Suzuki, K. (1995). Premier of instructional design from educational broadcasts: Message for young teachers. Japan Association for Educational Broadcasting

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Chapter 3 Framework to Categorize Instructional Objectives

- **Message**

Research on education through broadcasting should be aimed at generating outcomes that can be applied across the various school types, grade levels, and subject matters, from a common perspective of broadcasting.

- **Checkpoints**

1. Have you ever found any ideas for organizing your own instructional methods from instruction practice cases in different grades or subject matters? Or tried to get them?

   Yes/No

   If yes, what kind of ideas?

2. Do you think research on education through broadcasting across school types, grades, and subject matters, is possible? Or, should ideas always be acquired only from the same broadcast program, the same subject matter, or the same grade?

   Yes/No

   Why?

- **Note**

Before you read the main part, write down your comments on checkpoints.

Introduction: Framework for congruence of instructional design

Continued from the previous chapter, this chapter introduces five categories of learning outcomes, which is the second pillar of Gagne's instructional design theory (Nine events of instruction as the first pillar). The purpose for this chapter is to provide a way to realize the nine events of instruction according to the characteristics of learning objectives. Furthermore, a framework will be proposed to go between the uniformed golden rule of using broadcast program and case-by-case, first-round use. The uniformed use of broadcast programs is based on the concept that broadcast programs can always be effective when they are used in the proposed way. The case-by-case/first-round use of broadcast programs is based on the concept that effective ways to use broadcast programs vary depending on school type, subject matter, learning task, and children's conditions. The framework mentioned in this chapter is aimed at securing congruence among the three elements in instructional design; (1) the instructional objective, (2) their evaluation method, and (3) method of delivering instruction as the means to achieve the instructional objectives.

In the last amendment of the National Curriculum Standards, policies to place importance on interests, willingness, and attitudes were announced. Among the public, their evaluation methods have become the item of growing concern. Framework of student evaluation, such as "interest/willingness/attitude," "knowledge/understanding," and "thinking/judging" are based on the categorization of the instructional objective. Let us review the significance of categorizing objectives taking up the case of Gagne's categorization.

1. Gagne's five categories of learning outcomes – Categorization by difference in conditions for learning –

Gagne's categorization of learning outcomes is shown in Table III-1. Learning outcomes in the cognitive domain are grouped into three. The intellectual skills correspond to studying the rules of categorization and calculation and acquiring the ability to apply those rules to unforeseen examples (procedural knowledge). The verbal information represents acquiring the ability to re-describe given information such as names and names of eras (declaratory knowledge). The cognitive strategy indicates acquiring the ability to increase effectiveness of learners' own learning process (learning skills). Among these, the intellectual skills have subcategories set by Gagne based on his research outcomes over the years [1].

Table III-1 Five Categories of Gagne's Learning Outcomes

1. Intellectual skills (Procedural knowledge) (Discrimination, Concrete concept, Defined concept, Rule using, and Problem solving)
2. Verbal information (Declarative knowledge)
3. Cognitive strategy (Learning skills)
4. Attitudes
5. Motor skills

The affective domain includes acquiring of attitudes. An attitude is affirmative or negative feelings toward things and matters. Examples might be negative attitude toward racial discrimination or positive attitude toward studying mathematics. The attitude is regarded as

one of the learning outcomes, just like cognitive outcomes. In the psychomotor domain, achieving a certain task by moving the body (whole body, or part of a body) is taken up as motor skills. Touch typing of keyboards and pronouncing foreign languages as well as learning tasks in physical education are also included in the motor skill domain.

Categorization of educational objectives proposed by Gagne is not based on the difficulty of learning tasks, but on qualitative differences of learning outcomes [2]. Focusing on the differences in necessary conditions for learning, the categories are proposed, based on the differences in the preparation state required for a learner as internal conditions, and on effective instruction methods as external conditions for supporting the learning. Accordingly, hints for effective instructional methods for each outcome can be obtained as instructional strategy (realization methods for the nine events of instruction) as shown in Table III-2.

2. Learning conditions for intellectual skills

Intellectual skills are used to solve learning tasks by applying rules already learnt to the unforeseen cases. They are acquired only through applying to new cases, and different from learning by memorizing formulas and definitions and recalling them (categorized into verbal information). Until learners become able to apply certain rules to cases they have not yet seen, it cannot be said that learners have mastered the intellectual skill. For this end, examples used in the explanation cannot be used in practice, or those used in practice should not be used in a test, in order to avoid memorizing the solution of the examples.

