eラーニング・ファンダメンタル
eLearning Fundamental

Chapter 2: e-Learning Development Process

(Brief Outline of Instructional Design Process)

Learning Objectives:

Be able to explain what steps are in the ID process
Be able to explain the concept which lies in the background of ID process model, as well as the history of the ID process model itself.
Be able to explain towards what the criticism "ID is too slow to be used" is directed while touching upon the difference between ID model and ID process model.

Summary of this Chapter

- The ADDIE model, which is known as a general form of the ID process model, is an abbreviation of Analysis, Design, Development, Implementation, and Evaluation.
- The ID process model is based on systems approach. The ID process model can be applied broadly to a variety of activities from the development of a small material to the design of an education system for the entire company. There are models for beginners who are specialized in the material level, and models which deal with both the system level and the material level.
- It is sometimes said, "ID is educational technology for corporate education," because the ID process is similar to the definition of educational technology (Instructional technology is the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning (Seels & Richey, 1994)).
- One of the criticisms of ID has been "Even if you follow the ID process, you cannot develop effective and attractive materials." As the ID process model only shows procedures, for content, you have to refer to the ID model.
- Example attempts to shorten the processing time required by ID so that ID process can respond to the rapidly changing reality include the fourth generation model, which defines the ID process as a dynamic decision making system; EPSS; and Rapid prototyping.

Section 1 Criticism of ID and counterargument

As soon as people started to pay attention to Instructional Design (ID) in relation to e-Learning, we started to hear criticism such as "ID is not usable." Because my area of specialization is ID, I, the author, cannot let this comment go. On the other hand, in the back of my mind, I also think, "Well, there are all kinds of ID, so ..."

Let us take a look at the summary of criticism of ID contained in the report published by Human Value Co. International Society for Performance Improvement (ISPI) held a special session titled "The Attack on ISD: The Rest of the Story" at their Conference, which was followed by the article "The Attack on ISD" published in the April 2000 and February 2002 issues of "Training Magazine." The report summarizes that, at the session, they had discussion about the following criticism.

(1) ISD is too slow and clumsy to meet today's training challenges.
- ISD was developed to secure a skilled labor force in the era of industrialization where the pace of environmental change was slow.
- A faster and more flexible method is required in the age of the "New Economy"

(2) There's no "there" there.
- Although they claim that ISD is a technology to produce instruction, actually it's not.
- ISD seems to be a system of project management rather than an algorithm to develop instruction.

(3) When used as directed, ISD produces bad solutions.
- Although ISD is said to be a guideline, it is not a proper guideline.
- If you follow the inflexible ISD process, you lose dynamism to design the training.
- ISD results in boring training programs and materials.
- Moreover, ISD ends up with producing homogenized employees who have neither flexibility nor creativity.

(4) ISD clings to a wrong world view.
- ISD is based on the assumption, "Learners have no knowledge, whereas specialists are smart and knowledgeable."
- Although in ISD it is assumed that jobs can be defined in advance, you actually have to keep composing the job as you go.

Quoted from "The Attack on ISD: The Rest of the Story"

Source: Report on "Performance-Based Instructional Systems Design" held on 26-28 September 2002, Human Value Co.
http://www.humanvalue.co.jp/houkoku/pbisd/2002/index.htm (In Japanese)

Broadbent (2002), the author of "ABCs of e-learning" takes a stance that ID is a useful tool. In response to the criticism, "ISD has become linear, discrete, terminal, sequential, and driven by one SME," he argues, "ISD is a tool. Being the same as other tools, it can be misused from time to time. When used by experienced designers, the ISD process will become dynamic, flexible, and multifaceted." I feel so happy with this comment that I will quote a little bit of Broadbent's view below (Broadbent, 2002, pp. 69-71).

<ISD is a way of thinking>

ISD is not a flowchart, but a way of thinking. ISD is the way you frame your mind where you are determined to design training systematically, broadly, and reflectively. Although critics say it is slow, I would like to think that this means "thinking deep." Although application of ISD certainly takes time, if done by experienced designers, they can develop training which can "produce results" without failure.

<ISD is not fragmented but integrated>

ISD is a complicated process. To express the complexity, it is broken down into a number of steps when displayed on a diagram. It just means that it is as complex as can be broken down into a few steps. However, it does not mean that the steps are carried out in a fragmented manner. The steps work in such way that they interact and overlap each other to produce a synergistic effect. The whole is greater than the sum of the parts.

<ISD is an action plan>

As ISD process is not like instant foods, you cannot do such things like "Add some water then you will have training." ISD is like a road map used in a long process which requires challenging thinking. It is a map you use as a driver to take the customer in the backseat to the destination the customer wants to go to safely and without failure. Since ISD is a versatile action plan, the designer is required to have abilities/skills to use it wisely and flexibly in accordance with the situation at the time.

Although this is not limited to ID, it is natural for professional people to think, if they are specialized in a certain area, "This area is so difficult that amateurs cannot do it easily. If amateurs try to do that, they would fail." This is proof that you possess "a highly specialized skill," and you cannot ignore that you have spent a lot of time and efforts to come to have that specialized skill and it is that specialized skill that allows you to earn your living.

Meanwhile, as an educational specialist or an evangelist of ID, you must try to induce the ID's specialty into forms that are more understandable and easily learnable. This may be a dangerous thing to do, because you are jeopardizing your own specialty (there have been some examples similar to this in which people stayed away from writing helpful manuals because that is an action that jeopardizes their positions as system administrators by putting down in a document such know-how known only to themselves). However, facing the information society, people are trying to find a way to make our knowledge sharable, such close-minded attitude of never wanting to let information out cannot be tolerated any more, even if people might have sympathy for such a point of view.

Even when trapped in this dilemma, people are still trying (even though they have to be prepared for the possibility that the more you do this kind of thing, the more mechanical ID might be considered) to develop a tool to be used to implement ID so that the practicability of ID can be improved. From the very beginning, educational technology has been trying to achieve the goal of removing the veil of virtuosity from educational practices, breaking it down into a body of teaching know-how so that everyone can share and use it. From that point of view, it is NOT unnatural to aim to achieve ID that looks as simple as can be, can be

used by anyone, and results in a certain level of effectiveness. If that is the source of criticism, then I suppose that it cannot be helped: ID should look easy, and also be easy as a tool for everybody!

As stated above, ID has been criticized in all manners, but what is ID in the first place? Unless you know that, you cannot even talk about it. Therefore, in this chapter, let us find out what so-called ID actually is. It does not matter whether you do that to criticize it or defend it.

Section 2 ADDIE model: General form of the ID process

The ADDIE model, known as the general form of the ID process model, is an abbreviation of Analysis, Design, Development, Implementation, and Evaluation (Figure 2-1).

