

# Design of Metastructured Quality Education Which Is Information Design Oriented And IT-Strengthened - Case of Teacher Training Course -

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Abstract: Education as process is information, hence as act, information design. In education, like other fields, concerns about Information design are supposed to tend digital media because of "power of digital". And, accordingly, ability to educate with best use of digital media is expected to become a basic skill for future teacher. Thus, I subject here "quality education" from the standpoint of "information design" and "e-infrastructure/e-education". Especially, "e-education" subjected here is : (1) intended for promoting practice, rather than providing knowledge, (2) intended for complement of school education, rather than substitute for attending school, and (3) introduced as solution for problem-solving-type education.

In the teacher training course, quality education becomes metastructured, in the sense of "quality education for raising/training quality educator". The training ought to include *information design oriented e-educator* training.

In order to actualize such a training, a well-designed information/communication system, which would be web-based, must be employed. This system is to consist of two components : (1) server system of teaching/learning contents and (2) system for supporting teaching/learning activities.

Supported by such an e-infrastructure, and from the standpoint of "quality education", the course and classes are designed. It is both subject/meaning/essence-oriented and task-oriented, and the stance of "information design" makes this integration actual. In my mathematics education course, students practice information design in : (1) making teaching/learning contents and instruction scripts, (2) performing mock classes.

*Keywords: quality education, information design, e-infrastructure, teacher training course*

## 1. Introduction

"Design" is one of the major subjects on which interdisciplinary studies are invoked. Here "design" is inquired as method, action and/or practice for the realization of some kind of *well-being*. Indeed, when we start aiming at a *well-being*, we start considering *design*.

In this sense, to discuss the "design" is to go into particulars of "well-being" and to inquire what *design* can do for the *well-being* concerned.

From this standpoint, here I propose a *well-being* of education and corresponding *design* action. To be close, I discuss a method of quality education at a traditional teacher training course, in the following context :

1. Destination : Quality education which educates "quality mathematics-education"  
(Destination is metastructured !)
2. Criterion/indicator of "quality" : Being well-designed from the standpoint of "information design"
3. Amplifier of power of information design : IT-strengthened
4. Method for achievement :
  - (1) Course/class design, (2) Design of a web-based e-education system, and best use of it.

The reason of this context is :

1. The constraints on quality-oriented education are :
  - Mathematics is, by nature, hard to be learned.
  - Traditional communication media are poor for mathematics education.
2. The problem of "quality of education" is reduced to that of "quality of information design".
  - "*Education as information design*"
3. "*Breakthrough by power of IT*" holds as a strategy.

And it is the situation of "*IT revolution*" that makes this reason hold.

Distinguishing characteristic of this study is :

1. "Web-based e-education system" is subjected in combination with "quality education" (as a requisite of "quality education").
2. The "quality education" in this combination is a metastructured one.
3. "Quality" is reduced to "information design".
4. The study is based on sizable (long term) practice.

And the general subjects of "design" to which this study contributes implications are :

1. "*Process where e-infrastructure functions in its best sense*" (So should be the education over e-infrastructure.)
2. "*Consistent information process*" (So should be the information design for quality education.)
3. "*Complex system*" (So is the (quality) education.)
4. "*Information designer training*" (So is the teacher training.)

## 2. Method

### 2.1 Target and Outcome

In the sense that

- Overall goal is *quality education*
- Information design is the stance with which *quality education* is constructed

the outcome of my study/practice is :

- Method of *course design for quality education strengthened by e-education equipment*
- Method of *conforming e-education system to quality education*

which are especially targeted to

- Teacher training course, where the above methods are also what students learn. (*Metastructured!*)

The method of the study/practice is as follows :

1. Make the method be practical/concrete
  - Course, assignment, instruction/evaluation
  - E-education system
2. Narrow the target down
  - Mathematics education classes in teacher training college
  - E-education system as
    - Web-based self-teaching system
    - Server system of private space where student achieves her/his work in the form of homepage
3. Sizable enough to be coherent :
  - All the mathematics education classes, and more, which I am in charge.
4. Giving priority to covering a sizable unit of real course and seeing the prospect of the method, over practicing

analytical research.

## 2.2 Reduction of "Quality" to "Information Design"

Education is a process of information in the sense that the following equation holds :

The aim of the education is attained. = The information aimed at is completed.

