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Chapter 10 Viewing School Education as Technology

- **Message**

<p>Education through broadcasting is a research field concerning the use of broadcast media, and should be regarded as part of educational technology.</p>

- **Checkpoints**

1. What images does the word “technology” conjure up?
2. What kind of relationship does education through broadcasting have with educational technology? What do you think of the idea that education through broadcasting is a part of educational technology?

- **Note**

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

Introduction: Questioning the thoughtless succession of tradition

The previous chapters introduced ideas concerning the relationship between education and broadcasting, and the roles of teachers who facilitate the relationship. Such ideas are informative from the perspective of educational technology, especially instructional design theory, which is my specialty. This chapter will discuss my standpoint on educational technology, which does not depend on machines as a premise for education ^[1]. Starting with the utilization of broadcasting in instruction, we would like to review and consider everyday instruction overall. Then, we would like to select better alternatives by reviewing our own practice of instruction. Such a standpoint on educational technology is going to be discussed in this chapter, titled “Viewing school education as technology.”

1. Is educational technology the mechanization of education?

– Hardware as technology –

Educational (instructional) technology ^[2] has been developed as research on the application of various media (machines/hardware), which have become available for instruction through the development of technology, into education and the promotion of their effective utilization. This is hardware used in audio-visual education and educational technology. Generally, when people hear the word “educational technology,” they may think of machines from the word technology, and tend to have an impression of dehumanization or think that such education will hinder human nature. This may be because the hardware aspect is striking. Of course, many people are dealing with educational technology for the purpose of dissemination and utilization of certain hardware. However, not all researches of educational technology are focusing on hardware promotion.

Teachers who are engaged in education through broadcasting sometimes say “We have no interest in educational technology.” It seems that behind such an expression lies the same association that education through broadcasting means uniform school education by machines and the demise of the classroom teacher. They usually distinguish educational technology from education through broadcasting: while educational technology focuses on efficiency and cramming, education through broadcasting is human education which develops sensibility and critical skills. They may think they would not like to join the circle of educational technology. However, I regard education through broadcasting as a respectable field of educational technology, although this may bother some people. This is because education through broadcasting is a field that researches how to utilize broadcasting, or mass media (hardware) as a means of education ^[3].

2. Is educational technology research on machine utilization?

– Software as technology –

Research that tries to demonstrate the superiority of machine use has been conducted in order to use new machines in education from a hardware utilization aspect. Ironically, cure-all or unquestionable “panacea” media has not been found despite repeated studies. The results have always been the same as the common-sense view. Accordingly, it has been emphasized that it is necessary to understand the results of theoretical and basic research on instruction in order to use media effectively. In this way, educational technology started to explore research results in every field related to teaching, including learning theory, communication theory, business science, and ergonomics. This is software view of educational technology (in a sense of utilizing research results to educational practice). Many people may associate the word

software with computer programs. However, the word software used here is referred to as “the way to utilize machines; the mechanism (software) of utilizing machines,” compared with machines themselves (hardware).

In the example of a transportation truck, hardware used as educational technology conducts research on the transportation ability of the truck and improvements in loading^[4]. When a new truck is developed, it is marketed in the field of education. However, even if the truck is well made, it is not useful when it is just running without a fixed destination. It does not make sense that the truck is running unloaded. Even if a new type of truck is developed, big changes are not expected unless the content of the load changes.

Compared with hardware research as truck research, software utilization in educational technology can be regarded as load research. The researchers are interested in things loaded onto trucks, ranging from the selection of materials, purchasing, storing, through to the loading method. Even if the performance of trucks is improved, transportation work will not be achieved unless the load is properly selected and treated. Even if the same truck is used, a change in load will be required when new materials are developed as research results or market conditions change.

Of course, the kind of loads that can be carried varies depending on the kind of trucks. Seafood that is required to be kept chilled during delivery cannot be easily sent without using a refrigerated truck. In order to carry racehorses, or pianos, specialized vehicles are required accordingly. In the same way, it is true that the suitable field of education is different depending on the kind of media. It is more important to think of what to carry than how to carry. This is why it is more important to focus on the message rather than the media, and characteristics of programs or use of programs rather than characteristics of broadcasting.

