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INSTRUCTIONAL  
MODULE 2.3:

FORMATIVE EVALUATION:  
REDIRECTING LEARNERS

by

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series editors

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In modules 2.1 and 2.2 you learned the different purposes of formative evaluation and summative evaluation, and you learned that both kinds of evaluations could be used to develop, improve and evaluate:

a. A small unit of instruction, such as a lesson plan, and all the materials, procedures and pupil activities associated with the instruction.

b. A large unit of instruction, as for a total year, or an entire curriculum, or an instructional system.

c. A method for monitoring pupil progress, in order to provide confirmation of past learning, diagnosis and remedy of learning problems, and any other redirection of pupil effort (such as exempting a pupil from instruction over objectives he already has mastered, or devising a new plan of attack for a student, when necessary).

This module focuses on the third use of evaluation techniques named above, e.g. directing or redirecting pupil progress.

Module objective: At the close of work on this module, you should be able to describe explain, and demonstrate the application of formative evaluation techniques for directing or redirecting the efforts of the learners.

## Self Check of Entering Competencies

The discussion in this module assumes prior mastery of module 2.1, particularly relating to some key terms. Please write answers to the following questions, and check them with the answer key that follows. If needed, review module 2.1.

1. Define formative evaluation in respect to (a) a lesson plan; (b) monitoring and directing pupil progress.
2. Explain the difference between formative and summative evaluation.
3. Relate the above terms to the concept of "mastery".
4. Compare and contrast "mastery" and "the normal curve".
5. Define "design objective".
6. Relate formative evaluation to (a) objective-referenced tests, (b) content (norm) referenced tests.

## Answer Key

1. A lesson plan, or any unit of instruction (including materials, methods, media, and exercises for students) can be improved by trying it out, evaluating pupil performance, and using such performance data to revise the instruction. These early evaluations while the instruction is still being refined are called formative evaluations (of the instruction). Monitoring performance of a pupil during study toward mastery of an objective, and redirecting him as needed, is also called formative evaluation (of pupil progress).

2. Formative evaluations are conducted for the purpose of improving the instruction or for improving pupil progress during instruction. Summative evaluations of instruction are conducted after revisions have been completed in order to see if the design objective was met, and in general to evaluate the worth of the instruction. A summative evaluation of a pupil's progress is made after the instruction has been completed to determine whether the pupil mastered the objective (s) intended.

3. The concept of mastery assumes that if learners are given time enough and adequate instruction, most pupils can master most objectives at a level of performance that

is reasonable for the task. It may take several formative evaluations of the instruction, and adaptation of it to individual learners, before such a mastery level is attained. But continued revision of the instruction can often make possible genuine mastery learning, as indicated by summative evaluations.

4. "Mastery" assumes that if time and instruction is allowed to vary as needed for individual pupils, most of them can learn successfully. Under the fixed pacing of conventional group instruction conducted with set time limits, pupil achievement is distributed in a "normal curve". Only a few exhibit "mastery" -- most fall at some level below the criterion for mastery.

5. A design objective is to the instruction what an instructional objective is to the pupil -- a goal. A design objective states the degree of success the instruction is intended to reach before formative evaluations cease.

6. Formative evaluations require objective-referenced test procedures in order to determine when a pupil has achieved mastery, and when enough pupils have achieved mastery to conclude that the design objective has been met. Norm-referenced tests are often "content-sampling"

tests, but at any rate they are designed to compare pupils or to compare groups, not to determine whether a design objective has been met, or whether a pupil has achieved mastery of an objective.

### Determining Check Points in Pupil Progress

In order to employ formative evaluation techniques for directing or redirecting the learner, it is necessary to define some stages of progress (check points) at which you could find out how he is progressing. You need to check his progress often enough that he doesn't "spin his wheels" very long or become discouraged. But if you check too often, it may intrude too much upon his learning time or it may annoy him.

A teacher soon learns to adjust the frequency of checking based on learning how the pupil usually functions. A teacher may soon learn that one pupil needs frequent checking either because he has trouble learning, or because he needs frequent reassurance. Another pupil may decide wisely whether and when he needs to have his progress checked. So even among pupils of equal ability to learn, some may be more "self-directed" and "independent" than others.

Just as differences among learners need to be detected in order to plan progress checks, so different kinds of objectives (types of learning) can influence how the teacher decides when and how to check progress.

The nature of intellectual skills, as treated by Gagne in The Conditions of Learning (1970), is such as to suggest checking progress for mastery of each subordinate competency.

(enabling objective) of an intellectual-skill objective. This could be done by either a "self-test" or a "teacher conducted appraisal" at the close of study or instruction for each such subordinate competency.