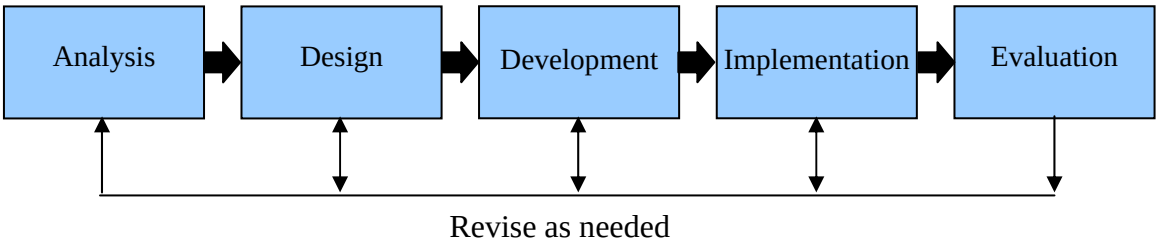


Figure 2-1: ADDIE model (general form of the ID process model)

In the background of the proposed ADDIE model lies the systems approach (a model where you improve a system's performance by turning the cycle of Plan "planning," Do "implementation," and See "evaluation/revision" multiple times). It should be noted that this model does not necessarily mean that if you go through each step of ADDIE only once, you can achieve good ID. In other words, in addition to the ADDIE steps, the system also includes an inconspicuous element "Revise as needed." This is the loop of "Feedback and Self-correction" in the systems approach, the assumption that you repeat the trial and error process a number of times to gradually improve quality. See Figure 2-2, shown for the sake of comparison, to understand how the same ADDIE model can give a different impression when arranged in a different way.

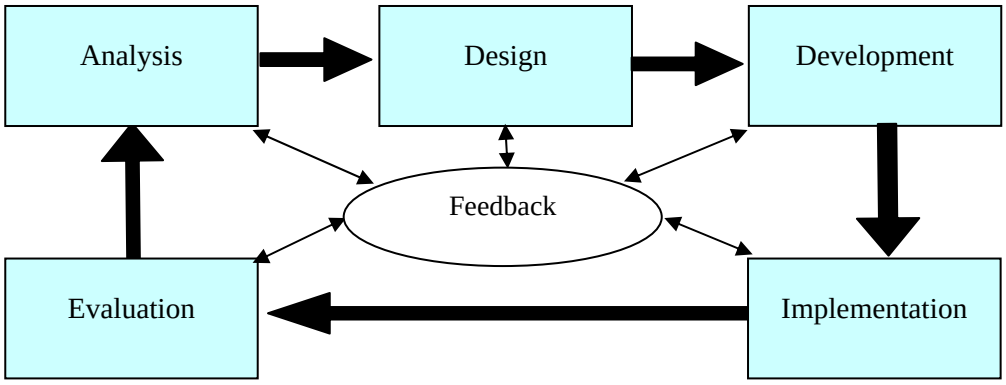


Figure 2-2: ADDIE model (Piskurich, Beckschi, & Hall, 2000, p. 29)

"S(ee)" (evaluation) is not carried out only at the end, because in the systems approach you turn the Plan-Do-See (PDS) cycle a number of times to make improvement. You should keep collecting information by evaluating, if necessary, the situation to add what is not there and improve on the areas that are not good enough. This principle is also applicable to the ADDIE model. The PDS cycle, depending on the area, has been modified to become PDCA (Plan-Do-Check-Action). Although they sometimes call it "Check & Action" rather than "See," since it is assumed, in the first place, that you turn the PDS cycle a number of times, after See, you go through Plan and Do then go back to See again where you recheck it.

As the ADDIE model is widely used as the most general model to show the ID process, you will come across this model frequently (For example: Katori, 2001, p.101; ALIC, 2002, p. 252).

Column: "ASTD handbook of training design and delivery"

Established in 1944 as a practical professional group to carry out research centered on human resource development (HRD) through corporate education, the American Society for Training and Development (ASTD) published "ASTD instructional technology handbook" in 1993, followed by publication of the second edition in 2000 under a different title "ASTD handbook of training design and delivery." ASTD is one of the largest ID related organizations in the world, boasting more than 70,000 members in 100 countries. The second edition consists of three parts, the subtitle "Instructor-led, computer-based, and self-directed" explaining exactly what these parts are. According to ASTD, 80% of the second edition is newly written due to the change of media environment such as the Internet. Meanwhile, instructor-led training was included as one of the fundamental pillars of the training when they explain the basics of ID. This book shows the way you ensure the quality of the training as a whole by, first of all, upgrading the skills of the instructor, then applying it to forms of training other than instructor-led training.

Figure 2-3 shows the composition of each chapter of "ASTD handbook of training design and delivery" (Piskurich, Beckschi, & Hall, 2000). You can see that this book includes the basics of ID (Chapter 2 and 4), the evaluation which is particularly emphasized by ID (Chapter 9), and the effect of investment (Chapter 10). Also included is the rapid development method created in response to the criticism of ID in Chapter 4.

Figure 2-3: Composition of "ASTD handbook of training design and delivery"

Part	Chapter
Part one: "Instructor-led training" (ILT)	Chapter 1: Provide a breath of fresh air to adult education Chapter 2: Instructional system design (ISD): ADDIE method Chapter 3: How to make the training proactive Chapter 4: Rapid instruction development method (RID) Chapter 5: Basic training: Preparing for presentation Chapter 6: Technology in the classroom: Sentiment Bonding Chapter 7: Activation of boring materials by the use of games Chapter 8: OJT Chapter 9: Evaluation of training program: Four levels Chapter 10: Measuring the effectiveness of the investment: Case study Chapter 11: Preparation for technology supported training
Part two: "Technology-based training" (TBT)	Chapter 12: Selecting commercially available materials: CD-ROM, LAN, and Web Chapter 13: Changing the curriculum: How to choose the right direction Chapter 14: ROI in TBT: Making business cases Chapter 15: Training management system: The most significant progress since the Internet Chapter 16: Team development to prepare TBT Chapter 17: Howe to design and develop TBT without a story board Chapter 18: Using voice and video on the Web Chapter 19: Virtual reality: Is this for you? Chapter 20: Brief outline of electronic performance support system (EPSS) Chapter 21: Online training in distributed learning framework
Part three: "Self-directed training"	Chapter 22: How to make it easy for them to learn: ID for self-directed training supported by technology Chapter 23: Learning contract: Learning techniques and development process Chapter 24: Performance support system and job aid Chapter 25: Establishing application to performance from learning Chapter 26: Applying technology to human performance improvement Chapter 27: Relationship between ID and performance improvement

Note: This is the "Table of Contents" of the book "ASTD handbook of training design and delivery" (Piskurich, Beckschi, & Hall, 2000)

Section 3 ID process model and systems approach

The ID process model can be applied broadly to a variety of activities from the development of a small material to the design of an education system for the entire company. First of all, let us look at the Dick & Carey's ID process model, which is suitable for beginners, as its focus of attention is at the material level.

