxonomy? Let us relate this question to the uses of a taxonomy.

1. To review the entire instruction for a year for desirable coverage in various domains of learning. It would appear that end-of-course and unit objective could be used for this purpose. While one might be able to classify words or phrases such as "appreciate", "realize the significance of", "recall", or "perform", in terms of gross taxonomy domains such as information, cognitive, affective, or motor skills, one could be more confident of the classification if the objectives were in performance terms because the classifications in the taxonomy are also in performance terms. Especially in the G/B taxonomy, where a total of some 17 domains and sub-domains of learning are included, precise classification is hardly possible

without performance objectives. In part this is because the G/B taxonomy, as presented by the Gagne and Briggs 1974 volume, requires two verbs in an objective to completely define both the overt performance of the pupil and the internal capability that such performances imply. Thus the system of writing objectives suggested in Chapter 5 by Gagne and Briggs (1974), distinguishes such capabilities as compose letters (as opposed to copying letters) as separate from the test performance of composing a specifically assigned letter. Success on one or more instances of the latter (observable) performance leads one to infer that the pupil is able to compose letters.

2. To prepare performance tests over the objectives. Clearly if an indefinite unit objective like "The Revolutionary War" is used, one cannot prepare a test congruent with such an objective. But if an objective says "list the economic and social factors leading to the war and defend an analysis of the relative impact of each type", one has some idea how to prepare a test for the unit objective. In this case, it is clear that a performance objective is needed but it is not entirely clear that a classification is needed for the unit objective for testing purposes.

3. For Measuring unexpected outcomes of instruction. Here one observes first, then classifies if needed.

But if planned outcomes benefit an overall review of the instruction, and they are classified to look for breadth of coverage, it would appear useful also to classify the unplanned outcomes.

4. For design of instruction. Here the G/B "model of instructional design" absolutely requires the classification of specific objectives, or at least their subordinate competencies. The reason for this is that in this approach to instructional design, the teaching strategy results from using the set of condition of learning which has been shown as applicable to the specific domain or type of learning which the objective represents.

In general, then, it would appear desirable to classify the general objectives to insure the intended scope of the total instruction, to classify other objectives when evaluation is to be done at that level, and invariably to classify all specific objectives or subordinate competencies of them when such objectives are the basis for lesson planning.

How to Classify Objectives

For classifying objectives (or enabling objectives or subordinate competencies) for the intellectual skills domain, we now refer to you to an external source. This

requires reading, working exercises and self-tests, and checking your answers with an answer key.

For classifying objectives in domains other than intellectual skills, you will return to this module.

So at this time, place a bookmark at this page so you will know where to return after using the external source, next given.

Now, turn to Handbook of Procedures for the Design of Instruction,
Briggs (1970).

Begin at page 31 in that source. (Early pages dealt with how to write objectives. But the present task is how to select and classify objectives for the purpose of organizing the instruction.

Read Pages 31-39

Then take exercises, pages 40-42

Check your answers in the back of the book.

Then return to this module.

Analizing and Classifying Enabling Objectives

The exercises and reading you have just finished doing have taken you through three steps in the 11-step outline, presented earlier in this module, for using the G/B taxonomy to design instruction:

1. Choosing goals and objectives at different levels.
2. Choosing unit objectives.
3. Choosing specific objectives under units.

These matters relate to overall organization of the course.

You are now ready for the next step:

4. Analizing a specific objective into its subordinate competencies (enabling objectives), in order to classify each competency as to type of learning under the general domain of intellectual skills.

Now:

1. Return to the Handbook (Briggs, 1970)
2. Read pages 73-84.
3. Do Exercise 10, page 85-86
4. Write an objective. (See page 87)
5. Construct an analysis of your objective, as on pages 88-89 in the Handbook. (Note that your objective should be a problem-solving objective, or at least require rule using, as defined in the readings.)
6. For each subordinate competency of your objective, classify it as to type of learning, using the numbers

1 to 8 as given in the readings.

7. Check this work with your instructor or resource person. When he has accepted this work, return to the next page of this module.

You have now completed step 4, Classifying Competencies, in the 11 - step procedure for design of instruction. You are ready now for step 5, next page.

Step 5: Using Instructional Events and Conditions of Learning to plan the instruction

We are now down to the heart of the procedure for designing a single lesson. You saw a completed example of such a lesson earlier.

Your plan for teaching a lesson should use media that are suitable for the intended learner and that are able to carry out the general instructional events needed for all lessons, and the special instructional events (conditions of learning) that are appropriate for the type of learning represented by the competency.