If modularized materials are used, the tests may be incorporated into the materials; otherwise the teacher may conduct either formal or informal checks by looking at completed work, by discussing the work with the pupil, or by an informal oral quiz. However it is accomplished, the purpose of such checking is not to "grade" the student, but to help him along toward mastery of an objective. (An evaluation of the pupil after study of the objective is finished would be a summative evaluation of his performance over that objective. Later on at the end of a unit of study, another summative evaluation could be done -- and, again, at the end of a year of study).

Thus the purposes of the formative evaluations of pupil progress are to find out how well he is progressing; to diagnose the source of any difficulty; to redirect him into other materials or methods for the objective; to exempt him from unnecessary study; or even, perhaps, to decide that the pupil should be given a different objective to work on.

It is clear that such individualized progress checks might be done most effectively by some overall form of individualized instruction in which the teacher has more

time for individual checking than is the case with conventional, teacher-conducted instruction. In any case, each pupil needs to have his progress check at whatever intervals the particular objective or the particular child seems to require.

For objectives in the intellectual skills domain, we have said, it would generally appear reasonable to check progress after study of each subordinate competency. The reason for this is due to the hierarchical nature of intellectual skill objectives, when analyzed as Gagne has demonstrated (Gagne 1970). In this type of learning, failure to master an earlier competency in the planned instructional sequence would probably lead to failure on the next one in the series. It is therefore essential to detect trouble or failure early, so that one failure will not be compounded into other failures. (This situation typically would be different in learning facts, names or labels, in which failure to learn one of them does not necessarily impede progress in learning of others).

#### Things to Look for in Formative Evaluation

Before asking you to plan a formative evaluation for a pupil working on an assigned objective, it might be useful if we list some "signs" that might help decide when a careful check of pupil progress is needed.

Suppose you are observing a class at work on a modularized unit. The teacher has assigned each pupil an objective and made sure he has obtained necessary materials or resources to begin the individualized study portion of a module. The child you are observing (and are to help monitor) was given a programmed instruction booklet as the first resource to be used. He goes to a study area, opens his booklet, and begins to work. Here are some things you might see him do:

1. He reads a page or two, writes an answer to a question, checks his answer, and goes on to the next page.

2. He sits quietly, turning no pages, and not using a pencil. This goes on for 10 minutes.

3. He leaves his study area and joins a small group watching a slide-tape series.

4. He puts his head down on his arms -- apparently asleep.

5. He cries softly while turning pages.

6. He turns pages at a normal reading rate but doesn't write any answers to the questions in the booklet.

7. He comes to you and says "I already know all this stuff."

8. He comes to you and says "This stuff is dumb. I don't want to learn this."

Depending upon the groundrules of the teacher for this unit of instruction, it would appear that all the activities

listed above, except No. 1, call for some form of inquiry or intervention, although the decision to be made following the intervention would apparently differ among all the listed actions you might observe. Possibly some decisions would have to be referred to the teacher; you might handle others yourself depending on what you learn by the intervention and how the child responds to your actions or questions.

But just on the surface of the information given here, these comments are offered on possible interpretation of the pupils' action and possible form of intervention. Comments are numbered to accord with the above pupil behaviors:

1. It looks like he has accepted the task, and is proceeding as intended. No sign that checking is needed until he finishes the booklet.

2. He seems not to be working. Going to him and asking if everything is all right, or if he understands how to use the booklet might be an opener.

3. This one depends first of all upon the flexibility the teacher permits. But the pupil action may mean that he would learn better by seeing the slide tape; that he doesn't like to read or that he prefers not to study alone. (Of course he may be a pupil who usually does something other than the directions given.)

4. This requires an effort to find out if anything is wrong -- ill; despondent; worried; hungry; what not. Once

assured on that point, a discussion of what to do next seems to be in order.

5. Much as No. 4, above, but something must be wrong, so don't focus first on his failure to follow directions.

6. If the booklet is short, you might wait until he finishes and is tested. He may be learning well, although he isn't "following the directions". He may be responding mentally to the questions, not wanting to bother to write the answers. This is equally effective for some pupils and some objectives. If, however he fails the check test, he probably then needs to be persuaded to follow directions, or if available, to be allowed to use a parallel set of materials. (Perhaps he would prefer the slide-tape, too.)

7. Fine. Give him the check test. If he passes, acknowledge his correct perception of his prior mastery so as to encourage his independence in self-direction and self-evaluation. If you have the latitude to do so, now could be a good time to permit him to do something he likes to do before putting him to work on the next assigned work. The check tests for the next work might be shown to him to see if he believes he could pass those, too, without study.