2-3-1: Dick & Carey model: ID process model at the material level

Figure 2-4 shows the Dick & Carey's (1978) ID process model (Suzuki, 1987), which is most extensively used at those graduate schools that train ID specialists. This model is proposed for situations where you are given a set of learning objectives and asked to develop instructional

materials, by keeping the "analysis" process of the ADDIE model to a minimum. In other words, it is suitable for the design of short course (or material). The characteristics of this model are that the model is used at the early stage of professional training, assuming that the purpose of this model is to train beginner-level instructional designers whose responsibility is to develop materials for a relatively short course or group training rather than senior-level instructional designers who carry out system level designs. The textbook "Instructional material design manual" (Suzuki, 2002) written by this author for beginners in ID is an application of this model.

In the Dick & Carey model, first of all, you confirm the purpose of training (learning objective) and what the learners can do at the start of the training (entry behavior), then you go on to design instructional materials to effectively overcome the gap between these two. After that, based on an ID models (in this case, Gagné's instructional theory), you design the sequence of learning objectives in such way that they are arranged in the supposedly most effective order and the instructional strategy for each objective. Then, you develop the material based on the design plan and check the material by going through the formative evaluation process to see if it is really effective. The data obtained from the formative evaluation are used for revision of the material or re-checking of the theoretical assumption so that the effectiveness of the learning can be confirmed even further. At the end, when there is no need for further revision of material, summative evaluation is carried out to complete the systematic process.

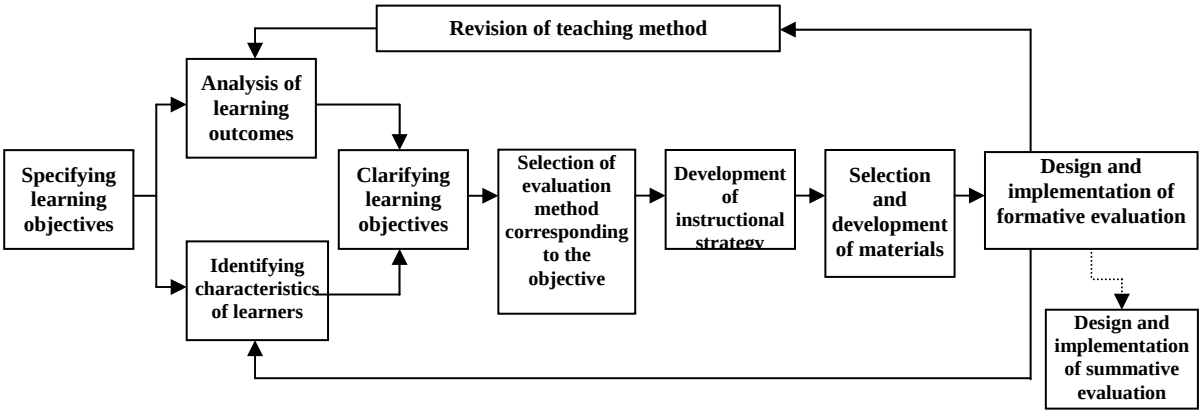


Figure 2-4: The Dick & Carey ID process model
(1978; 1985: for beginner's level instructional designers)

2-3-2: ID process model and development of evaluation plan: When are you going to prepare the test?

The Dick & Carey model, the ID process model most frequently referred to, is proposed principally assuming application to material development (Suzuki, 1987; 2002). The Dick & Reiser model (Dick & Reiser, 1989), on the other hand, is a simplified version of it, assuming to be used for courses offered by a school teacher or a corporate instructor (see Figure: 2-5). Whereas the ID process consists of the same elements; i.e., analysis, design, development, and evaluation and revision, there is no material development step; included instead is a step to evaluate/select existing materials.

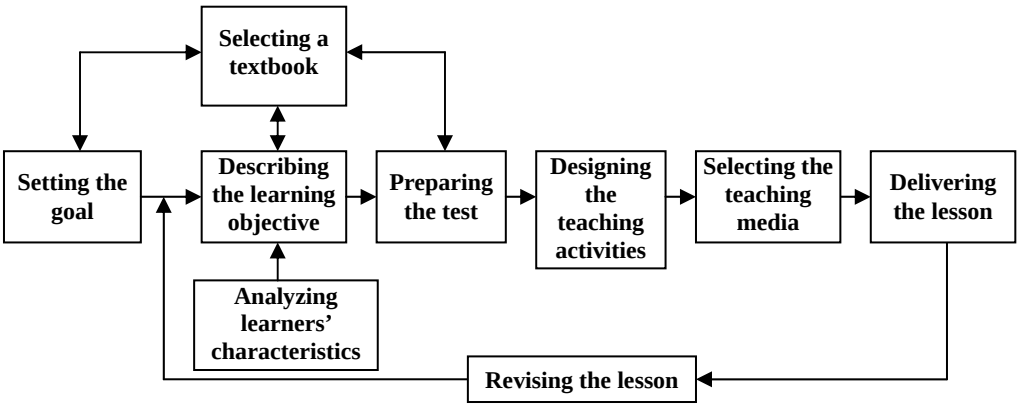


Figure 2-5: ID process model for instructors (Dick & Reiser, 1989)

The process on which the ID process puts emphasis is the evaluation plan, indicated by "Preparing the test." For the training to reach the expected goal, the goal must be described in more concrete terms (i.e., learning objective). As a process closely linked to this, you are required to make a plan; at the same time, as to how to check if the prescribed learning objective has been achieved (i.e., evaluation plan). You might feel it is strange to go through the test development process before you work out the details of how you carry out the training. However, it is thought that by making a concrete training plan using the already developed test which is directly linked to the learning objective as a guideline, the instructor, as well as the learners, can focus on fulfillment of the learning objective. In other words, it is possible for the whole course to be focused on the learning objective. This is one of the most important basic concepts of the ID process.ここまで

In such training courses that do not follow the ID process, they start to think about the method of evaluation when the course is about to finish, if there is evaluation perspective at all. In many cases, the only evaluation they do is just to collect a questionnaire asking if the participants felt happy about the course (Reaction, first of the 4-level evaluation: See Chapter 3). From the viewpoint that sees customer satisfaction important, administering a reaction questionnaire tries to identify any problems of the course from customer's eyes, and any problems were found, then they try to improve on them. As a result, however, the focus of attention tends to be placed on how the instructor should interact with the participants in such a way as not to offend them rather than to evaluate the course from a viewpoint of how effective the course was (Level 2: Learning) or how the results of the course could be utilized in the workplace (Level 3: Behavior). One of the important checkpoints of ID is to emphasize the results rather than the process.

The basic premise of the ID process is a concept called systems approach. Used as a general approach to solve a problem, this approach aims to solve the problem by first identifying the location of the problem (object to be solved), then gradually fixing performance through observing how the entire system behaves as feedback. The systems approach, together with behaviorist psychology, was introduced into the training/education area in the 1960's and contributed to the promotion of the ID process model by proving its effectiveness through concrete examples. See Figure 2-6 for a table that lists the major differences between the systematic approach and a conventional (non-systematic) approach when used for corporate training.