Mathematics is thought to require not only memorization of formulas but also using them accurately in solving problems, that is, intellectual skills. However, for passing mathematics exams to enter schools, it is thought that "mathematics should be mastered by memorizing (as verbal information)." Accordingly, students who are preparing for entrance exams are forced to learn the patterns of math problems and solutions by heart in order to solve problems in a limited time. In entrance exams, finding solutions after reading questions, takes too long to solve within the time given. In such a case, only calculation works done in the recalled pattern solving in the test are included in the intellectual skills, as recalling patterns of the problem is included in verbal information. It is a case in which the original nature of learning tasks is distorted by the exam conditions.

The entry condition of learning a certain intellectual skill is learning a set of more fundamental intellectual skills. Accordingly, the process of learning the intellectual skill can be structured so that the learner climbs up the pyramid of the intellectual skills. This is called learning hierarchy [3]. As learning tasks are to be structured by accumulation, entry conditions of a task are mastering the tasks one stage below. When learners fail in a practice, let them check the tasks one stage below according to the type of error, and let them attempt the practice again. There are many learning outcomes of this sort for the learning of arithmetic, mathematics, science principles, and English grammar.

As the structure of intellectual skills is hierarchical, the order of instruction is simple (from the bottom to the top). At the same time, it means that when basic skills are not mastered, learners have difficulty in mastering more advanced skills. It is true that learners can master them by going down the stages that they have mastered and climb up again, but it is also true that it takes considerable effort. As those who are allergic to mathematics say, "once you are puzzled, you will have no way of telling what's next," accumulation makes the problem more serious.

Table III-2 Gagne's Five Learning Outcomes and Principle of Instructional Design

Learning outcome	Verbal information	Intellectual information	Cognitive strategy	Motor skills	Attitude
Nature of achievement	Memorize specified items Declarative knowledge Reproductive knowledge	Ability to apply rules to new examples Procedural knowledge	Ability to increase effectiveness of one's own learning process Learning skill	Ability to move/control muscles of the body	Mind-set to choose/avoid a certain thing or situation
Capability verb that indicates category of learning (Event 2)	Describe	Identify Confirm Categorize Illustrate Generate	Adopt	Execute	Select
Evaluation of achievement (Event 8)	Recognize or reproduce the information that is presented in advance Test all of the items or random extraction	Apply to new examples rather than reproduce the rule itself Give questions from all of the types of tasks, to confirm the range over which one can apply the rule	Apply the process of learning rather than the result Observe the process of learning or use self-description report	Perform it: the knowledge how to do and ability to carry it out are different Utilize lists and check precision, speed, and smoothness	Prepare the scene to observe action or expression of intention to act. Deal with personal choice behavior, not in general terms
Entry condition (Event 3)	Recall well-learned, related information and its framework	Recall lower-level basic skills that are the entry condition of the new skills	Recall similar, learned strategies and related intellectual skills	Recall learned partial skill or more basic skills	Recall the content of choice behavior, and information of the scene
Present the content (event 4)	Present all of the new information categorized by similarity or characteristics	Present new rules and application examples by increasing levels of difficulty, on a step-by-step basis	Explain effects of the new strategy using examples	Explain the situation where the new skill is to be used, then show some examples	Human model actually performs and explains choice behavior and its consequences
Learning guidance (event 5)	Pun, metaphor, images, and positioning in the framework	Various types of application examples, keys to recall the rule, and indication of portions that are often failed	Application example in other situations, how to identify the situation where the strategy is to be applied	Indication of where attention should be paid, explanation of the differences between successful and failed examples. Image training	Explanation on the importance of choice behavior, introduction of the trends of other people or public opinions
Practice and feedback (Event 6,7)	Recongnize with hints, then practice to reproduce. Organize them into one's own framework. Removal of the acquired item and focus on the practice of unacquired items	First simple and basic examples, then complicated and exceptional examples. Always use new examples. Review lower-level skills depending on the cause of the mistake	Long-term practice in the order of forced application using similar examples, voluntary application, and unconscious application. Confirm through working on other learning tasks	First supported exercise considering the procedure, then independent exercise. After acquiring all of the procedure, repeat practice to improve speed or timing	Simulated chosen behavior (if it was you) and simulated experience by the information of consequence of alternatives. Rattle and deepening by exchanging opinions

3. Learning conditions for verbal information

Verbal information is to recall various data that was once learned. Those data include names of the things or persons the learner once met, symbols, historical events or others. While studies for intellectual skills use unforeseen examples, instruction of verbal information should give all things that learners should remember. Although it is true that a learning task of verbal information is to remember, it does not mean that learners should learn things by heart without grasping their meanings. Rather than just trying to print individual items in the learner's memory, sorting the items out and locating them in the image in their head will be effective.