8. This is a tricky one. The teacher will know whether he always says this. Another aspect is to find out whether he thinks the objective is not worthwhile, or whether he thinks the material "talks down to him" (Or maybe it is too difficult for him). He might accept another form of the

the materials for the same objective. It could also be that the objective fits into an "academic" program, while he has more "vocational" interests. If he always says this, and no other clear interpretation can be made, he may be displaying a general attitude or personality trait. In this case, opinions might differ on whether he need counseling, a family background check, or discipline.

### Learning Hierarchies and Checkpoints

For objectives in the domain of intellectual skills, the development of a learning hierarchy can be of great help in both planning the sequencing of instruction and in deciding upon the checkpoints at which pupil progress should be monitored.

Examples of such learning hierarchies are given in Gagne (1970) and Gagne and Briggs (1974). Both of these volumes contain examples for various teaching areas, such as reading, mathematics, science, foreign language, etc.

*Please refer to one or both of those volumes at this point. It will be helpful not only to study the hierarchies but also to read the discussion of them in the text. (See also the module on Task Analysis.)*

Note that when one constructs a learning hierarchy for

an intellectual skill objective, the subordinate competencies end up reflecting the nature of the taxonomy itself for intellectual skills. That is, one learns competencies involving discriminations before learning concepts; concepts before principles; and principles before problem solving. It is not that one sets out to arrange competencies in the order that the eight types of intellectual skills are taken up in the books referred to -- it is that one merely ends up doing so, because the logic of the teaching sequence is consistent with the taxonomy which arranges types of learning from simple to complex.

Thus, in an example of a hierarchy given in Gagne's 1965 edition, we find this correspondence between the ordering of the types of learning and the ordering of competencies in the teaching sequence implied by the hierarchy:

(Only one example of a competency is given for each type of learning; the actual hierarchy shows several competencies for each type of learning.)

Sequence	Type of Learning	Competencies of an Objective
1	S-R connections	Saying the names of numbers
2	Motor chains	Drawing numerals
3	Verbal associates	Stating sequence 1, 2, 3, 4
4	Multiple discriminations	Distinguishing among printed numbers
5	Concepts	Adding to
6	Principles	Forming the set "0"
7	Problem solving	Making computations

It is a formative evaluation function for the teacher to check that the child has mastered lower-order competencies before he attempts to learn higher order ones. The teacher should thus check each child at each competency level.

Keeping a chart to mark the progress of each child is a good way to check upon the development of important skills.

Such a chart could look like this:

	Jane	Billy	Mark	Ellen	Sara	Robert
Competency						
Saying names of numbers						
Drawing numerals						
Stating sequence 1, 2, 3						
Discriminating numerals						
Adding to concept						
Forming the set "0"						
Making computations						

For young children the teacher may do much of this checking during individual contact with each child. Other checks can be made during group work.

For older learners, written tests would be more convenient. Such tests often need not be lengthy because such intellectual skills tend to be either present or absent -- the child usually either can't do any examples, or he can do all those on a test.

It is clear that checking of progress is especially important for intellectual skill objective, because learning of some competencies are prerequisites for the learning of others. These skills cannot be learned helter-skelter, although some options in sequence are available, as discussed in the texts referred to.

Learning of discrete facts does not have the above characteristic. If one wishes the pupil to learn to give the year in which 10 historical events occurred, failure to name one date correctly would not prevent the learning of others. So here a child could be 80% correct, whereas with an intellectual skill, he is likely to be either zero or 100% correct (except for occasional errors due to carelessness, failure to check his work etc.) An adult makes an occasional error in adding or subtracting in his check stub, although he absolutely can do these skills correctly. We should have such considerations in mind, of course, in defining "mastery" of these skills.

For checking very simple skills (or subordinate competencies), often only 2 or 3 "problems" are sufficient, due to the "yes or no" nature of such skills. This is in contrast to "content referenced" tests of facts, names and symbols, where one might want to test a chemistry student, for example, on knowledge of all chemical symbols.

**Exercise: Recognizing Subordinate Relationships**

Here are a few competencies in reading listed in a learning hierarchy by Gagne (1965, page 201).

List them in the teaching sequence you believe would be needed, using "1" for the first to be taught, "2" for the second, etc.

- Organizing writing into paragraphs
- Classifying printed words as nouns, adjectives
- Making correct language sounds
- Recognition of printed words

(See next page for answer key)

Answer Key

- 4 Organizing writing into paragraphs
- 3 Classifying printed words as nouns, adjectives
- 1 Making correct language sounds
- 2 Recognition of printed words

Now write the type of learning beneath each line,  
above.