Figure 2-6: Corporate training based on systematic approach vs. that based on conventional (non-systematic) approach

Systematic approach	Conventional (non-systematic) approach
Objective/Goal is linked to external references other than education such as one's job or actual duties	Objective/Goal is decided by textbook or the content of conventional education, or the instructor's knowledge
Teaching strategy is based on empirical evidence in terms of its effectiveness	Teaching strategy is based on convention, skill of the instructor, or speculation
Learning Objective and evaluation criteria have been decided/notified at the start of the course and the learners know what the expected outcome of the course is. There is no surprise on the test.	Learners have to imagine what the expected outcome of the course is. Sometimes they are surprised when they see the test.
After the training, a high level of results is required from most or all of the participants.	The results of the training differ from participant to participant and are expected to form a normal distribution pattern.
If the learning performance was not good enough, it is considered that the training program should be improved.	If the learning performance was not good enough, it is considered that the participants (or instructor) should try harder.

Note: From Table 2-1 (p. 23) of Gagné & Madsker (1996), compiled based on Hannum& Briggs (1982).

2-3-4: Gagné & Briggs model: Model for advanced instructional designers keeping system development in mind

Figure 2-7 shows the ID process model by Gagné & Briggs (1986). The characteristic of this model is that the scale of the project to which this model is applied is larger than that of the Dick & Carey model. When you proceed with this ID process model, you come and go between the system level and the course (contents) level. It can be described as a model for advanced instructional designers who deal with system development. When I was studying at the Florida State University, I learned the Dick & Carey (1978) model to develop a small instructional materials; and after that, I learned Gagné & Briggs (1979) model as a part of my Ph. D coursework)[1]. Gagné & Briggs model, which combines Gagné's ID theory and Briggs's instructional system development procedure, is backed by the essence of learning psychology and systems development know-how.

[1]Note: Dick & Carey model has been revised a number of times, the most recent edition being the fifth edition published in 2001. With its volume increasing year after year, because after the third edition the model includes needs analysis and context analysis and incorporates such technique as portfolio evaluation, it seems that this model has reached the level where you can no longer call it a beginner's model. On the other hand, although the instruction strategy proposed in the Gagné & Briggs model now has more depth by incorporating the fruits of recent research, there has been no change in terms of the basic ID process. Thanks to the publication of the handbook for learning Gagné & Briggs model by Briggs & Wager (1981) and publication/revision of a guidebook for the learners (Wager, Applefield, Earl, & Dempsey, 1990), textbooks and other reference materials which can be used to teach the Gagné & Briggs model have been augmented.

Figure 2-7: The Gagné & Briggs ID process model

Level	Process
System level	1. Analyzing needs, objectives, and priorities
	2. Analyzing resources, limitations, and alternative delivery systems
	3. Deciding curriculum and course scope/sequence; design of delivery system
Course level	4. Deciding structure and the sequence of the course
	5. Analyzing course objectives
Lesson level	6. Defining the practicable objectives
	7. Preparing lesson plan (or module)
	8. Developing or selecting materials and media
	9. Preparing participant evaluation method
System level	10. Preparing instructors
	11. Formative evaluation
	12. Field test and revision
	13. Summative evaluation
	14. Delivery and promotion

Note: From Gagné, Briggs, & Wager (1992), p. 31. The same table is included after the second edition (Gagné & Briggs, 1979) (I have not confirmed this with the first edition).

Section 4 How different are educational technology and ID?

To answer the question of what educational (instructional) technology is, let us take a look at the definition of instructional technology in the book "Instructional Technology: The definition and domains of the field" (Seels & Richey, 1994) published by Association of Educational Technology and Communication (AECT) in 1994. It is sometimes said, "ID is educational technology for corporate training," because the ID process is similar to the definition of educational technology.

> Instructional technology is the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning (Seels & Richey, 1994, p.1).

It is considered that "of processes and resources for learning" means a series of procedures and activities (processes) to ensure good results of learning and all the materials (resources) to support it. Processes include delivery system such as videoconferencing, teaching type such as self-learning, teaching model such as discovery learning, and material development model such as ISD. Being a broad concept which encompasses support system and material or learning environment, resources are considered to include not only instructional materials and teaching aids used to give instructions, but just about everything which can be utilized such as human resources, budget, and facilities.

The phrase "for learning" attached at the end of this definition emphasizes the stance, "while education (teaching) is a means, what we aim to achieve is the results of learning, which can be measured by the change in knowledge, skills, attitude, etc". From the word technology,

people often misunderstand, thinking, "Being mechanization of education, educational technology is inhuman study." Its objective being "to make learning successful," the object of educational technology includes everything from the case where you use a machine to the case where a real human teacher deals with the learners face to face. Here the word "technology" is used in the context that "a study to solve the problem (of how to make the learning successful)."

Well, then, isn't ID and educational technology the same? Then it is no wonder you might have a question, "Why do people take the trouble to use the word ID?" Its study area being the whole ID process, educational technology has carried out a number of studies and accumulated piles of knowledge regarding each process. See Figure 2-8 for the study areas and their main themes of educational technology. In this chart, you can see that one of the areas of study is "Design." Similarly "Design," as one of the processes, is included in the ADDIE model, which is the general model of the ID model. In other words, there is a nesting structure where the whole process, which includes design as an element, is called the ID process. In my opinion, herein lies the source of confusion.