3. Educational as technology

In the above way, educational technology has been developed focusing on how both hardware and software sides of the technology can be applied to education. Outcomes of innovation are continually provided, and research outcomes on various possible fields suitable for the implementation of instruction are announced. Accordingly, alternatives for the implementation of instruction are ever increasing. Education through broadcasting has been considered as connecting all those alternatives to broadcasting as hardware, and now attempts are being made to solve every challenge through utilizing broadcasting. In the field of audio-visual education, the utilization of OHP and 16 mm films has been considered. Unexceptionally, educational technology has developed programmed learning, response analyzers, and computer education whenever new methodology comes onto the scene.

It is not bad to explore the potential of new things. Rather, new things may be cast away to conserve tradition before realization of its potential, unless we try to support new ideas. Among such many alternatives prepared today, however, it is difficult to solve all problems by a specific methodology. If we forget about the old ways, attracted by new ways, everything will collapse like a house of cards.

It is true that education through broadcasting, audio-visual education, or educational technology has developed as education through technology. If each field insists on its originality and sticks to specific hardware and a specific methodology, however, further development cannot be expected. It is important to see various media and instructional

methodologies from a relative standpoint, like a bird views things from the sky.

According to Terumi Nakano, current educational technology plays the role of reconsidering the educational process itself as technology (a problem solving process). Applying a specific technology (hardware and software) to education is called “education through technology.” On the other hand, Nakano points out that reflecting on current school education and instruction and consciously checking them, comparing instructional methods developed in the past, is also one of the important roles of educational technology. Such a role of educational technology is called “education as technology” because the word “technology” means providing a means of problem solving. This approach belongs to educational technology, but it does not focus on a specific use of hardware or specific application of instructional methods. More precisely, it is an approach that forms instructional design theory.

It does not make sense to try to figure out what is or is not education through broadcasting, or what the difference is between audio-visual education and education by broadcasting from my perspective. This is because popularization of a specific hardware is not of interest to me. The utilization of broadcasting is not my goal, but attaining something by using broadcasting is my goal. I believe that broadcasting or any other kind of hardware is just one of the alternatives. Any medium is just a mean, not an end.

It is important to consciously explore what technology (hardware/software) is suitable to use in the given conditions for the purpose of attaining an educational objective considering each tradition and all alternatives. An objective balance must be maintained when making decisions. On the one hand, it may be considered double standards, but in a positive light it could also be regarded as eclecticism. Some may not agree with this view as being named educational technology. Regarding the content of exploration, however, I hope many will subscribe to such a standpoint of education as technology.

4. Characteristics of thinking in educational technology – Understanding educational phenomena as a system –

Nakano explains the standpoint of educational technology as technology, by listing five basic viewpoints of current educational technology in Table X-1. According to these five viewpoints, this section will discuss what a review of school education as technology means.

Table X-1. Characteristics of Educational Technology (according to Nakano)

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1. Systematic thinking (understanding educational phenomena as a system)
 2. Flexible thinking or selection from various alternatives (removing thinking that conforms to customs)
 3. Willingness to solve problems (preventing research from becoming isolated from reality)
 4. Willingness to generalize (sharing the secrets of a master teacher with everybody)
 5. Empirical and inductive thinking (theorizing with data)
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1. Understanding educational phenomena as a system – system thinking –

The first viewpoint in education as technology is to regard instruction and other educational phenomena as a system. Some characteristics have been mentioned in the previous chapters. Let us take a look at these again.

- Describe instruction as the relationships of elements related to instruction. When an element changes, the other elements will be affected. Think of each element such as contents of instruction, method, children, and teacher as being strongly related to each other. Accordingly, the same instruction will not be reproduced twice.
- Educational phenomenon forms a multiple layer structure. One hour of classroom instruction plays a specific role as a part of an instructional unit. An instructional unit plays a specific role in the annual curriculum of a subject matter. Accordingly, implementing instruction always need to consider the framework one layer above (called superordinate system). Prevent each hour of classroom instruction from breaking away from the long-term objective of the unit or annual curriculum of the subject matter.
- Success or failure of the plan is judged by the degree of contributions to an objective's achievement. Clarify the objectives first. Make a plan using backward chaining methods (goal-directed judgment).
- Carry out a plan while modifying it. Always monitor (evaluate) the progress of plan implementation, and correct the plan as needed. This is based on the premise that an objective may be attained gradually by trial and error without expecting perfection from the beginning (If we know that the plan is successful from the beginning, there is no need for checking the progress. We need to check progress, because we will not be successful on the first trial).