Now read pages 94-101 in the Handbook

Step 6: Designing a lesson by use of Instructional Events

Then list the general and special instructional events you have adopted, and opposite show how you will implement the event. Refer back to the sample lesson plan given earlier in this module to see what it can be like.

Step 7: If a group is available, teach the lesson as outlined. In preparation, make a test over the lesson objective, and check it with your instructor. Also prepare any materials needed for teaching the lesson.

If a group is not available, take the lesson plan, the test, and necessary materials to the instructor for a critique.

Step 8 to 11: If the group was avaliable, do a revision (formative evaluation) of the lesson plan, based on the tryout and test results, and either (a) take it to the instructor for a critique, or (b) try out the revised lesson with another group, do a summative evaluation, and discuss the results with the instructor.

You have now used the intellectual skill domain of the G/B taxonomy to plan a lesson and evaluate the results. (We have short-cut the media selection step in the Handbook. You may want to read that portion, and to look at some of the more elaborate plans made by graduate students which are presented as "Student Products" in the Student Guide (Briggs, 1972).

You are now ready to see a summary of the conditions of learning (special instructional events) for domains other than intellectual skills in the G/B taxonomy. Then, if desired, you could repeat the 11-step lesson design process for objectives in other domains.

Turn the page for other domains.

Other Domains

Review of Intellectual Skills

The intellectual skills domain, with which you have just been dealing, represents a large and important segment of school learning. It includes the acquisition of competency in reading, computational skills, and other generalizable capabilities. These skills, composed largely of concepts, rule-governed behavior, and problem solving, have been labelled as productive learning, because they are applicable to a large range of situations. They are quite different from the lower-levels making up reproductive learning, in which one deals with specific verbal chains or discriminates specific, not general classes of stimuli.

To grasp the significance of the difference between these two levels of intellectual skills, let us contrast memorizing of a poem with learning to solve linear equations. When one recites a poem, he is reproducing the verbal chain of words that was given to him to memorize. Any change of a single word is therefore an "error". The learner must not just give the substance or general meaning of the poem in his own words -- e.g., he must not "generalize" or go beyond the verbal chain the author presented.

When solving linear equations, on the other hand, the learner is applying whole sets of rules that are applicable to all linear equations. On a test, he must not be given

the same "problems" that were used for learning, as he could have memorized the solution steps and the answer for specific problems. So new problems, never seen before by the learner, are used as a test of his ability to produce solutions for any sample of all posssible linear equations. During learning, then, he is not to recall the content of specific problems, but must learn to apply specific rules to a variety of problems of the same general type

Thus the lower forms of intellectual skills that are called reproductive learning require recall or discrimination of <u>specific stimuli</u>, while productive learning requires responding to entire <u>classes</u> of stimuli, and the nature of correct responding can vary within limits. That is, a skilled student is allowed to "skip" steps in written solution to problems, or to vary the order of steps, within limits. So both stimulus and response generalizatiion are the signs of mastery of productive learning, but they are "errors" in reproductive learning.

This difference between responding to specific stimuli (content), as in a poem, and responding in a flexible way to entire classes of problems, such as equations, will be a useful distinction in considering other domains and sub domains of learning. As in the intellectual skill domain, both types of situation will sometimes be found in other

domains, such as the one next discussed.

Information learning

Gagne and Briggs (1974) have identified sub-domains under the domain of information. These are:

1. Facts, Names, or Labels
2. Substance learning

Facts, Names, or Labels. These are isolated, independent bits of knowledge, such as "This book was written by Smith", or "July 4 is Independence Day". These facts may be recalled either in one's own words, or memorized as a verbal chain. If forgotten, unlike productive learning, they can simply be "looked up". Thus a fact can be looked up, but not an intellectual skill, such as reading or computing.

An important consideration in the design of instruction is to identify which facts are important enough or so frequently needed as to justify committing them to memory rather than just understanding them momentarily when first encountered, and later looking them up when needed.

Facts are often spoken of in a disparaging manner by those who emphasize the importance of attitudes and cognitive strategies. But the most capable people in any kind of endeavor usually also know more facts than do less capable

performers. Facts can be very crucial as elements in higher order intellectual activities. Thus if one must find the area of circles, he must know the fact relating to the value of pi, or he must have it constantly available for reference. A chemist who refused to learn chemical symbols or abbreviations would have rough sledding. So the choice of which facts should be learned among the huge number of available facts is worth serious consideration by every teacher.