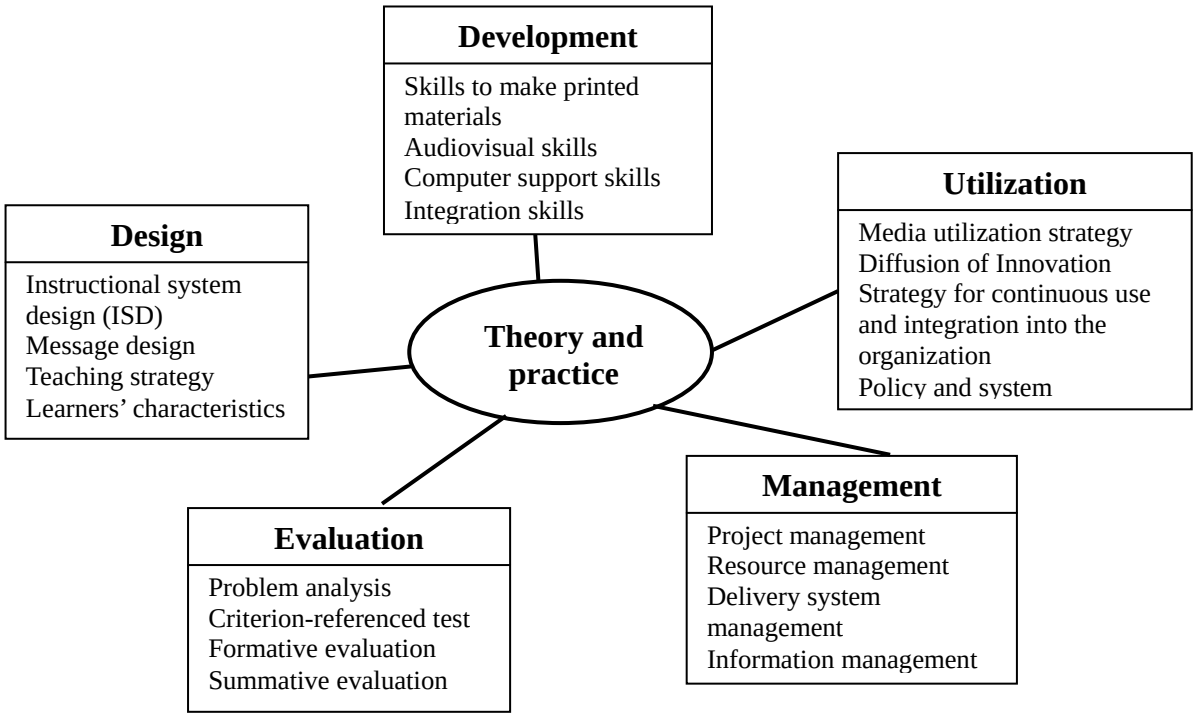


Figure 2-8: Five areas of instructional technology (Seels & Richey, 1994)

Professor Reigeluth, who was introduced in the Preface and is a leading researcher in ID, lists three things which are not the ID model, as shown in Figure 2-9 (Reigeluth, 1999, p.12-14). It is to say that, according to Reigeluth, NONE of the models introduced in this chapter so far is the ID model. Clearly distinguishing the ID process model, which shows the process of making from the blueprint to the result of making (instruction), he compiled a book consisting of just ID models (Reigeluth, 1983; 1999), in which neither Dick & Carey model nor Gagne & Briggs model is included.

Figure 2-9: Things which are not the ID model (Reigeluth, 1999)

(1) Theory of learning	The theory of learning is the foundation and the ID model is the house constructed on that foundation (relationship between house and its foundation). The theory of learning is descriptive and ID is prescriptive.
(2) Instructional system development model (ID process model)	Whereas the process model shows how to make, the ID model depicts the blueprint of what is to be made.
(3) Curriculum theory	Theory of educational contents (what to teach) vs. theory of educational method (how to teach). As the difference lies in points of emphasis, in many cases you cannot distinguish curriculum theory from the ID model

One of the criticisms of ID has been "Even if you follow the ID process model, you cannot develop effective and attractive materials." Answering this criticism by borrowing Reigeluth's rhetoric, "For the contents of the instruction you design, you have to refer to the ID model, as the ID process model only shows procedures (development process). To follow the ID process does not necessarily mean you can make good contents." Being aware of this point, I used in the title of this chapter "ID process" rather than "ID model."

Based on the stance that the ID process and the ID model/theory are two different things and we should combine these two together to solve problems, Gagné, the founder of ID theory, states as follows:

> Regardless of which (ID process) model you use, the core of the ID study is always <**principle of learning**>. No matter how you change the ID process, the ID process can never replace the understanding of formation process of learning and the method to support that. The principle of learning described in this book can be used, without contradiction, in conjunction with the more recent teaching design/development model (the ID process model), not to mention the conventional ISD framework (Gagné & Medsker, 1996, p.28). Note: the words in brackets were added by the author.

The "D" in ID not only means "D" in design, but it also means "D" in development. Development is another study area of instructional technology (see Figure 2-7). ISD model (i.e., the ID process model) originally was an abbreviation of Instructional System Development model. However, the word ISD (Instructional System Design) is also used when ID is applied to the system level rather than to the material development level. I can see the source of confusion here, because the same "D" could mean two different things (in some cases people use IDD, etc.!)

In this book, considering the general usage of ID, I do not take the strict stance as in Reigeluth to say that "the ID process model is NOT the ID model." On the other hand, be aware that with the term ID process model used in this book, there is always the following reminder note attached to this term: "This is NOT an ID model to draw a blueprint, but a model of a development process. Check it carefully to see what it is proposing in terms of how you envisage the contents." Actually, I think that ID model cannot be useful unless it is backed up by a theory of learning. However, at this stage I would like to include everything in the ID category. When necessary, I will give an additional description, such as ID process model,

system level ID, etc.

I feel happy in many ways when I hear people say "ID is educational technology for corporate training," because I feel that ID has become the focus of attention in educational technology. ID in the US is really regarded in such a way that plays the central role in the study of educational technology. However, in Japan ID has not been a mainstream. I hope that the situation of educational technology in Japan would be changed with the advent of e-Learning.

Section 5 Challenge to achieve ID process model which does not take time

2-5-1: The fourth generation ID process model and EPSS

ID process model itself keeps changing. The change of the ISD (Instructional System Development) model so far has been summarized in the form of four generations by Tennyson (1995). According to Tennyson, through the third generation, a stepwise approach was used in which development is carried out step by step. For example, the Dick & Carey's ID process model is considered to belong to the third generation. However, from the fourth generation, the model does not have any set order, as shown in Figure 2-10.