2. Remove thinking that conforms to the tradition – flexible thinking –

The second viewpoint of educational technology in reviewing education as technology is removing thinking that conforms to the tradition, just because it has always been that way. That is, the adoption of flexible thinking. There are many good ideas developed in traditions from the Meiji era in Japanese school education. If traditions are approved and new things are denied only because it has always been so, however, it is impossible to review and check them. Flexible thinking that doubts things taken for granted should be encouraged.

It does not necessarily mean that everything old should be denied and everything new should be adopted. Blind conservation of tradition only because it is tradition avoiding the responsibility for what is being done, should be prevented. Regarding a method that used to be carried out as one of the alternatives, always continue to question if other ways are possible. In the case of considering seriously how broadcasting should be used, discuss instruction without broadcasting first and instruction by media other than broadcasting later. Eventually, some ideas that definitely support broadcasting will possibly emerge. In this case, it should also be noted that there is a risk that reasons that clearly support broadcasting will not be generated. Same thing applies to any kind of technology (hardware/software).

It is difficult for anyone to do what he has not yet tried. Doing the same thing as before is the easiest and surest way for us. Proposing something new requires courage. A new idea is often

declined because there is no precedence. In this way, we tend to have defensive and conservative attitudes to support surer and safer methods, rather than having active attitudes of trying a new thing.

Why is flexibility with such danger required? This is because we have a dream to realize and we are not completely satisfied with the current instruction we are offering. We are responsible for our failures when we try new things. In the same way, we have to remember that we are responsible also for failing by not trying anything new if we support the current conditions without a complete satisfaction. Today, everything is drastically changing. There is no guarantee that the best way of yesterday will always be the best way of tomorrow. Conversely, there is no guarantee that impossible things of yesterday will always be impossible tomorrow.

3. Prevent research from becoming isolated from reality – willingness to solve existing problems –

The third characteristic is the problem-solving attitude to explore outcomes that will be useful for those who implement instruction in making decisions and solving their problems of actual instruction. How can you overcome the problem if you are not satisfied with your instruction? How can you realize your dreams as a teacher? Put down roots in everyday practice of instruction, pick up problems there, and explore ways to solve them. Rather than conducting research to solve ordinary general problems, tackle your own problems.

In many cases, research for researching has legitimate reasons that are flawless. However, they sometimes yield no outcomes other than the fact that the research is completed or the responsibility of conducting a research is fulfilled. They are flawless, but nothing has changed in the everyday instruction further down the line. If research outcomes do not directly affect the instruction after the research even though practical research is conducted, it cannot be said that it is useful to the teacher who conducted the research. Research is not an annual event or a throwaway match. In order to conduct useful research for your instruction tomorrow, the ideas of teachers who implement instruction, which are given based on concerns and questions about everyday practice of instruction, should be valued.

4. Share secrets of mastery with everybody – willingness to generalize –

The fourth characteristic of educational technology thinking is the willingness to generalize, or the aim to share research outcomes with other practitioners. Expert teachers' quality instruction is a treasure of education in Japan or any other countries. However, not only should other teachers be impressed by the expert teachers' practices, but they should also get some suggestions to their own practices and improve their actual instruction. Otherwise, the number of children who benefit from the treasure will be limited. In addition, when today's instruction seems satisfactory upon review, it may have just happened that way unless the experience is applied also for the next instruction. There is the fear that treasure that cannot be shared by other teachers will not be reproduced again when the teacher deal with other children in the next school year. Maintaining instruction in a highly reproductive fashion is called generalization or "exportability"^[5] in educational technology.

At schools in Japan, one's own original way, or originality, is especially respected while the significance of sharing materials and instructional designs developed and planned by other teachers tends to be undervalued. This is a waste. For example, it used to be said that the time

required to develop materials using a computer amounts to one hundred hours for one hour of instruction. Laboring over making instructional materials in itself is not a waste, because the person who makes them can learn quite a lot. However, you should consider making material that can be shared by one hundred teachers as obligation if you spend one hundred hours preparing it. Do not be satisfied with making material that can be used by only yourself. It is important to make materials that other teachers can use, as well as you can use it many times [6].