As mentioned earlier, facts may be recalled either due to memorization of them as verbal chains or by having learned them in a highly meaningful context. So it is often useful to organize facts in a way that aids recall, or to associate a fact with a highly interesting event which would be easy to recall. Being introduced to a person who promises to give you a good job might result in recall of his name more dependably than recall of names of other persons to whom you were introduced.

Names and labels, which may be arbitrary in nature, may be not easily placed in a meaningful context. In this case, memorization is achieved by repeated practice and by "encoding" -- using a familiar word or image as a link between a known word and a new one. An example used by Gagne (1970) is learning that the French word for "match" is "allumette". If one encodes "illuminate" or [illegible]

of a flare of a match", it can be a bridge to help associate "match" with "allumette". Sometimes such codes are supplied by a textbook writer or teacher; if not, the student needs to provide his own code, or "bridge".

Substance Learning

This is a term referring to a student's ability to summarize in his own words the most important ideas in a lecture or chapter in a book. He does not memorize the chapter as a verbal chain, nor does he merely identify some of the facts in the chapter. He reads or listens, attempting to organize the material in some abbrebiated fashion, such as by making an outline.

The teacher or materials designer can do two things to aid the student in this kind of learning. Ausubel refers to giving an "advance organizer" -- a paragraph or one-page length overview of the general substance in condensed form. In addition to furnishing an "advance organizer", the teacher can provide an outline and can arrange the material in a meaninful way, such as by chronological order, or connecting one portion of the text with another in an interpretive fashion.

Ausubel refers to listening to lectures or reading

books as "reception learning". The student receives a written or oral message of considerable length, meanwhile attempting to construct his own meaningful framework on which to attach different portions of the message. Gagne and Briggs refer to this kind of learning as "knowledge". Such learning requires the pupil to recieve, process, store, and retrieve the main "substance" of what was received.

In the opinion of the writer, much of what is presented to students for substance learning could be improved by writing specific objectives which would enable the pupil to convert the information into another kind of learning. For example, instead of asking the student to "read and remember the Chapter on the Revolutionary War", the teacher could ask any of several other things, such as:

1. As you read the chapter, make a list of the major events leading up to the war.

2. As you read, summarize the influential people and their role in the pre-war events.

3. As you read, list dates and associated events.

4. As you read, make an outline you will use in summarizing the chapter in your own words to the class.

Most of the above instructions would lead the student

to engage in rule using or problem solving. He would be reading to search for the most relevant information. This is a quite different activity than "read and remember as much as you can". This leaves the pupil at a loss to decide what to try to remember.

So while substance learning is no doubt essential in education, it might be reduced in magnitude by the simple device of stating performance objectives for each chapter or lecture.

Another technique for giving more focus to substance learning is now called "adjunct auto-instruction". This is simply the practice of supplying the pupil with a list of questions to be answered after the chapter is read. While results vary as to whether the questions are read before or after reading the chapter, or whether questions are interspersed within the reading material, in general the use of the questions results in higher retention test scores both over material related to the questions and other materials for which no questions were written.

It may be further noted that the same material (whether a book or a film) can be used to achieve different objectives, simply by stating the desired objective at the outset. A project illustrating this is next summarized briefly.

Under sponsorship of the U.S. Office of Education, several

state Departments of Education and several universitites participated in the use of "Protocol films" in teacher training. This term means simply that the film shows a teacher and class at work on a lesson, without narration to explain or indoctrinate. Thus the film is simply a "vignette" or "slice of life" as it goes on in a classroom. The same film could be shown several times, giving the trainees a different objective each time. Different objectives could relate to a wide variety of topics in teacher training. Here are some possible objectives for the same film:

1. Try to identify the stage of mental development displayed by the children, using Piaget's system.

2. Use the Flanders method to summarize the interactions taking place.

3. What principles of child development were illustrated in the film?

4. What instructional events did you see the teacher using?

5. Using Bloom's taxonomy, classify the levels of questions asked by the teacher.

6. Could you identify an isolated child? A leader? A sub-group?

7. Classify the classroom climate as democratic, autocratic or <u>laize fairre</u>.

Clearly, a lot of "mileage" could be gotten out of one film, although there may be an argument for changing films to avoid boredom. But the point being made is this: A teacher can create a great latitude of choice in how to use the materials available simply by stating objectives for the use of the materials.

An alternate approach, of course, is to decide upon the objective first, then select or develop materials that can be used to reach that objective.