Regarding the external conditions that support learning verbal information, it is said to be effective to prepare to incorporate new information in the existing knowledge before presenting the new information. In this method, by generally indicating things in common, similarities, or differences between the existing knowledge and new one, children are able to add new information to their already acquired information network systematically. This approach is based on idea of Ausubel's research (Advanced organizer [4]). In Ausubel's research, before teaching Buddhism to American children, they were made to recall Christianity, which is more familiar to them. Letting them compare the two religions and try to match the counterpart items resulted in something more than simply learning Buddhism by heart. In Gagne's words, recalling already familiar Christianity corresponds to his Event 3 of "stimulating recall of prior learning." In addition, introducing Buddhism by comparing Christianity corresponds to Event 5 of "providing learning guidance" (refer to Chapter 2).

In the learning of verbal information, the order of learning is not always as clear as the learning of intellectual skills. For example, there is no problem in learning Geography whatever area is learnt first. In the case of learning English words, there is almost no difference according to what word is learnt first. Accordingly, leaving difficult parts out will not have negative effects on the learning of the next item. At the same time, there is a risk that learners study verbal information without any order, ignoring the mutual relationship of the items being learnt. It is important to build a strong information network in the learner's head, focusing on similarities and differences among the items. In the learning of Geography, stressing similarity and differences between already learnt areas and new areas, and constructing a framework to grasp the characteristics of each area will be of help.

4. Learning conditions for cognitive strategies (learning skills)

Cognitive strategies, taken up as the third learning outcome of the cognitive domain, are strategies learnt for more effective learning. It leaves no doubt that designing effective instruction should be based on one's own successful experience of effective learning. That is why it is often said that the more difficult the time teachers spent in studying in the past as a learner, the more effectively they can teach. To put it the other way round, children who have rich experiences in receiving effective instruction will have indirectly learnt how to study.

For example, a strategy mentioned in the Event 9 in Chapter 2 says that it is effective to start review sessions without prior notice with solving problems in the form of a pop quiz. If children think that solving lots of pop quizzes many times eventually raised their abilities, they may prepare quizzes themselves so that they try them when they notice that they are forgetting what they have learnt. On the other hand, if they think that such pop quizzes are

given by a mean teacher in order to widen the score gaps among his/her students, they may grow up without having opportunities to acquire effective review strategies. Being exposed to various teaching strategies by teachers is one of the conditions for acquiring cognitive strategies. In order to allow learners to master them as a cognitive strategy, it is also important to let them recognize the method as an effective cognitive strategy (learning of learning methods = meta-learning).

The learning conditions for cognitive strategies are thought to have some parts in common with those for intellectual skills. That is, once the tact for learning was taught, learners can gradually become able to use cognitive strategies suitable to their needs by repeating the application of such tact in new learning scenes by themselves. It is also important to develop learners' attitudes toward considering various ways to learn through letting them review their own way to learn and check what was effective and what was ineffective. There is more to explore in the conditions for promoting acquisition of cognitive strategies. Such conditions are becoming more significant today as demands for developing self-learning abilities are increasing.

5. Learning conditions for attitudes

Learning attitudes Gagne is dealing with in the affective domain include general feelings to support children's act of "selecting" their own acts. It consists of a wide range of learning outcomes. Selecting the act of picking up waste can show a positive attitude toward environmental consciousness. Choosing doing arithmetic homework rather than playing PC games shows an affirmative attitude toward learning.

What Gagne notes as a condition that promotes formation or change of attitudes is a mechanism of experiences by observation (Bandura calls it "vicarious reinforcement" [5]), as well as children's own direct experiences. In other words, change your own behavior by observing others'. TV programs are said to be effective as media encouraging attitude learning because TV programs can exemplify actual humans and their selected behaviors, and have function to make the viewing audience experience the results of the models' behavior caused by proxy.