Once, a student who was taking a preservice teacher training course told me that she was told by one teacher that he wanted to give satisfactory lesson at least once a year, and if he can, he thought he did a good job. She wondered how he managed the rest of the year. I told her, "If you happen to come across an instruction that you want to imitate, you can do so. You don't have to worry about your originality, it is a common treasure. However well you try to imitate the other's instruction, it will not be the same. Increasing the number of times useful ideas for good instruction are shared among teachers is important. Do not try to work everything out by yourself. Start with imitation, and combine and use others' ideas in your own way." She felt relieved after hearing this.

5. Theorizing with data – empirical and inductive thinking –

The fifth characteristic of educational technology thinking is to explain by data: empirical attitude or inductive thinking toward education. Here, data includes observation records, results of questionnaires, test results and various other forms of data. However, major data should be those obtained from children, because instruction is carried out to support their learning. Not only numerical data, but also comments, ideas, and works of children are important data used for reviewing the instruction. I always like to sit in a review meeting when the instruction results are printed and distributed promptly, and proposals of for discussion are made in the following way: "Our research is on this topic. We took these data to confirm this agenda. We would like to discuss how to interpret this result in this meeting." Conversely, I hate to be in a review where no evidence was shown, despite a thick and detailed instruction plan is presented.

There may be contradicting ideas including: "Outcomes of instruction are not immediately recognized;" "Only a long-term change in children is the goal of education." If so, a research to investigate long-term change in children should be planned to carry out analysis of instruction, based on data collected over the years. There is no excuse for not collecting data. The research without data only shows that its plan was not suitable for the research theme. A journey of a thousand miles begins with a single step. Confirmation, step by step is required, if you accept the notion of education as technology.

There may be another contradicting idea, saying even if so much data is collected, it cannot tell all about the effects on children. That is natural. No one knows everything about how individual children are affected by instruction at school. However, this does not constitute an excuse for neglecting efforts to investigate how successful the aimed effect was. Such research only indicates that the research theme was not focused on.

5. A firm basis for reviewing = education

Educational technology has been explored from the perspective of viewing school education as technology (the problem solving process), in addition to applying technology to education

(education through technology). Pursuing this work, we eventually reach the fundamental issue of what kind of problem should be solved at school. In leaving what school education should achieve (objectives) unclear, how school education should be undertaken (methods) cannot be clarified.

School has various social functions. One of them is the day-care function to free parents from childrearing duties to give time to concentrate on productive duties of their professions. Another is the screening function to collect quality human resources that the state and businesses are looking for from a broad range of the general public. Another is the socializing function to develop children into adults who will not cause problems for society. Regardless of whether schools' teachers are actively intending to carry out those functions, various roles are expected from and actually carried out in school education. The practical duties that schools carry out are mainly through classroom instruction. Depending on the goals of schools, extremely different results of reviewing and checking its instruction will be obtained.

The models we can propose from the outcomes of educational technology are easy to use for training (or for brain-washing if you prefer this term). All of the following are training dealt with by school education: teaching children letters, developing their interest in science, developing their interest in environmental issues, and helping them to acquire logical thinking. However, efficient achievement of the above is not the only goal of school education. Nevertheless, schools will not function as schools without attaining the above mentioned training objectives. It is actually a problem if teachers cannot demonstrate how to learn letters efficiently when asked to teach children letters. An immediate objective of learning educational technology or instructional design theory may be to become a teacher who can provide effective training, even if you think of education different from mere training.

According to Haitani, a Japanese poet and former school teacher, "We teachers teach children things, letters, or numbers. However, we should not forget that actually we are teaching children humanity above and beyond the letters, and are thinking together!"^[7]

The work of viewing school education as technology includes recognition of the limitations of educational technology as a means of improving "educational" functions of the school, which corresponds to Haitani's above statement, and new challenges to realize it.

