Chapter 1   Framework to Organize Response Measures to Individual Differences

- **Message**

> **It is not teachers but children themselves that determine whether they should take the time needed to learn what is being taught.**

- **Checkpoints**

1.   What kind of measures do you use to reflect your classroom teaching?

2.   What is your ideal method for classroom teaching? Have you been taking it into consideration recently?

   Note: Before you read the main part, write down your comments.

Introduction: Carroll's model of school learning

The first attempt in developing abilities to utilize broadcast programs as a help is Carroll's model of school learning (time model). It is a model based on B. S. Bloom's mastery learning approach[1]. Carroll's model was widely publicized in 1963, approximately 30 years ago [at the time of this original writing]. Since then, the model has had a great influence on school education, mainly in the United States.

In the annual conference of the American Educational Research Association (AERA) held in New Orleans in 1988, John B. Carroll himself gave a lecture an invited speaker, entitled "Carroll's model of school learning: A retrospective of the 25 years." I obtained a recorded tape of this lecture, which was the only contact with him other than reading his articles to me.

1.   Encounter with Carroll's time model

I came across the time model in the first class of "Introduction to the media production process" that I took in the first semester while in the United States. I still have a lecture notes with clumsy English mixed with some Japanese. Now I remember that I attended the course easily, thinking that taking it was easy for students with difficulty in English as it dealt with technical perspective of media production process and would be provided mostly in a form of practical training. However, I had a shock then because I felt I really touched the essence of media utilization from the beginning by hearing the Carroll's model.

"Introduction to the media production process" was one of the required courses for my master's degree, which was given by Walter W. Wager, who later became my major professor for Ph.D. dissertation. It was a lecture course, but actually given in a form of practical training. The students studied the characteristics of media, program development process, and

technical terms for production through practices of simple CAI material, a slide series with voice explanations, and video material. The objectives of the course were to become familiar with the media production process for the purpose of utilizing media effectively as professional instructional designers, and to become able to carrying out collaborative work through close communication with professional media producers.

At the start of the first session, a course syllabus (course outline describing objectives, contents, schedule, and evaluation method) was handed out and an orientation was given. In the orientation, after a pretest to assess students' preliminary knowledge on 99 technical terms related to the media production process, a sheet listing the study objectives with assignments was handed out. The students were told to read almost half of the textbook and additional two papers by the next session that would take up general issues related to media selection. I remember that I lost my cool then.

The learning objectives of the first week included: Give a definition of "instruction"; explain three major factors regarding media selection; Explain the theoretical rationale of Dale's Cone of Experience; Explain the relationship between efficiency and effectiveness in the light of media selection; and others. The last objective was related to Carroll's model: Simply summarize how media can be used in order to advance the level of learning according to variables included in Carroll's model.

2. What causes disparities in academic performance – a paradigm shift from differences in ability to differences in time –

Carroll's model of school learning[2] was based on a paradigm shift from differences in ability to differences in time. The model was a result of trying to explain why some children were successful and others were repeatedly making errors in lessons, and exploring how to prevent children's errors and enable them to catch up.

Let us suppose a case in which Adams got 90 points and Bob got 40 points in a test of a certain subject. What causes the difference? Maybe Adams was smart, and Bob was not. Maybe Adams studied hard, and Bob did not. Or, maybe both apply to the case. It is possible that Adams, in an ironic sense, was merely lucky in the test and Bob was not. A teacher reviewing his way of teaching would think that his class was suitable to Adams and not to Bob. Any of the above reasons can be true. Depending on the focus, the countermeasures would vary.

Carroll explored ways to improve education considering that the difference between children's academic achievements is determined by whether they take the necessary time to achieve a good grade, rather than any difference in their abilities (innate abilities, IQ, etc.). If the apparent individual difference indicated by the test results is regarded as a difference in their fixed abilities, there is no way to improve. Rather than thinking that there is no way for children who cannot make progress even if they make the effort, it will of some help to think that most children are able to achieve most of the learning tasks when they take sufficient time. From such a perspective, Carroll explored ways to secure time needed for the children to achieve their tasks and ways to support (environment, task, advice, etc.) them to shorten the time needed for mastering the task.

It is true that some children achieve a certain learning task in a short time, and others take a lot of time. If so, it is natural that differences in test scores should be generated when the same

classroom instruction is given over the same period of time and the same test is taken by faster and slower learners. It will generate room for improvement if we think there are children who take time to learn or who require more help rather than labeling them as low ability students. In this way, a change in thinking from differences in ability to differences in time was proposed. As a result, many educational practitioners were given a theory to support their own efforts.

Considering that the degree of task achievement (test scores) is indicated by how much time children actually spend studying out of the time required for them to achieve the task, Carroll set the following formula for the learning rate.

$$\text{Learning rate} = \frac{\text{Time spent}}{\text{Time needed}}$$

Caroll's time model

For example, it is natural that Cathy, who needs two hours for completing a certain task, spends only one hour, and achieves only 1/2 (50%). This result is due to her not spending enough time on the task. If she studies for two hours, she would possibly achieve 100% (2/2). Suppose that Dorothy is able to master the same task by studying for one hour. It is possible that Dorothy will achieve 100% after one-hour of study.