Hence, constructing/performing education is act of information design :

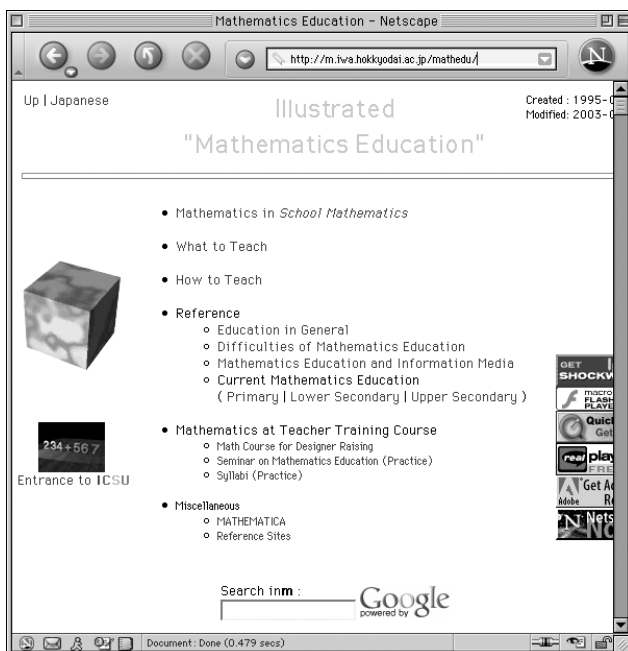
education (process) = information  
 implies  
 education (action) = information design

The domain of "education as information design" is as follows :

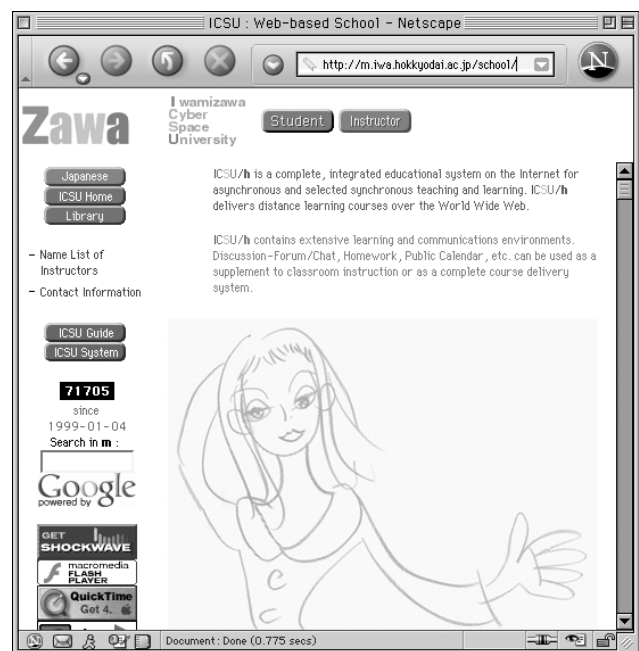
- a. Preparation/improvement of course/class infrastructure (facility/equipment/device, media, e-education system)
- b. Course design
- c. Class making (Table 1)
- d. Making teaching/learning contents from the standpoint of information design (Fig.1)

**Table 1. Class making - Information design**

<i>Making of</i> Script Contents Performance	<i>Expression of</i> Concept/idea/subject Problem Explanation Instruction	Terminology Visualization Animation
Information Design		



**Fig.1 Illustrated mathematics education page ([1])**



**Fig.2 E-education page ([2])**

## 2.3 Web-based e-education system

As a primary element for actualizing "quality education", a web-based e-education system was constructed and has been used/developed since 1996 (Fig.2).