Check answer key, next page.

Answer Key

- 4 Organizing writing into paragraphs  
Principle learning
- 3 Classifying printed words as nouns, adjectives  
Concept using
- 1 Making correct language sounds  
S-R learning
- 2 Recognition of printed words  
Verbal Sequence

### Monitoring Learning in Other Domains

We have shown that for intellectual skills, the derivation of a learning hierarchy can help determine the sequence of instruction and the points at which pupil progress should be checked.

Now we consider progress checks for other domains.

### Information Learning

For learning of facts, names, and symbols, the pupil deserves to know which of them are important enough to learn well enough to recall, either by verbal chains (a poem), association (a date and an event), or by meaningful context (recognizing a brief life description as referring to George Washington).

For these forms of learning, the pupil should be told which to remember and how his recall or recognition will be tested. So teaching for the test is a legitimate way (and the only fair way) to approach these forms of information learning. It does not make sense to ask pupils to "prepare for a test over all the dates and events" in a history book, just as it would be foolish to have a child read a whole book of poems, and test him by asking him to recite one poem chosen at random. Such tactics are inhumane since they are unreasonable in demand, they arouse extreme anxiety and they overlook the need to select which information is

most important.

As shown in another module, stating objectives in the information domain can inform the pupil which parts of a book he needs to understand (be able to give the substance of), and which parts he should memorize for future recall.

If all chemical symbols are to be learned, as demonstrated by writing all symbols opposite all chemical elements listed on a test, then he needs to know that this is the requirement.

So far, we have really been dealing with summative evaluation of information objectives, How can a teacher do formative evaluation of pupil progress on such objectives? One way is to break the total recall task into shorter lists of items to be learned, and to space practice periods for memory tasks by interspersing them with intellectual skill tasks. Since verbal chains and isolated facts, or names and their symbols, are easy to forget, due to interference or lack of meaningfulness it is best to break such learning into smaller units, and to keep such study interspersed with other kinds of learning activity.

For substance learning (understanding and recall of the main ideas, not the details), longer periods of study can be employed. But even so, one might break a chapter into parts, interspersing memory tasks and intellectual skills. Then the teacher can check for mastery in terms of small amounts

of the various kinds of information learning.

Exercise: Information Learning

Suppose that within a period of a few weeks you want the children to learn the following things:

1. Discriminate among shapes by sorting a box of leaves from four kinds of trees.

2. Learn to name the four kinds of leaves discriminated in the sorting.

3. Memorize four short poems.

4. Read two chapters in a history book, and give an oral summary of them.

5. Memorize a list of 20 dates on which important historical events occurred.

*Now write a paragraph or more showing how you would sequence the above learning, and how you will do formative evaluations of pupil progress.*

*(See next page for feedback.)*

### Feedback to Exercise

Your account should accomplish these purposes:

1. Break up work periods so that tasks 3, 4, and 5 are interspersed, and so that none of them is completed in a single long study session.
2. Do progress checks for small parts of tasks 3, 4, and 5.

The first two tasks should be done in a single "lesson", but I would make it two lessons to intersperse the "fun" of these tasks with other tasks.

Assuming the "leaves" tasks are favored by the pupils, you might say, "we will have one study period on leaves of different trees" after we learn one poem and read half a chapter in the history book. Then we will have another "leaves" period after everybody can give the first 5 dates correctly. Then progress checks would be made accordingly, in small pieces.

Then I would break task 5 into 4 interspersed periods, task 4 in 4 periods; task 3 into 4 periods, and sandwich in tasks 1 and 2 as indicated. Also, I would probably intersperse some intellectual skill tasks to achieve even greater distributed practice for the memory kinds of tasks. Doing anything possible to increase meaningfulness would also help.

### Assignment

Now, prepare a list of objectives or tasks to be taught over a period of a few weeks. Include both intellectual skills and information learning. Be sure to have both memory and substance types of information learning, as in the preceeding exercise. List at least six tasks.

Then write a "time plan" listing length and content of study periods, and show which whole tasks or parts of tasks will be used for formative evaluation.

Describe how formative evaluation will be done for each pupil.

Discuss your work with the instructor.

## Attitudes

Suppose you have the following attitude objectives, to be developed during a school year in a fifth grade class.

All attitude changes mentioned are those to take place between September and June.

1. The child will show increased concern for the rights and welfare of others.

2. The child will participate in discussion of controversial issues, showing some effort to influence the group, and some willingness to be influenced by the group.