Carroll provides five variables that affect the learning rate formula. The next section will explain the three factors that affect the time necessary for learning, and the other two factors that affect the time actually spent learning.

3.   Factors that affect the time needed for learning

- Aptitude for a given task

    When ideal classroom instruction for a certain learner is carried out, the characteristic of the learner indicated by the amount of time necessary to achieve a certain task is called aptitude. The shorter the time spent achieving a task in the desirable learning environment, the higher the learner's aptitude for the given task.

    It is thought that aptitude for a task varies depending on the content of the task. The amount of time needed for a child to learn a specific task is affected by all of his/her innate talent, learning skills accumulated through past learning experiences, and his existing knowledge. However, at the same time, it is also affected by how much time s/he has spent studying prerequisite or related items that are directly required for learning a specific task. In other words, a genius who smoothly accomplishes anything or a hard worker who has made efforts little by little have the same level of aptitude when they require the same amount of time to achieve a task at hand.

- Quality of instruction

    As far as a child's aptitude for a task allows, how long the child takes to master the task is also determined by the quality of instruction. With low quality instruction, the child would take a longer time due to not receiving the optimum support. It is one of the

reasons why there are differences among classes, taught by different teachers, even if the same time is taken for studying a certain task.

Among the factors of quality instruction are: children are informed about what and how they are going to learn in the class; learning materials are presented in a clear form; one session of a class is organically connected to the next; and consideration for the children's characteristics is taken into account. It goes without saying that the quality standards of the instruction mentioned here should also be applied to teaching materials including textbooks, task sheets, broadcast programs and computer assisted instruction materials, not only to classroom instruction conducted by a teacher.

- Ability to understand instruction

An ability to overcome low quality instruction is called the ability to understand instructions, which is the third factor for the time needed. Children who have high general intelligence and high language ability tend to possess a strong ability to understand instructions. This is because children with high general intelligence are able to guess and make up the unexplained connection between items of low quality and unkind instruction, and children with strong language ability are able to infer the meaning of unknown words. Accordingly, children with a strong ability to understand instructions are able to accomplish a task without taking extra time even with low quality instruction. On the other hand, children with less ability to understand instructions are directly affected by low quality instruction, and they require more time for learning.

4.   Factors that affect the time spent for learning

- Opportunity to learn (Time allocated for learning)

The instruction time required to learn a certain task prepared in the curriculum is called the opportunity to learn (time allocated for learning). It is regarded as the first factor to affect the time spent for learning. When it is expected that the school teaches many subjects, and each subject further covers many items to teach, the learning time allocated to a certain task shortens. As a result, many children, who cannot take time to master a task sufficiently, are forced to go on to the next learning task in their lesson without mastering the task. This aggravates the level of aptitude for the next instruction. As such, the classroom instruction continues, creating a vicious circle.

- Perseverance (Motivation for learning)

Among the given opportunities to learn, the rate of time that children actually spend on learning through their efforts is called perseverance. It is regarded that the higher the rate of the time spent, the higher the level of perseverance. If children with low levels of perseverance can concentrate on learning for only half of the class hour, they are not able to fully utilize the opportunity to learn. Accordingly, the opportunity to learn given to them is not always the same as the time spent on learning by them. Even if the same method of instruction is given (equal opportunity to learn is given), an individual difference in time spent will be generated depending on the difference in level of each student's perseverance.

Perseverance is affected by various factors. One of them is motivation for learning, and another is success/failure to adapt to the learning environment.

The following is a formula for which the above five variables are applied. In order to raise the learning rate, two kinds of effort are possible: (1) efforts to reduce the time needed for learning, focusing on the factors in the denominator, and (2) efforts to increase time spent for learning, focusing on the factors in the numerator.

$$\text{Learning rate} = \frac{\text{Opportunity to learn/Perseverance}}{\text{Aptitude for task/Quality of instruction/Ability to understand instruction}}$$

5. Organizing response measures to individual differences

The five variables included in Carroll's time model can be regarded as check points for teachers to elaborate instructions, to cut the time needed for learning, and for individual children to secure time spent for learning. Regarding media utilization, there is a wide range of opportunities to affect the variables. Especially in the case of broadcasting, it is possibility to expand the opportunity to learn through use of time other than classroom instruction hours. I listed, in no particular order, what can be done based on Carroll's model by expanding the answers to the first task in "Introduction to media production process" mentioned in the beginning of this chapter (refer to Table I-1). Referring to Table I-1, make a blank table by yourself and try filling it with your ideas.

Table I-1 Sample Response Measure to Individual Differences Based on Carroll's Model

Efforts to cut time needed for learning

<Aptitude for the task>
- Grasping children's readiness, plan an introduction that meets their actual conditions.
- Give opportunities for children who have not sufficiently mastered prerequisite items to review them before class instruction begins.
- Give examples related to the existing knowledge of children with insufficient aptitude.