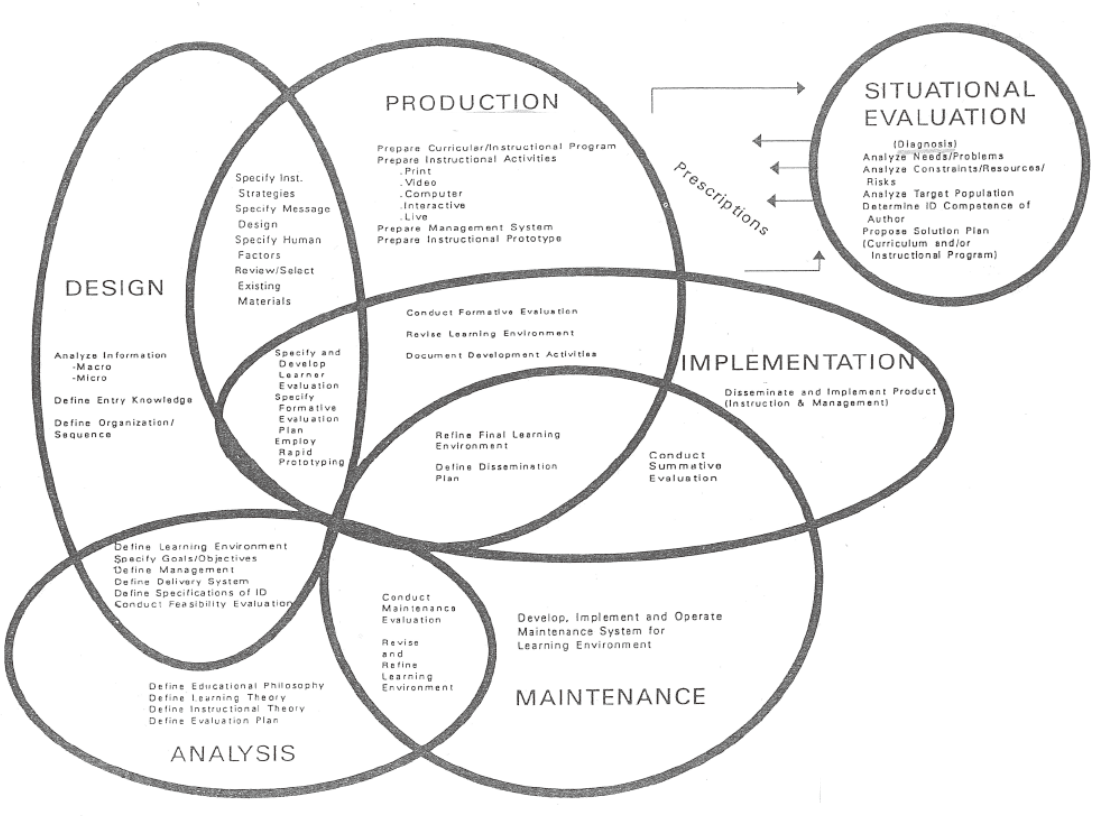


Figure 2-10: Fourth generation ISD model (Tennyson,1995)

"Situational evaluation," one of the elements included in the forth generation ISD model, has two functions, assessment of situation and formulation of prescription. This is a dynamic model where, depending on the problem diagnosed by the situational evaluation, you prioritize the most critical area to solve the problem while referencing the know-how categorized into five areas; i.e. analysis, design, preparation, delivery, and maintenance. This means that other ID processes are monitored to work out the most appropriate means for the situation.

2-5-2: Electronic Performance Support System (EPSS)

In response to the criticism that the conventional systems approach tends to be linear and inflexible (Seels and Richey 1994), Dick (1993) proposed enhanced ISD where emphasis is increasingly placed upon Electronic Performance Support System (EPSS), which aims to reduce the time required for the typical ID process by incorporating some elements of the performance technology approach. In other words, EPSS is a system reflecting the fourth generation ID process model. Although EPSS is an important element constituting e-Learning, here it is used in an entirely different context that if you have EPSS to support the ID process, the ID process will be semi-automated so that those instructional designers with limited training background can carry out the ID process in a more dynamic way.

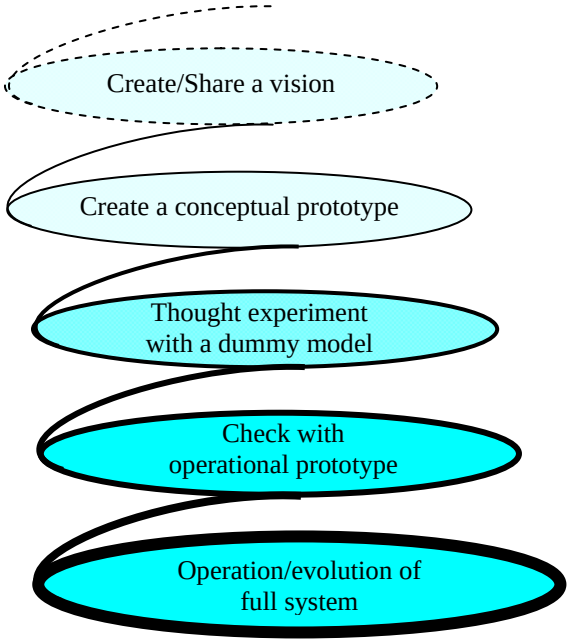
According to Gary (1991), EPSS is an electronic system to provide integrated on-demand access to information, tools, and methods to enable one to achieve a high level of job performance with minimal support from other people. It is generally said that the characteristics of EPSS are (a) computer-based, (b) accessible during the task, (c) available for use while working, (d) controllable by the operator, (e) reduces the pre-training requirement, (f) easy to update, (g) speedy access to the information, (h) does not include inappropriate information, (i) accommodates users having different levels of knowledge, (j) allows different learning styles, (k) integrates information, advice, and learning experience, and (l) uses artificial intelligence.

There has been a study which aims to achieve semi-automated ID by applying a knowledge-engineering-like method to the ID process. This approach follows the tradition of the educational technology study, which is based on the idea that, by attempting to let computers realize what people (teachers or instructional designers) are doing; i.e., by describing what people are doing in more detail and more objectively, we can provide it in a form which can be shared by everyone. The importance of continuing a study which aims to realize the ID process carried out by computer cannot be over-emphasized.

2-5-3: Rapid prototyping

Rapid prototyping is an attempt to shorten the processing time required by ID, so that the ID process can respond to the rapidly changing demands. Although rapid prototyping is a method originally used in software design, it is applied to the ID process as well to reduce the time needed for the development cycle. Rapid prototyping aims to make it easy to incorporate the request from the involved parties into the development process, or even moving forward a step further, to make the development process a collaborative work between the customer and the supplier. It can not only reduce the processing time, but also provide feedback to the involved parties more frequently (Dorsey, Goodrum, & Schwen, 1997).

See Figure 2-11 for rapid prototyping processes. You share the vision as to what kind of change you want to make in relation to the organization and its members for the purpose of developing the system while listening to the opinions of the customer and those involved (cycle one), making a conceptual prototype by sketching the ideas (cycle two), carrying out thought experiment using a "dummy" model (cycle three), testing it with the operational prototype for pilot testing (cycle four), and finally operating the full system, which is the realization of the vision (cycle five). Through these processes, you aim to develop the specifications by way of collaborative work rather than moving to the design/development stage after the required specifications are all set.



Source: Figure 2 (p. 454) of Dorsey, Goodrum, & Schwen (1997)

Figure 2-11: Rapid prototyping processes

Column: Suzuki's three-stage model

Suzuki's (1988) three-stage model is a proposal to carry out material development in three stages, development of material to diagnose, material for exercise, and material to instruct. The proposal consists of three processes; first of all the process to develop the test, followed by the process to develop the exercise and finally the process to develop the presentation of information. This can be seen as a kind of rapid prototyping (Figure 2-12).