3. Undesired behavior such as fighting, swearing, and disrupting the class will decrease.

4. The child will show increased interest in the government.

Instruction related to the above objectives clearly can often be combined with information objectives and intellectual skills, such as ability to summarize opposing positions on issues or to detect bias in viewpoints expressed during discussion. There do not appear to be sequencing problems as in deriving a correct hierarchy for an intellectual skill or breaking memory tasks up into smaller units. The conditions of learning for attitudes include the pupil's modeling of his own behavior after that of a respected person. So the "setting of an example" by the teacher's own behavior can be one influence. Stories of the actions of respected persons

also can be employed. Reinforcing desired behavior and ignoring undesired behavior (unless it endangers someone) is another condition of learning.

Discussions may help change attitudes; but possibly not as much as the above techniques. Use of slogans or direct appeals to change behavior are not very effective.

#### Exercise: Monitoring Attitude Change

Using the above list of attitude objectives for a fifth grade class, prepare a written or oral (check with instructor) account of how formative evaluation of pupil progress would be made. Recall that the purpose of such evaluation is to determine the present status of each pupil in regard to the objectives in order to modify your teaching or reinforcement procedures, if needed, to help the child continue to progress.

Your plan might respond to some of the following questions:

1. Are these objectives directly taught, like cognitive objectives, or do you work toward them as an incidental part of day-to-day teaching?

2. Is there any sequence implication of the objectives? Do you work on one each month, or all of them every month?

3. Assuming that some children show no progress, what special efforts to bring about improvement might you make?

4. Do you use tests, anecdotal records, or mere observation to do the formative evaluations?

5. If progress records are kept, what do they look like?

6. How often would you do a formative evaluation for these objectives?

7. In what terms is "progress" indicated? What data support the progress report? How do you guard against bias toward some children?

*Since attitudes are typically changed slowly, we do not require a "demonstration lesson", as for intellectual skill or information objectives.*

*However we suggest some supplementary activities that might be useful:*

*1. Seminar sessions to report on research data on ways to change attitudes and how to measure such changes.*

*2. Discussion of how review of observed teaching might suggest more ways to modify attitudes.*

*3. Discussion of this question: Are attitudes, affect, and values the same? If not, do they belong as classes under one domain, or do they belong to different domains? Recall that "domains" are not only "logically" different from each other; they also differ because the conditions of learning are different for each domain. In fact it is this latter fact, not merely logic, which led Gagne to identify different*

"kinds" of learning. He did not set up separate types of learning when there were no differences in the conditions of learning. The question remains, however, as to how different the sets of conditions should be to recognize a new "type" of learning. If you refer to page 99 in Briggs' Handbook of Procedures of the Design of Instruction (1970), you can see the degree of "overlap" in the sets of conditions as well as the degree of difference.

### Motor Skills

If one takes the ability to hit a baseball as an example of a motor skill, there is need to consider both process and product measures of improvement. Since the success at batting in a game is an interaction of the pitcher's performance and the batter's ability, the two kinds of measures need to be viewed separately. Also, considering "hits" alone, the hits for a day might be considered a formative evaluation, and the batting average at the end of a season a summative evaluation.

Process evaluations could be made by using a checklist to see if the person holds his hands properly, sets his feet properly, times his swing to adjust to speed of the ball, etc. A batter might make a good showing on a particular day if his performance is so analyzed, but he might still fail to get a hit due to the combined abilities of the pitcher

and the catcher.

It is apparently these process observations that a coach would use to help the batter improve his product measure (batting average), since the actual "swing" is improved mainly by kinesthetic feedback. On the other hand, no coach would expect a batter to improve without practice.

It is for the above reason that slow motion pictures are often used by a coach to determine what the learner is doing wrong that accounts for a low batting average. Faults in arm, leg, or body movements can be better detected by slow motion. Then verbal instruction and manual guidance (pushing the learner's elbows into correct position) can be employed to help the learner improve.

#### Exercise: Motor Skill

Select a motor skill (other than batting in baseball) and write an objective on basis of which a summative evaluation could be conducted.

Then describe the extent to which process and product types of formative evaluation are to be done; the results of such evaluations are to be used to redirect the learner's effort, if needed.

Describe the intervals at which formative evaluations are to be conducted, and describe the extent to which the evaluations are for separate skill components (subordinate

motor chains and executive sub-routines) or for gradual improvement of the entire motor skill. Describe any time-shared activities which require simultaneous performance of subordinate skills, in contrast to "linear" performance of first one component and then another.

Describe changes in your teaching strategy or in how you redirect the learner when a formative evaluation shows unsatisfactory progress.