<Quality of instruction>
- Prepare all clues for what to learn in the classroom.
- Make an order so that what is learnt in the session should become an introduction for the next instruction session.
- In order to organize the instruction framework, remove irrelevant content and obstacles to understanding.
- Use quality instructional materials in order to properly represent instruction content.
- Make efforts to prepare comprehensive and elaborate instruction by design.

<Ability to understand instruction>
- Using various media and experience-based learning, actualize reality of instruction content depending on the children's developmental stage (refer to Dale's Cone of Experience).
- Enable children to understand, notice, and strive to achieve the learning goals.
- Highlighting the instruction points, clarify the efforts to tackle the task

Efforts to increase time spent on learning

\<Opportunity to learn\>
- Introduce individual learning and let individuals learn at their own paces.
- Teachers provide unsuccessful students with supplementary instruction in addition to classroom instruction.
- Give individual learning materials (eg: CAI, practice exercise sheets with answers) to those who are interested.
- Prepare video-recorded instructions and broadcast programs and create opportunities for video learning for those who are interested.

\<Perseverance\>
- Make efforts to raise, keep, and deepen the motivation for learning.
- Consider rhythmic flow of classroom instruction, and change instruction tones according to the duration that children can concentrate for.
- Activate children, not only allowing them to listen passively to the teacher's instruction.
- Be careful not to hinder children's concentration by mistake before they achieve their task.
- Remove factors that affect psychological conditions of children and inhibit their efforts to learn.
- Train children to concentrate on instructions for longer.

6. Developing children who are able to make their own life plans
– Who decides how to use time? –

We often hear the complaints, "I have no time. I'm busy." How about responding to this by saying, "Only because we have limited time, we will try to think of the best ways to spend precious time. Such effort is unnecessary if we have enough time!" Learners prefer teachers to give instruction that allow them to acquire necessary important items accurately in a short time and let them spend the rest of the class hours freely, rather than the teachers giving prolonged, rambling instruction. Teachers would also prefer the same. In addition, we would like to find important content that is worth being thoroughly engaged in by all learners, and to give time to them, by minimizing the time spent on other contents. We, as teachers, would like to allow high-calibre children learn by themselves and use the rest of our time for children who need supports. We shall tackle these issues only because we have a limited number of instruction hours and limited working hours. This is what Carroll's time model taught me.

When individual differences correspond to a difference in time needed for learning, there is a possibility for improvement depending on willingness and ingenuity. I would like to make continued efforts to prepare effective classroom instruction for my learners and to increase the time spent by them on learning. Even if the teachers try to improve instruction methods, however, it is still NOT realistic to expect to be able to secure time needed for all children to achieve all learning. This is because there is a limited time given to each person's life, not because there is a limit to children's ability. Carroll's time model does not suggest that everybody can master everything. We need to be selective in which contents should be allocated enough time for learning and we make our students spend time needed for learning.

Making maximum efforts to teach in everyday classrooms should be considered NOT because I want all children to learn all things. It is because I hope that as many children as possible come up with something that they feel they would like to master even if it takes time and effort. As a teacher, I would like to create many opportunities for children to develop such ambitions. However, it is individual children who decide if they will study them, taking their own precious time in their life. In that sense, I would like to nurture children who can plan their own life. This idea is the greatest benefit I got from my study of Carroll's time model.

Until I became acquainted enough with Carroll's time model, I had spent a reasonable amount of time struggling to understand it. However, my time spent learning Carroll's model proved very fruitful.

<Notes>

[1] Mastery learning is referred to as a form of instruction in which each learner studies the basic items taking time until he or she completely masters them. Bloom's theory is explained in detail by the following references. You are recommended to read them.
  - Bloom, B.S., Kajita and Matsuda, trans. (1980). *Human Characteristics and School Learning*. Daiichi-Hoki.
  - Eiichi Kajita. (1983). *Educational Evaluation* (1st Ed.). Yuhikaku. 178-181. [In Japanese]
  - Kajita, Eiichi. (1986). Study of Bloom Theory. (vol. 4 of kyoiku-sensho). Meijitosho. [In Japanese]

[2] - Carrolll, J. B. (1963). A model of school learning. *Teachers College Record*, *64*, 723-733.
  - Carrolll, J. B. (1988). The Carrolll's model of school learning: A 25-year retrospective-prospective view. A paper presented at the1988 Annual Meeting of American Educational Research Association, New Orleans (Audio tape recorded by Teach'em Inc.)

Check of checkpoints (feedback)

1. How about organizing them according to the variables of Carroll's time model?

2. Without having concrete image of the ideal classroom instruction, your efforts will lose direction. If you think you used to feel satisfied, but you have lost your ideals recently, recall your youth. On the other hand, if you have impossible ideals, your efforts will not last long, or you may cover something up. Review your ideals.