It is possible, then, that when entirely new objectives are adopted, available material may be sufficient for some of the objectives simply by telling the pupils what the objective is.

In other instances, entirely new material may have to be developed.

The foregoing discussion relates to two distinctly different kinds of achievement test, discussed in another module:

1. Objective-referenced tests
2. Content-referenced tests

The above example of use of films in teacher training utilized performance objectives both to show the trainees

what to learn and to test their learning. When performance objectives are supplied for any lesson (regardless of materials used), an objective-referenced test can be developed, both to evaluate learner performance and to evaluate the lesson itself. It is very clear, for properly written objectives, how the test should be made and used.

When objectives are not given, the learner is back to the situation "read the book and remember all you can to prepare for the test". Then the test is content-oriented. The teacher selects at random (or in order of importance not made know to the students) those items of content in the book to be converted to test items. The resulting scores usually form a normal curve, suggesting that the scores could be reflecting any or all of these factors:

1. The I.Q. of the pupils
2. Luck in guessing which items of content the teacher will use for the test
3. Accidental success in reviewing the same content the teacher selected for the test.
4. Chance (guessing in objective tests).
5. Actual amount learned and recalled
6. Skill in separating key content from enrichment

Earlier, you worked up plans for a lesson dealing with an <u>intellectual skill</u>, preferably of the <u>productive</u>

learning type (types 6,7 or 8).

You went through the 11-step method for preparing, conducting, revising, and evaluating a lesson.

Now it is possible for you to repeat this process for an objective in the information domain.

You may refer back to the 11 steps if needed, and you may re-read the avove discussion of the information domain to identify the conditions of learning for this domain, for a memorized verbal chain or for substance learning. You may also refer again to page 97 in the Handbook to remind yourself of the general instructional events appropriate for all domains.

Now prepare a lesson plan for the information domain, and try it out if a group is available; if not, discuss the lesson plan and the evaluation plan with the instructor or resource person.

Cognitive Strategies

This learning domain is essentially a more general and a more complex form of problem solving. Being more general and complex, such strategies take longer to develop, and they require a variety of kinds of exercise; e.g., a wide range of kinds of subject matter and types of problem solution to be devised by the learner.

While a certain degree of independence and discovery is required in what was previously dealt with as problem-solving, an even higher degree of self-teaching is involved in forming cognitive strategies.

In a general sense, as the learner grows older, he is expected to manage his own learning, with less help from the teacher. So the instructional events that the teacher provides for young children may be gradually withdrawn as the child grows older. Younger children also receive more frequent checks on their progress, and more frequent feedback (correction or confirmation) from the teacher.

Within a given age level, of course, some children require more help and more frequent feedback than others. The more advanced child may be said to have more highly developed cognitive strategies than the child who needs more help; that is, he is more "self-taught" than is

his fellow pupil. While it could be assumed the faster child has more advanced strategies because he has a higher I.Q., this is not necessarily so. At least the correlation between I.Q. and tests of creativity are not as high as might be expected. It is probable then that the person with advanced strategies has been able to achieve them by a combination of a degree of native intelligence and a degree of practice in solving a wide range of problems, in which the key to success is discovered, not supplied by the teacher.

While our understanding of this domain is probably more meager than in the case of intellectual skills and information learning, the following conditions of learning have been identified by Gagne and Briggs for cognitive strategies:

1. Stimulate recall of relevant rules and concepts needed for the problem at hand.

2. Suggest that there may be more than one way to solve the problem at hand.

3. Present many kinds of problems to the learner (over an extended period of time), but do not specify any approach to a solution.

4. Ask the student to demonstrate his solution when he believes he has reached one.

In one sense, the above conditions amount to less direct prompting and guidance than is appropriate for, say, concept learning or information learning. The learner is "more on his own" than in most other forms of learning.

Since progress is gradual in this domain, progress rather than mastery appears to be a more appropriate criterion for acceptable performance. Also, since there is less direct teaching than for other forms of learning, absolute standards of acceptable progress are probably to be avoided. This would be a good domain in which to urge the learner to compete with his own past performance, rather than competing with other learners of greater ability. While all pupils in a class might be expected to master a short poem or a simple kind of computation, undue pressure should be avoided in regard to progress in strategy development. Since a teacher can "teach" a simple skill, but cannot "teach" a strategy so directly, the teacher takes by necessity less responsibility for pupil progress; therefore it is unfair to hold the pupil responsible for some arbitrary amount of progress, especially since he may have a genetic limit upon what he can do.