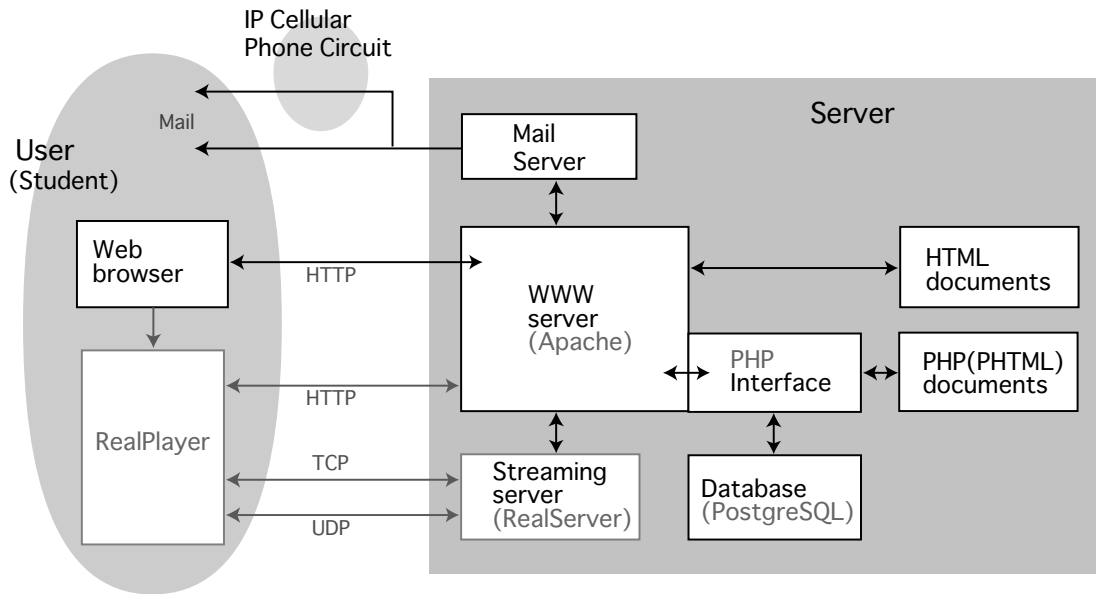
A web-based e-education system (Fig.3) with

- (1) dynamic webpage creation (with PHP)
- (2) web-enabled database sites

is almost uniquely determined, as to the structure, function/tool-set and appearance (user-interface). It becomes to

consist of following two levels :

- a. Course Level
  - The level which is visible to users (students, instructors)
  - The space where user's activity takes place.
- b. Administration Level
  - Registration (students, instructors, courses)
  - Preparation of course (content, members)
  - Recording course progress (member interaction, results)



**Fig.3 Web-based e-education system**

Aims , method, characterization of system, and contents design are related in such a way as the former determines the latter. Here I contrast the quality education over e-education system with the online education :

**Table 2. Cases of e-education**

	Quality education	Online educaiton
Aim	Raising information design ability	\Wide distribution of education Distance education\
Education method	Discipline of basics Task achievement	Put/get of knowledge
Characterization of system (Stance of system design)	Knowledge sever Workspace of information design activity Exhibition of works	Virtual school All staff entry
Site design	Design chages according to the level of course and what part/role is allotted to a class. (Thus, instructor must be an administrator.)	Uniformity - Targeted to the untrained → Easy to put/get contents → Uniform - Administrator cannot corresponds to diverse requests from instructors.

In the case of quality education, website design changes corresponding to course level, which is the change of

relative importance.

1. Stage of "Discipline of Basics" :
  - Knowledge sever
  - Exhibition of works
2. Stage of "Task achievement" :
  - Workspace of information design activity
  - Exhibition of works

### 2.4 E-educator training

In the current situation, the quality educator becomes e-educator. ( That is, unable to be a quality educator without being an e-educator.) Indeed, quality education is actuated in the structure shown in Fig.4.

### 2.5 Specialty discipline

Information design holds on (1) sound understanding of subjects and (2) media literacy (Fig.5). Media literacy alone is not the ability of information design. In particular, metastructured quality education asks discipline in the student's side.

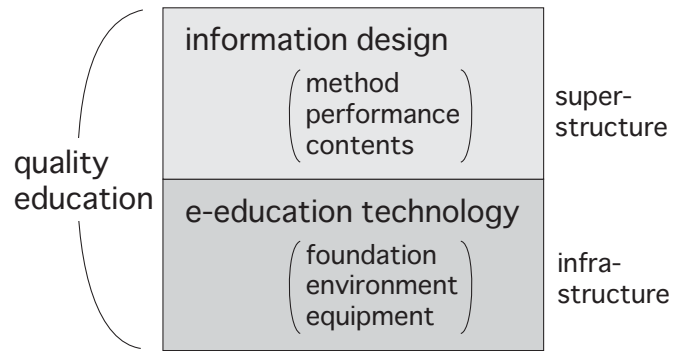


Fig.4 Structure of quality education

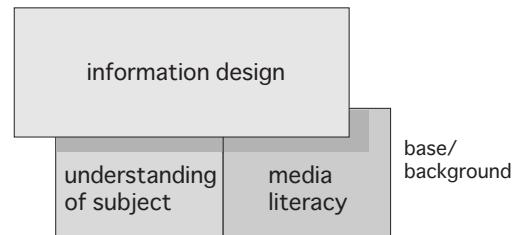


Fig.5 Information design

## 3. Results and Discussions

### 3.1 Progress of Practice

#### (1) Course design

It is required to apply different types of instruction because the classes are of different condition to each other. Our method is as follows :