<Note>

[1] See also the following paper that arranges my standpoint from a perspective of what will make instruction effective if we can do it with the use of educational equipment:

- Suzuki, K. (1995). "Effective Use of Educational Equipment," Education methods to develop personality: Comprehensive special topic for teacher training series 117. Kyoiku-kaihatsu kenkyusho. pp. 219-222. [In Japanese]

[2] Ichio Numano has used *Kyoju kogaku* as a translation of "instructional technology." He positioned *Kyoju kogaku* as the main subordinate domain that is limited to improvement of micro instructional systems directly related to instruction, not public/economic administration of education and others, under the research field of *Kyoiku-kogaku* (educational technology). Generally, educational technology and instructional technology is often used in the same meaning, according to Ichio Numano in the book of Hiroshi

Azuma, et al., (Eds) (1979). *New Encyclopedia of Pedagogy*. Heibonsha. p.236. In reverse, according to the definition by AECT in 1994, the word “educational technology” was replaced by “instructional technology,” as the word to indicate the research domain of *Kyoiku kogaku* (educational technology) (Seels, B. B., & Richey, R. C. (1994). *Instructional technology: The definition and domains of the field*. Association for Educational Communications and Technology, U.S.A.). This article is interested mainly in *Kyoju kogaku* (instructional technology) as named by Numano, or improvement of everyday instruction. However, this article uses the word *Kyoiku kogaku* (educational technology), which has a more general meaning.

- [3] Ichio Numano (above) regards education through broadcasting as a part of audio-visual education and audio-visual education as a part of instructional technology. In the U.S., the predecessor of AECT was the Department of Audio-Visual Instruction (DAVI) of the National Education Association (NEA). In its history, it changed the name of the association and its journals in order to respond to changes in societal trends. The definition by AECT in 1994 is as follows (Seels & Richey): “instructional technology is referred to as theory and practice on design, development, operation, management and evaluation of the learning process and resources.”
- [4] The logic of comparing media to a truck is used in Clark’s claim that “media has no effect under any circumstances,” which caused a controversy (Clark, R. E. (1983). *Reconsidering research on learning from media, Review of Educational Research, 53* (4), 445-459). The later controversy is introduced in the following: Imae, K., (1994), “Tentative Assumption for Effectiveness in Arguments Concerning Multimedia – Outlook of multimedia,” *Educational Media Research, 1* (1), pp.38-43 [In Japanese]. The recent ideas that learning should be embedded in the context view critically the concept that what children learn is carried by the truck (for example, Imae p.41). According to Gagne’s nine events of instruction, it is clear that only carrying information will not facilitate effective learning. Limitations of the metaphor of a truck lie in reminding us of one-sided information discharge (Nakano, T. (Ed.) (1979). *Course of Pedagogy 6: Educational Technology*. Gakken) [In Japanese].
- [5] Azuma, H. (1976). Educational Technology, *The Educational Technology Research Journal. 1* (1), p. 2 [In Japanese]
- [6] In this point, research by Kawagoe serves as a help. When Kawagoe developed computer materials including a sound velocity measurement device for his lower secondary school, he conducted research in order for all other lower secondary schools in the city to be able to use the material. For details, see: Katsuaki Suzuki, (1995), “Cases of Educational Research at Lower Secondary School,” *Educational Research of School Chap. 6, Sec. 2, vol. 2*, ed. Mizukoshi and Nagaoka, Gyosei, *Collected works of new school education, vol.28*, pp. 183-194. [In Japanese]
- [7] Hayashi, T., & Haitani, K. (19**), “Dialogue: Teaching and Learning,” Shogakukan, p.188. [In Japanese]
Suzuki, K. (1994). “Another Instruction Design,” *AV - SCIENCE*, pp. 12-16. [In Japanese]
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- **Check of checkpoints (feedback)**

1. Do you understand the concept other than the equality of “technology=Machine=alienation of man”? Can you make sense of the meaning of this chapter’s title “Viewing school education as technology”? Yutaka Saeki describes in the afterword of his book “Computer and Education” (Iwanamishinsho yellow 332, 1986) that “in thinking what is education and how it should be, the desirable image of the computer stands out. At least to me it did (p.225).” This is a conclusion of Saeki, who wanted to know about computers, and considered education antithetical to computers. Conversely, because I want to know about education, I would like to consider how things other than humans, such as broadcasting and computers, could be used in education. I expect to see what human teachers should do by thinking of how inhuman emotionless machines can be utilized. I am looking forward to seeing the day I can say, “at least to me it did.”

I think that research on education through broadcasting is a part of educational technology. It may be bothering you. It is good that you stick to media called broadcasting (because we tend to be good at those things we like), but do not forget flexibility.