In education by broadcasting, ethical education programs, which give opportunities for child audiences to learn various attitudes presented by characters of the same age group as the audience, are good examples of human models. A social science education program aimed at developing empathy and an inquiring mind by showing the life of children in various countries or at various ages also satisfies conditions for attitude learning.

In order to support attitude learning, various learning outcomes in the cognitive domain related to expression of attitudes are, in many cases, also inevitable in that attitudes are represented in the individual's selected acts. For example, knowledge and skills for putting attitudes into practice are also necessary to master. In a case of developing attitudes for conserving the global environment, it is necessary to know why it is now required and what can be done (verbal information) and to develop the ability to apply examples of various communities' commitments (eg: the procedure of recycling waste milk cartons = intellectual skills). Directly dealing with a generation of a certain attitude in children would result in enforcement. In order for individuals to select their own willingness, dealing with surrounding information that supports the selection of some attitudes is required.

From a different perspective, it should be noted that children develop certain attitudes as they receive everyday classroom instruction regardless of whether they are aimed at or not in the course of instruction. Such attitudes include: toward learning (studying is tedious); toward subjects (I do not like science); or toward learning methods (broadcast programs are not interesting), etc. There is an idea that whenever certain learning outcomes in the cognitive domain are taken up as instructional objectives, learning conditions should always be prepared so that learners will develop a positive attitude toward the learning as well (the idea is called twin objectives). It probably has something to do with the fact that the National Curriculum Standards takes up interests, willingness, and attitudes. It is useful to consider learning outcomes of attitudes according to Gagne's categorization.

6. Learning conditions for motor skills

Motor skills include not only learning outcomes of physical education, industrial arts/ homemaking, or art related subjects, but also those of cursive handwriting of English and fingering involved in counting on the abacus. In case of motor skill learning, not just behavior, but also speed, accuracy, and smoothness are often required.

Repeated practice with body movements is taken up first as a condition to support the learning of motor skills. In cases of complicated movements, it is effective to break up the movements into several constituent steps in order to completely master each step and integrate those steps into a series of movements. In order to realize smooth movements, effectiveness of letting learners imagine successful movements of themselves and rehearse them (image training) has recently been drawing attention.

An educational broadcast program of gymnastics titled "*Harikitte Taiiku* [Plow into Gym!]" from FY 1994 deals with motor skills. It is difficult for TV programs to support the acquisition of motor skills, for which practicing through body movements plays an important role. However, in addition to presenting easy-to-understand points for success, the program aimed at encouraging child audiences to try, after watching the process in which an unsuccessful child (human model) gradually becomes able to perform some movements. Presenting points for success in an understandable way is effective in supporting learning of the attitude "I can do this" and supporting learning of motor skills through forming successful images. It is also effective to give opportunities to review the program in order for learners to overcome actual problems generated during the practice.

7. How should this framework be utilized? -- For sharing educational research outcomes --

In the above sections, Gagne's category of five learning outcomes was introduced. This does not mean that we should disregard widely known categorizations by Bloom [6] or other objective categorization frameworks for various subjects that were proposed based on Bloom's taxonomy. Any adequacy of categorization framework should continue to be verified. Actually, there are examples of exploring ways to succeed and expand Gagne's categorization method in the attitude domain [7]. Gagne himself welcomes the attempts.

The purpose of introducing Gagne's categorization lies in reviewing the spirit of his categorization. Gagne's categorization framework has set new categories whenever apparently different conditions for promoting learning are found, not simply increasing the number of categories without significant reasons. Even an objective is categorized, based on

whatever categorization method, it is useless as an indicator to guide practice and research unless some actions are taken in the course of instructional design based on the category of the objective. Until categorization of an objective and consideration of its evaluation methods leads successfully to consideration of instructional methods to achieve the objective, the congruence of instructional design cannot be secured.

The spirit of Gagne's categorization is that categorization frameworks of instructional objectives are proposed reflecting differences in instructional strategies as well as evaluation methods. In other words, differences in external conditions to support learning are reflected in categorization; instructional objectives belonging to the same category have the same conditions to promote their achievement; such common conditions can be shared widely, as long as seemingly different objectives belong to the same category. So, when you wonder why a certain method successfully teaches a certain learning task, the reason can be pursued in terms of the categories of the instructional objective. It is also possible to judge to what extent similar teaching methods can be effectively applied for teaching different subject matters, or for different grade levels.