This account of cognitive strategies has been

abbreviated. If it is available, the trainee is advised to read portions of chapters concerning cognitive strategies in Gagne and Briggs (1974).

Due to the time span in developing strategies, as discussed above, no brief experience in the classroom would be of use. It is, instead, suggested that you write a brief description of an instructional plan for a year of instruction, showing how you intend to use various specific objectives or lessons to achieve a long-term perspective on how the more complex aspects of the subject area may be approached.

Due to the nature of this assignment, you may need to distribute effort on it over a period of several weeks.

If possible, the instructor will arrange small group discussion sessions to give you maximum interchange with your peers as well as instructors or resource persons.

Attitudes

The present treatment of attitude development follows the definition and approach presented by Gagne and Briggs (1974).

You should not expect to find the present discussion of attitudes to be highly similar to the Krathwohl taxonomy of the affective domain.

Affect means various things to various people. To some it means emotions, such as unusual fears based on early childhood experiences (conditioning). To others, affect is closely related to the values that a person expresses by his words or other behavior. To some, there is a heavy cognitive component of affect, such as arriving at defensible points of view on controversial social issues. To still others, affect is used to cover unexplained, "intuitive" feelings, or subjective experiences, or basis for overt actions.

The present definition of attitudes is operational in nature, and consistent. One may agree or disagree with this view of attitudes, but we have at least tried to make it clear, consistent, and operational.

We view an attitude as an inferred tendency to act one way rather than another in a choice situation. By observing the person's actual behavior in several instances of a similar choice situation, we say that he tends to make choice X and not to make choice Y. Once such a consistent

pattern of behavior is observed, we infer that the person has developed a relatively stable tendency to behave consistently in the way he is observed to behave.

In stating educational objectives relating to attitudes, we might find such an objective as this one for fourth grade children: "The child will display more concern for the welfare of others at the end of the year than he did at the beginning". Then a teacher may keep anecdotal records of the number of times a child is observed to perform acts indicating concern for others, such as: helping locate lost articles for a classmate; comforting a child who is upset; calling for first aid in case of a playground injury; helping tutor a child who has been absent due to illness; writing letters to an ill classmate.

There seems little question as to the desirability of such an objective. But other instances of attitudes would not be so clear cut, such as attitude toward the Republican party. The school can justify attempting to shape or modify an attitude such as concern for others; but in the case of political parties and controversial social issues, one would avoid influencing the attitude in a given direction, in favor of encouraging through study and discussion of both sides of an issue, in order for the child to form his own conclusion and be able to cite logical reasons for it. For such issues, respect for the rights of others to hold opposing views could

be a defensible objective.

Given that the school has a legitimate right and duty to attempt to develop some specific attitudes in children, how does one go about this? What are the conditions of learning for an attitude? Gagne and Briggs (1974) have listed these conditions:

1. Recall of information and intellectual skills relevant to the personal actions subject to personal decision making.

2. Establishment or recall of respect for a "source" -- usually a person whom the learner respects.

3. Rewarding personal action either by direct experience or vicariously by observation of the actions of the respected "source" or "model".

In addition, the teacher can set an example by behaving in ways that are desired of the children.

It appears than that encouraging the child to "model" the behavior of a respected person, and rewarding the child for similar actions are the most effective ways to influence attitude.

Much less effective, in general, are slogans, such as "Be kind to animals". Such purely verbal admonitions have not usually proven to be effective.

A teacher who is trained in "contingency management" techniques, would practice the strategy of requesting an

unfavored activity of the child (picking up trash on the floor) before rewarding the child by permission to engage in a desired activity (play a game). The preferred activity is thus used to reinforce the non-favored activity. Techniques vary somewhat for correcting unwanted behavior as compared to promoting wanted behavior. And in cases of danger of injury to the child or another person, temporary removal of the child from the situation is employed when slower measures are too risky at the moment.

Since many attitudes are formed in pre-school years, and since persons other than teachers are often more influential on the child (his peers, for example), there are limits to the school's capability for changing attitudes. Continuted exposure to conflicting attitudes (as parents vs. teachers) could conceivably have a damaging effect upon the child, if he tends to respect both his parents and his teachers.

While direct verbal appeals, such as slogans, appear ineffective, it is likely that open discussions of various issues can have some influence, particularly at ages when the learner is more influenced by his peers than by his parents or teachers.