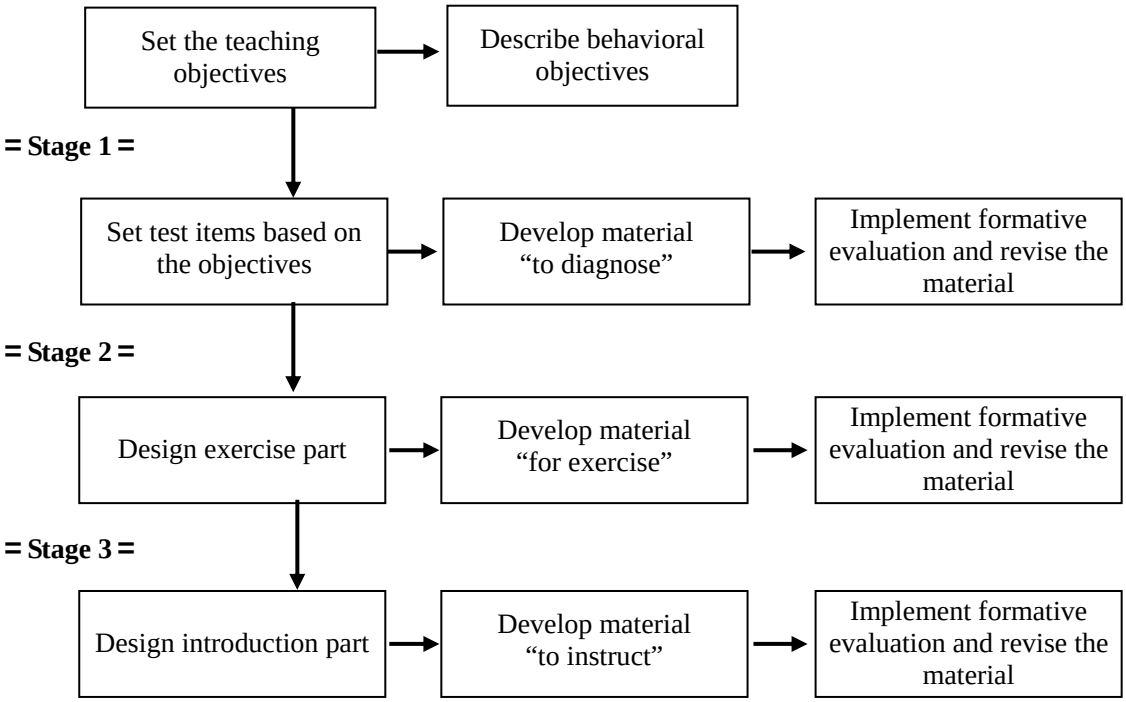


Figure 2-12: Three-stage CAI material development method for practitioners (Suzuki, 1988)

The "Three-stage method" is a proposal which aims to develop worthwhile materials in a shorter time by dividing the procedures into three stages. It refers to the procedures from the design of CAI material to the completion of it in systems material design/development model (Suzuki, 1987; Suzuki, 1988). Each of these three stages is arranged in such way that, while the stages themselves constitute independent processes of material development, the material developed at one stage becomes the basis of the next, so that you can create it in the manner of piling up things one after another.

1) Stage 1: e-Learning material to diagnose

In stage one, you develop "e-Learning material to diagnose" by computerizing a test. When you feel that people need training, the first thing you should do is to clarify "What you are going to let them learn." Considering that you are not familiar with the practice of the systems ID process, you had better start with developing the test items rather than trying to come up with clearly stated learning objectives. It is easy to work out clarified learning objectives later

on based on the test items. Although by describing objectives it would become easier for you to utilize the products of theoretical studies when you select instructional strategy later on, it is enough, at this stage, for you to make it clear, by setting the test items, what you are going to let them learn, using e-Learning materials. If you use the template for "screen for question" included in the WBT material development support tool, computerization of a test is a matter of inputting a test question and giving it a correct answer. In this case, omit the feedback and make the system able to record the answer to each item of the question (particularly, leave those incorrect answers as they are). You can make management of administrating the test easy by computerizing the test you are using now. You might be able to add a top page to the test, or a screen at the end of the test to let the users know the result of the diagnosis using the template for "explanation screen" included in the WBT material development support tool.
ここまで
When you finish inputting the test items, carry out formative evaluation of the "material to diagnose" by asking people around you to become volunteer testers. Start one-on-one formative evaluation (Suzuki, 1987) by asking 2 to 3 people who are familiar with the contents of learning in question to try the "material to diagnose." Having already learned the contents in question, these volunteer testers should NOT have any problems in getting diagnosed as "already learned." If they had any problem with the test, it is considered that the test items, rather than volunteer testers themselves, would have some problems. Through this process, you identify the problematic test items, input mistakes (typos), and so on. Based on the result, find out the problems of "material to diagnose" to make improvement.

Next, try/use the "material to diagnose" which has been revised based on the result of one-on-one formative evaluation as a posttest, with the help of a group of volunteer testers who have just finished a relevant course in relation to the learning task in question. Through this process, you can check if the e-Learning material corresponds to what was presented in the course. In addition, record the types of mistakes common to a certain number of volunteer testers so that you can use this information when you develop the Stage 2 material. The material at this stage can be also used as a pretest to the participants of a class which has not completed the relevant course. If many of the participants were diagnosed as "already learned" before they had taken the course, it might be either that the question item itself contained a hint to answer the question, or that the question was too easy for the participants who are the prospective users of the material.

2) Stage 2: Material for exercise

In the second stage of the "Three-stage model," you develop so-called drill-and-practice type exercise material. As the final product of stage one ("material to diagnose") clearly shows what you are going to let them learn in relation to this learning task, all you have to do in the design work for this drill-and-practice type exercise material is to simply add, for the purpose of exercise, more questions that are equivalent to the test items used before, and remedial feedback in response to the mistakes. The consistency between assessment and exercise can be maintained by utilizing the test items as a basis for creating the exercise items. Taking advantage of the information in relation to the mistakes recorded at the time of formative evaluation in stage one, prepare feedback for each type of mistake. By referring to the mistakes the participants actually made, you can avoid spending too much time on thinking about how to formulate feedback for the types of mistakes which are very unlikely to happen. It is possible to add feedback to the questions you used for "material to diagnose" so that "material to diagnose" can be upgraded into "material for exercise." You could also formulate questions for exercise purpose separately from test items so that you can have materials which

can be used for both "exercise" purpose and "diagnosis" purpose by either using the menu function of the material development support system or making your own menu utilizing the template for "question."

For the formative evaluation in stage two, you need two different types of volunteer testers. One group consists of those participants who have been given thorough explanation about the target learning task in the course, and the other consists of those who have not learned it at all. Those participants who have been given explanation in advance are used to check to see if this e-Learning material was successful in giving sufficient opportunities to exercise, and those participants who have not learned it at all are used to obtain information regarding to what extent you need to increase the volume of material in relation to this learning task in the future. In other words, if the use of "material for exercise" by the participants, without being given any explanation, was proved to be sufficiently effective, you can say that no more material is required for this learning task. Although you start to develop the material based on the judgment of the instructional designers who think that such material might be effective for the target learning task, since such full-fledged "needs analysis" in the normal system's ID process model is skipped, you have to keep checking the performance of the participants to see if spending more time on this task is worthwhile. If you can see that a certain level of effectiveness has been achieved, then it might be more effective for you to spend your time on developing materials for other learning tasks.