The research domain including education by broadcasting, audio-visual education, educational technology has explored methodologies which enable generalization across subject matters and school types, although it took research outcomes of subject-specific education methods and education based on children's developmental stage into consideration. Research will not progress even through accumulating first-round/case-by-case practice reports that seem to insist that optimum instruction method is different depending on each learning task and each learner. Strictly speaking, it is natural that research deals with human-centered instruction that cannot be duplicated. However, it is preferable to maintain an attitude of sharing research outcomes among as wide a range of researchers as possible. The research of education by broadcasting can be worth existing only when the outcomes are applied to other contents, subject matters, grades, and type of schools. A framework is expected to be established intentionally in order to share outcomes of education research widely through a facet of broadcasting or other media. I would be grateful if you would review Gagne's categorization framework with such a concept in mind.

<Notes>

[1] Taken up in Chapter 4 in detail.
[2] This book does not deal with subordinate categories of intellectual skills in detail. For a detailed explanation, see Chapter 5 to 7 of Gagne, R. M. (1982). *Conditions of Learning*, (3rd Ed.). See also Chapter 4 of Gagne, R. M., & Briggs, L. J. (1986). *Principles of Instructional Design* (1st Ed.).
[3] Categorization framework in only the cognitive domain in the early age, Gagne (1968), in the first edition of *Conditions of Learning*, proposed eight stages of categorization based on the difficulty of a task. In Japan, this categorization is still known as Gagne's framework. Gagne's current five categories are totally different from categories in the first edition.
[4] Regarding learning hierarchy, detailed explanation is found in Chapter 6 of Gagne & Briggs (1986). *Principles of Instructional Design*, (1st Ed.),.
[5] Ausubel's research on advance organizer is introduced in, for example, Nagano and Azuma (Eds.) (1979). *Course of Pedagogy 5: Instruction/Leaning/Evaluation*. Gakken. 83-86 [In Japanese].

[6] Bandura's research on modeling and vicarious reinforcement is introduced in, for example, Azuma et al. (Eds.) (1979). *New Encyclopedia of Pedagogy*. Heibonsha. p. 152.

There are the following specialized books:

- Bandura, A. (1979). Social Learning Theory − The Basic of Human Conprehension and Education. Translation supervisor. Harano. Kanekoshobo. [In Japanese]
- Sukemune, Seizo, et al., ed. (1985). New Development of Social Learning Theory - Bandura in Japan. Kanekoshobo. [In Japanese]
  (The term "Twin objectives" is named by Briggs and Wager. For details, see Katsuaki Suzuki, (1994). "Another Instruction Design," AV-SCIENCE: 12-16. [In Japanese]

[7] The following introduce the categorization framework of B.S. Bloom, et al. (framework of cognitive/affective/psychomotor domains):

- Nakano, Terumi, ed. (1979). Course of Pedagogy 6: Educational Engineering. Gakken. 56-59 [In Japanese]
- Azuma, et al. (1988). Enchclopedia of Contemporary Educational Evaluation. Kanekoshobo. 323-326, 359-361, 480-482. [In Japanese]
- Kajita, Eiichi. (1992). Educational Evaluation. 2nd ed. Yuhikaku. [In Japanese]

[8] Martin, B. L., & Briggs, L. J. (1986). *The affective and cognitive domains: Integration for instruction and research*. Educational Technology Publications, U.S.A.

- **Check of checkpoints (feedback)**

1. When you apply the framework to, for example, instruction aimed at the development of attitude, or instruction for intellectual skills, you can see the common points in implementation reports across subjects and types of schools. In the research of education by broadcasting, you can see practices in the domains of subjects and grades that are different from domains you take charge of. When we consider the usefulness of such research, Gagne's spirit of categorization framework is of help. His categorization tries to explore the common points among practices in various subjects and various grades focusing on what kind of characteristics the learning tasks have.

2. It does not make sense if the presentation of practical research outcomes is not useful to other teachers who take charge of the same grade and the same subject. However, there is no need to make such a hasty conclusion. I expect to not only report the results of certain instructional methods, but also report the results of explorations of the reasons behind the successful cases. That may be the difference between practical reports and practical research. I recommended applying the practice results to Gagne's categorization framework to build a step from just a report to a piece of research.