It would appear that the community itself should have some mechanism for influencing decisions the schools make about attitudinal objectives. This probably should be

the case for the entire objectives, but in areas where regional differences in attitudes are known to exist, the school should be cautious in becomming a "foreign influence". Many problems arise when teachers have attitudes greatly at variance with prevailing attitudes in the community. Teachers would have to be quite sure their preferred attitudinal objectives are preferable (more humane, for example) to those of the community before pressing for such objectives vigorously. This problem becomes somewhat less severe to the extent that both school and community prefer to make relevant information available and let children determine their own course of behavior. But even so, some limits must usually be set to avoid conflicts that disrupt the learning environment.

Perhaps in the area of attitudes, especially, "education is too important to be left up to the educators". Better that a broad based sample of the community have a collective voice in some to the major decision making in the attitude as well as in other domains.

Motor Skills

You encountered type 3 learning, motor chains, on page 83 of the Handbook. These usually refer to rather brief actions, such as hitting a golf ball, unlocking a door, starting a car engine, or pronouncing a new sound in learning a foreign language.

By motor skills we refer to longer, more complex sequences of actions, such as driving a car or flying an airplane. These complex acts are in part composed of separate short chains "hooked together" into a longer sequence. But there is also a "time sharing" or simultaneous performance of several chains learned earlier as unrelated chains.

Thus a pilot in an actual flight might be using his controls to execute a turn or bank, at the same time watching the altimeter and compass, and also perhaps changing engine speed.

The pilot may have practiced banking on a "part-task" simulator that does not simulate all the conditions of actual flight. He might have practiced "monitoring dials and other indicators" on a similar simplified piece of equipment. Then he may have practiced "putting it all together" by completing entire simulated flights -- all before riding in an actual airplane at all. Then, eventually, he first takes flights

accompanied by an instructor in a plane having dual controls. Finally, if it is a one-man plane, such as a fighter plane, he must take off alone for the first time for an actual flight, unaided by an instructor.

It is clear, of course, that flying requires more than complex motor skills. It also requires cognitive skills, decision making, and certain attitudes. While it may be difficult to disentangle all the kinds of learning in an actual flight, the value of taxonomies is in the instruction phase, where often only one kind of learning goes on at one time.

Leaving aside the intellectual skills and attitudes, the motor skills themselves appear to require three conditions of learning. These are:

1. Recall and use of previously learned motor chains (part-skills).

2. Establishment or recall of executive sub-routines (rules on how and when to perform the act).

3. Practice of the total, complex motor skill, receiving many forms of feedback (kinasthetic; visual; auditory; vibrations, etc.).

Some verbal instruction would be relevant for condition 2, above, but the other conditions depend more on practice than upon verbal instruction.

However there are some instances in which a single sentence spoken to the learner by the instructor results in as much improvement as several additional practice trials.

In sports, an instructor may call out "watch your feet", as a cue that a verbal rule presented earlier is being violated in a practice trial.

Thus while verbal instruction judicially applied can be of great help, long verbal descriptions of correct body movements are of little value. A slow motion picture or a series of still pictures might be much more effective.

One designer used a combination of verbal and motion picture instruction in golf to supplement the practice on the golf course.

But for attaining high levels of proficiency in a motor skill, practice (with accompanying kinasthetic feedback) is the secret of success.

For a more detailed treatment of motor skills, the trainee may consult appropriate chapters in Gagne and Briggs (1974).

You have previously planned two lessons, using the G/B taxonomy; one was for an <u>intellectual skill</u>, and one was for <u>information</u> learning.

For most teachers, the above experience is probably representative of most lessons taught. That is, the more "academic" subjects draw heavily on those two domains.

Then we suggested a group approach in planning a <u>cognitive strategy</u> objective. This was because it is more difficult to come to grips with that domain. Most teachers would in some way have some contact with this domain.

The remaining domains, <u>attitudes</u> and <u>motor skills</u>, are likely of concern to teachers of young children, to social studies, and to physical education and the arts. Most teachers will deal with attitudes, but many will not deal directly with motor skills.

For the above reason, we are not assigning lessons to be developed and taught in the latter domains. The instructor and the trainee should confer regarding any application the trainee might undertake in these domains.

. <u>Suggested Group Activity</u>: It is suggested that groups be formed on basis of age of learner or subject specialty to discuss meaningful applications that might be carried out.

Also it is suggested that groups develop examples of performance objectives in all domains and sub-domains, using them as group practice in correct classification of objectives.

The limited practice in doing this for <u>intellectual skills</u> in the <u>Handbook</u> could suggest exercises groups could prepare to try out on each other as further practice in classifying objectives in all domain.

LJB/ajp