- a. In the case of a class where the attendants are many, and only "lecture" is allowed as the form of instruction, the instruction is made in the form of "homepage-based digital presentation".
  - "Demonstration of 'information design'" is one of the important effects I estimate.
  - And I explicitly make "information design" a subject as well, in the form of "instruction-design/teaching-material-making = information design".
  - A homepage-based self-learning system is served. This is necessary because instruction becomes quick in the case digital presentation is its form.
- b. In the case of a class where the attendants are not so many and, therefore, the homepage-based training is possible, the class is designed to be of "report (as homepage) making".
  - Students' results are evaluated from the viewpoints:
    - Do they reach an subject(content)-understanding aimed at in this stage?
    - Do they reach an information-design-ability aimed at in this stage?
  - In this case, the homepage-based self-learning system mentioned above works especially in the following manner :
    - Report making is a work on computer. Operations required there are carefully instructed.
    - While making the report, students can refer to the system about the subject (meaning, application, etc.).
- c. In the case of the seminar, where "self-development" is set to be student's general objective, students are to develop teaching material for WBT, to undertake interactive remote-education (make program and perform), etc., while developing the skills for planning, contents making, product-out, and so on, through practice.

#### (2) Course

In the following two tables the classes I am in charge are shown. In the first table, classes are arranged according to the grade, and the second, the type of learning activity. (Taking charge of "Computer Operation" and "Integrated Research Activity" is irregular.

**Table 3. Allocation of classes**

Grade	1	Spring	Computer Operation	Integrated Research Activity
		Fall		
	2	Spring	Lower Secondary School Math	Elementary School Math
		Fall		
	3	Spring	Math Information Design	
		Fall		
	4	Spring	Upper Secondary School Math	Seminar on Math Education
		Fall		

**Table 4. Class-type, content**

Type	Class Name	Content	Primary basic skill
Audit	Elementary School Mathematics	Mathematics in elementary school math	Basics of elementary school math
	Information Design	-	-
	Course Development	-	-
Practice	Computer Operation	Computer operation Homepage making Digital presentation	File management HTML
Task achievement	Lower Secondary School Mathematics	Mathematics in lower secondary school math Making instruction script (homepage) Presentation of results	Basics of lower secondary school math HTML Painting/drawing software
	Upper Secondary School Mathematics	Mathematics in upper secondary school math Making instruction script and teaching material (homepage) Perform mock class	Basics of upper secondary school math HTML Flash Mathematica
	Mathematics Information Design	Making instruction script and teaching material (homepage) Perform mock class	HTML Flash
Project	Integrated Research Activity	Planning, achievement Group working	-
	Seminar on Mathematics Education (Detailed in the following)		

(3) "Seminar on Mathematics Education"

In order to see how the course is, here I introduce the "Seminar on Mathematics Education".

In the seminar, it is ruled that students are responsible for developing their own ability. Here ability for planning, computer/media-literacy (web-design, etc.) and presentation (digital, in English) are regarded basic.

The ability/skill to be developed is about:

### 1. Mathematics education

Objectives of mathematics education; For each mathematical subject, its meaning; Instruction/learning media; Instruction/learning method; Instruction design, etc.

### 2. Project achievement

Joint responsibility for achievement; Making plan/proposal; Practice; Presentation; Goal-reaching

### 3. Design of web-based education of mathematics

### 4. Homepage making, web design

HTML; FTP; Flash, etc.

### 5. Digital contents making

3D CG; Digital video editing; Streaming video, etc.

### 6. Interactive remote education

### 7. Digital Presentation

### 8. English ability

The above-mentioned abilities/skills are trained by the two types of practice:

- Self-discipline of basic skills
- Group-working of project-achievement type

The tasks/assignments for self-discipline are:

- Making the experience in university mathematics be a sound selling point
- Raising skills for digital contents making
- Expressing own ability in the form of personal website for e-education
- Making a digital presentation in every meeting of the seminar.

And the tasks/assignments for group-working are:

- Making and achieving a program of "CS Distance Learning" presided by Iwamizawa city.
- Making an exhibition in the campus festival.
- Presentation in English to visitors from other countries
- Presentation at a cross-universities meeting on digital contents making

What I pay attention, while producing a group-working, is

- to restrict the period of working and
- to let students be responsible for reaching the goal,

which is a condition of full-fledged members of society to be able to work in this manner. Indeed, the tasks/assignments mentioned above is such that :

- It is required to achieve carefully because the target is other people.
- Deadline exists.