As for drill-and-practice type exercise material, people criticize it saying, for example, that it is not taking full advantage of the computer functions. However, the role of "material for exercise" here is not "to present questions," but its aim is "to guide the learners in such way that they become able to answer the question." Therefore, learners who have completed the "material for exercise," so long as the learner was able to apply the assumed subordinate skills and the introduction given by the instructor was successful, must become able to answer the question. It is necessary for you to carry out the formative evaluation and revision of material while keeping this perspective in mind. If you are successful in developing high-quality drill-and-practice type exercise material, the material could become the heart of high-quality tutorial-type material.

3) Stage 3: Material to instruct

In the final stage of the "Three-stage model," you develop so-called tutorial type materials. In case either students could not answer the initial questions in and up to the second stage or you want to computerize the explanation part provided by a human teacher, develop "material to instruct" by adding information presentation screens and/or basic exercise questions to the final product of stage two. In this process, it would be effective for you to refer to the ID model (see Chapter 8 to Chapter 10 in this book) for the purpose of taking advantage of the know-how regarding instructional guidance accumulated so far.

You can find information regarding effective teaching strategy required herein, rather than the ID process model which shows you the process of material development, ID theories which show you what sort of things you should let the learners do for you to be effective in encouraging them to learn a certain task (for example, Gagné & Briggs, 1986).You could broaden the user ranges or incorporate learners control by adding "Introduction" part in parallel with the "Diagnosis" part and "Exercise" part using a menu mechanism.

A variety of screens could be added to make what is called tutorial-type material, depending

on what was lacking in the material to "Exercise." For example, in some cases it would be enough for you to add a HELP screen to the "Exercise" part so that the user can branch out or add a 2 to 3 page summary prior to the "Exercise." On the other hand, in some cases, you have to develop exercise questions separately for basic prerequisite skills and let the participants review them before the introduction of the learning task in question. However, in any case, you are required to think about how to introduce the task in such way that you can enhance the level of understanding of the learners to the extent that they are ready for "material for exercise," because the last part has been already developed at stage two. In the introduction part, you could, in addition to presenting information using the template for "explanation," take advantage of various templates for "question" to solicit learners' active responses.

Carry out the formative evaluation for stage three in accordance with the method which has been proposed so far (Suzuki, 1987) to identify/revise any areas which need to be improved. It is anticipated that if there is any problem, the problem would be in the "introduction" part, because the "diagnosis" part and the "exercise" part have already been revised. The problem could be: that the explanation regarding the learning task was not enough; lack of learning guidance (see Chapter 8) to let the students understand the meaning of the task; or that the entry conditions were not checked in a satisfactory manner. Carry out this formative evaluation and revise the materials based on the results to complete the development process of the "Three-stage model."

[Reference material]

Katori, K. (2001) “E-learning management”, ELCO [In Japanese]

Gagné, R.M., & Briggs, L.J., translated by Mochidome & Mochidome (1986), “Curriculum and lesson structure”, Kitaohji-shobo [In Japanese] Gagné, R.M., & Briggs, L.J. (1979). Principles of Instructional Design (2nd Ed.). Halt, Rinehart, & Winston

Suzuki, K. (1987), “Formative evaluation technique in the design and development of CAI material”, ‘Audio-visual education study’ No. 17, pp.1-15

Suzuki, K. (1988), “Development of CAI material which is easy and long-lasting – Three-stage model for practitioners -”, A paper presented at the 14th conference of Japan Association for Educational Technology ’, pp.203-208

Suzuki, K. (2002), “Instructional material design manual: To support self-leaning”, Kitaohji-shobo [In Japanese]

Briggs, L.J., & Wager, W.W. (1981). Handbook of procedures for the design of instruction (2nd Ed.), Educational Technology Publications.

Broadbent, B. (2002). ABCs of e-learning: Reaping the benefits and avoiding the pitfalls. Jossey-Bass/Pfeiffer, ASTD.

Dick, W. (1993). Enhanced ISD: A response to changing environments for learning and performance. Educational Technology, 33 (2), 12-16.

Dick, W., & Carey, L. (1978). The systematic design of instruction. Scott, Foresman and Company.

Dick, W., & Reiser, R.A. (1989). Planning effective instruction. Prentice-Hall.

Dorsey, L.T., Goodrum, D.A., & Schwen, T.M. (1997). Rapid collaborative prototyping as an instructional development paradigm. In C. R. Dills, & A. J. Romiszowski (Eds.), Instructional development paradigms. Educational Technology Publications, 445-465 (Chapter 26).

Gagné, R. M., & Briggs, L. J. (1979). Principles of instructional design (2nd Ed.). Halt, Rinehart, & Winston.

Gagné, R. M., Briggs, L. J., & Wager, W. W. (1992). Principles of instructional design (4th Ed.). Harcourt Brace Jovanovich College Publishers.

Gange, R. M, & Madsker, K. L. (1996). The conditions of learning: Training applications. Harcourt Brace, ASTD.

Gery, G. (1991). Electronic performance support systems. Weingarten Publications, Boston, MA

Hannum, W. H., & Briggs, L. J (1982). How does instructional systems design differ from traditional instruction? Educational Technology, 22 (1), 9-14.

Piskurich, G. M., Beckschi, P., & Hall, B. (Eds.) (2000). ASTD handbook of training design and delivery: Instructor-led, computer-based, and self-directed. McGrow-Hill.

Seels, B. B. & Richey, R. C. (1994). Instructional Technology: The definition and domains of the field. AECT, Virginia, U.S.A.

Suzuki, K. (1987). A short-cycle approach to CAI development: Three-stage authoring for practitioners. Educational Technology, 27(7), 19-24

Tennyson, R. D. (1995). The impact of the cognitive science movement on instructional design fundamentals. In B. B. Seels (Ed.), Instructional design fundamentals. Educational Technology Publications, New Jersey, U.S.A.

Wager, W. W., Applefield, J. M., Earl, R. S., & Dempsey, J. V. (1990). Learner's guide to accompany principles of instructional design (3rd. Ed.). Harcourt Brace Jovanovich College Publishers.

End of chapter report assignment (Chapter 2）

Please write a report on one or more of the following three assignments:

(1) Please summarize your questions, comments, opinions, and impressions you had after reading through this chapter (Chapter 2). In addition, if you have any experience, additional information, or have done research (do not forget to name the source) in relation to what is written in this chapter, you are encouraged to include them in your report so that you can extend your understanding even further.

(2) Please analyze the examples of e-Learning around you in relation to Figure 2-6: Corporate education based on systematic approach vs. that based on conventional approach. For the sake of comparison with e-Learning examples, you are also encouraged to analyze your experience in terms of how you have been educated or educational activities you are doing now so that you can extend your understanding even further.

(3) Please summarize your opinions regarding the criticism of ID and counterargument to the criticism. In doing that, you are encouraged to put forward your discussion while taking notice of the distinction between the ID model and the ID process model