And students work with tension, feeling that their retreat is cut off.

It must, however, be added that this way of instruction has become possible genuinely since last school year (2002 school year). What has been solved is the requirement of tools (hardware and software) and facilities for student's use. Formerly, I used to manage "information design"-oriented education in various kinds of "lack" (expense, performance of soft/hardware, number of soft/hardware, infrastructure and so on).

## 3.2 Method of metastructured quality education

The method of metastructured quality education which I reached is as follows :

### (1) Course

The method is applied to standard (traditional) course/curriculum. It is not required to install specially new

course/classes.

(2) Instruction

Emphasis is put on :

1. Importance of understanding the meaning/essence of subjects
2. To understand that education as the practice of information design; that objectives of information design is to make others become able to accept/understand the meaning/essence of the subject, and that aptness of design depends on receivers.

(3) Task assignment to students

1. Given a subject, to intend to understand its meaning/essence.
2. To make web-based teaching materials, which are of two types :
  - a. for class instruction
  - b. for online self-teaching
3. Respectively, to perform presentation in style of :
  - a. Mock class
  - b. Demonstration/explanation

(4) Evaluation

1. Degree of understanding subjects
2. Quality of information design :
  - Understanding of subjects (meaning/essence)
  - Design of web-based teaching material
  - Design of presentation performance
3. Media literacy for information design :
  - Computer, network, WWW
  - Application software

(5) Web-based e-education system

1. Course level
  - Student's private home in the server, as working space :
    - Knowledge management
    - Exhibition of achievement
    - Making contents used at mock class performance
  - Self-teaching contents server
2. Administration level
  - Management of course/student

(6) Prime constituents of course design :

1. A scholarly (or specialized-subject-based) course, such as "mathematics education", is the main. And e-education-related subjects are instructed in it as applications.
2. Prefer "narrow and deep" to "wide and shallow".
  - As personal trait, "generative", "transferable" and "self-support" are aimed at in this course.
  - *Remark:* "Graduate school" is not a solution. Relying on an upper school is just to put off making present courses practical.
3. Oriented to task-achievement, problem-solving
  - Of integrated structure
  - Appreciation of works
  - Discipline
4. Accumulation of experiences of e-education performance
  - Web-site construction/design



5. Information design

6. Media literacy

- To improve student's communication skills through different communication media (especially, teaching tools).

*Remark*

1. Education programs, which are designed from department-oriented or course-structure-oriented standpoint may not work. It tends to go "exhaustive" and, therefore, the education becomes shallow and diffuse. It is not a way to make students gain "real power".
2. In the sense that ability to e-educate is an integration of various types/levels of "information design", e-educator training is a discipline of information design. And an appropriate way of "discipline of information design" is to make a regular instruction (instruction on traditional academic specialized field) embody "task working (problem solving)". Indeed, if the subject in the task is not authentic and materials are collected at opportunity, students set themselves to work just for the sake of task -- this is not a discipline of "real power".
3. On the other hand, to make a regular instruction embody "discipline of information design" leads to an improvement of the instruction itself. It is genuinely an improvement in the sense of enrichment, not to change the instruction to a different thing.
4. After all, what instructors do in e-educator training course is not to teach about "e-education", but to make students do "e-education".

#### **4. Conclusions**

A conception of "well-being" invokes actions for pursuing it, where "design" takes place. Conversely, we may say that in each action of design a "well-being" is implicitly/explicitly conceived. And, in this era, "IT" concerns "well-being/design" as an infrastructure of prime importance.

In this paper, I applied this scheme to education - that is, "quality education" as a "well-being" of education. Indeed, IT has become a prerequisite to "quality education". And it is definite that we soon become to consider e-infrastructure as a requisite of "quality education". We, then, cannot be a quality educator without being an e-educator.

In particular, the metastructured quality education - *quality education for training quality educator*, which is the case of traditional teacher training course, is actuated in such a way as both instructor and students best-use e-infrastructure contrivance.

"Quality educator" is an integration of various types of faculty, from academic specialty to IT-literacy. It releases practice of information design and, conversely, what raises it is information design oriented practice.

An adequate way of "discipline of information design" is to make a regular instruction (instruction on traditional academic specialized field) embody "task working (problem solving)". Here the subject of the task must be authentic. Otherwise, students become to set themselves just to answer the assignment -- the task triggers/generates/develops little.

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